

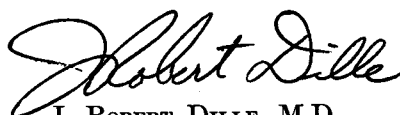
AVIATION MEDICINE REPORTS:

An Annotated Catalog of Office of Aviation Medicine Reports:
1961 Through 1965

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FEDERAL AIR SURGEON

January 1966

FEDERAL AVIATION AGENCY
Office of Aviation Medicine

FOREWORD

During the period covered by this catalog, scientists of the Office of Aviation Medicine of the Federal Aviation Agency published 110 laboratory reports. The scientific research upon which these reports were based was conducted for the purposes of (1) preventing aircraft accidents and (2) preventing injuries should accidents occur. The information is available to flight surgeons, Agency personnel, the aircraft industry, and others with a responsibility in air safety.

From 1961 through 1963 CARI laboratory reports were disseminated as CARI Publications. During 1964 and 1965 research papers from CARI and other divisions and services of the Federal Aviation Agency were published as Office of Aviation Medicine reports.

Further information can be obtained by writing to:

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AVIATION MEDICINE REPORTS: AN ANNOTATED CATALOG OF OFFICE OF AVIATION MEDICINE REPORTS: 1961 THROUGH 1965

Mary Ellen Allen and Stanley R. Mohler, M.D.

REPORT NO.

- 61-1 *Problems in air traffic management: I. Longitudinal prediction of effectiveness of air traffic controllers. D. K. Trites, 1961 (Dec.), 11 pp.*

The contribution of psychological testing to the screening of applicants for air traffic control work is discussed. The significance of evaluations made by ATC school instructors in predicting future job performance of controllers is also reported.

- 62-1 *An analysis of sitting areas and pressures of man. J. J. Swearingen, C. D. Wheelwright, and J. D. Garner, 1962 (Jan.), 10 pp.*

Seat pressure distribution data are presented. The data are being utilized by certain helicopter and aircraft designers in an effort to fabricate seats which better accommodate themselves to the occupant. The implications concerning the protection these newer seats afford the occupants during impacts are quite significant in impact survival.

- 62-2 *Problems in air traffic management: II. Prediction of success in air traffic controller school. B. B. Cobb, Jr., 1962 (Feb.), 15 pp.*

As a result of this study, the Civil Service Commission incorporated in "Announcement 281-B, Career Opportunities in the FAA for Air Traffic Control Specialist," dated May 22,

1962, certain tests recommended by this research. It is estimated that more than two million dollars will be saved through this study since potentially unfit persons will be eliminated from entrance into training.

- 62-3 *Problems in air traffic management: III. Implications of age for training and job performances of air traffic controllers. D. K. Trites, and B. B. Cobb, Jr., 1962 (Feb.), 10 pp.*

The data in this report confirm conclusively the existence of an inverse relationship between chronological age upon entry into ATC training and school and later job performance.

- 62-4 *Sonotropic effects of commercial air transport sound on birds. J. J. Swearingen, and S. R. Mohler, 1962 (Mar.), 5 pp.*

Repeated difficulties experienced by certain turboprop aircraft with regard to startling ingestion may be, in part, due to the sonotropic effects of various frequencies for these small birds. Suggestive observations are discussed and possible remedies provided.

- 62-5 *Prediction of energy cost of treadmill work. P. F. Iampietro, and R. Goldman, 1962 (Apr.), 4 pp.*

The utilization of the treadmill as an instrument to determine physical fitness has become a widespread activity. Certain considerations relative to the interrelations between rate,

- load and incline are reported for the utilization of those conducting these studies on airmen.
- 62-6 ***Human tolerances.*** B. Balke, 1962 (Apr.), 15 pp.
The ultimate limitations in flight performance and in future civil air carrier equipment are limitations imposed by what may be termed "human tolerances." The first effort by airline personnel to determine the most desirable crew composition and methods of selection, with respect to the Supersonic Transport, have been based, in part, upon this report (see the paper by Mr. J. G. Brown of United Airlines, ASME-AHGT-84, March 1963).
- 62-7 ***Failure of rearward facing seat-backs and resulting injuries in a survivable transport accident.*** A. H. Hasbrook, and J. C. Earley, 1962 (Apr.), 11 pp.
Rearward facing seats are generally superior to forward facing seats with respect to impact survival. However, improperly installed aft facing seats can be hazardous. As a result of this report, all Military Air Transport Service aircraft were checked, and corrections made to all aft facing seats found improperly installed.
- 62-8 ***Toxic hazards in aerial application.*** P. W. Smith, 1962 (Apr.), 8 pp.
The Civil Aeronautics Board has provided all of its field accident investigators with copies of this comprehensive study of the toxic hazards in aerial application activities. In addition, the major organizations involved in crop dusting have requested copies of this report, and are utilizing the recommendations made in it.
- 62-9 ***Evacuation pattern analysis of a survivable commercial aircraft crash.*** A. H. Hasbrook, J. D. Garner, and C. C. Snow, 1962 (May), 10 pp.
This study provides facts on the reasons for the failure of all occupants to evacuate a survivable jet aircraft accident. The major U. S. airlines have utilized the report, including its utilization as a textbook in crew emergency training courses.
- 62-10 ***Problems in aerial applications: I. Some biochemical effects of lindane and dieldrin on vertebrates.*** J. W. Daugherty, D. E. Lacey, and P. Korty, 1962 (May), 6 pp.
Investigation of the relatively unknown biochemical effects of organic insecticides is conducted at CARI. It is projected that these studies will result in preventive, protective, and therapeutic measures which will decrease the morbidity and mortality rates in the field of aerial application. The investigation of the chlorinated hydrocarbon insecticides lindane and dieldrin is discussed in this report.
- 62-11 ***Tactile communication.*** G.R. Hawkes, 1962 (May), 7 pp.
The use of tactile communication in aviation is relatively unexploited for situations when visual and auditory stimuli reach the saturation point. The report suggests possibilities in this regard plus the possibility of transmitting emergency warning signals.
- 62-12 ***The effects of simulated altitude on penetrating eye injuries.*** J. R. Dille, N. L. Newton, and J. F. Culver, 1962 (May), 5 pp.
Air may exist in the human eye following injury or surgery. The effects of aerial flight, at reduced barometric pressure, upon these conditions are reported and guidelines are given for evaluating these cases for transportation by aircraft.
- 62-13 ***Kinematic behavior of the human body during deceleration.*** J. J. Swearingen, A. H. Hasbrook, R. G. Snyder, and E. B. McFadden, 1962 (June), 8 pp.
Lethal structures of present aircraft seating and cockpit arrangements are revealed by correlating crash injuries with kinematic data. Specific data for the use of aeronautical design engineers are provided, and are of

significance in particular to the future SST and lightplane designs, plus all other planes now on the drawing board.

