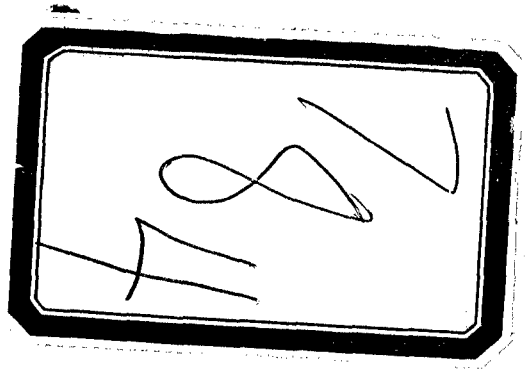

BIBLIOGRAPHY ON AEROMEDICAL RESEARCH WITH ABSTRACTS

Joan C. Robinette, Editor

Aerospace Medical Laboratory

DECEMBER 1959

WRIGHT AIR DEVELOPMENT DIVISION

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BIBLIOGRAPHY ON AEROMEDICAL RESEARCH WITH ABSTRACTS

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2,800 — November 1960 — 10-460

FOREWORD

This bibliography compiles abstracts of Technical Documentary Reports issued by the Aerospace Medical Laboratory, Wright Air Development Center, from 1957 through 1959.

The major areas comprising the Laboratory's mission are behavioral sciences, biomedical sciences, and engineering as related to human factors in aircraft design and survival equipment. The reports documenting the first two areas are subdivided into more specialized categories: engineering psychology, training psychology, bioacoustics, biophysics, and physiology.

The reports are available to Government contractors and Department of Defense agencies from the Armed Services Technical Information Agency (ASTIA), Arlington Hall Station, Arlington 12, Virginia. Organizations not affiliated with the Government may purchase the majority of the reports listed from the Office of Technical Services (OTS), Department of Commerce, Washington 25, D. C. Requests for reports should be directed to either of these organizations as applicable.

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BEHAVIORAL SCIENCES

ENGINEERING PSYCHOLOGY

(1)
TN 52-106 March 1957

Hunt, Darwin P.; Warrick, Melvin J. (Antioch College & AML)

ACCURACY OF BLIND POSITIONING OF A ROTARY CONTROL

The accuracy of blindly positioning a bar type rotary control knob was investigated. Four subjects made right-handed and left-handed blind settings with a tapered and with a parallel-sided knob. The range of the setting errors was approximately 28° for the tapered knob and 22° for the parallel-sided knob. With the tapered knob the average difference between right-handed and left-handed settings was approximately sixteen degrees; whereas with the parallel-sided knob the average difference was less than two degrees. In general, the right-handed settings were more accurate between the nine and twelve o'clock positions and the left-handed settings more accurate between the twelve and three o'clock positions. For accuracy of blind setting, it appears that a parallel-sided bar knob is superior to a tapered bar knob and that, for ease of accurate setting, the spacing between discrete positions of the control should be approximately 35° or more.

Project & Task: 7182-71514 Contract No. AF 18(600)-50
ASTIA No. AD-142291

(2)
TN 56-485 November 1956

Learner, David B.; Alluisi, Earl A. (Ohio State University)

COMPARISON OF FOUR METHODS OF ENCODING ELEVATION INFORMATION WITH COMPLEX LINE-INCLINATION SYMBOLS

Four groups of 20 subjects each decoded elevation information that had been encoded by the use of 4 different coding ensembles. Each group worked with a different 1 of the 4 codes. The 4 ensembles were called the binary, the decimal, the wheel, and the clock codes. The first 3 of these were based on the same type of stimulus symbol (8 lines radiating at 45° angular separations from a central hub), whereas the clock code was based on a stimulus symbol consisting of a circle and 2 lines, each of which could be discretely positioned to correspond to the hour positions of a clock. The decimal and clock codes were decoded with greater speed than the wheel and binary codes. The wheel code was inferior to the other 3 codes with regard to accuracy. These data are regarded as another demonstration of S-R compatibility effects, and of the importance of considering both the alphabet and the readout in selecting an S-R ensemble for encoding any specific type of information. The results were obtained with subjects who had undergone less than 1 hr of practice in reading the specific code used by their group, but with displays that were oriented in fixed positions relative to the subjects. Although the 2 best of the 4 codes employed should undergo further study before being used for encoding elevation information, the data indicate that they are psychologically feasible for such use.

Project & Task: 7192-71596 Contract No. AF 33(616)3612
ASTIA No. AD-110547

(3)
TN 56-499 December 1956

Alluisi, Earl A.; Webb, Ilse B. (Ohio State University)

FOUR-PLACE LOGARITHMS TO THE BASE 2 OF THREE-DIGIT NUMBERS

Four-place logarithms to the base 2 are presented in tabular form for the three-digit numbers between 1.00 and 9.99. The table can be used to obtain the logarithmic values of all three-digit numbers between 0.00000100 and 9,990,000. The logarithms-base-2 are tabled in a form convenient to use, since all values are placed on two facing pages.

Project & Task: 7192-71596 Contract No. AF 33(616)3612
ASTIA No. AD-110581

(4)
TN 56-541 December 1956

McGuire, J. C.; Kraft, C. L. (Ohio State University)

REACTION OF TEN RADAR AIR TRAFFIC CONTROLLERS TO OPERATIONAL USE OF THE TELEX TWIN-MICROPHONE, BOOMTYPE, SPLIT HEADSET

A light-weight, twin-microphone, boom-type, split headset developed by the TELEX Company was used during a four-hour period of radar air traffic control by each of ten controllers. After each controller had used the TELEX headset, he was asked to complete a questionnaire designed to obtain his reactions to the headset as compared with the standard "earmuff" headset. The responses made to the questionnaire by the ten controllers are summarized in this report. Some deficiencies were noted, and these deficiencies in the TELEX headset are reported along with some recommendations for the corrections necessary. In general, the reactions of the controllers were very favorable to the lightweight TELEX headset.

Project & Task: 7192-71596 Contract No. AF 33(616)3612
ASTIA No. AD-110691

(5)
TN 56-542 December 1956

McGuire, J. C.; Kraft, C. L. (Ohio State University)

REACTION OF SIX RADAR AIR TRAFFIC CONTROLLERS TO CONFERENCE CONTROL OF TARGETS SIMULATED ON A 19-INCH HORIZONTAL DISPLAY

The question of the relative merits of horizontal versus vertical display of radar information for the purpose of controlling air traffic has become urgent in the effort to develop an optimum air traffic control system. Most radar air traffic controllers have not had experience with conference control on a horizontal display. In order to provide some such experience and to obtain some qualitative reactions to a horizontal control system, a preliminary test was carried out using a 19-inch Navy VN horizontal plotter. The purpose was not to evaluate the VN, but rather to obtain controller reaction to the horizontal method of control. Pickup and feeder controller positions only were used. Nine simulated targets provided the traffic load for the six experienced radar air traffic controllers who each controlled in each position at different times. Two-thirds of the operators were favorably inclined toward the horizontal-type display. All stated that coordination was easier with the horizontal than with the vertical display; this apparently resulted from standing beside, rather than sitting in front of, the indicator. All preferred a display larger than 19 inches for horizontal-display operation. The favorable opinions expressed indicate the necessity for an early experimental evaluation of horizontal versus vertical control procedure.

Project & Task: 7192-71596 Contract No. AF 33(616)3612
ASTIA No. AD-110692

(6)
TN 57-260 March 1958

Sabeh, Raymond; Jorve, W. R.; Vanderplas, J. M. (Aerospace Medical Laboratory)

SHAPE CODING OF AIRCRAFT INSTRUMENT ZONE MARKINGS

This technical note reports a study designed to determine whether aircraft instrument zone markings could be profitably shape-coded rather than color-coded as presently specified in Technical Order No. 05-1-17. Seven shapes, selected on the basis of a preliminary survey, were displayed on simulated instrument dials. Seventy college students and seventy rated Air Force officers were asked to indicate by a forced-choice matching technique their preferences for association of each of the shapes with each of seven stated aircraft functional categories. The results indicate the feasibility of using the seven selected shapes as instrument zone markings. Further consideration of the shapes is suggested.

Project & Task: 7186-71549
ASTIA No. AD-118343

(7)
TN 57-305 September 1957

Debons, Anthony; Chiles, W. D. (Aerospace Medical Laboratory)

THE EFFECTS OF COLD ON PSYCHOPHYSICAL WEIGHT JUDGMENTS: A METHODOLOGICAL STUDY

A methodological experiment was carried out to study the problems involved in obtaining psychophysical weight-judgment functions at lowered ambient temperatures. Weight judgments were obtained from two subjects by the method of constant stimulus differences with the temperature of the weights at 70°, and 0° and at -25° Fahrenheit. Although the limens did not display any sort of trend (either as a function of learning or as a function of temperature), the sensitivities were significantly less at 0° (both jubjects) and at -25° (one subject) than at 70°. In addition, the sensitivities displayed an adaptation and/or a learning effect as a function of repeated exposure to cold. The phi-gamma hypothesis was found to be tenable under the conditions of the present experiment.

Project & Task: 7193-71615
ASTIA No. AD-131004

(8)
TN 57-424 April 1958

McGuire, J. C.; Kraft, C. L. (Ohio State University & AML)

A RADIO CHANNEL LOAD DISTRIBUTION ANALYZER FOR USE IN STUDIES OF COMMUNICATIONS FLOW IN RADAR APPROACH CONTROL CENTERS

The Radio Channel Load Distribution Analyzer described in this report was developed in order to obtain measures of frequency of use and time-in-use of radio channels in a radar approach control center. Essentially, the device consists of 110 impulse counters arranged in pairs. One of the counters of a pair records the frequency of use of a channel; the second counter records cumulative time-in-use of the same channel. Microswitches associated with the radio channel key switches of each AN/FSA-4 control console serve to select the appropriate counting circuits. Operation of the radio transmitter footswitch by a controller causes the Radio Channel Load Distribution Analyzer to record the tramsmission of a message by that controller on a given channel as well as the cumulative duration of all transmissions.

Project & Task: 7192-71596
ASTIA No. AD-142243 Contract No. AF 33(616)-3612

(9)
TN 57-431 July 1958

Howland, Daniel (Ohio State University)

AN INVESTIGATION OF THE PERFORMANCE OF THE HUMAN MONITOR

Two groups of 12 subjects each were required to monitor for a continuous 4-hr. period four voltmeters which presented readings that were randomly assigned from a normal distribution with a mean of 12 v. and a standard deviation of 2 v. Subjects were instructed to note shifts in the mean of each voltmeter reading. One group kept a written log of the voltmeter readings; the other group kept no records. Experimental data included number of correct reports of shift of the mean, number of false reports of shift, and time taken to report a change in the mean. Results indicate that subjects who kept a log made fewer false reports of shift, more often failed to report a true shift in the mean, and took more time when they did report a true shift. The difference in performance between subjects who kept a log and those who did not increased during the last 2 hr. of the observation period.

Project & Task: 7192-71596 Contract No. AF 33(616)-3612
ASTIA No. AD-142259

(10)
TN 58-29 April 1958

Kraft, C. L.; McGuire, J. C. (Ohio State University & AML)

SUITABILITY OF THE INSTALLATION OF THE ILLUMINATION SYSTEM FOR THE EXPERIMENTAL RAPCON CENTER

An experimental RAPCON Center is being installed in Bldg. 206, WPAFB. Specifications for the illumination system for this RAPCON were prepared by the Laboratory of Aviation Psychology of The Ohio State University and are included as an Appendix to this report. The installation of the lighting system was evaluated and found to comply with specifications in most respects. Exceptions are: (a) the extreme weight of the special luminaires gives rise to a safety hazard, (b) the blue paint of the upper walls and ceiling has too low a reflectance, and (c) the external doors require more effective light seals.

Project & Task: 7192-71596 Contract No. AF 33(616)-3612
ASTIA No. AD-151148

(11)
TN 58-37 June 1958

Simons, J. C.; Richardson, W. H.; (Aerospace Medical Laboratory)

AIRBORNE EQUIPMENT FOR RECORDING AIRCRAFT FLIGHT PATHS

The Aero Medical Human Factors Airborne Laboratory, C-131B 53-7823, has been equipped to continuously record pitch, bank, heading, altitude, airspeed and other flight path parameters. This report reviews the capability and reliability of the recording systems and establishes general operating and calibrating procedures for the equipment. A general description of the systems research capability including methods of scoring, data reduction and experimental controls is given.

Project 7189
ASTIA No. AD-131058

(12)
TN 58-210 September 1958

Biagioni, J. R.; McKelvey, R. K.; Mousted, J. F. (Aerospace Medical Laboratory)

A RADAR MAPPING DISPLAY SIMULATION AND PERFORMANCE RECORDING DEVICE

The apparatus described in this report simulates the essential display features of a fixed antenna radar mapping system. It is designed to record operator speed and accuracy in identifying various targets on strip-map display materials. Features of general interest include flexibility of application to a variety of problems involving similar materials, convenience and reliability of operation under conditions of extended use, and a high yield of data pertinent to performance. A number of structural and operating innovations have been incorporated and are described in detail for the benefit of those who may wish to employ them in their own research and development programs.

Project & Task: 7184-71580
ASTIA No. AD-203396

(13)
TN 58-292 January 1959

Vanderplas, J. M.; Debons, Anthony; Crannell, Clarke (Aerospace Medical Laboratory)

LUMINANCE AND "EXPECTANCY" AS DETERMINANTS OF RESPONSE TIME TO A LIGHT SIGNAL

This report describes an experimental evaluation of two factors affecting the speed with which human operators respond to a warning light. The two factors studied were the intensity of the light signal, and the delay interval between an auditory alerting signal and the light signal. Four levels of intensity of the signal light and seven variations from a standard ten-second delay between the auditory signal and the light signal were used. Speed of response was found to be related positively to the intensity of the signal light and to be affected by deviations from the expected standard ten-second delay.

Project & Task: 7184-71580
ASTIA No. AD-209390

(14)
TN 59-261 July 1959

Rohles, F. H., Jr.; Coy, R. (University of Dayton & AML)

A MINIATURIZED OPERANT CONDITIONING CHAMBER FOR BEHAVIORAL RESEARCH IN THE UPPER ATMOSPHERE

A miniaturized operant conditioning chamber for a mouse was designed for behavioral research in the upper atmosphere. It requires the animal to press a lever on a fixed ratio schedule of 25:1 for 20 minutes out of every 6 hours for food reward. The chamber utilizes mechanical power, and response recording is compatible with telemetry systems. The unit is 3.5 inches in diamter, 6.5 inches long, and weighs approximately 2.25 pounds.

Project & Task: 7184-71587 Contract No. AF 33(616)6264

(15)
TN 59-299 August 1959

Rohles, F. H., Jr.; Grunzke, M. E. (University of Dayton & AML)

SUSTAINED OPERANT BEHAVIOR IN MICE

A male C-57 mouse was trained to respond on a fixed-ratio-100 operant reinforcement schedule for 20 minutes out of every 6 hours. The subject was isolated and performed on this schedule for food reward for 96 hours. The feeder in the operant chamber was disconnected and performance was observed under extinction conditions without food for an additional 96 hours. The results of the study showed that the response rate during the 96-hour reinforced session was high and consistent from work period to work period. Meaningful performance data were also obtained under extinction conditions. The study illustrates a potential method of obtaining meaningful behavioral information from animals in orbital flight.

Project & Task: 7184-71587 Contract No. AF 33(616)-6264

(16)
TN 59-442 July 1959

Ross, D. A. (Aerospace Medical Laboratory)

COMPREHENSIBILITY EVALUATION OF TECHNICAL MANUALS

From a search of the literature pertaining to technical writing a list of desirable features of Maintenance Technical Manuals was compiled. This list formed the basis of a checklist used to survey comprehensibility features of six representative manuals. The relative merit of each manual was evaluated by the way it measured up against the "ideal" traits in the checklist. Specific deficiencies were reflected by low scores on single items or sections of the checklist. The results indicate that the manuals evaluated in this study were prepared with deficiencies in number sufficient to bring about a serious reduction in their comprehensibility. The conclusion is reached that Air Force Technical Manuals on maintenance are generally deficient in comprehensibility.

Project & Task: 7184-71586
ASTIA No. AD-228235

(17)
TR 55-471 October 1958

Conover, Donald W.; Kraft, Conrad (Ohio State University)

THE USE OF COLOR IN CODING DISPLAYS

The objectives of this study were to (a) determine the maximum number of absolutely identifiable hues, (b) construct an "equal-discriminability" scale of hues, and (c) to validate the scale on an independent population sample. Surface colors from the Munsell fifty-hue series of colored paper provided the stimulus material. Results indicate that for practical coding purposes a maximum of five to eight colors can be used, with the exact number depending on the viewing condition and the proportion of the population that must read the code without error. Advantages and disadvantages of color in coding are discussed; current engineering practice is reviewed. A color plate gives examples of 8, 7, 6, and 5-category codes. Specifications for these codes are given in the text.

Project & Task: 7192-71596 Contract No. AF 33(616)-3612
ASTIA No. AD-204214

(18)
TR 56-71

August 1956

Kraft, Conrad L. (Ohio State University)

A BROAD BAND BLUE LIGHTING SYSTEM FOR RADAR APPROACH CONTROL CENTERS: EVALUATIONS AND REFINEMENTS ON THREE YEARS OF OPERATIONAL USE

This report contains detailed specifications for the installation and use of a Broad Band Blue (selective chromatic) lighting system for radar approach control centers. This lighting system provides (a) sufficient light for scope observers, maintenance personnel, and other individuals to work simultaneously in the operations room, thus allowing 24 hour-a-day operations, and (b) an element of flexibility that allows the scope observer the option of increasing his visual sensitivity, through dark adaptation, without decreasing the light provided for the work of other personnel. In this report the varied requirements of a lighting system are stated, the relevant psychophysiological and physical facts are summarized, the Broad Band Blue and alternative lighting systems are critically evaluated, and the results of extensive operational suitability tests of the proposed system are given. As a ready reference the essential characteristics of the Broad Band Blue system are summarized.

Project & Task: 7192-71596
ASTIA No. AD-118090

Contract No. AF 33(616)-43;
Continuation of Contract No.
AF 33(616)-3612

(19)
TR 56-172

November 1956

Ely, Jerome H.; Thomson, Robert M.; Orlansky, Jesse (Dunlap and Associates, Inc.)

DESIGN OF CONTROLS

Operator performance in most man-machine systems is directly affected by the design of the controls. A number of human engineering recommendations are presented which consider various aspects of control selection and design. Three principal topics are discussed: selection of proper control, general control design considerations, and detailed design recommendations for specific controls. Acceptable controls for 5 types of system response are tabulated as well as the characteristics of 9 common controls. These include the hand push button, the foot push button, the toggle switch, the rotary selector switch, the knob, the crank, the handwheel, the lever, and the pedal. Other tabulations cover the advantages and disadvantages of various types of coding, and general standards for color coding.

Project & Task: 7180-71501
ASTIA No. AD-118023

Contract No. AF 33(616)-419

(20)
TR 56-488

October 1956

Van Cott, Harold P.; Altman, James W. (American Institute for Research)

PROCEDURES FOR INCLUDING HUMAN ENGINEERING FACTORS IN THE DEVELOPMENT OF WEAPON SYSTEMS

This report is intended to suggest systematic procedures for the human engineering of developmental weapon systems. A brief discussion of man-machine systems and the role of human engineering in their design is followed by a design schedule. This schedule suggests at what points and in what ways human engineering should be accomplished. Following the design schedule, procedures that may be used to assess and solve human engineering problems are suggested. Finally, human capabilities and limitations are discussed from the point of view of the man as a system component.

Project & Task: 5(7-7192) - 71633
ASTIA No. AD-97305

Contract No. AF 33(616)-2986

(21)
TR 56-524

October 1957

McRuer, Duane T.; Krendel, Ezra S. (Control Specialists, Inc.)