- 62-14 *Determination of centers of gravity of man.* J. J. Swearingen, 1962 (Aug.), 37 pp.

During abrupt decelerations, the occupant tends to spin around his center of gravity. Consequently, the design of shoulder harnesses and other restraint systems must take this information into consideration. This report has provided design engineers with the requisite facts for consideration.

- 62-15 *The visual perception of size and distance.* W. C. Gogel, 1962 (July), 19 pp.

The perception of the size of objects and the depth between them is important in aviation. The importance of perception of absolute distance, convergence of the eyes, and accommodation is challenged. A different mechanism, the "adjacency principle," is proposed as the key process in judging distance visually.

- 62-16 *Absolute identifications of cutaneous stimuli varying in both intensity level and duration.* G. R. Hawkes, 1962 (Sept.), 6 pp.

This report discusses the effects of spacing, intensity, and duration of the stimuli as well as immediate knowledge of results and experience, upon the amount of information that can be transmitted by cutaneous communication. The implications have a bearing on tactile communication processes.

- 62-17 *Manipulation of arousal and its effects on human vestibular nystagmus induced by caloric irrigation and angular accelerations.* W. E. Collins, 1962 (Oct.), 12 pp.

The results of several experiments, in which methods were used to control the psychological attitude of the subject during disorientation-producing stimulation, are reported here. Active

mental work (such as occurs during instrument flying) produces a heightened responsivity of the nystagmus (involuntary eye flicks to and fro which blur vision). The study bears directly upon IFR vertigo problems.

- 62-18 *Effect of increased venous pressure on renal hemodynamics.* L. B. Hinshaw, C. M. Brake, P. F. Iampietro, and T. E. Emerson, Jr. 1962 (Oct.), 12 pp.

Pressure in the renal vein is increased during changes in body posture, congestive heart failure, and, relatively, in shock and low blood pressure. The resultant effects upon the kidney blood flow and urine composition are poorly understood, yet are important to the physical and laboratory evaluation of airmen.

- 62-19 *A case of survival of extreme vertical impact in seated position.* R. G. Snyder, 1962 (Oct.), 15 pp.

Emerging from these studies is the fact that the outer limits of human impact survival are considerably greater than was heretofore recognized. The implications for crash impact survival are of the greatest significance.

- 62-20 *Civil Aeomedical Research: Responsibilities, aims, and accomplishments.* S. R. Mohler, 1962 (Oct.), 18 pp.

A comprehensive survey of the Civil Aeromedical Research program of the FAA is provided, along with documented instances of specific contributions made to air safety.

- 62-21 *An improved method for determining the efficiency of crew and passenger oxygen masks.* E. B. McFadden, J. W. Raeke, and J. W. Young, 1962 (Nov.), 16 pp.

A method of determining oxygen mask leakage is evaluated. This method successfully determined the deficiencies in a newly-designed passenger oxygen mask which was subsequently discarded.

- 63-1 *The development of reversible hematuria and oliguria following elevation of renal venous pressure.* T. E. Emerson, Jr., L. B. Hinshaw, C. M. Brake, and P. F. Iampietro, 1963 (Jan.), 5 pp.
- This type of research is aimed toward helping the FAA to develop more accurately the aeromedical standards regarding proteinuria in airmen applicants. There is some disparity in this area at present, as evidenced by the fact that postural proteinuria is considered disqualifying by the U. S. Air Force, but not so by the FAA Aviation Medical Service.
- 63-2 *Resume and index of reports of the Civil Aeromedical Research Institute 1961-1962.* S. R. Mohler, and R. J. Dille, 1963 (Feb.), 6 pp.
- This resume and index provides a ready reference for use by those engaged in civil aviation and related activities. A descriptive statement of each CARI report published in 1961 and 1962 is presented.
- 63-3 *Observations on the elicitation of secondary and inverted primary nystagmus from the cat by unilateral caloric irrigation.* W. E. Collins, 1963 (Feb.), 11 pp.
- The findings are related to adaptation of the vestibular system and provide a basis for a theoretical framework of vestibular adaptation to disorientation-producing stimulation.
- 63-4 *Problems in aerial application: II. Effects of chlorinated hydrocarbons on substrate-linked phosphorylation.* J. W. Daugherty, D. E. Lacey, and P. Korty, 1963 (Mar.), 5 pp.
- The mechanism of the harmful effects of toxic substances on the performance of aerial application personnel lies at the cellular level. Effective field detection of early toxicity and the application of sound preventive methods can only be achieved following an understanding of the biochemical mechanisms involved.
- 63-5 *Neural control of the ciliary muscle.* C. E. Melton, Jr., 1963 (Mar.), 11 pp.
- "Space myopia" and "night myopia" will be encountered by civil aircraft pilots with increasing frequency as newer and faster aircraft (e.g., the supersonic transport) become operational. This report explains the neural mechanisms involved in these conditions.
- 63-6 *A simple field test for the assessment of physical fitness.* B. Balke, 1963 (Apr.), 8 pp.
- A 15 minute "best-effort" run can be utilized as a substitute for a standard laboratory work capacity test. The run constitutes a satisfactory assessment of the potentially available functional reserves in personnel directly involved in operations of general, commercial, and military aviation.
- 63-7 *Relation of earphone transient response to measurement of onset-duration.* J. V. Tobias, and L. A. Jeffress, 1963 (Mar.), 3 pp.
- Measurements of the transient response of PDR-8 earphones indicate that the onset-duration of auditory stimuli can be revised downward to 0.8 ms. Results provide cautions in evaluating the output characteristics of commonly used earphones with short- or single- transient inputs.
- 63-8 *Calibration of an electronic counter and pulse height analyzer for plotting erythrocyte volume spectra.* J. M. McKenzie, P. R. Fowler, and P. J. Lyne, 1963 (Mar.), 8 pp.
- Certain studies of blood samples drawn from large numbers of airmen are hampered by the lack of rapid and efficient means of obtaining quantitative data on red cells. The calibration technique reported here permits a greater degree of accuracy and speed in measuring cell volume spectra than is presently available with conventional techniques.

- 63-9 *Studies of air loads on man.* J. J. Swearingen, and E. B. McFadden, 1963 (May), 8 pp.

Data obtained in three different studies related to measurement of forces on the body due to air movement are summarized. The effects of short duration blast forces on personnel seated or standing at various distances from openings during pressure loss, blast forces necessary to disorient the body from numerous positions, effects of clothing on the drag forces, and measurements of forces and moments on the body during wind tunnel tests are discussed and compared.

- 63-10 *The perception of depth from binocular disparity.* W. C. Gogel, 1963 (May), 10 pp.

An investigation of the importance of so-called "monocular cues" upon the depth perception resulting from binocular cues was carried out in a visual alley. Results provide information concerning visual cues encountered by the pilot in a "landing-strip" situation.

- 63-11 *"In vivo" measurement of total gas pressure in mammalian tissue.* M. T. Lategola, 1963 (July), 7 pp.

An in vivo method for the quantitative estimation of total gas pressure in mammalian tissue is described. This technique is of value to rapid decompression studies concerning high altitude flight.

- 63-12 *The mitigation of physical fatigue with "spartase".* F. Nagle, B. Balke, R. V. Ganslen, and A. W. Davis, 1963 (July), 10 pp.

An evaluation was made of the effects of the drug "spartase" on work capacity before and after episodes of physically fatiguing exercises. Results indicate that the drug is effective in mitigating physical fatigue in untrained individuals engaging in strenuous work such as that engaged in by flight controllers and many other aviation personnel.

- 63-13 *Primary, secondary, and caloric nystagmus of the cat following habituation to rotation.* W. E. Collins, 1963 (July), 19 pp.

A study was made of adaptation of vestibular responses to angular accelerations and of generalization of this adaptation to other disorienting stimulation. Findings indicate a need for the establishment of appropriate testing techniques for the analysis of vestibular function in air- or space-vehicle crew members. Responses to a clinical stimulus may not give an accurate index of the start of adaptation to angular accelerations.

- 63-14 *Nystagmus responses of the cat to rotation and to directionally equivalent and non-equivalent stimuli after unilateral caloric habituation.* W. E. Collins, 1963 (Aug.), 10 pp.

The questions of habituation to disorientation-producing stimulation and of subsequent transfer of adaptation were investigated. Data obtained concerning specificity of direction of response-reduction parallel observations of a relationship between directional preponderance of nystagmus in certain pilots and their choice of direction in "rolling" their aircraft.

- 63-15 *Human survivability of extreme impacts in free-fall.* R. G. Snyder, 1963 (Aug.), 29 pp.

Human deceleration tolerances were studied through case histories of survivors of extremely abrupt impacts in free-falls, including a large number of individuals who fell from aircraft in flight. A detailed analysis of factors found to affect survivability in free-fall impacts is made.

- 63-16 *Mechanisms of action of the insecticide endrin.* T. E. Emerson, Jr., C. M. Brake, and L. B. Hinshaw, 1963 (Aug.), 15 pp.

Cardiovascular effects of endrin insecticide are obscure, and pose a problem in crop dusting operations. Experiments were carried out to in-

- investigate the insecticide's effects and suggested mechanisms of action are proposed.
- 63-17 *Application of a "relative" procedure to a problem in binaural beat perception.* J. V. Tobias, 1963 (Aug.), 8 pp.
In hearing, the existence of the "binaural beat" phenomenon indicates a binaural interaction for timing information. This study, using a new technique, provides a means for extending the range over which listener can obtain timing information by means of binaural beats.
- 63-18 *Experimental evaluation of work capacity as related to chronological and physiological aging.* B. Balke, 1963 (Sept.), 6 pp.
Evidence for the potential value of regular physical exercise in reversing the process of physiological aging is advanced. Observations concerning the importance of physical training for persons frequently under great mental and psychological strain and tension (such as air traffic control personnel) are presented.
- 63-19 *A central factor in pure tone auditory fatigue.* J. S. Wernick, and J. V. Tobias, 1963 (Sept.), 6 pp.
Central factors (mental states) during prolonged noise are shown to affect the sensitivity of the ear to sounds. Ear sensitivity is greater after a noise period if subjects have not been required to perform alerting tasks during that period.
- 63-20 *The visual perception of spatial extent.* W. C. Gogel, 1963 (Sept.), 11 pp.
A visual alley which approximates a landing field was used to test the "size-distance invariance hypothesis" of making depth judgments. Equations generated from the hypothesis do not allow a simple predictive system of depth perception in the air-strip situation. The data suggest other equations so that depth judgments may be more readily predicted.
- 63-21 *Inflight loss of consciousness, a case report.* P. C. Tang, and J. R. Dille, 1963 (Sept.), 12 pp.
A case of inflight vertigo and loss of consciousness in a private pilot, flying alone, is presented. This case illustrates the threat to aviation safety posed by loss of consciousness due to nervous disorders.
- 63-22 *The mechanisms of intrarenal hemodynamic changes following acute arterial occlusion.* L. B. Hinshaw, B. B. Page, C. M. Brake, T. E. Emerson, Jr., and F. D. Masucci, 1963 (Oct.), 24 pp.
An investigation was undertaken to evaluate the effects upon the kidney of stresses encountered in aviation, such as acute hypoxia and explosive decompression. The study provides one answer to the question concerning the degree of temporary or permanent damage to the kidney under these forms of stresses by undertaking an analysis of phenomena operating following temporary renal vascular occlusion.
- 63-23 *The effects of a tranquilizer on body temperature.* E. A. Higgins, P. F. Iampietro, T. Adams, and D. D. Holmes, 1963 (Oct.), 5 pp.
Results show that a tranquilizer has little effect on internal body temperature during exposure to normal temperature conditions. However, an impairment of heat loss and heat conservation mechanisms occurred during changes in environmental temperature (thermal stress). Use of the tranquilizers in the latter situation may thereby affect performance.
- 63-24 *Central nervous system effects of chronic exposure to organophosphate insecticides.* J. R. Dille, and P. W. Smith, 1963 (Oct.), 7 pp.
Two cases are reported in which persistent CNS changes were noted in aerial applicator pilots after chronic exposure to organophosphate insecticides. The symptomatology, the basis for these symptoms and EEG changes, and their reversibility are discussed.

- 63-25 *A method for the measurement of physiologic evaporative water loss.* T. Adams, G. E. Funkhouser, and W. W. Kendall, 1963 (Oct.), 15 pp.

The precise measurement of evaporative water loss is essential in establishing an index of emotional stress of the type that is frequently encountered in various aviation situations demanding great mental alertness and application. This report describes a technique for measuring local sweat responses which is accurate, relatively inexpensive, and highly stable.

- 63-26 *Acute and chronic effects of the insecticide endrin on renal function and renal hemodynamics.* D. A. Reins, D. D. Holmes, and L. B. Hinshaw, 1963 (Oct.), 9 pp.

Chronic and acute effects of the insecticide endrin on renal function were studied. Results of the study provide information concerning insecticide poisoning during aerial application.

- 63-27 *The flammability of lip, face and hair preparations in the presence of 100% oxygen.* J. R. Dille, C. R. Crane, and G. E. Pendergrass, 1963 (Nov.), 5 pp.

Examination was made of possible hazards created by the combination of the widespread use in aviation of high concentrations of oxygen and the common practice of using hydrocarbon preparations on the lips, face, and hair.

- 63-28 *Size cues and the adjacency principle.* W. C. Gogel, 1963 (Nov.), 8 pp.