DYNAMIC RESPONSE OF HUMAN OPERATORS

Effort was made to provide a suitable mathematical description of human operator dynamic response. The operations which were of primary concern were those in which continuous closed-loop control is exerted in a visual input, manual output tracking situation subjected to excitation by random appearing forcing functions. The basic input was a relatively large body of data on human response characteristics from earlier investigation and concurrent experiments. All of the quasi-linear describing data obtained, including some presented for the first time, were curve fitted to yield simple mathematical expressions which are descriptive of the linear position of the operator's response for varying machine dynamics and forcing functions. The available remnant data statistics were correlated with task difficulty and an attempt was made to explain the remnant in terms of 3 logically distinct sources, each resulting in equivalent operator output power. On the basis of these correlations and explanations the dynamic behavior of the operator for the class of tasks considered appeared definable. However, the definition becomes increasingly questionable as the demands of the tasks decrease.

ASTIA No. AD-110693

Contract No. AF 33(038)-10420
Contract No. AF 33(616)-2804 and
Contract No. AF 33(616)-3610

(22)
TR 56-526

December 1956

Williams, Alexander C., Jr.; Adelson, Marvin; Ritchie, Malcolm L. (University of Illinois & Stavid Engineering, Inc. & Hughes Aircraft Co.)

A PROGRAM OF HUMAN ENGINEERING RESEARCH ON THE DESIGN OF AIRCRAFT INSTRUMENT DISPLAYS AND CONTROLS

"This report outlines a program for research on the human factors in the design of aircraft instrument displays and controls. The effort is intended as a source for the Air Force Integrated Display-Integrated Control Program. It consists of three major approaches. One of these concerns the development of a cockpit for a particular airplane or type of airplane. Another consists in the development of principles of man-machine relations applicable to many types of aircraft. The third approach is that of working with formal conceptual systems which may have some promise of general applicability to the cockpit problems."

Project & Task: 6190-71753
ASTIA No. AD-110424

Contract No. AF 33(616)-3000 and
Contract No. AF 33(616)-2219

(23)
TR 56-532

November 1956

Bradley, James V. (Aerospace Medical Laboratory)

EFFECT OF GLOVES ON CONTROL OPERATION TIME

Five types of control (push buttons, toggle switches, knobs, horizontally operable levers, and vertically operable levers) were operated at room temperature with the hand clothed as follows: no glove, wool glove, double glove, i.e.; leather glove over wool glove. Operation time was measured. The double glove was superior to both the bare hand and the wool glove for operation of the toggle switch. The wool glove was inferior to both the bare hand and the double glove for operation of the push button and was inferior to the bare hand for operation of the vertically operable lever. The wool glove was slightly (but nonsignificantly) inferior to the other two hand conditions for all of the other possible comparisons. There was considerable indication that, though not statistically significant, this effect may be real. It was concluded that the effect of gloves on control operation time depends upon the type of glove worn, the physical characteristics of the control, and the type of control operation required. Specifically, it was concluded that the wool glove is inferior to the bare hand and double glove because of the tendency of wool to slide on the types of smooth material of which controls are constructed and possibly because of the failure of wool knit gloves to fit tightly; and that the double glove is superior in those situations where a rapid control operation may injure an insufficiently protected hand. Since the double glove was never significantly inferior to the bare hand, and since there seemed to be a real but small disadvantage to the wool glove in all cases, it was concluded that, for the type of control operations investigated, the only justification for wearing the wool glove instead of the double glove would be that the double glove was too warm.

Project & Task: 7182-71514
ASTIA No. AD-110565

(24)
TR 57-14 January 1957

Jerison, Harry J.; Wing, Shelley (Antioch College & AML)

EFFECTS OF NOISE AND FATIGUE ON A COMPLEX VIGILANCE TASK

Nine volunteer male undergraduates with normal hearing were required to monitor three clocks simultaneously, and to respond when a clock hand made a double jump (about once a minute for each clock). During a two-hour control session in quiet (83 db) no significant changes in performance level occurred. During another two-hour session in which the noise level was raised to 114 db after the first half hour, the subjects' performance was not changed significantly until the final half hour of work. At that time performance in the noise session became significantly worse. These results support conclusions based on other types of monitoring tests, that performance involving vigilance suffers under noise stress. They do not confirm findings of other laboratories that a monitoring task worked at for two hours in relative quiet will show measurable performance decrements.

Project & Task: 7193-71614 Contract No. AF 18(600)-50
ASTIA No. 110700

(25)
TR 57-21 February 1957

Schipper, Lowell M.; Kraft, Conrad L.; Smode, Alfred F.;Fitts, Paul M. (Ohio State University)

THE USE OF DISPLAYS SHOWING IDENTITY VERSUS NO-IDENTITY

This experiment is the sixth in a series of system studies dealing with various aspects of air traffic control. The purpose was to evaluate the performance of one-controller system with (a) an omnipresent clock-type identity code vs. (b) the absence of identity on the radar blips. Data were recorded for a total of 1267 movements of jet-type fighter and bomber aircraft, which were accepted at four different entry rates. Four experienced USAF controllers served in the study. No conflicts (failures to achieve specified separations) and no missed approaches occurred at the slowest input rate (an average of one aircraft every 105 sec.), but a few conflicts and go-arounds (about 3%) occurred at the higher rates. This decrease in safety margin was most notable at the highest rate (60 sec. separation). Measures of fuel consumption and control time in moving aircraft through a zone of 50-mi. radius around the GCA gate showed significant superiority for the system that provided aircraft identity. An analysis of communications from controllers to pilots also showed small reductions in communications under the identity condition.

Project & Task: 7192-71596 Contract No. AF 33(616)-3612
ASTIA No. AD-110713

(26)
TR 57-54 March 1957

Jerison, H. J.; Crannel, C. W.; Pownall, Dorothy (Miami University & AML)

ACOUSTIC NOISE AND REPEATED TIME JUDGMENTS IN A VISUAL MOVEMENT PROJECTION TASK

Two hundred volunteer male students, working individually, were required to follow a moving target visually and to imagine the continuing movement of the target after it disappeared. When the target was believed to have reached a crosshair the subject squeezed a trigger. The task, which simulates radar observation of a target obscured by visual noise, was repeated ten times. The effect of different acoustic noise programs on the accuracy of judgment was assessed, and the independence of successive judgments was determined. The performance measure was judgment time, the interval between the disappearance of the target and the subject's response. It was found that a noise program in which it was quiet (78db) during the visible portion of the target's course and noisy (110 db) when the target disappeared gave longer judgment times relative to those obtained under control conditions of quiet or noise throughout. The opposite program of "noise then quiet" was not differentiated from the control conditions. It was also found that judgment times became longer in succeeding trials under all four noise programs.

Project & Task: 7193-71614
ASTIA No. AD-118004 Contract No. AF 33(616)-2844

(27)
TR 57-63

March 1958

Cohen, Jerome; Dinnerstein, Albert J. (Antioch College)

A COMPARISON OF A LINEAR SCALE AND THREE LOGARITHMIC SCALES ON THE TIME FOR CHECK READING

Four circular dials, three with logarithmic scales and one with a linear scale, were compared on the basis of the exposure time required to read them. The results indicate that a linearly graduated scale is read faster than a highly asymetrical logarithmic scale. The inferiority of the highly asymetrical logarithmic scale is believed to be caused principally by the progressive changes in meaning of the graduation marks. Although linear scales are generally preferred to logarithmic scales, logarithmic scales are satisfactory providing the scale graduation marks retain their identity over the entire scale.

Project & Task: 7186-71545
ASTIA No. AD-118017

Contract No. AF 33(616)-3404

(28)
TR 57-64

May 1958

Cohen, Jerome; Dinnerstein, Albert J. (Antioch College)

FLASH RATE AS A VISUAL CODING DIMENSION FOR INFORMATION

An experiment was performed to determine the relationship between flash frequency of a light and the ability to correctly identify the various rates. This information is needed to make recommendations about flash rate as a stimulus dimension for the coding of information for visual displays. Ten subjects made absolute judgments of nine flash rates varying from one flash per four seconds to twelve per second. The rates were presented by a high intensity blue-white strobotron tube, masked to a point source. The main conclusion is that not more than five discriminable steps may be employed in coding information, so flash rate is a poor coding dimension in general. But if it is desirable to select a few flash rates for the presentation of information, they should be logarithmically spaced to be maximally discriminable.

Project & Task: 7186-71545
ASTIA No. AD-118018

Contract No. AF 33(616)-3404

(29)
TR 57-65

March 1958

Cohen, Jerome; Senders, Virginia L. (Antioch College)

THE EFFECTS OF ABSOLUTE AND CONDITIONAL PROBABILITY DISTRIBUTIONS ON INSTRUMENT READING III: A COMPARISON OF A LINEAR SCALE AND TWO SCALES WITH EXPANDED CENTRAL PORTIONS

The experiments were performed to compare the readability of both a sigmoid scale and a scale with an expanded central portion with the readability of a linear scale. The average reading error for each of the conditions was determined both in scale unit and degrees of dial circumference. The linear scale is significantly superior to the sigmoid for errors in degrees and in scale units, and the expanded scale equals the linear scale in all respects. The regular order is better than the random, affecting each scale and distribution by about the same amount.

Project & Task: 7186-71545
ASTIA No. AD-118019

Contract No. AF 33(616)-3404

(30)
TR 57-71 February 1957

Eriksen, C. W. (The Johns Hopkins University)

EFFECTS OF PRACTICE WITH AND WITHOUT CORRECTION UPON DISCRIMINATION LEARNING UNDER ABSOLUTE CONDITIONS.

The present report describes an investigation of the ability of "observers (O's)" to learn to discriminate among a series of stimuli under conditions of absolute judgment. Discrimination learning was determined as a function of the discriminability of the stimulus series and as a function of knowledge of errors. Two groups of six O's each made absolute judgments of six series of stimuli that differed in discriminability. Observers in the correction group were informed of the correct response after each judgment while O's in the non-corrected group were given no information as to their errors. The results show a clear improvement in discrimination with practice for all six stimulus series although the amount of gain with practice appeared to be inversely related to the discriminability of the stimulus series. It was further found that correction or knowledge of results contributed primarily to O's choice of responses and only in a minor way to his ability to discriminate among the stimuli. It was suggested that what O learns on this task is not to recognize individual stimuli as such but instead to establish a frame of reference for the series of stimuli as a whole.

Project & Task: 7192-71598 Contract No. AF 33(616)-2918
ASTIA No. AD-118027

(31)
TR 57-103 April 1957

Ritchie, Malcolm L.; Bamford, Harold E., Jr. (University of Illinois)

THE EFFECT UPON THE OUTPUT OF A COMPLEX MAN-MACHINE SYSTEM OF QUICKENING AND DAMPING A DERIVATIVE FEEDBACK DISPLAY

Mounting the gyroscopic turn indicator on the sloping panel of an all-weather interceptor resulted in negative quickening of the display indication. Experiments in an electronic flight simulator demonstrated the adverse effect of negative quickening and the favorable effect of positive quickening on the output of the man-machine system. Damping the motion of the indicator needle also improved performance. The optimum combination appears to be the quickening produced by 5° of gyro tilt plus 500% of normal damping. The findings are discussed in relation to a simplified model of the experimental man-machine system.

Project & Task: 6190-71573 Contract No. AF 33(616)-3000
ASTIA No. AD-118069

(32)
TR 57-117 April 1957

Ritchie, Malcolm L.; Baker, Charles A. (University of Illinois & AML)

PSYCHOLOGICAL ASPECTS OF COCKPIT DESIGN - A SYMPOSIUM REPORT

This report contains the papers and discussions of the WADC symposium on the Psychological Aspects of Cockpit Design, which was held October 24, 25, 1956. Seven papers were presented which represent in-service and contractor efforts in the Air Force and the Navy programs to improve flight instrumentation. In addition to these papers a panel discussion was held on each of three subjects: "Problems and Methods in Cockpit Research", "Problems and Methods of Whole-Panel Flight Evaluation", and "Whole-Panel Design Objectives to be met in Future Aircraft."

Project & Task: 6190-71573, 71556 Contract No. AF 33(616)-3000
ASTIA No. AD-118079

(33)
TR 57-130

April 1957

Debons, Anthony; Crannell, Clarke W. (Miami University & AML)

FACILITATING IDENTIFICATION OF AIRCRAFT BY USE OF REFLECTIVE MATERIAL

The Air Defense Command frequently requires interceptors to identify unknown aircraft at night. The unknown aircraft can be positively identified if the aircraft number is readable to the interceptor pilot. Determinations were made to assess the value of reflex-reflective material as a means for enhancing the readability of digits, the size and type utilized in aircraft identifications. The study compared performances for black, standard aircraft digits which were placed on a background of white paint, aluminum or reflex-reflective material, and for digits fabricated of reflex-reflective material and placed on a black background. Five horizontal lines of sight were used. These were at 90°, 60°, 40° and 18° to the surface viewed. Viewing distances were 144, 218, 330 and 500 feet. Data were collected for 13 subjects and under nighttime conditions. In these experiments the superiority of the reflex-reflective material as a background was demonstrated for all distances at the extreme viewing angles and for all viewing angles at the greater distances. When digits composed of reflex-reflective material and superimposed on black backgrounds were compared with black digits superimposed on reflex-reflective backgrounds, the reflex-reflective digits were found to be superior.

Project & Task: 7186-71551
ASTIA No. AD-118094

Contract No. AF 33(616)2844

(34)
TR 57-196

April 1957

Alluisi, Earl A.; Martin, Hugh B. (Ohio State University)

COMPARATIVE INFORMATION-HANDLING PERFORMANCE WITH SYMBOLIC AND CONVENTIONAL ARABIC NUMERALS: VERBAL AND MOTOR RESPONSES

It may sometimes be more economical to display numerical information not with the conventional Arabic numerals, but with symbolic numerals consisting of simple figures that are relatively easy to generate electronically. One such set of symbolic numerals (these were generated from an eight-element straightline matrix) was used in the present study along with a set of conventional numerals (AND-10400). The purpose of the study was to compare the information-handling performance of subjects in making verbal (number-naming) and motor (key-pressing) responses to the two sets of numerals. When verbal responses were made, the conventional numerals were found to be consistently superior in performance to the symbolic numerals. This was true whether performance was measured in terms of the amount of information transmitted per unit time, the time required for 100 responses, or the proportion of errors made. No such clear superiority was evidenced for either set of numerals when motor responses were made. It was suggested that this interaction of numeral type with response mode might be a stimulus-response compatibility effect resulting from use of the much-practiced ensemble of number-naming responses to conventional Arabic numerals. It was also hypothesized, considering the data of other investigators that perfor- with straight-line and angular figures should be superior to performance with conventional numerals under difficult or threshold-like viewing situations as, for example, in visibility studies.

Project & Task: 7192-71596
ASTIA No. AD-118160

Contract No. AF 33(616)-3612
Continuance of No. AF 33(616)-43

(35)
TR 57-201

June 1957

Christner, C. A.; Debeau, D. E.; Drozda, W. (Battelle Memorial Institute & AML)

THE DEVELOPMENT OF NEW METHODS OF MEASUREMENT FOR ASSESSING ELECTRONIC COUNTERMEASURES EFFECTIVENESS

This report summarizes the results of a psychological study program to develop methods of measurement of the effectiveness of electronic countermeasures. Methods are reported for characterizing the signal-masking properties of various countermeasures. Results are also reported for a validation study using the methods developed.

Title unclassified; report secret.

Project & Task: 7192-71595
ASTIA No. AD-118164

Contract No. AF 33(616)-3666

(36)
TR 57-205 May 1957

Bamford, Harold E., Jr.; Ritchie, Malcolm L. (Illinois University)

INTEGRATED INSTRUMENTS: A ROLL AND TURN INDICATOR

Measurements of the performance of nine Air Force pilots in simulated flight demonstrated an improvement in direction control when an integrated roll and turn indicator was substituted for the standard turn indicator. The finding is discussed in relation to a simplified model of the experimental man-machine system. Three principles of display design are offered by the authors in conclusion: a. the command effectiveness of a feedback display is increased by the distinct indication therein of control-induced components of the system output; b. the command effectiveness of a feedback display is increased by anticipatory indication therein of the feedback signal; and c. the interpretability of an instrument display is increased by the distinct indication therein of each aspect of the condition displayed.

Project & Task: 6190-71573 Contract No. AF 33(616)-3000
ASTIA No. AD-118170

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(37)
TR 57-206 April 1957

Jerison, Harry J.; Wallis, Ronald A. (Aerospace Medical Laboratory)

EXPERIMENTS ON VIGILANCE ONE-CLOCK AND THREE-CLOCK MONITORING

Two experiments on prolonged monitoring of Mackworth-type clocks are reported. In one experiment with thirty-six subjects a single clock was monitored. It was found that performance dropped from about ninety percent of the signals found to about fifty percent during the first half hour of work, and that the performance drop appeared to be continuous. In a second experiment, eleven subjects each monitored a panel of three clocks. Their performance curve appeared to be flat, but it seems likely that a rapid decrement from the 45 percent to the 27 percent level occurred during the first three minutes of work. These results are discussed in terms of the present state of knowledge about the human operator as a monitor and in terms of recommendations that have been made in the past concerning limitations of length of watches for monitors in order to maintain their efficiency.

Project & Task: 7193-71610 Contract No. AF 33(616)-3404
ASTIA No. AD-118171

(38)
TR 57-210 May 1957

Jenkins, W. L. (Lehigh University)

MEAN LEAST TURN AND ITS RELATION TO MAKING SETTINGS ON A LINEAR SCALE

This study was concerned with the least turn of a knob that can be made on a tactual-kinesthetic basis without visual guidance under various conditions of knob diameter, inertia, and friction; and also the influence of knob shape, position, and orientation on mean least turn and on the time to make settings on a linear scale. Mean least turn of less than one degree can be obtained under the most favorable conditions. With heavy friction and a small knob diameter, however, the value may rise above three degrees. Conditions other than knob diameter and friction have much less effect. Mean least turn is crudely related to adjusting time (time to make final adjustment) on a linear scale, but mean least turn is more sensitive to changes in conditions. Three interesting paradoxes in the data are: (1) Mean least turn is lower with knob positions to the left of normal, although in such positions the arm must be stretched across the body. (2) Mean least turn tends to be lower in the counterclockwise direction with right-hand operation and also with left-hand operation, instead of showing a mirror-image effect. (3) Both mean least turn and time for making settings on a linear scale are improved by wearing gloves when the knob diameter is small. This improvement disappears or is reversed when the knob diameter is large.

Project & Task: 7182-71512 Contract No. AF 33(616)-2850
ASTIA No. AD-118174

(39)
TR 57-222 April 1957

Erlick, Dwight E.; Hunt, Darwin P. (Aerospace Medical Laboratory)

EVALUATING AUDIO WARNING DISPLAYS FOR WEAPON SYSTEMS

There is a pressing need for evaluating the merits of audio signals as warning indicators in weapon systems. The scarcity of the literature and the lack of any critical evaluation of the major problems in this area have led to the compiling of this report.. Four major problem areas are discussed in terms of the variables that should be considered when evaluating and using audio warning displays. The problem areas discussed relate to the determination of the criticality of events, the human and equipment characteristics involved in the selection of audio warning displays and the task dimensions essential to evaluate audio warning displays. Operational and research implications are discussed for a two step audio warning display; the first step being designed to bring about detection, maintain attention, and identify a general category; the second, to isolate the specific malfunction within the category. Consideration is also given to a general program of research to evaluate some of the foregoing problems.

Project & Task: 7189-71570
ASTIA No. AD-118189

(40)
TR 57-270 September 1957

Gardner, J. F.; Lacey, R. L.; Seeger, C. M.; Wade, J. E. (Aerospace Medical Laboratory)

IN-FLIGHT COMPARISON OF PERFORMANCE ON A STANDARD USAF AND AN EXPERIMENTAL INSTRUMENT PANEL

Six USAF pilots each flew 48 Instrument Landing System approaches. Each pilot flew 24 approaches using a standard Air Force instrument panel and 24 approaches using an experimental panel that employed an aircraft reference type presentation that used the "principle of the moving part". For each series of 24 ILS approaches, half were flown using the ID-249 cross-pointer instrument, and half were flown using a Zero Reader instrument for primary glide path and localizer information. It was hypothesized that pilots would quickly adapt to this type of presentation and would perform better with the experimental panel than with the standard type presentation. Results were inconclusive and did not lend unqualified support to the above hypothesis. Pilots did not report any consistent difficulty in going from panel to panel. Pilots expressed a preference for the standard panel. Most favorable average scores consistently were made while flying the experimental panel when the Zero Reader was used for primary ILAS information.