A study of visual cue systems operative in flight and landing situations is presented. The perception of relative depth from size cues is explained through the "adjacency principle."

- 63-29 *Task-control of arousal and the effects of repeated unidirectional angular acceleration on human vestibular responses.* W. E. Collins, 1963 (Nov.), 26 pp.

Adaptation of human vestibular responses to disorientation-producing

stimulation during the performance of attention-demanding tasks was investigated. Results of the study provide information relative to questions of spatial orientation which have been of interest in aviation medicine since World War I.

- 63-30 *Biomedical research studies in acceleration.* R. G. Snyder, J. Ice, J. C. Duncan, A. S. Hyde, and S. Loverett, Jr., 1963 (Dec.), 3,072 pp.

A comprehensive bibliography of biomedical research studies in acceleration, impact, weightlessness, vibration, and emergency escape and restraint systems is presented.

- 63-31 *Problems in air traffic management: IV. Comparison of pre-employment, job-related experience with aptitude tests as predictors of training and job performance of air traffic control specialists.* D. K. Trites, and B. B. Cobb, Jr., 1963 (Dec.), 11 pp.

An examination of problems in air traffic management is presented. A study of over 700 air traffic control trainees revealed that different kinds of pre-employment, and job-related experience had differential value for the prediction of training performance.

- 63-32 *Mechanism of autoregulation in the intact kidney.* L. B. Hinshaw, T. E. Emerson, Jr., and C. M. Brake (With the assistance of M. S. Brown, and F. D. Masucci), 1963 (Dec.), 12 pp.

Man in flight may encounter environmental conditions which markedly affect renal hemodynamics. This study serves to reveal the important links between intrinsic-extrinsic controlling mechanisms in renal hemodynamics operative in man during conditions of stress.

- 63-33 *Work tolerance: Age and altitude.* D. B. Dill, S. Robinson, B. Balke, and J. L. Newton, 1963 (Dec.), 8 pp.

An investigation was made of work capacity as a function of age and altitude. The maximum capacity for oxygen intake declined with age, both at high altitude and at sea level.

- 63-34 *Effects of some tranquilizing, analeptic and vasodilating drugs on physical work capacity and orthostatic tolerance.* R. V. Ganslen, B. Balke, E. E. Phillips, and F. Nagle, 1963, (Dec.), 8 pp.

Serious incidents and fatal accidents may be precipitated by emotional indifference to suddenly arising problems or as a consequence of delayed circulatory responses during flight maneuvers. In this study attempts were made to explore effects of tranquilizing and analeptic drugs, and results raise a question about the safety of people engaged in the operation of aircraft when "sedated" by certain of these drugs.

- 63-35 *Human factors aspects of lightplane safety.* R. G. Pearson, 1963 (Dec.), 13 pp.

Aircraft accident investigation and aeromedical research efforts are related for the purpose of clarifying research needs. Programs of biomedical and human engineering research as they relate to lightplane safety are described.

Tech. Pub.

- No. 1 *Annotated bibliography of recently translated material. I.* W. E. Collins, J. V. Tobias, M. J. Capps, and M. E. Allen, 1963 (Aug.), 8 pp.

An annotated bibliography of translations of foreign-language research articles in the field of aviation medicine is presented.

- 64-1 *Studies on aging in aviation personnel.* A. E. Wentz, 1964 (Aug.), 12 pp.

Investigative work on clinical aspects of aging in aviation personnel is being conducted in the cardiovascular, neurological, pulmonary, vision and auditory, and the biochemical systems. Behavioral tasks are incorporated in the individual survey. Subjects for studies are selected from aviation personnel. Significant numbers for each 10-year age group will be examined annually for buildup of individual profiles. Consecutive studies should develop techniques for rating

physiological aging in individuals; for evaluating and detecting pathological states at earliest age; and to aid in formulating physical standards by physiological rather than chronological age, in aviation personnel.

- 64-2 *The effect of physical conditioning on an individual before and after suffering a myocardial infarction.* J. Naughten, B. Balke, and F. Nagle, 1964 (Jan.), 10 pp.

This report deals with the value of a regular program of physical conditioning in the prevention of clinically manifest coronary artery disease. The need for such a program might be especially great in individuals employed in a relatively sedentary occupation requiring little strenuous physical activity but great mental alertness.

- 64-3 *The gradational step test for assessing cardiorespiratory capacity: An experimental evaluation of treadmill and step test procedures.* F. Nagle, and B. Balke, 1964 (Jan.), 12 pp.

The definite need for an objective and practical test of cardiorespiratory adaptive capacity exists in aviation medicine. As a result of this study a suitable device and a feasible testing procedure for the assessment of functional adaptive capacity have evolved.

- 64-4 *Cardiovascular health status, age, and psychological performance.* W. Spieth, 1964, 8 pp.

Psychological performance tests and a series of elaborate research tests were administered to more than 600 pilots and air traffic controllers, in addition to the standard legally-prescribed physical examination for aviation medical certification. Cardiovascular disease was found to be associated with slow, and to a lesser extent, poor performance. It is suggested that much of the typical downward trend of performance with age is a reflection of cardiovascular diseases rather than of aging per se.

- 64-5 *Current status of clot dissolution therapy.* K. M. Moser, 1964, 8 pp.

The threat of venous and arterial thromboembolism is a constant companion of virtually every practicing physician, including those engaged in aviation medicine. Clot dissolution using fibrinolytic agents is a promising approach to the treatment of thromboembolic disease, particularly peripheral venous and arterial occlusion. The present report considers the concept of fibrinolytic therapy, the available agents, and problems surrounding application of the agents. Limitations of these preparations are discussed.

- 64-6 *Unsuspected neurologic disease in aviation personnel: Survival following seizures in flight.* J. H. Seipel, and A. E. Wentz, 1964, 7 pp.

The problem of the early detection of neurological disease in aviation personnel is serious because of the possibility of the sudden and catastrophic incapacity that may result from such disease. Case histories illustrating important facets of neurological disease, its etiology, and its management are presented. Cases presented were selected from those of a large number of airmen with neurological problems bearing on aviation medical certification.

- 64-7 *Chronic thrombotic obstruction of major pulmonary arteries.* V. N. Houk, C. A. Hufnagel, J. E. McClenathan, and K. M. Moser, 1964, 14 pp.

Reported is a case of chronic massive thromboembolic occlusion of major pulmonary arterial branches successfully treated with embolectomy and endarterectomy. The historic features, physical signs and pathophysiologic alterations which form the basis for the diagnosis of this disorder are reviewed.

- 64-8 *Cardiopulmonary consequences of pyrogen-induced hyperpyrexia in man.* K. M. Moser, R. B. Perry, and P. C. Luchsinger, 1964, 9 pp.

Detailed cardiopulmonary studies were carried out in ten male subjects free

of overt cardiopulmonary disease before and at four intervals after intravenous injection of a pyrogenic lipopolysaccharide extract of gram-negative bacilli. The data indicate that the degree of temperature elevation cannot be used as a reliable guide to degree of cardiac or respiratory alteration induced by a pyrogen reaction. It is concluded that the acute cardiopulmonary burdens imposed by a pyrogen reaction may be of sufficient magnitude to promote decompensation in patients with compromised cardiac or respiratory function.

- 64-9 *Duration of spiral aftereffect as a function of retinal size, place, and hemiretinal transfer.* S. L. Freud, 1964, 7 pp.

A large number of studies have been performed on the diagnostic application of the spiral aftereffect (SAE) as a test for organic brain damage. Review of the clinical literature reveals that distance from the subject to the spiral and the objective spiral size often vary from experiment to experiment. Results of the present study on the underlying physiological mechanisms indicate that size of retinal image is a potent variable, and it is proposed that a standard spiral size and testing distance be introduced for clinical use.

- 64-10 *Duration as a measure of the spiral aftereffect.* S. L. Freud, 1964, 4 pp.

Duration is a convenient measure of the spiral aftereffect, (SAE) and has been used as an index of SAE strength in tests for organic brain damage. The purpose of the present study was to examine the reliability of duration as an SAE strength index. The results for 10 subjects indicate that duration is both a highly reliable measure and a simple monotonic function of exposure time.

- 64-11 *Effect of glyceryl trinitrate on pulmonary vasculature of anesthetized dogs.* A. L. Pinkerson, P. A. Kot, and D. M. Knowlan, 1964, 3 pp.

The effect of glyceryl trinitrate (GTN) on the pulmonary vasculature was tested

in animals with an intact circulation, with a mechanical pump substituted for the left ventricle and with the pump bypassing the right ventricle. The results of the experiments indicate that the direct effect of GTN in the pulmonary circuit is to decrease pulmonary vascular resistance. The observed increase in pulmonary artery pressure in intact subjects following the injection of GTN is due to increased pulmonary blood flow.

- 64-12 *Comments on progress in ballistocardiographic research and the current state of the art.* W. R. Scarborough, 1964, 24 pp.

Presented is an overview of the field of ballistocardiographic (BCG) research, including a discussion of instrumental considerations, the physiological significance of the ballistocardiogram, and a review of clinical investigations. The BCG shows much promise in the detection of cardiac problems in people under 40 years of age.

- 64-13 *The size cue to visually perceived distance.* W. C. Gogel, 1964 (Jan.), 25 pp.

This study deals with the size cue as an important determiner of apparent distance, and provides information relative to distance judgments required in flight situations. Results indicate that both perceived size and retinal size are involved in both the relative and familiar size cue to relative depth.

- 64-14 *Effects of bilateral caloric habituation on nystagmus responses of the cat.* M. J. Capps, and W. E. Collins, 1964 (Sept.), 22 pp.

Adaptation to disorientation-producing stimulation and subsequent generalization of adaptation were examined. Results have possible application to the assessment of performance capabilities during disorienting stimulation.

- 64-15 *Design and performance characteristics of a mechanically driven vestibular stimulator.* W. E. Collins, and H. W. Huffman, 1964 (Oct.), 9 pp.

In order to determine response characteristics of mammalian vestibular systems, the systems so important for spatial orientation in aviation, a device to provide programs of controlled angular accelerations is required. The rotation device described in this report was designed to meet this need.

- 64-16 *Aviation Medicine Translations: Annotated bibliography of recently translated material. II.* J. V. Tobias, W. E. Collins, and M. E. Allen, 1964 (Oct.), 10 pp.

An annotated bibliography of translations of foreign-language research articles of importance in aviation medicine is presented. The publication provides researchers with information which might otherwise be unavailable and prevents duplication of translation costs and efforts.

- 64-17 *The physiological locus of the spiral aftereffect.* S. L. Freud, 1964, 8 pp.

As an Archimedes spiral is rotated, an illusory motion of swelling or shrinking, depending on the direction of rotation, will be perceived. If, after the spiral is rotated, it is stopped and the subject looks at a stationary spiral, an aftereffect of motion (the spiral aftereffect—SAE) opposite to that produced by the moving spiral will be seen. The SAE can be used as a device to produce vertigo and as a diagnostic test for organic brain damage in aeromedical evaluations. Results of the present study indicate that a major central component exists for the SAE.

- 64-18 *Physiological recording from pilots operating an aircraft simulator.* C. E. Melton, Jr., 1964 (Sept.), 11 pp.

Ten physiological records were obtained from each of six pilots performing simulated flight problems in a C-97 aircraft simulator. The techniques developed during this study are suitable for physiological recording from subjects in the work situation.

- 64-19 *The recognition of strictly posterior myocardial infarction by conventional scalar electrocardiography.* J. K. Perloff, 1964, 13 pp.

Accurate diagnosis of posterior myocardial infarction is important in aviation personnel. This study was undertaken in order to determine whether the standard scalar electrocardiogram contains sufficient information to permit the recognition of strictly posterior myocardial infarction. Differential diagnoses are presented along with characteristic manifestations which should facilitate recognition of the infarction.

- 64-20 *Aviation medical papers and reports: A bibliography.* Aviation Medical Library, FAA, 1964, 90 pp.

Presented is a bibliography of aviation medical papers and reports compiled by the Aviation Medical Library of the Federal Aviation Agency, listing those papers and reports available in the Federal Aviation Agency Headquarters Library. Included in the bibliography are three indexes: A Subject Index, an Author Index, and a Title Index. This bibliography is a result of the long-felt need for an easily accessible record of work done under CAA, FAA, and their forerunners in the field of aviation medicine.

- 65-1 *Auditory fatigue: Influence of mental factors.* M. J. Capps, and W. E. Collins, 1965 (Jan.), 4 pp.

Results of this study hold especially meaningful implications for aviation procedures, as auditory fatigue was found to be greater when subjects engaged in attention-demanding tasks during exposure to noise than when they merely relaxed.

- 65-2 *Effects of several mental tasks on auditory fatigue.* W. E. Collins, and M. J. Capps, 1965 (Jan.), 6 pp.

The relative influence of different "mental tasks" upon amount of auditory fatigue was examined. Findings have bearing upon the importance of atten-

tion factors with regard to central fatigue and signal detectability in aviation personnel.

- 65-3 *Medical services at airports.* H. L. Reighard, 1965, 14 pp.

Presented is the report of a study to determine (1) the nature and extent of medical service desirable at large airports; (2) the manner in which such services are now met, and (3) the means by which these services might be provided in a more effective and comprehensive manner. The study was conducted at a civil airport reasonably representative of large municipal airports.