Project & Task: 7189-71571
ASTIA No. AD-118255

(41)
TR 57-277 May 1957

Harter, George A.; Gain, Peter (Ohio State University)

AN ELECTRONIC TARGET SIMULATOR FOR USE WITH OPERATIONAL RADAR SURVEILLANCE SYSTEMS

An Operational Target Simulation (OTS) system for simulating targets and mixing them with "live" targets on operational PPI-type radar displays has been described. Three designs have been proposed. Each of the three was composed of an electronic target generator (of the type used in the OSU 30-target electronic radar ATC simulator) and the additional circuitry required to convert the rectangular-coordinate output signals of the target generator to polar-coordinate signals compatible with the video-type intelligence required for radar display. It was in the method used for the transformation of this information from rectangular to polar form that the three designs differed. The first design makes use of a carrier system to facilitate an all-electronic coordinate transformation. It has the advantage of providing the possibility of packaging a small, self-contained, target simulator unit. The second design makes use of analog-computer elements to achieve the necessary coordinate transformation. This design should be especially applicable to laboratory situations in which a standard analog computer is available, in which extreme versatility is important, and in which only a few simulated targets need be displayed. The third design makes use of elements of the Moving Radar Targets Generator, Device 15-J-1c, to form an OTS system using the electronic target generator of the OSU-ATC simulator. Although not as efficient as the first or second designs, this third design has the advantage of making use of elements of the 15-J-1c that may be available at the present time. It could be used as an interim OTS system; it should provide adequate radar target simulation for ATC training and limited experimental purposes. A prototype unit based on the third design was constructed and tried out using the operational AN/CPN-4 radar at the RAPCON Center, Wright-Patterson Air Force Base, through collaboration of the Directorate of Flight and All Weather Testing. These tests were successful.

Project & Task: 7192-71596 Contract No. AF 33(616)-3612
ASTIA No. AD-118261

(42)
TR 57-278

June 1957

Schipper, Lowell M.; Kidd, J. S.; Shelly, Maynard; Smode, Alfred F. (Ohio State University)

TERMINAL SYSTEM EFFECTIVENESS AS A FUNCTION OF THE METHOD USED BY CONTROLLERS TO OBTAIN ALTITUDE INFORMATION. A STUDY IN HUMAN ENGINEERING ASPECTS OF RADAR AIR TRAFFIC CONTROL

In this experiment four single, highly-experienced controllers were each in turn required to control simulated aircraft from entry points fifty miles out to the GCA gate. The entry conditions were chosen to simulate aircraft returning from a combat-type mission in a forward zone. System performance was measured over a series of problems, each of which involved handling ten F-86 and ten B-47 type aircraft. The major experimental variable was provided by the presence or absence of a continuous visual display of altitude which could be used by the pattern-feeder controller. Altitude was displayed on a 17 x 12-in. cathode ray tube which was mounted directly above the plan position indicator scope (see Fig. 1, p. 3). The display allowed the controller to determine visually the altitude of any or all aircraft within a 50-mi. radius of the GCA gate. A second experimental variable used was mean aircraft entry rate. Two entry rates were used: an average interval of 90 sec. between aircraft and an average interval of 50 sec. However, the interval between any two aircraft was random. System effectiveness was measured by a variety of indices. Among these were control time per aircraft, average fuel consumption, delay in landing the last few aircraft in each problem (delay buildup), number of go-arounds at the GCA gate, number of aircraft conflicts, and number and type of controller-pilot communications. The principal findings of the experiment were that the presence of a continuous altitude display did not materially effect system performance, except that a significant reduction in the number of controller requests for altitude information from pilots was accomplished when the display was present. All measures of system performance were affected by the entry rate variable. When aircraft entered the system at an average interval of 50 sec., control time, fuel consumption, delay buildup, and number of mid-air conflicts were all reliably greater than they were under the condition of 90 sec. between entering aircraft. It was concluded from the results that the use of an auxiliary, continuous display of altitude information would not materially improve system performance in circumstances similar to those encountered in the experiment (i.e., when system performance is dependent chiefly on the efficiency of single controller, and these controllers are provided with aircraft identity as well as position information), but that in situations in which communication availability is low or in which a monitoring or supervisory function is important, such a display may have a potential value.

Project & Task: 7192-71596
Contract No. AF 33(616)-3612
ASTIA No. AD-118267

(43)
TR 57-285

April 1957

Deese, James (Johns Hopkins University)

CHANGES IN VISUAL PERFORMANCE AFTER VISUAL WORK

Experimental and field studies on the effects of prolonged visual work are reviewed. There are 2 basically different kinds of visual work, one primarily involving search for infrequently occurring signals (vigilance tasks) and the other involving active continuous use of the oculomotor system and requiring more or less continuous mental operation (active tasks). Relatively brief periods of time spent at visual vigilance results in a reduction of visual sensitivity. Sensitivity can be restored by the occurrence of extraneous events; soon after a "disinhibiting" stimulus, sensitivity is likely to decline unless there is further activity. Relatively long periods of time at active tasks produce either no deterioration or very little deterioration in the capacity for further visual work unless the situation is complicated by extreme loss of sleep, anoxemia, or drug effects. Continuous work at active visual tasks, produces depression, headaches, feelings of tiredness and irritability, and is accompanied by a general increase in somatic muscle tension.

Project & Task: DO No. 694-43 - DO No. 694-45
Contract No. AF 33(038)22642
ASTIA No. AD-118266

(44)
TR 57-301 April 1958

Nicklas, Douglas R. (University of Illinois)

HISTORY OF AIRCRAFT COCKPIT INSTRUMENTATION

This report is an historical review of aircraft cockpit instrumentation from 1903 to 1946. It is unusual in two respects. First, it spans a greater length of time than most historical accounts. Second, a greater emphasis is given the informational presentations to the pilot. This report attempts to relate how information is sensed, transmitted, and displayed, with the principles related to these brought forth. It deals with the evolution of instruments and with their combination, simplification, and arrangement. In the main, the report concentrates on instruments used in operational aircraft.

Project & Task: 6190-71573 Contract No. AF 33(616)-3000
ASTIA No. AD-118299

(45)
TR 57-318 June 1957

Jerison, H. J.; Wallis, R. A. (Antioch College & AML)

EXPERIMENTS ON VIGILANCE: PERFORMANCE ON A SIMPLE VIGILANCE TASK IN NOISE AND IN QUIET

Twenty male undergraduate volunteers worked on a simple vigilance task without interruption for 1 3/4 hours in noise (112.5 db SPL) and 1 3/4 hours in quiet (79 db SPL). The performance function was the typical one found in such tasks; performance dropped off rapidly after an initial high level. There was no differentiation, however, between performance in the noise session and in the quiet session. This result, which differs from previous results at this and at other laboratories on effects of noise on "vigilance", is explained on the basis of the absence of a need for flexibility of attention for performance on the simple "vigilance" task used here and the presence of such a need for performance on "vigilance" tasks in which an effect of noise was found.

Project & Task: 7193-71614 Contract No. AF 33(616)-3404
ASTIA No. AD-118337

(46)
TR 57-326 September 1957

Rockway, M. R. (Ohio State University & AML)

EFFECTS OF VARIATIONS IN CONTROL DEADSPACE AND GAIN ON TRACKING PERFORMANCE

The present experiment was designed to investigate the effects of joint variations in control deadspace and gain on the efficiency of a first-order manual control system. Six experienced subjects performed on a one-dimensional compensatory tracking device using each of the twelve control conditions resulting from combining four levels of control deadspace and three levels of gain. The experimental results were as follows: (a) There was a systematic decrease in system performance with increasing control deadspace. (b) In general, performance with the low and medium control gains was superior to performance with the high gain. And, (c) the higher the control gain the greater the rate of decrease in system performance with increasing control deadspace.

Project & Task: 7197-71635 Contract No. AF 33(616)-3076
ASTIA No. AD-118347

(47)
TR 57-378 June 1958

Xhignesse, Louis V. (University of Illinois)

SELECTIVE SURVEY OF FRENCH DEVELOPMENTS IN FLIGHT SIMULATORS AND FLIGHT INSTRUMENTS: I. FLIGHT SIMULATORS

A selective survey of French developments in aircraft and missile simulation was conducted. The survey covered the characteristics of a flight simulator for a primary trainer of the conventional engine type, three types of helicopter simulators, and a simulator for an air-to-ground or ground-to-ground missile.

Project & Task: 6190-71573 Contract No. AF 33(616)-3000
ASTIA No. AD-142130

(48)
TR 57-384 March 1958

Mengelkoch, Robert F.; Houston, Robert C. (University of Illinois)

INVESTIGATIONS OF VERTICAL DISPLAYS OF ALTITUDE INFORMATION I. COMPARISON OF A MOVING-TAPE AND STANDARD ALTIMETER ON A SIMULATED FLIGHT TASK

This is the first of a planned series of experiments, and was designed to compare performance of experienced pilots on a standard altimeter and a vertical, moving tape altimeter on a specified series of flight tasks in a link trainer. Twenty subjects flew the series of maneuvers using each altimeter and deviations from desired altitudes were observed. Analysis of the data resulted in the following conclusions: (1) under the experimental conditions, performance on the standard altimeter was significantly superior to performance on the vertical, moving-tape altimeter, (2) the method of evaluation is sufficiently sensitive to be a useful research tool and (3) further evaluations of the effects of an expanded scale and additional training should be conducted. The results are discussed relative to the rather small overall difference in performance between the two altimeters.

Project & Task: 6190-71573 Contract No. AF 33(616)-3000
ASTIA No. AD-130828

(49)
TR 57-385 March 1958

Mengelkoch, Robert F.; Houston, Robert C. (University of Illinois)

INVESTIGATIONS OF VERTICAL DISPLAYS OF ALTITUDE INFORMATION II. THE EFFECT OF PRACTICE ON PERFORMANCE ON A SIMULATED FLIGHT TASK USING A MOVING-TAPE ALTIMETER

This is the second study in a planned series of investigations of vertical displays of altitude information. The purpose of the experiment was to determine the effects of practice on a moving-tape display on performance using a standard altimeter. Fourteen subjects used in the first study were given practice on the vertical display and then were retested. The results confirmed the original findings and again demonstrated, statistically, that reference to the standard altimeter makes greater precision of control possible than reference to the moving-tape display used.

Project & Task: 6190-71573 CONTRACT No. AF 33(616)-3000
ASTIA No. AD-130829

(50)
TR 57-388 July 1957

Bradley, James V. (Antioch College & AML)

DIRECTION-OF-KNOB-TURN STEREOTYPES

The principle that rotary controls should turn clockwise to increase was investigated to determine whether it corresponds to a true population stereotype or is simply adopted for purposes of standardization; and, if a stereotype does exist, to determine its nature and how best to exploit it. Right-handed subjects were asked to grasp a knob and turn it so as to effect a specified change in the intensity of a light mounted just above it. Equal numbers of subjects were asked to increase and to decrease the brightness of the light, the request being phrased in a variety of ways. Two significant tendencies were found. First, 73.3% of the subjects turned the knob clockwise to increase or counterclockwise to decrease the brightness of the light. This tendency was strongest when an increase was required and when the function to be controlled was phrased in positive terms (i.e., as "brightness" rather than "dimness"). It was not significantly dependent upon the use of the words "increase" or "decrease" or upon the sex of the operator. Other experiments indicate that these results are contingentupon the use of a display which presents changes in information without visible movement. Second, 62.5% of all subjects turned the knob clockwise. This general turn-clockwise tendency was found to persist among an additional set of righthanded subjects when the light was covered up, and the subject was asked simply to turn the knob; among left-handed subjects (used only in this condition) the tendency to turn clockwise was not statistically significant. (See also AD-61819)

Project & Task: 7182-71514 Contract No. AF 18(600)50
ASTIA No. AD-130835

(51)
TR 57-389 August 1957

Bradley, J. V. (Aerospace Medical Laboratory)

GLOVE CHARACTERISTICS INFLUENCING CONTROL MANIPULABILITY

A successful methodology was developed for the objective definition and measurement of certain glove characteristics which affect the speed of operation of instrument controls by a gloved hand. Correlations were then obtained between speed of gloved operation of controls and the degree to which the gloves possessed certain characteristics. Significant positive correlations were found between speed of operation and the following characteristics: tenacity, i. e. resistance to sliding over a grasped surface (for operation of on-off controls), suppleness (for adjustable controls), and snugness of fit (for both types of control).

Project & Task: 7182-71514
ASTIA No. AD-130836

(52)
TR 57-448 August 1957

Brown, John Lott (Columbia University)

REVIEW OF THE CONE-TO-ROD EFFICIENTY RATIO AS A SPECIFICATION FOR LIGHTING SYSTEMS

The need for systems of illumination which will afford the maximum stimulation of the eye at low luminances has led to the widespread use of red light. The theoretical basis for the advantage of red light is reviewed. Several methods for the practical specification of illumination which are based on a cone-to-rod luminous efficiency ratio are considered. These methods are analyzed and compared in terms of the actual physical significance of the numerical values which they yield. It is evident that no method of calculating a cone-to-rod ratio provides an index from which the effects on sensitivity after adaptation to a given illumination system can be predicted. The general problem of specification is discussed in relation to a number of the underlying practical problems, such as luminance level at which a given illumination system must be used, the nature of the visual tasks for which it is provided, and the nature of the visual tasks for which sensitivity must be preserved. It is concluded that a cone-to-rod luminous efficiency ratio may afford a satisfactory index for the specification of lighting systems. However, the use of such a ratio to predict the effect on eye sensitivity of exposure to different lighting systems must await a careful experimental investigation of the relations among cone-to-rod ratio, luminance, and criteria of sensitivity within the context of specific practical situations.

Project & Task: 7186-71544 Contract No. AF 33(038)-22616
ASTIA No. AD-130927

(53)
TR 57-449 August 1957

Brown, John L.; Kuhns, Margaret P.; Adler, Helmut E. (Columbia University)

THE RELATION OF THRESHOLD CRITERION TO THE FUNCTIONAL RECEPTORS OF THE EYE

Luminance thresholds for the resolution of grating test patterns were determined by the method of constant stimuli. Measurements were made for the dark adapted eye. Thresholds were determined with each of eight selected color filters and also with Wratten neutral tint filters. The gratings consisted of parallel opaque lines separated by transparent spaces, all of equal width. A series of seven gratings was used which required a range in visual acuity from 0.042 to 0.625. With gratings which demanded high visual acuity for resolution, minimum luminances for resolution of a grating were very nearly the same for all the color filters. As visual acuity requirements were decreased, however, luminance thresholds determined with the red filters became higher relative to thresholds determined with the other filters. Luminance thresholds with blue filters became lower relative to thresholds obtained with the other filters. The change in the relative threshold luminance is similar to the Purkinje shift which occurs with change in adaptation of the eye from high to low luminances. These results were interpreted to indicate that changes in the threshold criterion may result in changes in the character of visual function from rod function, through mesopic function, to cone function, even though the eye remains dark adapted. In situations where a pilot is adapted to a visual field of low overall luminance and must periodically, in short glimpses, make acuity discriminations of visual displays illuminated at a higher level, specification of the relative effectiveness of a given bank of colored light will depend on the visual acuity required to read the display.

Project & Task: 7186-71544 Contract No. AF 33(038)-22616
ASTIA No. AD-130928

(54)
TR 57-454 January 1958

Jerison, H. J.; Arginteau, J. (Aerospace Medical Laboratory)

TIME JUDGMENTS, ACOUSTIC NOISE, AND JUDGMENT DRIFT

Six male undergraduates made time judgments in the rate projection situation with five rates and four different noise conditions. It was found that noise programs involving different levels for the stimulus and response periods lengthened the time judgments relative to those involving the same noise level. Repetition of the task also lengthened judgments. The judgment functions were similar to those in classical time judgment experiments in that shorter intervals were overestimated more than longer intervals. The results are discussed in terms of effects of acoustic noise and of psychological stress on subjective time, and the shift due to repetition is related to a similar effect on time-order errors in psychophysical experiments.

Project & Task: 7193-71614
ASTIA No. AD-130963

(55)
TR 57-457 July 1957

Chiles, W. Dean (Aerospace Medical Laboratory)

PSYCHOLOGICAL STRESS AS A THEORETICAL CONCEPT

An examination of some typical treatments of psychological stress is carried out in this paper. The approach of construing stress in analogy to physical and physiological concepts is rejected since these approaches have not led to quantifiable insights into the action of stress with respect to human behavior. A systematic approach, based on the presentation of J. S. Brown and I. E. Farber, is suggested along with the framework for the quantification of psychological stress as a theoretical concept. Some of the implications of this approach with respect to performance variables are discussed.

Project: 7193
ASTIA No. AD-130942

(56)
TR 57-509 August 1958

Hall, Ian A. M. (Princeton University)

EFFECTS OF CONTROLLED ELEMENT ON THE HUMAN PILOT

A simulator study of the human pilot performing a two dimensional tracking task, with random excitation, is presented. The investigation is directed toward studying the effects on the pilot of various longitudinal controlled element dynamics. A technique for representing the pilot's response mathematically is reviewed, and the describing function and remnant term in the representation are obtained for a wide range of controlled elements. Pilot opinion of the controlled element's handling qualities are recorded. The study shows how, in the plane of short period frequency and damping, distinct regions appear in which the describing function form remains the same. Evidence is also presented of two distinct sources of remannt. Consistant physical explanations of these remnant terms and of the changes in describing function are presented and found helpful in understanding pilot opinions. The investigation should be regarded as exploratory in that the data is limited and analysis was somewhat abbreviated. Areas of interest for further detailed investigations are indicated.

Project & Task: 7182-71510 Contract No. AF 33(616)-2506
ASTIA No. AD-130979

(57)
TR 57-520

August 1958

McRuer, D. T.; Seckel, Edward; Hall, Ian A. M. (Princeton University & Control Specialists, Inc.)

HUMAN PILOT DYNAMIC RESPONSE IN FLIGHT AND SIMULATOR

Results of an effort to determine differences in pilot tracking behavior in flight and in a flight simulator are presented. The experiment was designed to estimate the quasi-linear describing functions and linear correlations of several pilots when engaged in lateral and longitudinal tracking tasks. Statistical analyses of describing function and linear correlation data revealed: (1) Individual phase angle, amplitude ratio, and linear correlation data were approximately normally distributed about their means; (2) Significant differences in the mean values of pilot's describing functions were noted for phase angle and amplitude ratio in longitudinal flight, and for phase angle in lateral flight; (3) Significant differences in linear correlations between flight and simulator were noted; (4) Significant differences were noted in the variances for lateral amplitude ratio and lateral and longitudinal phase, but not for longitudinal amplitude ratio or lateral and longitudinal linear correlations; (5) The results implied that the pilot's effective reaction time delay was longer in flight and that his gain was lower.

Project & Task: 7182-71510
ASTIA No. AD-130988

Contract No. AF 33(616)-2506 and
Contract No. AF 33(616)-3080

(58)
TR 57-533

September 1957

Gardner, J. F. (Aerospace Medical Laboratory)

THE EFFECT OF MOTION RELATIONSHIP AND RATE OF POINTER MOVEMENT ON TRACKING PERFORMANCE.

Forty-eight college students, using an aircraft-type control stick, attempted to keep cross-pointers centered on a simulated display in spite of random disturbances. Both the rate of pointer motion and the motion relationship between the control stick and the pointers were varied. Results indicate that: (a) tracking performance improves as the rate of pointer movement decreases; (b) the "fly-from" motion relationship is superior to the "fly-to" relationship; (c) the interaction of rates of pointer movement and direction of motion relationship is not significant; (d) practice and learning did not nullify the effects of an adverse motion relationship or of higher rates of pointer motion.