- 65-4 *Cranial impedance plethysmography — Rheoencephalography as a method of detection of cerebrovascular disease.* J. H. Seipel, S. A. R. Ziemnowicz, and D. C. O'Doherty, 1965, 19 pp.

Rheoencephalography, the monitoring of cerebral blood flow by impedance methods, is potentially applicable to the diagnosis of any condition that may significantly affect intracranial blood flow. It therefore should be a valuable technique for the clinical evaluation of aviation personnel. It appears that the method may yield otherwise unobtainable data; however, the authors conclude that further investigation is warranted.

- 65-5 *Biomedical survey of ATC facilities: 1. Incidence of self-reported symptoms.* G. T. Hauty, D. K. Trites, and W. J. Berkeley, 1965 (Mar.), 48 pp.

From 6 enroute and 6 terminal air-traffic-control facilities selected on the basis of differences between shift-rotation schedules and high traffic volume, journeymen and assistant controllers served as volunteer subjects to complete a biomedical inventory daily for a period of 90 consecutive days. The inventory elicited information relating to health, morale, behavioral habits, and side effects of medications. Of 300 subjects, 209 fulfilled the daily reporting requirements of the 90 days. For one

index of information — stress-related symptoms — analyses of the data revealed that: (1) Facilities differed significantly in the incidence of reported symptoms, but these differences could not be attributed to shift-rotation schedules; and (2) 8 hours or less between 2 successive shifts occasioned the highest incidence of reported symptoms, and more than 24 hours between shifts the next highest.

- 65-6 *Biomedical survey of ATC facilities: 2. Experience and age.* G. T. Hauty, D. K. Trites, and W. J. Berkley, 1965 (Mar.), 21 pp.

From 6 enroute and 6 terminal air-traffic-control (ATC) facilities selected on the basis of differences between shift-rotation schedules and high IFR traffic volume, journeymen and assistant controllers served as volunteer subjects to complete a biomedical inventory daily for a period of 90 consecutive days. The inventory elicited information relating to health, morale, behavioral habits, and side effects of medications. Of 300 subjects, 209 fulfilled the daily reporting requirements. For one index of information — stress-related symptoms—analyses of the data revealed that: (1) The greater the number of years of ATC experience and the greater the age of the subject, the higher the incidence of symptoms reported; and (2) of these two relationships, the higher (more significant) one was that involving years of ATC experience.

- 65-7 *Human factors of emergency evacuation.* S. R. Mohler, J. J. Swearingen, E. B. McFadden, and J. D. Garner, 1965 (Sept.), 18 pp.

A summary of evacuation experience since WW II in civil tests and actual civilian airliner accidents is presented. Results of recently conducted aeromedical research into means of affording the more rapid evacuation of high-density piston and jet passenger aircraft are given. Recommendations are made rel-

ative to air crew training programs and future aircraft design considerations.

- 65-8 *Hydraulic model studies on ULF ballistocardiograms: Elimination of pulse wave velocity in stroke volume computation.* A. G. W. van Brummelen, W. R. Scarborough, and W. K. T. Josenhans, 1965, 5 pp.

A hydrodynamic model of the systemic circulatory system was mounted on an ultralow-frequency ballistocardiograph (ULF-BCG). The relationship between stroke volume and ballistocardiographic amplitude was investigated for different pulse wave velocities. It was found that the amplitude of the displacement ballistocardiogram is strongly correlated to stroke volume; however, the relationship is highly dependent on pulse wave velocity. There is also a combination of amplitude measurements that gives a strong correlation between amplitude and stroke volume but which is independent of pulse wave velocity. The findings are of significance to techniques of early diagnosis and prognosis of heart disease.

- 65-9 *Pupillary movement during acute and chronic fatigue.* O. Lowenstein, R. Feinberg, and I. Loewenfeld, 1965, 20 pp.

The pupillary waves of dilation and contraction which accompany the waves of arousal and drowsiness in the tired individual are one of the direct physiologic expressions of cortico-diencephalic activity present at a particular moment. Their quantitative, objective nature, their sensitivity, and the ease with which they can be recorded accurately make them an ideal indicator of tiredness. As a practical test, they can be used as an index of the fatiguing effect of environmental conditions, such as those occurring in flight situations.

- 65-10 *ATC system error and appraisal of controller proficiency.* W. F. O'Connor, and R. G. Pearson, 1965 (July), 32 pp.

System-oriented suggestions for the design of an air-traffic-control (ATC)

incident-reporting procedure aimed at maximizing the amount of corrective feedback to the ATC system are presented. Included is a philosophy of corrective and punitive action relative to controller involvement in an incident. Recommendations are included for the design of incident-report forms and incident chronology and of a checklist to be used in periodic appraisal of controller performance. Emphasis is given in format design to use of systems and human function, rather than regulatory and procedural terminology. Implementation and data-analysis techniques are also discussed.

- 65-11 *The equidistance tendency and its consequences: Problems in depth perception.* W. C. Gogel, 1965 (Apr.), 13 pp.

The equidistance tendency is the tendency for objects in the field-of-view to appear at the same distance as each other. The strength of this tendency is inversely related to directional separation. The evidence for the existence of the tendency and for its ability to modify perceived depth resulting from size or other cues is reviewed. The tendency is discussed as a necessary factor in the understanding of several visual illusions and similar phenomena.

- 65-12 *Survival of high-velocity free-falls in water.* R. G. Snyder, 1965 (Apr.), 12 pp.

Forty-four cases of free-falls survived by individuals impacting water environments under conditions of high velocity (50 to 116 ft/sec, corrected for aerodynamic drag) have been intensively investigated and analyzed. Ages varied from 7 to 80 years and the study included 34 males and 10 females. The falls occurred in 17 states, mainly over a 3-year period, and included all known survivals of water impact at over 50 ft/sec. It was found that the most survivable body orientation, by a factor of five to seven, is a feet-first impact in which critical velocity for human survival was approximately 100 ft/sec. No correla-

tion of velocity with degree of injury was found, although distinct patterns of injury were shown. Factors believed to influence human survival tolerances are discussed.

- 65-13 *Fatigue in aviation activities.* S. R. Mohler, 1965 (Mar.), 15 pp.

This report gives a comprehensive survey of work in the field of aviation fatigue. Both work still in process and earlier work are surveyed. The nature of fatigue is discussed, along with factors that contribute to both physical and mental fatigue. Topics covered include flight-time limitations, indicators of excessive fatigue, new developments related to intercontinental flights and Forest Service flights, and the author's detailed comments and recommendations.

- 65-14 *The angle of shoulder slope in normal males as a factor in shoulder harness design.* C. C. Snow, and A. H. Hasbrook, 1965 (Mar.), 3 pp.

In order to establish criteria for more comfortable shoulder-harness design, this study was conducted to determine the angle of slope of the top of the shoulders where poorly fitting shoulder harness may produce discomfort and, occasionally, functional impairment through compression of the underlying soft tissues. The mean shoulder-slope angle (measured from the vertical body axis) of normal males based on this study of 55 Air Traffic Service trainees is 67.5° with a standard deviation of 5.0°.

- 65-15 *Ballistocardiography: A bibliography.* W. R. Scarborough. Joint NASA-FAA publication, 1965, 46 pp.

The publication of this bibliography fulfills a long-standing requirement for a comprehensive and retrospective collection of references on a subject that is of particular interest to medical investigators and cardiovascular physiologists engaged in aerospace studies. The bibliography consists of a compilation of references to papers, reports, mono-

graphs, reviews and books, of both domestic and foreign origin, which appeared during the period 1877-1964.

- 65-16 ***Pilot fatigue: Intercontinental jet flight I. Oklahoma City — Tokyo.*** G. T. Hauty, and T. Adams, 1965 (Mar.), 22 pp.

Following 3 consecutive days of biomedical assessment in Oklahoma City, 6 healthy subjects were transported to Tokyo where assessments were made on alternate days throughout a period of 10 days. Subjects were then transported back to Oklahoma City, where assessments were made for 3 consecutive days. Mean data revealed that biological time had apparently shifted from Oklahoma City to Tokyo time within 3 days, and from Tokyo back to Oklahoma City time within 1 day. However, a profound range of individual differences was evident. The proficiency with which the subjects performed certain tasks was adversely affected to a substantial extent during the first day in Tokyo and, to a lesser extent, the first day of return to Oklahoma City.

- 65-17 ***Aviation Medicine Translations: Annotated bibliography of recently translated material. III.*** M. E. Allen, W. E. Collins, J. V. Tobias, and R. A. Crain, 1965 (Apr.), 16 pp.

An annotated bibliography of translations of foreign-language aviation medicine research articles is presented. The 26 listed entries are concerned with studies of general aviation medicine, periodicity, optokinetic nystagmus, vision, vestibular function, and physical science. Procedures for obtaining copies of the translations are included.

- 65-18 ***Adaptation to vestibular disorientation: I. Vertigo and nystagmus following repeated clinical stimulation.*** W. E. Collins, 1965 (May), 15 pp.

Exposure to repeated vertigo-producing stimulation in the laboratory resulted in a modification of the nystagmic eye response which differed depending upon

whether subjects were tested in total darkness or with opportunities for visual fixation. The response did not recover its initial form even after one month of rest. Sensations of vertigo declined for both "darkness" and "fixation" groups, but showed recovery after a one-month rest period. Complete suppression of disorientation is not readily achieved in spite of many exposures to laboratory vestibular stimulation.

- 65-19 ***Problems in air traffic management: V. Identification and potential of aptitude test measures for selection of tower air traffic controller trainees.*** B. B. Cobb Jr., 1965 (July), 9 pp.

A study of over 200 Terminal Air Traffic Control Specialists indicated that their training performance could be well predicted by pre-employment experience directly related to air-traffic control and a composite of four aptitude tests measuring: numerical ability, nonverbal abstract reasoning, ability to solve simplified air-traffic problems, and verbal abstract reasoning. With the exception of verbal abstract reasoning, which is both unique and important for the prediction of Terminal ATCS performance, the group of Civil Service Commission tests presently being used to select all ATCS trainees provides adequate measures of those aptitudes that this study has identified as most significant for the prediction of Terminal performance and is still appropriate for the selection of Terminal and Enroute trainees.

- 65-20 ***Tolerances of the human face to crash impact.*** J. J. Swearingen, 1965 (July), 24 pp.

Evaluation of the injury potentials of commercial airline seat structures, light-aircraft instrument panels, and other *deforming* structures requires data on forces that produce fractures, lacerations, or unconsciousness when applied to different parts of the face. Unconscious commercial passengers, although not seriously burned, may asphyxiate or burn to death in a few minutes. Data of

facial tolerances of living human heads and forces required to render unconsciousness were gathered. These data were checked by making a series of 45 cadaver head impacts against *deforming* structures. Results show that blows of as low as 30 to 40 g for 10 to 40 milliseconds will produce temporary unconsciousness. Maximum forces that may be tolerated without fracture during facial impacts are presented.

- 65-21 *Problems in air traffic management: VI. Interaction of training-entry age with intellectual and personality characteristics of air traffic control specialists.* D. K. Trites, 1965 (July), 12 pp.

Over 900 Enroute and Terminal Air Traffic Controller Specialist (ATCS) trainees were administered a large number of aptitude and personality tests. The relationships between performance scores and age at entry into training revealed that: (1) older trainees had lower scores than younger trainees on tests of immediate memory and non-verbal abstract reasoning; (2) older trainees had higher scores than younger trainees on tests of arithmetic and verbal ability; (3) in highly speeded aptitude tests, the type of test (e.g., arithmetic, vocabulary, etc.) apparently determined which group would have the higher scores; and (4) older trainees were more intellectually efficient, responsible, and tolerant than their younger classmates. Higher failure rates in the training of older individuals could be partially accounted for by age-related deficiencies in nonverbal abstract reasoning, by immediate memory for new and different material, and by the requirements to perform their job tasks rapidly and accurately.

- 65-22 *Problems in air traffic management. Part VII. Job and training performance of air traffic control specialists: Measurement structure and prediction.* D. K. Trites, M. C. Miller, and B. B. Cobb, Jr., 1965 (Apr.), 38 pp.

Training and job performance measures of several hundred Air Traffic Control Specialists representing different specialties revealed that training performance measures reflected (1) performance in training laboratories; (2) academic performance; and (3) instructors' opinions. In job performance, supervisors seemed to be evaluating (1) overall ATCS performance; (2) interpersonal orientation; (3) job orientation; (4) job potential; (5) job performance; and (6) emotional stability. In examining the predictability of job performance measures, evidence was elicited that (1) ATCS specialties differ in characteristics required for job performance; (2) Terminal supervisors more consistently evaluate their ATCS in comparison with Enroute supervisors; (3) opinions of ATCS training course instructors are the best predictors of subsequent job performance, and (4) aptitude tests, previous job-relevant experience, and age at entry into training are related to job performance but not at very high levels.

- 65-23 *Determination of centers of gravity of children, sitting and standing.* J. J. Swearingen, and J. W. Young, 1965 (Aug.), 16 pp.

The present seat belt used in commercial aviation is not a satisfactory restraint device for children 2 to 10 years of age.

To supply data for center-of-gravity design requirements, approximately 1,200 children (ages 5-18) were balanced on a specially designed machine. The center of gravity for small children sitting in an airline seat is located roughly 5 inches above the seat belt and explains why they slip out over the seat belt during crash decelerations. The center of gravity of small children in the standing position will be used in the design of flotation equipment.