Project & Task: 7189-71571
ASTIA No. AD-131002

(59)
TR 57-549

March 1958

Mengelkoch, Robert F.; Houston, Robert C. (University of Illinois)

INVESTIGATIONS OF VERTICAL DISPLAYS OF ALTITUDE INFORMATION: III. THE EFFECT OF AN EXPANDED SCALE ON PERFORMANCE OF A SIMULATED FLIGHT TASK USING A MOVING-TAPE ALTIMETER

As the third of a series of studies in the vertical display of altitude information, this experiment compared an expanded scale, moving-tape altimeter with a standard altimeter on a simulated flight task. It was concluded that, under the experimental conditions, performance on a moving-tape altimeter with a scale factor of 2.375 inches per thousand feet is essentially equivalent to performance on a standard altimeter. Further evaluation under conditions more closely approximating jet flight conditions, and in relation to other parameters displayed vertically, would be desirable.

Project & Task: 6190-71573
ASTIA No. AD-142042

Contract No. AF 33(616)-3000

(60)
TR 57-582 November 1957

Ely, Jerome H.; Bowen, Hugh M.; Orlansky, Jesse (Dunlap and Associates, Inc.)

MAN-MACHINE DYNAMICS

This report identifies and discusses factors affecting human performance in tracking and watchkeeping (vigilance) tasks, and makes recommendations toward improving the performance of such systems. Whenever these recommendations are the direct outgrowth of published research, the appropriate studies are cited. Other recommendations have been developed by the authors from their own experiences. The report is divided into three main parts: General Information, Important Design Factors in Closed-Loop Systems, Human Time Lags. A table of contents and a subject index are provided as aids to the user.

Project & Task: 7180-71501 Contract No. AF 33(616)419
ASTIA No. AD-131082

(61)
TR 57-621 October 1957

Hake, Harold W. (Johns Hopkins University)

CONTRIBUTIONS OF PSYCHOLOGY TO THE STUDY OF PATTERN VISION

A survey is provided of major research topics in psychology having relevance to patterned vision--including the study of threshold measurements, visual distortion, form discrimination, constancy in form perception, memory for form, and training problems. An analysis of the perceptual task suggests that true fidelity in visual perception is not possible, but that the visual system does operate to produce coherent reconstructions of visual stimulation.

Project & Task: 7192-71598 Contract No. AF 33(616)2918
ASTIA No. AD-142035

(62)
TR 57-663 April 1958

Kidd, J. S.; Shelly, Maynard W.; Jeantheau, Gabriel (Ohio State University)

THE EFFECT OF ENROUTE FLOW CONTROL ON TERMINAL SYSTEM PERFORMANCE: A STUDY IN HUMAN ENGINEERING ASPECTS OF RADAR AIR TRAFFIC CONTROL

The purpose of the experiment was to determine the effect of regularization of approach traffic in time, place, and sequence upon the safety and efficiency of a terminal system. Enroute flow-control facilities were simulated by preprogramming arrivals at the terminal boundary. The terminal system was manned by a two-man pattern-feeder control team. Six pairs of experienced USAF controllers participated. The control zone included two landing fields and each controller handled aircraft destined for each of these fields. Data were recorded for a total of 2880 movements of mixed types. The results and conclusions of the experiment are as follows: (1) Traffic input regularization in time, place, and sequence relative to the controller who accepted the traffic had an insignificant effect on terminal system performance. (2) Human controllers can provide the flexibility necessary to accommodate widely varying input entropy.

Project & Task: 7192-71596 Contract No. AF 33(616)-3612
ASTIA No. AD-142096

(63)
TR 57-726 December 1957

Chiles, W. Dean (Aerospace Medical Laboratory)

EFFECTS OF ELEVATED TEMPERATURES ON PERFORMANCE OF A COMPLEX MENTAL TASK

Eleven subjects were tested on a complex mental task at four different effective temperatures - 76, 81, 86, and 91 degrees F. Differences among the temperature conditions were not significant. This result is in contrast to that obtained by Pepler who reported significant differences under essentially the same conditions. It is concluded that there is no effect of elevated temperatures, within the range used, on the performance of this task.

Project & Task: 7193-71615 Contract No. AF 33(616)-5040
ASTIA No. AD-142192

(64)
TR 58-2 April 1958

Bradley, J. V.; Wallis, R. A. (Antioch College & AML)

SPACING OF ON-OFF CONTROLS. I: PUSH BUTTONS

Thirty-six right handed male college students performed a standardized control operation in which the center one of three closely spaced push buttons was reached to and operated while avoiding contact with the adjacent controls. Manipulated variables were: diameter of all three controls, orientation of the linear array of controls, and spacing between edges of the controls. Reach-and-operation time, inadvertent touching of adjacent controls, and inadvertent operation of adjacent controls were recorded. It was concluded that efficiency of operation and economy of panel space are best combined when push buttons no larger than 1/2 inch in diameter are arranged in a horizontal (rather than a vertical) array, regardless of the spacing between edges; under these conditions performance efficiency increases rapidly and significantly with increasing spacing up to 1/2 inch between edges, and less rapidly thereafter although the trend continues up to the largest interperipheral spacing tested, i. e., 3/4 inch.

Project & Task: 7182-71514 Contract No. AF 33(616)-3404
ASTIA No. AD-142272

(65)
TR 58-47 January 1958

Crannell, Clarke W.; Debons, Anthony (Miami University)

ILLUMINATION AND TILT AS FACTORS IN THE LEGIBILITY OF REFLEX-REFLECTIVE NUMERALS

AND 10400 digits made of reflex-reflective material and placed on a black background were found to be superior in identifiability to black digits on white or aluminum backgrounds at distances greater than 400 feet and also at lesser distances when the digits are tilted from the vertical axis. When the angle of observation is perpendicular to neither the vertical nor horizontal axis, legibility of digits of all types is reduced. At 500 feet, increases in illumination resulted in negligible improvement in legibility of the reflex-reflective digits.

Project & Task: 7186-71551 Contract No. AF 33(616)-2844
ASTIA No. AD-142327

(66)
TR 58-49 November 1958

Narva, Marshall A. (The Martin Company)

EVALUATION OF DECISION-MAKING PERFORMANCE ON THREE PICTORIAL NAVIGATION DISPLAYS

A group of pilots and a group of non-pilots solved two representative types of navigation problems using three map-type navigation displays representing different movement relationships between the aircraft symbol and a ground station symbol. The three displays were as follows: (A) "aircraft movement" display: aircraft symbol translates in x and y and rotates in theta (heading), station symbol (map) is fixed; (B) "mized movement" display: aircraft symbol fixed in position but rotates in theta, station symbol (map) translates in x and y; (C) "earth movement" display; aircraft symbol is fixed, station symbol (Map) translates in x and y and rotates in theta, to indicate change in position and heading. For the non-pilots, there were no significant differences in performance attributable to the different movement relationships. For the pilots, a significant interaction between the displays and the problem types was obtained for two of the measures.

Project & Task 6190-71556 Contract No. AF 33(616)-3749
ASTIA No. AD-142329

(67)
TR 58-113 June 1958

Kidd, J. S.; Kinkade, Robert G. (Ohio State University)

AIR TRAFFIC CONTROL SYSTEM EFFECTIVENESS AS A FUNCTION OF THE DIVISION OF RESPONSIBILITY BETWEEN PILOTS AND GROUND CONTROLLERS: A STUDY IN HUMAN ENGINEERING ASPECTS OF RADAR AIR TRAFFIC CONTROL

This experiment evaluated the inclusion of airborne navigational aids in a radar approach control system. A comparison was made between systems in which all changes in flight path were initiated by the controller, pilots initiated changes in speed and altitude, and pilots initiated heading changes as well as changes in speed and altitude. Heterogeneity of aircraft types was also studied by the inclusion of single-type, two-type, and four-type problems. Nine relatively novice controllers participated under each of the nine experimental conditions; the order of conditions was different for each controller. The major results were as follows: (1) Significant improvement in system performance, as measured by such criteria as control time, was obtained by providing airborne position information equipment. (2) Superior system performance occurred for mixed aircraft types, in the sense that relative delay was reduced.

Project & Task: 7192-71596 Contract No. AF 33(616)-3612
ASTIA No. AD-151082

(68)
TR 58-117 June 1958

Chiles, W. Dean (Aerospace Medical Laboratory)

EFFECTS OF SHOCK-INDUCED STRESS ON VERBAL PERFORMANCE

An experiment is reported involving the determination of the effects of shock on the learning of two types of verbal tasks; one type was characterized by a high degree of association between the stimulus and the response (synonyms) and the other by no association (unrelated words). A total of 54 subjects were tested, 30 of them under an experimental anxiety (shock) condition and 24 under a non-anxiety (buzzer) condition. It was found that the introduction of the electric shock produced significantly better performance on both types of tasks. The implications of the results for behavior theory as well as their relationship to the experimental use of test-measured anxiety are discussed. It is concluded that the factors measured by the Manifest Anxiety Scale are too complex to be interpreted unambigously in most experimental situations. It is also concluded that a relatively mild stress can serve to improve performance on a verbal task.

Project & Task: 7193-71615
ASTIA No. AD-151083

(69)
TR 58-323 July 1958

Chiles, W. Dean (Aerospace Medical Laboratory)

EFFECTS OF HIGH TEMPERATURES ON PERFORMANCE OF A COMPLEX MENTAL TASK

Ten subjects were tested on a complex mental task during one-hour exposures to different dry bulb/wet bulb temperature conditions - 85°/75°, 90°/80°, 110°/90°, 120°/105° degrees F. Differences in performance among the temperature conditions were not significant. This result corroborates earlier findings reported by this laboratory.

Project & Task: 7193-71615
ASTIA No. AD-155811

(70)
TR 58-369 December 1958

Jerison, Harry J. (Antioch College)

EXPERIMENTS ON VIGILANCE: DURACTION OF VIGIL AND THE DECREMENT FUNCTION

Results of previous experiments on vigilance were reanalyzed for data on human performance during short (half-hour) and long (two-hour) vigils. The analysis indicated that length of vigil did not affect either the initial or terminal level of performance. However, the decrement in performance which begins immediately after the start of a long vigil was delayed in the short vigil. This change in the shape of the decrement function was attributed to different expectations by the subjects about the duraction of the vigil, and is consistent with an expectancy theory of vigilance. These results support recommendations that monitoring tasks should be kept short if optimal performance is required.

Project & Task: 7184-71581 Contract No. AF 33(616)-3404
ASTIA NO. AD-155772

(71)
TR 58-449 January 1959

Kidd, J. S. (Ohio State University)

A COMPARISON OF TWO METHODS OF CONTROLLER TRAINING IN A SIMULATED AIR TRAFFIC CONTROL TASK: A STUDY IN HUMAN ENGINEERING ASPECTS OF RADAR AIR TRAFFIC CONTROL

Improvement in performance with training in a complex task of radar air traffic control was compared under a condition of constant high input load during training vs. a condition of graduated input load during training. Relative input load was defined as the number of aircraft under the control of a single pattern-feeder operator. The test performance of controllers trained under constant high input load was significantly superior on several criteria to that of controllers trained under the graduated input load condition. An explanation was proposed in terms of the heightened frequency of feedback of knowledge of performance experienced by the high constant input load group.

Project & Task: 7184-71583 Contract No. AF 33(616)-3612
ASTIA No. AD-212269

(72)
TR 58-472 February 1959

Elkin, Edwin H. (Ohio State University)

EFFECTS OF SCALE SHAPE, EXPOSURE TIME, AND DISPLAY-RESPONSE COMPLEXITY ON SCALE READING EFFICIENCY

Three scale-reading variables (scale shape, exposure time, and degree of display-response complexity) were examined in both quantitative and qualitative reading tasks. The scales were calibrated to the nearest unit or five units on a 100-unit scale. Speed and accuracy scores were recorded for 48 scale-reading conditions. The results for quantitative reading indicate (a) the order of superiority for speed and accuracy is open-window, circular, and vertical; (b) reducing exposure time leads to more errors and slower reading times; and (c) reducing the number of response categories required increases reading efficiency, the effect on speed being greater than on accuracy. For qualitative reading (a) all scale shapes are equally adequate in terms of accuracy; and (b) the order of superiority in terms of speed is circular, vertical, and open-window. It is concluded that there is no one best scale design to fit all reading requirements.

Project & Task: 7184-71583 Contract No. AF 33(616)-3612
ASTIA No. AD-209381

(73)
TR 58-473 February 1959

Kidd, J. S.; Hooper, James J. (Ohio State University)

DIVISION OF RESPONSIBILITY BETWEEN TWO CONTROLLERS AND LOAD BALANCING FLEXIBILITY IN A RADAR APPROACH CONTROL TEAM: A STUDY IN HUMAN ENGINEERING ASPECTS OF RADAR AIR TRAFFIC CONTROL

The general problem of optimum division of duties between two or more men who are performing essentially the same functions in a complex man-machine system was investigated. Six two-man control teams were employed in an experiment which evaluated three methods of control assignment and two procedures for exchange of control assignment in a simulated radar approach control system. Assignment of control on the basis of aircraft destination was found to be superior to assignment by alternation or assignment by sector of entry. There was some evidence that a condition of partial restraint on the exchange option impaired system performance, although the data were not conclusive. An explanation based on the balance of demand on operator capacity across task segments was suggested as one which was compatible with the data.

Project & Task: 7184-71583
ASTIA No. AD-214616 Contract No. AF 33(616)-3612

(74)
TR 58-474

April 1959

Kinkade, Robert G.; Kidd, J. S. (Ohio State University)

THE EFFECT OF TEAM SIZE AND INTERMEMBER COMMUNICATION ON DECISION-MAKING PERFORMANCE

The performance of single individuals, two-man teams without intercommunication, and two-man teams with intercommunication was compared in a complex decision-making task. The task was an operational "game" derived from radar approach control. Forty-eight students participated. The experimental design utilized a subjects x conditions balanced Latin square having six independent replications. Two-man team performance was superior to that of single individuals but not proportionately so. Interpretation of the data in terms of productivity per person showed the person working alone to be significantly superior to the person working in a two-man team. Teams with communication were slightly superior to teams having no communication. The explanation of the results of the individual vs. individuals in a team comparison is hypothesized to lie in the diversion of time and productive capacity in the team situation away from the prime task and into integrative and coordinative behavior.

Project & Task: 7194-71584
ASTIA No. 215621

Contract No. AF 33(616)-3612

(75)
TR 58-475

March 1959

Bradley, J. V.; Wallis, R. A. (Antioch College & AML)

SPACING OF ON-OFF CONTROLS. II: TOGGLE SWITCHES

Thirty-six right-handed male college students performed a standardized control operation in which the center one of three closely spaced toggle switches was reached to and operated while avoiding manual contact with the adjacent switches. Four experimental variables were investigated: type of toggle switch, spacing between edges, orientation of the linear array, and direction of throw to operate. Performance measures recorded were: reach-and-operation time, inadvertent touching, and inadvertent operation, of adjacent switches. Each experimental variable had a significant effect upon some measure of performance. The results suggest that when on-off controls must be crowded into a given amount of panel space, so that they are closer than one inch between centers, performance may be optimized by using miniaturized toggle switches having considerable resistance to operation. Data obtained with toggle switches were compared with those obtained in a previous, similar experiment using push buttons.

Project & Task: 7182-71514
ASTIA No. AD-212270

Contract No. AF 33(616)-3404

(76)
TR 58-521

April 1958

Kreezer, George L. (Washington University)

ATTENTION VALUE OF AUDIO AND VISUAL WARNING SIGNALS

Relevant literature is reviewed. A laboratory method to assess the effectiveness of a stimulus in attracting the attention of an otherwise occupied subject is described. This method permits utilization of both threshold and reaction-time technique. Using this method quantitative comparisons were made of the attention-demanding value of auditory stimuli of various frequencies and of visual stimuli of various wave lengths, under different conditions of background noise.

Project & Task: 7184-71580
ASTIA No. AD-213603

Contract No. AF 33(616)-135

(77)
TR 58-522 December 1958

Williams, Alexander C., Jr; Hopkins, Charles O. (Hughes Aircraft Company)

ASPECTS OF PILOT DECISION MAKING

A detailed analysis was made of the tasks performed by the pilot of a modern airborne weapon system. The results of this analysis were coded and presented in diagrammatic form to show alternative courses of action that may result in successful completion of a mission phase. Instances of pilot decision making so as to encompass these instances was proposed. The more prominent decision theories were reviewed briefly and the applicability of each theory to the problem of pilot decision making was considered. Problem areas requiring experimental sutdy were discussed and some approaches to the study of these problems were suggested.

Project & Task: 6190-71556 Contract No. AF 33(616)-5135
ASTIA No. AD-209382

(78)
TR 58-526 January 1959

Jerison, H. J. (Antioch College)

EXPERIMENTS ON VIGILANCE: THE EMPIRICAL MODEL FOR HUMAN VIGILANCE

A model for human vigilance is presented which is an integrated summary of empirical studies. Vigilance is defined as a probability of detecting rare and near-threshold events (signals). In the model this probability is described as a function of the combined effects of signal frequency, response frequency, signal detectability under ideal observing conditions, time at work, complexity of the monitored display, and various subject variables. A deductive theory of vigilance should have this function as one of its consequences.

Project & Task: 7184-71581 Contract No. AF 33(616)6095
ASTIA No. AD-202883

(79)
TR 58-543 November 1958

Wright, G. O.; Deininger, R. L.; McGuire, J. C.; Queal, R. W., Jr. (Aerospace Medical Laboratory)

EQUIPMENT MAINTENANCE WITH VARIOUS NUMBERS OF SERVICE MEN: A SIMPLE ANALYSIS

An analysis is made of a maintenance problem that concerns a piece of equipment and a group of maintenance men. The simplest case considers one type of equipment and one type of maintenance man in terms of the Markov Process, a form of probability theory. The decision whether to leave the equipment alone, to have one man service it, or to have a series of more than one man service it depends on the initial condition of the equipment and on the skills of the men. Several more complicated cases are considered briefly.

Project: 7192
ASTIA No. AD-206921

(80)
TR 58-574, I September 1959

Bradley, J. V. (Aerospace Medical Laboratory)

STUDIES IN RESEARCH METHODOLOGY

The compatibility of typical psychological measurements with the assumptions of common, parametric, statistical tests is examined. Empirically obtained distributions of time scores and mathematically derived error distributions are used to illustrate conditions which give rise to serious violations of assumptions.

Project & Task: 7184-71581

(81)
TR 58-574, II

September 1959

Bradley, J. V. (Aerospace Medical Laboratory)

STUDIES IN RESEARCH METHODOLOGY

Methods of investigating the effects of assumption-violation are examined. Particular attention is given to methodological, and other, bias operating in favor of the conclusion that parametric tests are extremely insensitive to violations of their assumptions. Fallacious arguments advanced in support of this conclusion are discussed. Using a new method, the effect of nonnormality upon the probability levels and power of the critical ratio test is investigated. Results show that under certain perfectly realistic conditions the test is rendered completely powerless by the violation investigated.

Project & Task: 7184-71581

(82)
TR 58-584

March 1959

Hunt, Darwin P. (Aerospace Medical Laboratory)

TRACKING PERFORMANCE AS A FUNCTION OF FEEDBACK SPECIFICITY

The research reported herein was conducted to determine (a) the relationship between complex compensatory tracking and the specificity of displayed error, i. e., the number of categories of error information, and (b) the extent to which this relationship is influenced by task difficulty and amount of practice. Tracking error and control motion were the criterion measures. The results suggest that (a) linear increments in the number of categories of error information result in a negatively accelerated reduction in the tracking error; (b) as the operator becomes more proficient, the superiority of the greater number of categories is reduced; (c) the effects of the number of categories of information on control motion depends upon the difficulty of the task; and (d) although the amount of control motion generally decreases as the operator becomes more proficient, the magnitude of this decrease is greater for the "easy" task than for the "difficult" task.