- 65-24 *Adaptation to vestibular disorientation: II. Nystagmus and vertigo following high-velocity angular accelerations.* W. E. Collins, 1965 (Sept.), 10 pp.

On a daily basis, professional figure skaters expose themselves, without any apparent ill effects, to levels of vestibular stimulation which would induce vertigo, disorientation, and perhaps nausea in ordinary subjects. The present study indicates that, in the absence of visual cues, the skaters give relatively normal-appearing responses to caloric stimulation, passive rotation, and on-ice spins, and that they become disoriented and lose their balance while attempting to maneuver after spinning. These data show: that the human semicircular canals, without incurring damage, can withstand stimulation of a much higher order than previously supposed; that proposed training of pilots to overcome disorientation may result in adaptation that is specific to the training condition; that persons with considerable experience in vertigo-producing situations may still suffer adverse effects when visual references to the external world are not present; that in the absence of visual cues external to the aircraft, immediate reliance on instrument flight is essential.

- 65-25 *Latency of pupillary reflex to light stimulation and its relationship to aging.* R. Feinberg, and E. Podolak, 1965 (Sept.), 14 pp.

A method is described for measuring pupillary contraction latency period regardless of initial absolute pupil diameter. Pupillary contraction latency period was found to increase with age, as does original pupil size. A limited number of subjects with myopia coupled with mydriasis had relatively long latency periods. The technique is useful in the examination of processes associated with aging.

- 65-26 *Anthropometry of Air Traffic Control trainees.* C. C. Snow, and R. G. Snyder, 1965 (June), 14 pp.

This report presents the body measurements of 684 Air Traffic Control trainees enrolled in training programs conducted at the Federal Aviation Agency, Aeronautical Center at Oklahoma City between August 12, 1960 and June 30, 1961. It includes the means, standard deviations, coefficients of variation, percentiles and related statistics of sixty standard anthropometric and functional measurements. The survey was initiated in order to provide adequate criteria for improving the workspace design for the Air Traffic Controller and to provide anthropometric baseline data for future biometric and aging studies of Air Traffic Service personnel.

- 65-27 *Intrarenal hemodynamic changes following acute partial renal arterial occlusion.* C. M. Brake, D. Reins, and L. E. Wittmers, 1965 (Oct.), 13 pp.

The effects upon the kidney of stresses associated with aviation problems such as explosive decompression were examined. Partial renal artery occlusion, with a reduction in pressure to forty or fifty per cent of control or lower, resulted in a decrease in renal vascular resistance during the period of partial occlusion followed by a marked increase in resistance following release of the obstruction. Absence of an immediate decreased resistance following release of partial occlusion, suggests that dilation, autoregulation, and constriction (presence of constrictor substance(s)) are opposing forces during partial occlusion. Results exclude the participation of catecholamines in the constrictor response and suggest the elaboration of renin by the partially ischemic kidney.

- 65-28 *Phase shifts of the human circadian system and performance deficit during the period of transition: I. East-West flight.* G. T. Hauty, and T. Adams, 1965 (Dec.), 9 pp.

At periodic intervals throughout the biological day, biomedical tests were made for a week prior to jet flight to Manila, for 8 days of layover at Manila,

and for a week following return to the environment of origin. Data indicated: (1) Rapid translocation through 10 time zones effected a primary phase shift of circadian periodicity in several physiological functions. (Phase shifts for rectal temperature and heart rate were completed in approximately 4 days; palmar evaporative water loss took approximately 8 days.) (2) Return back to the environment of origin produced a phase shift which was completed within 1 day. (3) Reaction time tasks and subjective reports showed degradation during the primary period of transition and, to a lesser extent, during the period of transition occasioned by return to the environment of origin. (4) Duration of the decline in behavioral tests was much shorter than the lag time of physiological phase shifts.

- 65-29 *Phase shifts of the human circadian system and performance deficit during the periods of transition: II. West-East flight.* G. T. Hauty, and T. Adams, 1965 (Dec.), 24 pp.

At periodic intervals throughout the biological day, biomedical tests were made for a week prior to jet flight to Rome, for 12 days at Rome, and for a week following return to Oklahoma City. Data indicated: (1) Rapid translocation through 7 time zones effected a primary phase shift of circadian periodicity for rectal temperature and heart rate (time required for completion of phase shift was 4-6 days and 6-8 days, respectively). (2) Return back to the environment of origin also produced a phase shift in rectal temperature which, for 2 subjects, was completed in less than 5 days and, for the 2 remaining subjects, was not completed within 5 days. (3) Increase in subjective fatigue occurred during the primary period of transition and following return to the environment of origin but psychological performance on several tests was not impaired during either period. (4) Duration of subjective

fatigue was shorter than the time lag of the physiological phase shifts.

- 65-30 *Phase shifts of the human circadian system and performance deficit during the periods of transition: III. North-South flight.* G. T. Hauty, and T. Adams, 1965 (Dec.), 22 pp.

At periodic intervals throughout the biological day, biomedical tests were made for a week prior to jet flight to Santiago, for 12 days at Santiago, and for a week following return to Washington, D. C. From a comparison of these data with those obtained from East-West and West-East flights, the following conclusions were derived: (1) While East-West and West-East flights produced a primary phase shift of circadian periodicity manifested by certain physiological functions, the North-South flight did not. (2) All 3 flights produced a significant increment of subjective fatigue. (3) Significant impairment of psychological test performance occurred only in the East-West flight.

- 65-31 *Development and evaluation of a radar air traffic control research task.* R. G. Pearson, C. E. Hunter, and G. L. Neal, 1965 (Dec.), 103 pp.

A system is described in which various elements of the radar air traffic controller's tasks can be simulated. Automatic programming tests such operator skills as vigilance, problem solving, monitoring, and reaction time. Electronic scoring of subject responses is accomplished automatically. Approximately eight hours of practice are required for subjects to achieve a stable level of proficiency on subtasks. Suggestions are made for use of the system in human factors research on ATC operator problems and for modification as a training device. Technical appendices include description of a complete problem script and of the electrical engineering design characteristics of the programming-data acquisition system.

- 65-32 ***Problems in depth perception: A method of simulating objects moving in depth.*** W. C. Gogel, and H. W. Mertens, 1965 (Dec.), 15 pp.

Equations were developed for the simulation, on a screen, of the movement of an object or surface toward or away from an observer by the movement of a positive photographic transparency of the object or surface away or toward a point source. The general case was examined for simulating objects in which the distance of the observer from the screen

was constant, but not necessarily equal to the distance of the point source from the screen. Equations were developed relating the dimensions of the rigid transparency to those of the rigid simulated object. These equations, under a wide variety of conditions, permit the simulation of surfaces or objects moving in depth at any designated linear speed or acceleration with respect to the observer. As such, they provide a finely controlled laboratory approach for the examination of problems of depth perception in aviation.

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