Project & Task: 7184-71580
ASTIA No. AD-212311

(83)
TR 58-624

March 1959

Kinkade, Robert G.; Kidd, J. S. (Ohio State University)

THE EFFECT OF PROCEDURAL VARIATIONS IN THE USE OF TARGET IDENTIFICATION AND AIRBORNE POSITION INFORMATION EQUIPMENT ON THE PERFORMANCE OF A SIMULATED RADAR APPROACH CONTROL SYSTEM

Two experimental steps were employed to evaluate the interaction effects of airborne position information equipment and continuous target identification in a simulated radar approach control task. Several variations in the procedures and system configuration were also compared. Ten laboratory-trained controllers participated. The results led to the conclusion that some of the functional characteristics of API and target ID are interchangeable in that API provides an independent method of target identification. Ground reference points and fixed approach paths employed as possible aids in the use of the API facility proved to interfere with the flexibility of operations.

Project & Task: 7184-71583
ASTIA No. AD-216361

Contract No. AF 33(616)-3612

(84)
TR 58-660

December 1958

Kris, E. Christine (Massachusetts Institute of Technology)

A TECHNIQUE FOR ELECTRICALLY RECORDING EYE POSITION

This report presents a technique for electrically recording eye position and eye movements. The associated instrumentation, including a multichannel d-c differential input oscillograph and a special visual angulometer, is described in detail. Examples of several types of eye-movement recordings are presented, and the method of constructing "iso-potential eye-position maps" is outlined. Certain uses of these techniques in studies concerned with variations in the function of the visual system are briefly discussed.

Project & Task: 7193-71612
ASTIA No. AD-209385

Contract No. AF 33(616)-3849

(85)
TR 58-687 June 1959

Green, M. R.; Muckler, F. A. (The Martin Company)

CRITICAL MOVEMENT AREAS IN FIGHTER TYPE COCKPITS

Simple speed of visual positioning responses to nine critical cockpit movement areas was studied. Slowest performance was found to extreme right, extreme left, and lower middle areas of the center instrument panel. The forward right side console area elicited the fastest responses. In all cases, responses to the right side of the cockpit were faster than to the left. There were no statistically significant performance differences between pilot and non-pilot subject groups.

Project & Task: 6190-71573, 61920 Contract No. AF 33(616)-5472

(86)
TR 59-43 July 1959

McConnell, D.; Shelly, M. W. (Ohio State University)

TRACKING PERFORMANCE ON A SEQUENCE OF STEP FUNCTIONS WHICH APPROACHES A CONTINUOUS FUNCTION AS A LIMIT

This study examined the relations between continuous tracking error and error entailed in tracking a sequence of step functions which approached the continuous signal as a limit. Random and periodic targets, as well as different frequencies of the periodic targets, were used. Results indicated that as step amplitude was decreased, error linearly approached the limiting error involved in tracking the continuous function, and form of approach was virtually independent of frequency or whether the limiting function was periodic or random. Correlation of lead-lag and left-right data with the foregoing results suggested that the subject reduced his error by leading the target, and that this lead is introduced predominantly on flexion of the arm.

Project & Task: 1710 Contract No. AF 41(657)-70
ASTIA No. AD-222417

(87)
TR 59-45 July 1959

Erdman, A. C.; Fontaine, A. B.; McConnell, D. G. (Ohio State University)

THE AMPLITUDE ANALYZER

This report describes a device developed at The Ohio State University for extracting information for a trend analysis of low-frequency (0.66 cpm to 4.98 cmp) signals with respect to amplitude of occurrence during a time period. The system here described uses 30 mechanical counters to accumulate a score equivalent to the time that a signal dwells within a pre-determined voltage band. A comprehensive discussion as to the electronic principles and techniques is provided.

Project & Task: 1710 Contract No. AF 41(657)-70

(88)
TR 59-51 March 1959

Ernst, Arthur A. (United States Department of Commerce)

FEASIBILITY STUDY FOR A MAN-MACHINE SYSTEMS RESEARCH FACILITY

This report concerns an advanced laboratory facility for research on man-machine systems. The study postulates the need for an optimal division of labor among men and machines in complex weapon systems, and is oriented toward the functional rather than the physiological and psychological factors of the human environment. The study also postulates the possibility of employing dynamic simulation of such systems as an appropriate tool for optimization. The study is addressed to the feasibility of implementing and operating a research facility having the necessary simulation capabilities. Feasibility was judged through designing, implementing, and operating a scale model of the desired facility. This process served to delineate the characteristics required of the necessary equipment. The experience thus obtained also enabled the drawing of conclusions as to how well the design objectives might be met and how much the facility and its operation might cost.

Project & Task: 7184-71583 Delivery Order
ASTIA No. AD-213598 No. (33-616) 56-10

(89)
TR 59-94

April 1959

Dzendolet, Ernest; Rievley, John F. (Aerospace Medical Laboratory)

MAN'S ABILITY TO APPLY CERTAIN TORQUES WHILE WEIGHTLESS

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

Project & Task: 7184-71586
ASTIA No. AD-220363

(90)
TR 59-104

June 1959

Kidd, J. S. (Ohio State University)

A COMPARISON OF ONE-, TWO-, AND THREE-MAN CONTROL UNITS UNDER VARIOUS CONDITIONS OF TRAFFIC INPUT RATE

The performance of various sized pattern-feeder approach control teams was compared under three conditions of input load in a simulated air traffic control situation. Conditions in which either one, two, or three men operated the system were compared. Input loads were 90 sec., 60 sec., or 30 sec. average interval between aircraft arrivals. Nine laboratory-trained controllers participated in a total of 54 problems. Results indicated a consistent decrement in performance as a function of increased input load. Crew augmentation led to only moderate facilitation of performance when the input load to the system was held constant and the number of controllers was increased. When input load was increased proportionately to the size of the control unit, there was a marked decline in system performance. It was concluded that simple crew augmentation imposes coordination demands that interfere with primary task activities. Maximum autonomy of system operators was recommended.

Project & Task: 7184-71583
ASTIA No. AD-225965

Contract No. AF 33(616)-3612

(91)
TR 59-120

March 1959

Adams, Oscar S.; Levine, Raphael B.; Chiles, W. Dean (Lockheed Aircraft Corp. & AML)

RESEARCH TO INVESTIGATE FACTORS AFFECTING MULTIPLE-TASK PSYCHOMOTOR PERFORMANCE

This study showed the performance tests used to have moderately high reliability and sensitivity to work load but a negligible amount of intercorrelation. While no significant correlation was obtained between performance scores and measures of psycho-physiological activity, several of the psycho-physiological measures showed significant reliability, intercorrelation, and sensitivity to conditions of rest and performance activity.

Project & Task: 7184-71582
ASTIA No. AD-213592

Contract No. AF 33(616)-6050

(92)
TR 59-158

March 1959

Rees, David W.; Kama, William N. (Aerospace Medical Laboratory)

SIZE OF TABS: A FACTOR IN HANDLING OF GUIDES IN CHECK-LISTS

This experiment was designed to investigate the performance of subjects in locating particular sections within check-lists as a function of tab size. The interactions of tab size with degree of subject encumbrance and tab position were also investigated. The results support the following design conclusions: (1) Provision of tabs along the left margin of a check-list significantly improves facility-of-access to information within the check-list. (2) Facility-of-access improves with increase in tab dimensions up to at least the 3/4 x 3/4 inch size.

Project & Task: 7184-71586
Astia No. AD-213595

(93)
TR 59-182

September 1959

Bradley, J. V. (Aerospace Medical Laboratory)

TACTUAL CODING OF CYLINDRICAL KNOBS

Tactual coding of knobs by use of bizarre shapes is frequently achieved at the expense of manipulability and setting precision, which appear, in many cases, to be optimal when knobs are cylindrical. In order to be able to maximize both discriminability and manipulability, certain parameters of cylindrical knobs were investigated as bases for tactual coding. Rim surface, diameter and thickness were all found to be useful for this purpose. When feeling one of two knobs whose pictures were before them, subjects rarely (less than 1% of the time) identified the wrong picture as the felt knob in any of the following situations: diameters differ by 1/2 inch or more, thicknesses differ by 3/8 inch or more, rim surfaces belong to different ones of the three families: smooth, fluted, knurled.

Project & Task: 7184

(94)
TR 59-240

May 1959

Knowles, Dr. W. B. (General Electric Company)

AUTOMATION AND PERSONNEL REQUIREMENTS FOR GUIDED MISSILE GROUND SUPPORT FUNCTIONS

This report summarizes an investigation of the high skill level requirements found in missile systems employing automatic electronic test and checkout equipment. Automation has not resulted in lowering manpower demands because (1) testing and maintenance requirements and objectives have not been systematically defined and (2) manual operations have not been completely described or programmed. A "maintenance system" design approach is outlined as a method for overcoming these deficiencies. Further research is recommended in development of techniques for evaluating the design of test logic, maintenance operations, and manual tasks.

Project & Task: 7185-71584

Contract No. AF 41(675)-170

(95)
TR 59-418

August 1959

Baker, Charles A.; Morris, Dominic F.; Steedman, William C. (Aerospace Medical Laboratory)

TARGET RECOGNITION ON COMPLEX DISPLAYS

This study was conducted to determine the speed and accuracy of form recognition as a function of (1) the amount of distortion between the reference form and the task form, (2) the number of irrelevant forms in the target display, and (3) the stimulus properties of the forms involved. The stimulus forms were generated by filling in, on a statistical basis, some of the cells of a 90,000-cell matrix. The subjects were shown a reference photograph of a target and instructed to locate that target on a display containing numerous other forms. Both criterion measures, viz., search time and errors, increased as a function of: (1) an increase in the number of irrelevant forms on the target display, and (2) an increase in the difference between the resolution of the reference form and that of the target display. A quantitative description of the targets, which can be used to predict relative target difficulty, was developed.

Project & Task: 7184-71580
ASTIA No. AD-228809

(96)
TR 59-434

August 1959

Lewis, Alan; Kanareff, Vera T. (University of Delaware)

USE OF AUTOCORRELATION AND UNCERTAINTY MEASURES FOR THE ANALYSIS OF DECISION BEHAVIOR

A discussion of two methods of analysis of sequential dependencies is discussed in relation to the study of decision behavior. The methods considered are autocorrelation and uncertainty analysis. Each of these approaches is described in terms of computational techniques and specific applications are presented.

Project & Task: 7183-71618 Contract No. AF 33(616)5845

(97)
TR 59-548

September 1959

Bradley, J. V. (Aerospace Medical Laboratory)

UTILIZATION OF MULTIPLE CUES IN PAIRED COMPARISONS

Subjects were given one, two or three cues with which to make an either-or decision. Certain hypotheses were formulated to describe the subject's thought process in utilizing the multiple cues, and mathematical models were constructed to simulate them. The models were then used upon data for the single-cue case to predict performance in the multiple-cue case. Predicted performance "data" were then compared with actually observed data for the same multiple-cue case, thus testing the predictive validity of the mathematical model and the tenability of the corresponding hypothesis.

Project & Task: 7182-71514

(98)
TR 59-552

September 1959

Rees, D. W.; Copeland, N. K. (Aerospace Medical Laboratory)

THE EFFECTS OF SERIAL POSITION IN CHECK-LIST DESIGN

An experiment was conducted to determine (1) whether serial position effects occur in the use of check-lists, and (2) whether these effects can be modified. Subjects responded to a serial presentation of instructions by actuating switches. Two check-lists of instructions were tested: a high generalization list and a low generalization list. The two criterion measures of performance were: time spent observing the list (search time), and number of errors made. Results indicate that (1) the serial position effect occurs when search time is the criterion variable, and (2) this effect can be modified to improve performance by structuring the check-list to increase perceptual discrimination between items. No conclusions were reached on serial position effects as related to error scores because of insufficient data.

Project & Task: 7184-71586

(99)
TN 57-352 December 1957

Kopstein, F. F.; Morgan, R. L. (Aerospace Medical Laboratory)

HUMAN FACTORS CONSIDERATIONS IN THE DESIGN PROPOSALS FOR A BALLISTIC MISSILE UNIT PROFICIENCY SYSTEM

A UPS is the means by which proficiency training and measurement are obtained. Its characteristics depend upon the training and measurement job that must be accomplished. The job, in turn, depends on the system's demands for human performance (both manual and intellectual) and the initial capabilities of the personnel in the system. A "task analysis" is a systematic method for finding what trainees must do in their jobs. Personnel and training records predict initial trainee capability. Various means for achieving training objectives must be considered relative to their cost and efficiency. The UPS must be designed in accordance with the principles of human learning. The UPS must also give a valid and reliable indication of the overall status of unit proficiency. This requires establishment of appropriate criteria.

Project & Task: 7197-71640
ASTIA No. AD-142040

(100)
TN 58-374 January 1959

Cotterman, T. E. (Aerospace Medical Laboratory)

TASK CLASSIFICATION: AN APPROACH TO PARTIALLY ORDERING INFORMATION ON HUMAN LEARNING

It is proposed that a task classification scheme(s) be developed in terms of which it is possible to sort all human learning tasks. Each task category would be set up in such a way that a specified set of common principles of learning referring to basic variables would operate in essentially the same way in all task situations subsumed under it. In this way the actual and hypothesized effects of various basic and task variables and their interactions would be set forth. Task categories seem best defined in terms of general physical language with particular attention to the nature of the transformation of stimulus into response events, rather than in terms of inferred behavioral processes. The most practical method for developing the scheme probably would entail several persons intimately acquainted with the literature alternately hypothesizing schemes and sampling the more relevant literature as a check. Task classification would serve the general purpose of making information on human learning more usable and also result in a number of specific advantages both for research and application.

Project & Task: 7183-71578
ASTIA No. AD-210716

(101)
TN 59-61 March 1959

Randle, R. J., Jr. (Aerospace Medical Laboratory)

VIBRATIONS IN HELICOPTERS: TRAINING CONSIDERATIONS

Helicopter instructor pilots were interviewed individually to analyze in detail the role that vibrations play in piloting helicopters. Information was gathered which indicated that vibrations are utilized as cues in both normal control and the detection and diagnosis of system malfunctions. Training considerations are discussed and recommendations made for a relatively gross simulation of each of the several classes of vibrations in a proposed helicopter instrument trainer.

Project & Task: 7197-71640
ASTIA No. AD-212314

(102)
TN 59-140

May 1959

Hansen, O. K.; Franks, P. E.; Modrick, J. A. (Aerospace Medical Laboratory)

NATURE AND USE OF THE MAC-2 (MALFUNCTION AND CIRCUITRY) TRAINER

Increases of costs and complexity of equipment have forced consideration of using simulators for maintenance training. The MAC-2 trainer, simulating the data flow of the MA-7A bomb-nav system, can be used for training and proficiency measurement in the use of data flow information and technical manuals by flight-line mechanics. The report includes a brief history, physical and functional characteristics, purpose, advantages and limitations, suggested modifications, research problems and empirical basis for uses of the trainer. The trainer has considerable face validity but its specific purpose and the limited knowledge about its proper use should be considered in recommending this type of training equipment.

Project & Task: 1710-71606
ASTIA No. AD-216532

(103)
TR 56-279

December 1957

Duncan, C. P.; Underwood, B. J. (Northwestern University)

THE EFFECT ON TRANSFER OF VARYING STIMULATION DURING TRAINING

The effect of both variation and amount of training on transfer among perceptual-motor paired-associate tasks were studied. Different groups of subjects were trained with 1, 2, 5, or 10 tasks (different sets of stimuli) for 2, 5, or 10 days. Some additional groups were trained 2, 5, or 10 days with 10 different repairings of the responses with the stimuli of a given set. After training, all groups were tested for transfer to three (some to four) new sets of stimuli. With amount of training constant, all degrees of varied training produced greater transfer than did either constant training or training with repairing, which were equally poor. Transfer increased both with amount and increase in variation in training. But, amount and variation did not interact. Differences between varied-and constant-training groups decreased considerably with successive transfer tests. Subjects trained with different sets of stimuli develop a general skill, probably observational or perceptual, which facilitates dealing with new stimuli. Thus, provision in training devices for varied training may enhance transfer, although this advantage should justify the expense.

Project 7197
ASTIA No. AD-142134

Contract No. AF 33(616)-308

(104)
TR 56-369

January 1959

Muckler, F. A.; Nygaard, J. E.; O'Kelly, L. I. (University of Illinois)

PSYCHOLOGICAL VARIABLES IN THE DESIGN OF FLIGHT SIMULATORS FOR TRAINING

In the design, construction and use of flight simulators and trainers, two problem areas have been contrasted frequently. The first concerns the degree of fidelity of physical simulation that may be achieved between training device and operational aircraft. The second is termed the problem of psychological simulation, i.e., the training value that results from use of a synthetic training device - fundamentally a psychological problem of transfer of training from the device to the aircraft. A survey of many of the problems that have arisen in the context of psychological simulation is included. Existing training research literature on flight trainers and simulators is evaluated; and a number of experimental programs are suggested. Several specific problem areas concerning design and use of flight training devices have continually appeared and these areas have been examined briefly, with particular emphasis on possible empirical solutions. In addition, motivational, instructional, and methodological variables are considered. Finally, conventional theories of transfer of training are evaluated in terms of their predictive efficacy in the area of fidelity of psychological simulation.

Project & Task: 7191-71635
ASTIA No. AD-97130

Contract No. AF 33(616)-2725

(105)
TR 56-527 September 1958

Schohan, Benjamin (American Institute for Research)

HUMAN FACTORS RECOMMENDATIONS FOR THE DESIGN OF COCKPIT PROCEDURES TRAINERS

The cockpit procedures trainer (CPT) appears to have promising potential as a training aid to teach pilots knowledge about aircraft systems, nomenclature and location of cockpit controls and displays, and procedures required to operate aircraft safely. This report is intended to aid design engineers by presenting first a discussion of the cockpit procedures trainer's role in training, and, second, a set of human engineering recommendations pertinent to the design of such trainers for fighter-type jet aircraft.

Project & Task: 7197-71640 Contract No. AF 33(616)-2080
ASTIA No. AD-110654

(106)
TR 57-71 February 1957

Eriksen, C. W. (Johns Hopkins University)

EFFECTS OF PRACTICE WITH AND WITHOUT CORRECTION UPON DISCRIMINATION LEARNING UNDER ABSOLUTE CONDITIONS

The present report describes an investigation of the ability of "observers(O's)" to learn to discriminate among a series of stimuli under conditions of absolute judgment. Discrimination learning was determined as a function of the discriminability of the stimulus series and as a function of knowledge of errors. Two groups of six O's each made absolute judgments of six series of stimuli that differed in discriminability. Observers in the correction group were informed of the correct response after each judgment while O's in the non-corrected group were given no information as to their errors. The results show a clear improvement in discrimination with practice for all six stimulus series although the amount of gain with practice appeared to be inversely related to the discriminability of the stimulus series. It was further found that correction or knowledge of results contributed primarily to O's choice of responses and only in a minor way to his ability to discriminate among the stimuli. It was suggested that what O learns on this task is not to recognize individual stimuli as such but instead to establish a frame of reference for the series of stimuli as a whole.

Project & Task: 7192-71598 Contract No. AF 33(616)-2918
ASTIA No. AD-118027

(107)
TR 57-326 September 1957

Rockway, M. R. (Aerospace Medical Laboratory)

EFFECTS OF VARIATIONS IN CONTROL DEADSPACE AND GAIN ON TRACKING PERFORMANCE

The present experiment was designed to investigate the effects of joint variations in control deadspace and gain on the efficiency of a first-order manual control system. Six experienced subjects performed on a one-dimensional compensatory tracking device using each of the twelve control conditions resulting from combining four levels of control deadspace and three levels of gain. The experimental results were as follows: (a) There was a systematic decrease in system performance with increasing control deadspace. (b) In general, performance with the low and medium control gains was superior to performance with the high gain. And, (c) the higher the control gain the greater the rate of decrease in system performance with increasing control deadspace.

Project & Task: 7197-71635

ASTIA No. AD-118347

(108)
TR 57-548

March 1958

Wickens, D. D.; Cotterman, T. E. (Ohio State University & AML)

THE EFFECT OF DISPLAY INTERRUPTION ON TRANSFER OF TRAINING BETWEEN TASKS OF DIFFERENT CONTROL SENSITIVITY

Six groups of 15 male undergraduates were given 25, one-minute, two-dimensional tracking trials on two successive days. Three control groups always tracked with a sensitive control, while three experimental groups transferred to this condition after using a less sensitive control the first day. In the first experiment one experimental and one control group performed both days with four, five or six one-second interruptions in the display. In a second experiment one pair of groups was treated like those in the first and another pair performed without interruptions. Tracking performance during training was adversely affected by the higher sensitivity control and interruptions; but, while interruptions lowered tracking performance during test, no transferred group was significantly inferior to its control. Tracking with the display interruptions used is not more sensitive to differential transfer based on different control sensitivities than is tracking with continuous displays.

Project & Task: 7197-71637
ASTIA No. AD-131027

Contract No. AF 33(616)-3076

(109)
TR 57-551

November 1957

Houston, R. C.; Green, M. R. (University of Illinois)

TRAINING EVALUATION OF AN INSTRUMENT PANEL HOMOGENEOUS WITH RESPECT TO THE PRINCIPLE OF THE MOVING PART

Twenty flight-naive student pilots were trained in a modified Link trainer to fly ILS approaches in a C-47 under simulated instrument conditions. Ten students were trained using an experimental panel in which the moving indices consistently represented the aircraft's performance, and ten were given identical training on a conventional panel. Six subjects in each group flew the C-47 on ILS approaches under simulated instrument conditions. Analysis of the objective records of performance obtained during ground training and in the air shows that the group trained on the experimental panel performed in a significantly superior manner.

Project & Task: 6190-71573
ASTIA No. AD-142241

Contract No. AF 33(616)3000

(110)
TR 58-553

January 1959

Rockway, M. R.; Franks, P. E. (Aerospace Medical Laboratory)

EFFECTS OF VARIATIONS IN CONTROL BACKLASH AND GAIN ON TRACKING PERFORMANCE

Six subjects performed a simulated aircraft tracking task using each of 12 control conditions resulting from combining four levels of control backlash and three levels of gain. The experimental findings demonstrated a significant interaction between the effects of backlash and gain on system performance. That is, there was a monotonic increase in system error with increasing backlash at all levels of gain. However, the higher the gain the greater the rate of increase. The implications of these results for the design of manual control systems were discussed briefly.

Project & Task: 7197-71635
ASTIA No. AD-209384

(111)
TR 58-687

June 1959

Green, M. R.; Muckler, F. A. (The Martin Company)

CRITICAL MOVEMENT AREAS IN FIGHTER TYPE COCKPITS

Simple speed of visual positioning responses to nine critical cockpit movement areas was studied. Slowest performance was found to extreme right, extreme left, and lower middle areas of the center instrument panel. The forward right side console area elicited the fastest responses. In all cases, responses to the right side of the cockpit were faster than to the left. There were no statistically significant performance differences between pilot and non-pilot subject groups.

Project & Task: 6190-71573, 61920

Contract No. AF 33(616)-5472

(112)
TR 59-320

July 1959

Hatch, R. S. (Aerospace Medical Laboratory)

AN EVALUATION OF THE EFFECTIVENESS OF A SELF-TUTORING APPROACH APPLIED TO PILOT TRAINING

This study concerns the problem of insuring ready recall of a large body of in-flight job information for Air Force pilots. The effectiveness of a voluntary self-tutoring approach utilizing one type of "game appeal" device was examined. Two matched groups of Air Force pilots were pre-tested on their knowledge of instrument flying information. The device was then installed in the crew lounge of one of the groups. No device was available to the other group. After a two-month period both groups were post-tested. Despite the fact that minimal exposure to the machine occurred, players improved significantly on the criterion tests while non-players did not improve. Factors pertinent to the interpretation of the results and implications for further research were discussed.

Project & Task: 1710-77535

(113)
TN 56-488 December 1956

Cole, J. N.; Kyrazis, D. T.; Oestreicher, Hans L. (Aerospace Medical Laboratory)

A METHOD FOR CALCULATING THE ACOUSTICAL CHARACTERISTICS OF AIRCRAFT IN FLIGHT

A procedure is presented for transposing from sound pressure-time information received at a stationary ground point to information on the radiation characteristics of the moving source. Included are such physical mechanisms as propagation time lags, energy losses through a diverging sound field, atmospheric absorption losses, and Doppler shifts in frequency. A graphical approach is utilized wherever feasible to facilitate calculation. The method is equally applicable to cases where the microphone is in motion parallel to the axis of an axially symmetrical source at rest.

Project & Task: 7210-71705
ASTIA No. AD-110562

(114)
TN 56-489 November 1956

Berg, Paul; Latta, Gordon (Stanford University)

THE FUNDAMENTAL SOLUTION TENSOR FOR SYSTEMS OF LINEAR, CONSTANT COEFFICIENT, PARTIAL DIFFERENTIAL EQUATIONS

A formal method is developed for obtaining the fundamental solution matrix for systems of linear, partial differential equations with constant coefficients. The procedure involves the determination of an operator matrix, and the fundamental solutions of certain scalar equations derived from the given system. Application of the operator to the scalar fundamental solutions yields the required fundamental solution matrix.

Project & Task: 7211-71706 Contract No. AF 33(616)-2987
ASTIA No. AD-110564

(115)
TN 57-10 April 1957

Stevens, Kenneth N.; Pietrasanta, Adone C. (Bolt, Beranek, and Newman, Inc.)

PROCEDURES FOR ESTIMATING NOISE EXPOSURE AND RESULTING COMMUNITY REACTION FROM AIR BASE OPERATIONS

Detailed engineering procedures are presented for computing the noise exposure in communities near air bases where jet aircraft operate. Both ground run-up and take-off operations of all types of USAF jet aircraft are considered in determining the total noise exposure in a community adjacent to an air base. Graphical aids for computing the noise exposure are included in the form of noise contour overlays. Corrections are applied to the estimated noise exposure to account for the normal background noise in the community, the previous noise exposure of the community, and the community-air base relations. The result of these computations is a quantity called the Composite Noise Rating. Tentative relations that can be used to estimate the complaint behavior of a community from the Composite Noise Rating are presented and discussed. The procedures discussed in this report can be employed to assess community reaction to noise from future as well as present air base operations. They also permit a determination of the relative contributions to the total noise exposure in a community from the various noise-producing operations on air bases, such as take-offs on several different runways, run-ups of various types of aircraft, etc. The report stresses the need for considering the total air base operations in computing noise exposure in order to avoid misleading conclusions that can result from an analysis of just one or two isolated noise-producing operations.

Project & Task: 7210 Contract No. AF 33(616)-2151
ASTIA No. AD-110705

(116)
TN 57-248

November 1957

von Gierke, H. E.; Pietrasanta, A. C. (Bolt, Beranek, and Newman, Inc. & AML)

ACOUSTICAL CRITERIA FOR WORK SPACES, LIVING QUARTERS, AND OTHER AREAS ON AIR BASES

A summary of noise control criteria recommended for use in air base planning is presented. The modifications of earlier criteria which were necessitated by recent research are reflected in this summary. Criteria are given for noise environments which allow safe and satisfactory performance of human functions in the following classes of occupied areas on air bases: air base living quarters, important communications and office areas.

Project & Task: 7210-71711
ASTIA No. AD-130839

Contract No. AF 33(616)-3685

(117)
TN 57-389

October 1958

Doelling, N.; Pearsons, K. S.; (Bolt, Beranek, and Newman, Inc.)

ACOUSTICAL EVALUATION OF A B-58 RUN-UP PEN AT CONVAIR-FORT WORTH

This report describes the acoustical evaluation of the run-up pen with the B-58 at CONVAIR - Fort Worth. Data are presented which show that the noise reduction in foreward quadrants is of the order of 20 or 30 decibels while in the aft quadrants it is about 0 db. This pen provides hearing protection to personnel located in adjacent pens. The noise characteristics of the B-58 are also presented.

Project & Task: 7210-71708
ASTIA No. AD-142160

Contract No. AF 33(616)-3938

(118)
TN 57-391

March 1958

Hoover, R. M.;(Bolt, Beranek, and Newman, Inc.)

ACOUSTICAL EVALUATION OF GENERAL SOUND CONTROL MODEL N-400 JET AIRCRAFT NOISE SUPPRESSORS

The General Sound Control Model N-400 jet aircraft suppressor which is used in conjunction with an F-100 A aircraft has been evaluated acoustically. This noise suppressor combines diffusion and absorptive suppressor components. The evaluation shows that the noise reduction of the suppressor varies from 0 to 50 db depending upon frequency and angular location about the suppressor-aircraft combination. It is also found that, in the highest octave bands, the use of the intake unit increases the noise reduction over that achieved by the exhaust unit alone up to 20 db directly in front of the aircraft.

Project & Task: 7210-71708
ASTIA No. AD-142162

Contract No. AF 33(616)-3938

(119)
TN 57-393

March 1958

Hoover, R. M.; (Bolt, Beranek, and Newman, Inc.)

ACOUSTICAL EVALUATION OF THE THE NACA 10' x 10' WIND TUNNEL

An acoustical evaluation of the Lewis Unitary Plan Wind Tunnel exhaust section at NACA, Cleveland, Ohio, is presented. The noise reduction of this treatment varies from 5 db below 80 cps to a maximum of 60 db at 800 cps, with 50 db or greater noise reduction being achieved for all frequencies from 400 cps to 5000 cps. Also presented are data indicative of the additional noise reduction achieved by the large right-angle bend following the acoustical treatment. This is of the order of 5 db for all frequencies. Measurements at various points show that the decrease of sound pressure level with distance is more pronounced at the higher frequencies and, in some of the lower octave bands, the rate of decrease varies with distance. All measurements were made using an explosive noise source

Project & Task: 7210-71708
ASTIA No. AD-142164

Contract No. AF 33(616)-3938

(120)
TN 58-112 September 1958

Hoeft, L. O. (Aerospace Medical Laboratory)

ACOUSTICAL EVALUATION OF THE F4D NOISE SUPPRESSION RUN-UP HANGAR AT DOUGLAS, EL SEGUNDO

This report describes the acoustical characteristics of the F4D run-up hangar at Douglas Aircraft Company, El Segundo, California. Measurements in three areas are presented: (1) on a circle of 250 foot radius with the engine at military power; (2) around the outside of the run-up hangar with the engine at military power; (3) inside the hangar with the engine at idle power. These measurements indicate that at 250 feet this noise suppressor had an average reduction above 300 cps of about 28 db. Some aerodynamic measurements and comments on the construction are included in this report.

Project & Task: 7210-71705
ASTIA No. AD-203644

(121)
TN 58-163 August 1958

Pietrasanta, A. C. (Bolt, Beranek, and Newman, Inc.)

FIELD MEASUREMENT OF COMMUNITY NOISE EXPOSURE NEAR HANSCOM FIELD

The noise exposure at a location near Hanscom Field was measured for an eight-hour period by recording the noise levels from all aircraft flyovers during this period. The measured noise exposure, in terms of the equivalent continuous sound pressure level in the 300-600 cps band (L_{eq}) was found to be 74 db. It is compared with several calculated values of L_{eq} which differ depending on whether assumed or actual flight paths, flight profiles, or activity data were used. For assumed values for each of these three items, the calculated L_{eq} is 79 db. For the observed flight path, flight profile, and aircraft activity, the calculated and measured L_{eq}'s are in agreement.

Project & Task: 7210-71705
ASTIA No. AD-155879
Contract No. AF 33(616)-3335 and
Contract No. AF 33(616)-3938

(122)
TN 58-213 February 1959

Clark, W. E.; Pietrasanta, A. C. (Bolt, Beranek, and Newman, Inc.)

INTRUSION OF AIRCRAFT NOISE INTO COMMUNITIES NEAR TWO USAF AIR BASES

Field studies performed to provide experimental data on noise intrusion into community areas from aircraft flight operations are described. Air traffic activity over selected community areas in the vicinity of two bases were determined from analysis of air base flight movements and from field observations. Flight paths, pattern altitudes, climb profiles and engine power changes were determined from aircraft tracking observations, from interrogation of flight and operations personnel and from special logs prepared by crew members on aircraft in flight. Noise from flyovers observed at ground locations was recorded in synchronization with position data.

Project & Task: 7210-71705
ASTIA No. AD-212223
Contract No. AF 33(616)-335 and
Contract No. AF 33(616)-3938

(123)
TN 58-221 November 1958

Harris, C. M. (Columbia University)

RESIDUAL MASKING AT LOW FREQUENCIES

Short duration auditory fatigue has been termed "residual masking." This is the shift in the threshold of hearing following the cessation of a masking tone. A study of curves of residual masking vs. frequency, i.e., "masking patterns," contribute much to our understanding of properties of the hearing mechanism. Data of this type have been obtained in the low frequency range, i.e., for masking tones of 250 cps at sound pressure levels of 110 db and 90 db, following the methods of Munson and Gardner. These masking patterns were obtained 150 and 200 milliseconds following the cessation of the masking tone. In the course of this study--in which three subjects were used--the free-field threshold of hearing for binaural listening was measured between 130 and 1,000 cps. Auditory activity patterns were computed from residual masking patterns, and the loudness of the pure tone masking source was evaluated.

Project & Task: 7210-71700
ASTIA No. AD-207245
Contract No. AF 33(616)-2331

(124)
TN 58-243 November 1958

Hoover, R. M.; Pietrasanta, A. C. (Bolt, Beranek and Newman, Inc.)

SOME MEASUREMENTS OF NOISE REDUCTION OF AIR BASE STRUCTURES

Measurements have been made of the noise reduction of exterior walls of an air base structure utilizing wood frame construction. Typical air base jet aircraft operations were used as noise sources. The results show that the noise reduction achieved by this type of construction, with operable sash windows occupying about 20 percent of the wall area, varies from 15 to 30 db. This is considerably less than would be predicted on the basis of wall weight alone, but it is shown that the noise reduction may be estimated correctly by assuming the existence of a distributed open area in the wall (cracks around windows) equivalent to 0.1% of the wall area. For open windows the measured data agree with estimates made considering the actual open area in the wall. Estimated and measured values for both open- and closed- window conditions agree within 1 or 2 db in the 150-300 and 300-600 cps octave bands, which are the most important bands for noise control design of air base offices.

Project & Task: 7231-71787 Contract No. AF 33(616)-3938
ASTIA No. AD-208156

(125)
TR 54-152, Part II March 1958

Fry, W. J.; Dreyer, L. D.; Dunn, F. (University of Illinois)

PHYSICAL ACTION OF INTENSE HIGH FREQUENCY SOUND ON VERTEBRATE TISSUE

The work described and the results presented in Part A of this report relate to the initiation of an elaborate series of experiments designed to yield information regarding the fundamental physical mechanisms involved in the irradiation of biological materials with ultrasound. The work was undertaken to demonstrate that it is possible to realize accurately reproducible results on a suitably prepared and precisely irradiated biological specimen. In Part B some aspects of the muscle contraction problem are discussed and an elaborate precision muscle irradiation laboratory, including a new type of myograph are discussed. Results with this instrument are not included.

Project & Task: 7210-71703 Contract No. AF 33(038)-20922
ASTIA No. AD-151086

(126)
TR 56-655 December 1956

Hoeft, Lothar O. (Aerospace Medical Laboratory)

A SYSTEM FOR MEASURING THE HIGH SOUND PRESSURE LEVELS FROM ROCKETS

A system for measuring the high intensity noise produced by rockets is described. The system (1) should be capable of measuring sound pressure levels to 195 db (re 0.0002 dynes/sq cm), (2) should have a flat frequency response from 37.5 c to 10 kc (with usable response to 20 kc), and (3) should be reliable. A 21 channel sound recording system was developed to obtain far and near field noise characteristics in the short firing time of rocket engines. The selection of microphones and other components, and testing and calibration of the equipment are discussed. The technique of setting up a noise survey, the procedure for operating the equipment and the system used to analyze the data are described in detail.

Project & Task: 7210-71707
ASTIA No. AD-110669

(127)
TR 56-656 December 1956

Hoeft, Lothar O. (Aerospace Medical Laboratory)

THE DEVELOPMENT OF A MOBILE ACOUSTICS LABORATORY

The mobile acoustics laboratory built and used by the Bio-Acoustics Branch is described. This laboratory consists of a 6 ton semi-trailer equipped with a 15 kilowatt motor generator, relay racks for equipment and a work bench. It features a custom-built console, UHF radio, air conditioning and heating, and an observation dome to provide unobstructed view of the surrounding area. The mobile laboratory is completely self-contained and can be moved without dismantling. Storage space is provided for spare parts and non-rack-mountable equipment. Due to the fairly heavy construction and judicious placing of vents, the trailer may be used in moderately high sound fields without difficulty.

Project & Task: 7210-71707
ASTIA No. AD-110670

(128)
TR 57-87 February 1957

Stadelman, William J.; Kosin, Igor L. (Washington State College)

THE EFFECTS OF SOUNDS OF VARYING INTENSITIES ON CHICKENS AND HATCHING EGGS

Young chickens were grown in pens subjected to sound levels varying from 80 to 115 decibels pressure at 20 minute intervals. The sound field was obtained with sound reproduction equipment using a tape with jet and propeller driven plane flyovers and airfield noises. Chickens grown under noise conditions from day old developed just as rapidly as chickens grown in control pens with a noise level of 65 decibels. There were no differences in growth rate, body weight, feed efficiency, feathering, mortality and abnormalities. When the noise level was maintained near 65 decibels for the first 30 days and then noise levels up to 120 decibels were applied, there was evidence of fright resulting in stampeding, crowding and smothering of chicks. Sound levels in excess of 120 decibels had no effect on hatchability of hatching eggs stored prior to incubation in such a sound field. Likewise, sound had no apparent effect on hatchability when applied during incubation and hatching. The moving of setting hens from normal hen house environment to a pen with noise levels of about 115 decibels was effective in "breaking up" the setting hens. Eleven of 12 hens so treated did not remain broody. Other setting hens moved to similar pens except for the sound field remained broody and hatched chicks. The subjecting of mature New Hampshire male chickens to sound levels of 112 decibels failed to affect the rate and nature of spermatogenesis when judged by both quantitative and differential sperm counts.

Project & Task: 7210-71729 Contract No. AF 33(616)-2552
ASTIA No. AD-118038

(129)
TR 57-114 March 1958

Misrahy, G. A. (Aerospace Medical Laboratory)

AN ANALYSIS OF THE ACTIONS OF ADRENAL CORTICAL STEROIDS AND OTHER AGENTS ON THE CEREBRAL CORTEX OF THE RABBIT

The purpose of this investigation was to study the actions of adrenal cortical steroids and other agents on the cerebral cortex of the rabbit. Studies were conducted in the action of cortisone, compound F, desoxycorticosterone acetate (DOCA) and cholesterol on the excitation of peripheral nerves. It was found that, whereas DOCA and cholesterol had no consistent effect on thresholds, compound F and cortisone in general tended to elevate thresholds. In addition to cortisone, compound F and DOCA tended to prevent the spontaneous rhythmic activity of nerves placed in acid phosphate, whereas cholesterol had no effect. Arguments have been advanced which indicate that the depressant effects of cortisone on peripheral nerves cannot account for the analgesic action of the compounds.

Project & Task: 7210-71733
ASTIA No. AD-118077

(130)
TR 57-320 June 1957

Clarke W. E.; Pietrasanta, A. C.; Gallaway, W. J. (Bolt, Beranek and Newman)

NOISE PRODUCED BY AIRCRAFT DURING GROUND RUN-UP OPERATIONS

Abstract classified.

Project & Task: 7210 Contract No. AF 33(616)-2151
ASTIA No. AD-130763 and Contract No. AF 33(616)-3335

(131)
TR 57-353 March 1958

Benson, R. W.; Karplus, H. B. (Armour Research Foundation)

SOUND PROPAGATION NEAR THE EARTH'S SURFACE AS INFLUENCED BY WEATHER CONDITIONS

The influence of various weather conditions on sound propagation in the atmosphere has been studied. The source was a propeller type aircraft flown at altitudes up to 4800 feet and distances up to 9600 feet. The propagation was studied for angles of elevation with respect to the earth's surface of $14\text{-}\frac{1}{2}^{\circ}$, 30°, and 90°. Noise data were collected for 1300 passes of the airplane over and around a ground observing point. The weather conditions varied during a year's time to include typical weather conditions which were available in the area of Chicago, Illinois.

Project & Task: 7210-71709 Contract No. AF 33(616)-2470
ASTIA No. AD-130793

(132)
TR 57-354 December 1957

Cole, J. N.; von Gierke, H. E.; Kyrazis, D. T. (Aerospace Medical Laboratory)

NOISE RADIATION FROM FOURTEEN TYPES OF ROCKETS IN THE 1,000 TO 130,000 POUNDS THRUST RANGE

Detailed noise characteristics were measured on fourteen types of rockets, with both solid and liquid propellants, in the thrust range from 1,000 to 130,000 pounds. Near field and far field levels on static fired and vertical launched rockets were measured under essentially free field conditions. Measurements and data reduction methods are described. Final results are given as near field sound pressure spectra, far field directivities, acoustic power spectra and pressure-time histories. This noise environment is studied as a function of several nozzle configurations and as a function of flame front action in the jet stream. Generalization and correlation of the data results in a formula for the overall acoustic power level output of rockets, OA PWL = 78 + 13.5 $\log_{10} W_m$ db re 10^{-13} watts, where W_m is the rocket jet stream mechanical power in watts. Also given is an approximate generalized power spectrum dependent upon nozzle diameter and jet flow characteristics. These correlations result in procedures for predicting far field noise environments produced by static fired or launched rockets.

Project & Task: 7210-71709
ASTIA No. AD-130794

(133)
TR 57-368, Part I June 1958

Meeker, W. F. (Radio Corporation of America)

ACTIVE EAR DEFENDER SYSTEMS: COMPONENT CONSIDERATIONS AND THEORY

The potentialities of the noise cancelling principle to improve ear protectors were investigated. The basic theory, discussed in an appendix, is applied to (1) a non-feedback cavity ear muff system, wherein noise picked up by a microphone outside the ear muff and adjusted for phase and amplitude is transmitted through earphones under the ear muff, (2) a feedback ear muff system similar to system 1, yet employing negative feedback with the pick-up microphone located inside the ear muff, (3) a free-field loudspeaker system. A laboratory model of system 2 achieved 15-17 db noise reduction from 100 to 200 cps in addition to the ear muff attenuation. Special transducers designed for this system should permit 20 db noise reduction from 50 to 400 cps. For maximum noise reduction systems 1 and 2 should be combined. The performance of system 3 was too limited to warrant its further consideraction as an active ear defender.

Project & Task: 7210-71700 Contract No. AF 33(616)-3051
ASTIA No. AD-130806

(134)
TR 57-410 July 1957

Misrahy, G. A.; Hildreth, K. M.; Clark, L. C.; Shinabarger, E. W. (Aerospace Medical Laboratory)

MEASUREMENT OF THE pH OF THE ENDOLYMPH IN THE COCHLEA OF GUINEA PIGS

Using a potassium chloride reference microelectrode and an antimony-Cerroseal alloy active microelectrode, the pH of the perilymph exposed to the atmosphere was found to be 7.8-8.0 and the endolymph in situ 7.3-7.5 in the guinea pig. The acidity of these fluids in situ appears to be very sensitive to changes in carbon dioxide tension.

Project & Task: 7210-71733
ASTIA No. AD-130858

(135)
TR 57-411 July 1957

Misrahy, George A.; Hildreth, Kenneth M. (Aerospace Medical Laboratory)

ENDOLYMPHATIC OXYGEN TENSION IN THE COCHLEA OF THE GUINEA PIG

Oxygen tension of the endolymph in the scala media of the guinea pig cochlea was measured using a micropolarographic technique. Near the stria vascularis the oxygen tension was 55-70 mm Hg. Deeper in the scala media it decreased gradually to 16-25 mm Hg. Effects of sound, hypoxia, hyperoxia and hypercapnea were studied. Oxygen tension decreased with hypoxia and sound and increased with hyperoxia and hypercapnea. A technique to check the integrity of a metallic plated microelectrode is described.

Project & Task: 7210-71733
ASTIA No. AD-130859

(136)
TR 57-453 May 1958

Misrahy, G. A.; Gannon, W. J.; Hildreth, K. M. (Aerospace Medical Laboratory)

EFFECTS OF LOUD SOUNDS ON THE EEG AND EVOKED POTENTIALS IN RABBITS

Young rabbits were subjected to 1000 cps tones ranging in intensity from 100 to 130 db. Normal patterns of EEG and evoked potentials are presented and discussed as well as changes produced during sound stimulation. The latter consists of a flattening of the EEG with increased fast activity and a diminution of the amplitude of the various components of the evoked potential. Chlorpromazine hastened the return to normal of the EEG and evoked potential.

Project & Task: 7210-71733
ASTIA No. AD-130935

(137)
TR 57-461 June 1957

Ackerman, Eugene; Anthony, Adam; Berger, Robert L., Campanella, Angelo J.; Danner, Patricia A.; Farwell, Robert W.; Frings, Hubert W.; Oda, Fujio; Tu, Lin (Pennsylvania State University)

SOUND ABSORPTION AT THE SURFACES OF SMALL LABORATORY ANIMALS

This report describes the theory, equipment and experimental results of the measurement of the acoustic absorption coefficients for the surfaces of rats, guinea pigs, and haired and hairless mice. These coefficients were measured at The Pennsylvania State University by various methods in the frequency band from one to twenty kilocycles per second. All experiments showed that the absorption coefficients rise between six and twenty kc. Those for the haired animals approached 100%. Hairless mice, on the other hand, had lower absorption coefficients. These were still appreciably higher than corresponding absorption coefficients for humans. The data for haired rats are consistently higher but in reasonable agreement with those obtained by others. The acoustic absorption coefficients for both haired and hairless animals in a randomly oriented sound field appear to be due at least in part to the excitation of surface waves.

Project & Task: 7210-71703 Contract No. AF 33(616)-2770
ASTIA No. AD-130946

(138)
TR 57-462 August 1957

Misrahy, George A.; Shinabarger, Edward W.; Hildreth, Kenneth M.; Gannon, William (Aerospace Medical Laboratory)

STUDIES ON THE ELECTRICAL PROPERTIES OF THE COCHLEA (GUINEA PIG)

By measuring potential drop produced by a constant current across the partition between scala media and scala tympani it was found that the average resistance of this partition was 4,700 ohms at the round window, 3,500 ohms at the first turn, 1,200 ohms at the second turn and 600 ohms at the third turn. Just preceding or simultaneously with a drop in DC potential there was a drop in resistance to loud sound. Recovery of the resistance preceded recovery of DC potential. Anoxia first lowered DC potential, then resistance. Both appeared to recover at nearly the same time. Destruction of the fourth, third, and second cochlear turns did not affect DC potential or microphonics in scala media recorded from the first turn through the round window. Both were abolished upon destruction of the first turn. No spread of current was found from one turn to another. Implications of these results are discussed.

Project & Task: 7210-71733
ASTIA No. AD-130947

(139)
TR 57-463 July 1957

Laird, Donald T.; Ackerman, Eugene; Randels, James B.; Oestreicher, Hans L. (Pennsylvania State University & AML)

SPHERICAL WAVES OF FINITE AMPLITUDE

Large amplitude pressure waves in air are distorted during propagation due to the non-linear nature of the differential equations describing the motion of gases. The present report investigates the propagation, the distortion of wave shape and frequency spectrum, and the formation of shocks for spherical symmetrical waves, generated by a pulsating sphere. As no exact solution is known, the boundary value problem is numerically integrated. For this purpose two perturbation methods are developed in this report. The first is a conventional type of perturbation; the second is a perturbation in the characteristics. Using these, one may solve the equations numerically for a pulsating sphere providing that the velocity amplitude at the sphere does not exceed 0.4 normal velocity of sound, and also that, at its smallest limit the radius is not decreased from equilibrium by more than a factor of two. The solution may be extended beyond the formation of iterated shock waves by this method. The results are presented for an illustrative number of spheres radii, amplitudes and frequencies in dimensionless form.

Project & Task: 7210-71706 Contract No. AF 33(616)-2772
ASTIA No. AD-130949

(140)
TR 57-467 August 1957

Misrahy, George A.; Shinabarger, Edward W.; Hildreth, Kenneth M. (Aerospace Medical Laboratory)

STUDIES OF FACTORS AFFECTING THE SUMMATING POTENTIAL

The role that distortion within the cochlea, streaming of endo- or perilymph, and sensitivity of microelectrodes to oxygen play in the genesis of the summating potential was studied. The most important factor appears to be mechanical distortion of the scala media. Any condition tending to increase distortion of the scala media lowers the threshold and increases the amplitude of the summating potential at given sound levels. Conditions preventing distortion have the reverse effect.

Project & Task: 7210-71733
ASTIA No. AD-130956

(141)
TR 57-547 September 1957

Cole, J. N.; von Gierke, H. E. (Aerospace Medical Laboratory)

NOISE FROM MISSILE STATIC FIRING AND LAUNCH SITES AND THE RESULTANT COMMUNITY RESPONSE

A procedure is given for evaluating areas adjacent to a missile operations site as regards to their suitability for housing. These procedures are applicable to operations of large thrust-class rockets which are vertically mounted and statically fired through simple 90° bucket deflectors, and those which are vertically launched. Those factors influencing the noise stimulus and the subsequent community response are discussed along with the limitations and sources of error inherent in the prediction procedures. Some conclusions are drawn as to the need for additional information in this problem area.

Project & Task: 7210-71705
ASTIA No. AD-131025

(142)
TR 57-570 April 1958

Clark, L. C.; Fox, R. P.; Misrahy, G. A. (Antioch College & AML)

STUDIES WITH CHRONICALLY IMPLANTED POLAROGRAPHIC ELECTRODES

Insulated metal polarographic cathodes were permanently implanted in the brain of cats allowing continuous recording of oxygen availability. A study was made of the current flow as related to applied potential, nature of the cathode and alterations in brain physiology. The oxygen availability to the brain remains essentially unaltered by a wide variety of pharmacological agents, including anesthetics and pressor agents, but appears to parallel changes in carbon dioxide tension add to be increased by ethyl and vinyl ether. All the observations to date are consistent with the concept that they represent fluctuations in the amount of oxygen available at the cathode due to rhythmic variations in blood flow through the finer cerebral vessels.

Project & Task: 7210-71733 Contract No. AF 33(616)-2316
ASTIA No. AD-131064

(143)
TR 57-647

November 1957

Anthony, Adam; Ackerman, Eugene (Pennsylvania State University)

BIOLOGICAL EFFECTS OF NOISE IN VERTEBRATE ANIMALS

This report deals with the stress effects of noise on bodily functions other than hearing. It includes physiological, biochemical and behavioral effects of intense acoustic noise at low and high frequencies. Specific approaches employed are as follows: (1) flame spectrophotometric analyses of serum electrolytes, (2) serum ascorbic acid and blood sugar changes, (3) changes in adrenal and plasman cholesterol, (4) behavioral changes in noise exposed rats, mice and guinea pigs, (5) relationship of seizure-susceptibility to noise stimulation and (6) design and construction of a corona speaker for use in bioacoustic studies. It was demonstrated that short daily exposures to intense noise of about 132-140 db pressure levels can act as a physiological stress to which rats, mice and guinea pigs can satisfactorily adapt. These studies have also helped clarify the nature of the normal physiological defense mechanisms to excessive noise stimulation. By investigating the factors determining the severity of noise as a stress stimulus and using objective measures of the limits of endurance of animals to different types of intense noise situations, one can more intelligently cope with the problem of preventing noise from becoming a serious health menace to man.

Project & Task: 7210
ASTIA No. AD-142078

Contract No. AF 33(616)-2505

(144)
TR 57-706

August 1958

Heuter, T. F. (Massachusetts Institute of Technology)

VISCO-ELASTIC LOSSES IN TISSUES IN THE ULTRASONIC RANGE

The propagation of ultrasonic waves is accompanied by a loss of vibrational energy whose frequency dependence is characteristic of the structural properties of the medium. A review of the various loss mechanisms that may occur in animal tissues or in other live colloids reveals that the different organizational levels of these structures— from the protein molecule to the gross-tissue matrix, may contribute to the losses in many different ways. A transition of low-to high-frequency absorption indicative of visco-elastic relaxation processes is observed. On the basis of new data, the hypothesis is advanced that low-frequency absorption is due mainly to gross-tissue properties, whereas the seat of high-frequency absorption is mainly in the molecular constituents of the tissues, i.e., in the protein molecules.

Project & Task: 7210-71703
ASTIA No. AD-142171

Contract No. AF 33(616)-2976

(145)
TR 57-772

May 1958

Hansen, R. G.; Blackstock, D. T. (Aerospace Medical Laboratory)

FACTORS INFLUENCING THE EVALUATION OF EAR PROTECTIVE DEVICES

The primary purpose of this study was to determine the number of subjects and the number of repeat measurements necessary to obtain a reliable value for the average attenuation of an ear plug under specific controlled conditions. Results indicate that satisfactory data would be obtained with ten subjects making three repeat measurements. Approximately the same results would be obtained with six subjects making five replications or 15 subjects making one replication. The method established by the American Standards Association for determining "real-ear" attenuation of ear protectors was employed to provide a trial study of the method. Attenuation values for the V-51R ear plug were obtained at each of nine frequencies for each of 20 subjects on each of five separate occasions.

Project & Task: 7210-71700
ASTIA No. AD-142266

(146)
TR 58-107 April 1958

Roman, J. (Aerospace Medical Laboratory)

EFFECTS OF SEVERE WHOLE BODY VIBRATION ON MICE AND METHODS OF PROTECTION FROM VIBRATION INJURY

A pilot study was carried out to investigate the mechanism and cause of death as well as other effects of severe vibration. Two hundred mice were exposed to severe vibration in planes parallel to and perpendicular to the longitudinal body axis. Sinusoidal vibration of varying frequency and amplitude was used and death was selected as the physiological end point. When injuries were sustained, they consisted of G. I. tract bleeding, lung damage and various sites of minor hemorrhage. Data showing the relationship between frequency and duration of exposure required to kill are given for a constant acceleration and they point to a "maximum effect frequency" of 25 cps for transverse vibration and 18 cps for longitudinal vibration. Tissue damage appears to have been caused by distortion and relative displacement of tissues or organs. Pure pressure effects were not observed.

Project & Task: 7210-71703
ASTIA No. AD-151070

(147)
TR 58-169 April 1959

Arde Associates

RESPONSE OF STRUCTURES TO AIRCRAFT GENERATED SHOCK WAVES

A study of the response of structures to aircraft generated shock waves is presented. Peak, free-stream, shock wave pressures producing failure of various structural elements of building are given. The failure pressures are functions of shock wave and structural parameters. Methods and basic data for predicting shock wave failure pressures of structural elements are also presented. Experimental structural failure data and aircraft generated shock wave and wind damage information are employed in conjunction with theoretical considerations to obtain the predicted failure pressures. Extensions of blast wave theory are made to account for the differences in shape and pressure levels between aircraft generated N-waves and blast waves. The pressure loads on structures produced by aircraft generated shock waves (necessary for structural response predictions) are computed within the general framework of blast wave procedures.

Project & Task: 7230-71780 Contract No. AF 33(616)-5197

(148)
TR 58-280 May 1959

Nixon, Charles W.; Hansen, Ronald G.; Blackstock, David T. (Aerospace Medical Laboratory)

PERFORMANCE OF SEVERAL EAR PROTECTORS

Attenuation and wearability features were evaluated for a number of ear protective devices: earplugs, ear muffs, helmets, and various combinations of devices. Attenuation is the prime objective of an ear protector; however, other features may eventually determine the suitability or non-suitability of an item for Air Force use. The current Air Force standard earplugs (V-51R) and ear muffs (PRU-1/P) were the best "overall" ear protectors of the reported evaluation. Many other devices considered unsatisfactory for military use in their present form contain particular features that are superior to the respective features of the standard items. Minor modifications of certain of these devices might well result in items suitable for Air Force use.

Project & Task: 7210-71700

(149)
TR 58-293 August 1958

Fyfe, I. M.; Klotter, K. (Stanford University)

NONLINEAR PROBLEMS OF ONE-DIMENSIONAL WAVE PROPAGATION IN GASES (TREATED BY THE RITZ METHOD)

The Ritz Method has been used extensively in solving statical and vibration problems. In this report the feasibility is investigated of applying the Ritz Method to wave propagation problems involving one space coordinate in addition to the time. In order that the Ritz Method can be applied it is necessary to obtain a functional in an integral which fully describes the problem, and if possible contains only one dependent variable. The bulk of this report is concerned with the two problems of (a) obtaining that functional and (b) of selecting the appropriate assumed form of the solution. The problems of a plane wave propagating in a tube and of spherical symmetrical waves are considered as examples.

Project & Task: 7210-71706 Contract No. AF 33(616)-3490
ASTIA No. AD-155880

(150)
TR 58-368

July 1958

Oda, F. (Pennsylvania State University)

CORONA TYPE LOUDSPEAKER

This report describes the development of a high frequency (1-50 kc), high power (1.3 kw) speaker needed in biological research. It includes a theoretical discussion of corona sound generation (thermal) and the reasons for upper (corona size) and lower (corona cooling rate) frequency limitations. Eleven speaker designs were tested. A 60 watt and a 1.3 kilowatt speaker system are described.

Project & Task: 7210-71701
ASTIA No. AD-155782

Contract No. AF 33(616)-2505

(151)
TR 58-416

August 1958

Latta, G.; McGregor, J. (Stanford University)

THE FUNDAMENTAL SOLUTION MATRIX FOR SYSTEMS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS

The construction of the fundamental solution matrix for systems of linear partial differential equations with real analytic coefficients is shown to depend on the fundamental solutions of a number of scalar equations, the connection being purely algebraic. The given differential operator matrix A is diagonalized by the operation AB = D, where B , D are differential operator matrices with real analytic coefficients, and D is diagonal.

Project & Task: 7210-71706
ASTIA No. AD-155824

Contract No. AF 33(616)-2987

(152)
TR 58-442

October 1958

Corso, J. F. (Pennsylvania State University)

SURVEY OF HEARING IN A LOW INDUSTRIAL NOISE-LEVEL POPULATION

This report summarizes a series of studies performed in conducting a survey to evaluate the hearing characteristics of a population exposed to minimal levels of industrial noise. Each of the studies reported contains a section on purpose, procedures, tests and instructions, results and conclusions. The basic topics covered relate to the threshold of hearing for pure tones as measured by different audiometric techniques, the threshold of hearing for speech, and the discrimination loss of speech. The results of the survey are presented in terms of normal threshold values and provide an adequate basis from which hearing loss due to noise exposure may be evaluated. It is recommended that the present standards of normal hearing be reestablished to account for the factors of age and of sex as important determinants of hearing ability.

Project & Task: 7210-71700
ASTIA No. AD-204799

Contract No. AF 33(616)-2626

(153)
TR 58-622

September 1959

Anthony, A.; Ackerman, E. (Pennsylvania State University)

STRESS EFFECTS OF NOISE IN VERTEBRATE ANIMALS

Rats, mice and guinea pigs were exposed to noise in two frequency ranges (150-4800 cps and 2-40 kc) at a sound pressure level of 135-140 db. Exposure time was 20-40 hours per week for 2 to 9 weeks. Stress response of the animals was measured by changes in the adrenal glands and other organs. It was most severe in animals exposed for the longest time to high frequency noise.

Project & Task: 7231-71786

Contract No. AF 33(616)-2505

(154)
TR 59-200 August 1959

Winchester, C. F.; Campbell, L. E.; Bond, J. (United States Department of Agriculture)

EFFECTS OF AIRCRAFT SOUND ON SWINE

To determine whether or not aircraft sounds affect swine unfavorably, a number of different lines of investigations have been carried out. Direct observations and motion picture records have been made of animals exposed to reproduced aircraft sounds at high levels of intensity. Heart rate measurements have been made in an attempt to determine possible rate changes due to noise. Feeding trials in which pigs were exposed daily to the sound of random "fly-overs" have been carried out. Possible effects of noise on reproduction have been investigated. In addition, histological studies of the ears and adrenal and thyroid glands of swine after sound exposure have been made. None of these lines of investigation has yielded evidence indicating that swine are influenced significantly by noise.

Project & Task: 6-(8-7210) Contract AF 33(616)-55-15

(155)
TR 59-201 April 1959

Peters, Robert W. (Mississippi Southern College)

MULTIDIMENSIONAL SCALING APPROACH TO THE DETERMINATION OF BASIC PSYCHOLOGICAL PARAMETERS FOR PURE TONES

The multidimensional scaling model of successive intervals was applied to investigate the dimensionality of auditory perception of pure tones. The stimuli consisted of 16 pure tones. Thirty-nine observers made distance judgments of simularity between stimuli. These inter-stimuli distances were analyzed mathematically to reveal the minimum number of dimensions necessary to account for the distances between stimuli. The results of the analysis indicated that there were two dimensions, pitch and loudness. The purpose of the study was to evaluate the multidimensional scaling method for use in auditory areas where the dimensions are not well known, and, since the two anticipated dimensions, pitch and loudness, were revealed, proposed use of the model in other auditory areas is supported.

Project & Task: 7231-71701
ASTIA No. AD-229447 Contract No. AF 33(616)-3644

(156)
TR 59-311 August 1959

Stark, Lawrence (Yale University)

TRANSFER FUNCTION OF A BIOLOGICAL PHOTORECEPTOR

A biological transducer of electromagnetic radiation energy to pulse rate modulated nerve impulse signals has been selected for study because of its lack of complex specialized accessory mechanisms. This simple crayfish photosensitive ganglion was subjected to a steady state analysis relying mainly on sinusoidal input light signals. The output signals of the population of nerve fibers were analyzed to yield a linear transfer function over the frequency range studied.

$$G(s) = \frac{ke^{-0.5s}}{(1+1.1s)}$$

The significance of these results, their context in neurophysiology, and possible direction for further investigations are discussed.

Project & Task: 7232-71785 Contract AF 33(616)-5708
ASTIA No. AD-228513

(157)
TR 59-391 July 1959

Ziegenruecker, G. H.; Magid, E. B. (Aerospace Medical Laboratory)

SHORT TIME HUMAN TOLERANCE TO SINUSOIDAL VIBRATIONS

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

Project & Task: 7231-71786
ASTIA No. AD-227341

(158)
TN 56-397

BIOPHYSICS

April 1958

Cohen, S. I.; Silverman, A. J.; Zuidema, George D. (Aerospace Medical Laboratory)

SKIN RESISTANCE CHANGES DURING ACCELERATION

Basal skin resistance level changes are felt to be due primarily to changes in over-all central nervous system arousal, as reflected in alterations in autonomic nervous system activity. Human subjects exposed to centrifugal forces demonstrated decreases in skin resistance. Rapid onset acceleration produces greater decreases in skin resistance than gradual onset acceleration or rapid onset acceleration of subjects protected by anti-G suits. The role of blood volume changes and compensatory sympathetic vasoconstrictive activity as the primary determinant of skin resistance decreases during acceleration was investigated in dogs which were hemisympathectomized and exposed to accelerative forces. The intact side showed a considerably greater decrease than the sympathectomized side.

Project & Task: 7215-71713
ASTIA No. AD-97275

(159)
TN 56-400

September 1958

Silverman, A. J.; Cohen, S. I.; Zuidema, G. D. (Aerospace Medical Laboratory)

PSYCHOLOGIC AND BIOELECTRIC ASSESSMENT OF G-SUIT PROTECTION

Performance of a psychomotor task and arousal as measured by GSR were assessed on six subjects who were centrifuged at 3 g for ten rides, while protected and again while unprotected by an anti-g suit. Results suggested less arousal and better sustained performance when protected by the suit.

Project & Task: 7215-71713
ASTIA No. AD-97278

(160)
TN 56-491

January 1957

Zuidema, George D.; Clarke, Neville P.; Smith, George D. (Aerospace Medical Laboratory)

A VERSATILE ANESTHESIA MACHINE FOR EXPERIMENTAL SURGERY

A readily adaptable and dependable anesthesia machine was developed to meet a need for controlled intermittent positive pressure or alternating positive-negative pressure during research work involving open-chest experiments or thoracic surgery. The design and operation of this device is described, and several clinical applications are suggested.

Project & Task: 7216-71712
ASTIA No. AD-110567

(161)
TN 57-234

February 1958

Pettit, J.; Cohen, S. I.; Silverman, A. J. (Aerospace Medical Laboratory)

MULTIPLE PSYCHOPHYSIOLOGIC MEASURES DURING GRADUAL ONSET ACCELERATION

Psychophysiological factors associated with the response of subjects to gradual onset acceleration have been investigated. The level of central nervous system arousal, as well as the vascular changes which occurred during G, appear to be related to blackout and performance decrement. The phonomenon of blackout is hypothesized as a complicated psychophysiologic phenomenon not dependent merely on the function of vascular reflex mechanisms.

Project & Task: 7215-71713
ASTIA No. AD-130796

(162)
TN 57-268 July 1958

Zuidema, G. D.; Cohen, S. I.; Silverman, A. J. (Aerospace Medical Laboratory)

CLINICAL EVALUATION OF LOW G TOLERANCE

Twelve student pilots were referred to this laboratory for evaluation of their g tolerance, following inflight blackout episodes. The patients were studied by a team using cardiovascular, neurohormonal, bioelectric, psychologic, and psychiatric techniques. Results showed that the patients could be divided into 4 groups: (1) 6 patients had no demonstrable physiological or psychological difficulties; (2) 2 subjects had been incorrectly performing protective maneuvers; (3) 2 patients had inadequate vasomotor reflexes; (4) 2 subjects had psychologic characteristics felt to be important determinants of lowered acceleration tolerance. The relationship of cardiovascular and psychophysiological factors in tolerance to g forces is illustrated.

Project & Task: 7216-71712 and 7215-71713
ASTIA No. AD-130918

(163)
TN 57-371 November 1957

Chapman, K. M. (Aerospace Medical Laboratory)

A MINIATURE, DIRECT-PLOTTING PULSE-FREQUENCY NOMOGRAM

A device is described for conveniently and inexpensively plotting event rates from time-based data records, such as heart rate from electrocardiograms, (ecg's), and discharge frequency from volleys of nerve impulses. Principles of design, construction of a prototype, and photographic duplication of copies in quantity are discussed. The use of the nomogram for plotting nerve impulse frequencies is illustrated.

Project & Task: 7216-71712
ASTIA No. AD-142097

(164)
TN 57-372 December 1957

Chapman, K. M. (Aerospace Medical Laboratory)

A NORMALIZED NOMOGRAM FOR THE "WYE-DELTA" TRANSFORMATION

The nomogram described here performs the transformations between the "wye" and "delta" forms of three-terminal networks. While the coordinates are normalized with respect to the smallest "wye" element, an operating procedure is described which is only slightly more complicated than using an ordinary slide rule. It will handle any three-terminal network whose elements can be represented simultaneously as positive real numbers. In general, it cannot be applied to complex impedances. The range of the nomogram includes networks having as much as 100:1 ratio between the largest and smallest "wye" elements.

Project & Task: 7216-71712
ASTIA No. AD-142098

(165)
TN 57-427 December 1957

Bonner, R. H. (Aerospace Medical Laboratory)

THE EFFECTS OF STRESS ON UROPEPSIN EXCRETION

The effect was investigated of various forms of stress, as encountered in certain AF operational situations, on uropepsin excretion in urine. Twenty-three subjects were tested under conditions of prolonged positive G, crew confinement, exposure to high temperature-high altitude, and visual and auditory deprivation. Volumes, specific gravities, and collection times were recorded for the urine samples taken from the crew. The assay method of M. L. Anson (J. Gen. Physiol. 22:79, 1938) was used with some modification. The order of adding reagents was shown to be significant in developing color to reflect the degree of uropepsin excretion. An attempt was made to determine which proteolytic enzyme was being measured. The greatest activity was observed at pH 1.5 which is optimum for pepsin, indicating that pepsin was the enzyme being measured. The results showed that uropepsin excretion increased before the application of specific simulated flight stresses and decreased during the application of specific simulated flight stress. Deprivation of visual and auditory stimuli did not produce any significant change in uropepsin excretion from pretest levels.

Project & Task: 7220-71742
ASTIA No. AD-142256

(166)
TN 58-85 May 1958

Zuidema, G. D.; Clarke, N. P. (Aerospace Medical Laboratory)

A PULSE SIMULATOR FOR THE STUDY OF FLASH BURNS

A technique is presented which modifies the beam of radi ant energy from a carbon arc source. A rotating wheel, bearing a series of 22 screen filters, is interposed in the beam, and in one complete revolution simulates the pulse of thermal radiation emanating from an atomic or thermonuclear explosion.

Project & Task: 6311-63352
ASTIA No. AD-155621

(167)
TN 58-284 October 1958

Morrison, N. K. (Aerospace Medical Laboratory)

DEVELOPMENT OF CONDUCTIVE CLOTH PLANTAR ELECTRODE FOR USE IN MEASURING SKIN RESISTANCE

This report describes the design and development of a conductive cloth plantar electrode for use in studies of galvanic skin resistance changes. The conductive cloth electrode proved to be more effective than lead electrodes due to its flexibility, comfort over extended time periods, light weight, and better continuous contact with the foot. The concept of placing the electrodes inside socks is presented as it was developed for skin resistance studies of subjects who were active over extended periods of time. These sock electrodes were worn continuously for periods up to seven days without discomfort, and the GSR writeout was relatively free of movement artifacts.

Project & Task: 7222-71747
ASTIA No. AD-204425

(168)
TN 58-376 December 1958

Zechman, F. W., Jr. (Aerospace Medical Laboratory)

THE EFFECT OF FORWARD ACCELERATION ON VITAL CAPACITY

The effect of forward acceleration on vital capacity has been measured on six human subjects. Vital capacities were reduced in a fairly uniform manner with increasing g. Values reached on average of 1.5 liters at 8 g when the trunk was inclined 25° forward. This degree of reduction was reached at 6 g when the trunk was not inclined.

Project & Task: 7222-71746
ASTIA No. AD-209411

(169)
TN 59-92 March 1959

Riley, M. B.; Bernardini, A. T. (Aerospace Medical Laboratory)

ANIMAL AND HUMAN STUDIES OF THE EFFECTS OF LOW-FREQUENCY OSCILLATION COMBINED WITH TRANSVERSE ACCELERATION

Animal and human endurance is reported to low-frequency oscillation combined with acceleration having a resultant force acting in the back-to-chest direction. No significant suggestion of trauma was found in animal subjected to a maximum oscillation-g pattern of 2.8 cycles per second through a 36° arc in a 12 g field. In humans, there was no identifiable endpoint when they were subjected to a maximum oscillation-g pattern of 0.7 cycle per second through a 36° arc in an 8 g field.

Project & Task: 7222-71748

(170)
TN 59-109 July 1959

Clarke, N. P.; Hyde, A. S.; Cherniack, N. S. (Aerospace Medical Laboratory)

A PRELIMINARY REPORT OF HUMAN RESPONSE TO REARWARD FACING RE-ENTRY ACCELERATIONS

Tidal volume, electrocardiographic changes, tracking performance ability, and subjective response were evaluated during an acceleration profile designed to encompass several possible rearward facing re-entry patterns. A maximum acceleration of 16.5 g and a total time of 170 seconds were employed. Subjects faced the center of rotation with the trunk and head inclined 12° in the direction of the centrifuge axis. The subjects were supported with a contoured net system. Two of seven subjects repeated the experiments wearing the MC-2 full pressure suit, both pressurized and unpressurized.

Project & Task: 7222-71746

(171)
TR 56-30 May 1958

Hansen, Robert; Cornog, Douglas Y.; Hertzberg, H. T. E. (H. L. Yoh Company & AML)

ANNOTATED BIBLIOGRAPHY OF APPLIED PHYSICAL ANTHROPOLOGY IN HUMAN ENGINEERING

This volume contains condensations of 121 reports in the field of Applied Physical Anthropology. A majority of the annotations are grouped under three headings, Anthropometry, Biomechanics, and Comfort; a few are included in a General Group. Working data and important illustrations are quoted directly from the original papers in most cases. A complete index is arranged by author as well as by subject. An additional list of reports (not annotated) is included as background material. Two appendices containing relevant commentary of Seating Comfort and Anthropomorphic Dummies, are also included.

Project & Task: 7214-71727 Contract No. AF 33(616)-2353
ASTIA No. AD-155622

(172)
TR 56-364 February 1957

Emanuel, Irvin; Barter, James T. (Aerospace Medical Laboratory)

LINEAR DISTANCE CHANGES OVER BODY JOINTS

Linear distance changes over the body surface resulting from various joint movements were studied on a series of thirty young men. The following joints and joint complexes were studied: head and neck, shoulder, elbow, wrist, fingers, trunk, hip, knee, and ankle. Summary statistics and design values are presented for 48 linear distance changes measured over these joints. While there are usually definite and significant changes in bodily dimensions resulting from joint movements, these changes are generally fairly constant in magnitude. At the same time, the changes are mostly unrelated to body size. The information is designed for application to close fitting altitude clothing which must provide both physiological protection and body mobility. In addition, these data can serve as a guide for determining easement factors for more commonplace types of clothing.

Project & Task: 7214-71727
ASTIA No. AD-118003

(173)
TR 56-365 April 1959

Emanuel, I; Alexander, M.; Churchill, E. (Aerospace Medical Laboratory)

A HEIGHT-WEIGHT SIZING SYSTEM FOR FLIGHT CLOTHING

This report presents a height-weight system for use by designers and fitters of flight clothing. A re-analysis of the 1950 Anthropometric Survey consisted of selecting pairs of dimensions and correlating these with other dimensions important in clothing design. Tables of body dimensional data are presented for several basic size programs (6-size, 8-size, 9-size, and 12-size), since the number of sizes varies with the type of garment. These tables include fitting charts, estimated procurement tariffs, design ranges, mean values for size groups, and bivariate tables for height and weight size categories marked off for each program. The choice and application of these programs are discussed in detail. Advantages of the height-weight system include improved fit, fewer alterations, minimal adjustability, and simplified procurement, distribution and fitting procedures.

Project & Task: 7214-71739
ASTIA No. AD-130917

(174)
TR 56-404 February 1957

Alexander, Milton; Hertzberg, H. T. E. (Aerospace Medical Laboratory)

A COMFORT EVALUATION OF A FORM-FITTING HIGH ALTITUDE HELMET

This report describes comfort tests on an experimental pressure helmet assembly, consisting of an outer rigid shell and an inner compressible, form-fitting liner of polyurethane foam. Seventy-two subjects were used, of whom twenty-one were rated military pilots. A number of testing techniques and fabricational requirements for comfort and acceptability are discussed, and their applicability to most forms of headgear, especially those using compressible liner material, is indicated.

Project & Task: 6333-71738
ASTIA No. AD-110548

(175)
TR 56-458 December 1956

Meyers, H. C., Jr.; Daniels, G. S. (Antioch College)

BODY DIMENSION CHANGES DURING BASIC TRAINING

Changes during basic training in the body dimensions of approximately 200 male and a similar number of female airmen were measured. Eight circumferences, weight, and stature were measured weekly during each of the first 4 wk and during the eighth and twelfth weeks of training. The resulting data were analyzed in the hope that changes in proper clothing size which occur during the training period could be predicted in advance. Variability in the changes was too large and the relationships among the changes and the airmen's original dimensions too poor to permit useful predictions. A complete resume of the results of the investigation are presented for the guidance of personnel concerned with the design and the issuance of clothing for and to basic trainees.

Project & Task: 7214-71728 Contract No. AF 33(616)3841
ASTIA No. AD-97216 Contract No. AF 18 (600)30

(176)
TR 56-588 November 1956

Zuidema, George D.; Clark, Neville P.; Minton, Mary F. (Aerospace Medical Laboratory)

OSMOTIC REGULATION OF TOTAL BODY FLUIDS

Experiments utilizing intracarotid injections of hypertonic solutions were carried out on animals which had been lightly anesthetized with chloralose to eliminate the possibility of conditioning an antidiuretic response. These experiments, raising carotid osmolarity by approximately 50% for a 10-second period, confirmed previous observations that an antidiuresis follows an increase in carotid osmolarity. When carotid osmolarity was increased by less than 2% over a 40-minute period, an antidiuresis also resulted. Under the latter circumstances, little difference was observed between the relative effectiveness of hypertonic urea, sodium chloride, or sodium sulfate, as substances for injection, all of which were calculated to raise osmolarity by approximately equal amounts. Bio-assay technics showed greatly increased amounts of antidiuretic substance in urine after intracarotid injections of hypertonic solutions; in comparison, controls taken after isotonic saline injections showed only minimal antidiuretic activity. Intrafemoral injections of identical solutions were followed by slight diuresis and increased urine osmolarity in the case of sodium chloride and urea, while sodium sulfate injections were followed by slight decreases in urine flow, of short duration, as well as decreases in total urine osmolarity. The marked antidiuretic effect seen following intracarotid injections of hypertonic solutions and the lack of evidence of antidiuretic activity following intrafemoral injections of the same solutions lends support to the theory of central localization of the osmotic control center.

Project & Task: 7216-71712
ASTIA No. AD-110569

(177)
TR 56-599 December 1956

Barter, James T.; Alexander, Milton (Aerospace Medical Laboratory)

A SIZING SYSTEM FOR HIGH ALTITUDE GLOVES

This report presents the rationale for and procedures followed in the development of a sizing program for high altitude gloves. This program is based on four divisions of hand circumference, each subdivided into three divisions of hand length making a total of twelve sizes. A selected sample of 100 hands was measured to provide the thirty-one dimensions presented for design purposes. Summary statistics, regression equations, design dimensions, and a procurement tariff are presented in various tables throughout the report. The results of a fit-test of two differing styles of gloves sized according to this program indicate that a high percentage of personnel can be fitted adequately in their indicated size. Detailed instructions for determining the indicated size of gloves are also included.

Project & Task: 7214-71739 Contract No. AF 18(600)-30
ASTIA No. AD-110589

(178)
TR 56-621 June 1957

Churchill, Edmund; Truett, Bruce (Antioch College)

METRICAL RELATIONS AMONG DIMENSIONS OF THE HEAD AND FACE

Correlation data for the head and face dimensions of two groups of USAF personnel are presented. These data extend the useful information about these dimensions into the areas in which two or more dimensions are considered simultaneously. Forty-one dimensions of flying personnel, based on a sample of over 4,000, and six dimensions of WAF trainees, based on a sample of 852, are reported. In addition to a presentation of the data, the report discusses the utility of correlational statistics in the design of personal equipment and describes the procedures used in obtaining these data. Coefficients of correlation for the 820 pairs of flying personnel data and the 15 pairs of WAF data are given. Multiple correlation coefficients for each dimension and selected pairs of dimensions for the flying personnel are also given. Regression equations for estimating one dimension from values of another are listed for most pairs of flying personnel dimensions which are at least moderately well correlated. About seventy bivariate frequency tables are presented. No useful summary of this large body of statistics can be made since it is the individual data which are of importance.

Project & Task: 7214-71728 Contract No. AF 33(616)-3841
ASTIA No. AD-110629 Continuation of
Contract No. AF 18(600)-30

(179)
TR 57-125 April 1957

Bevan, William; Patton, Rollin M. (Lockheed Aircraft Corporation)

FATIGUE, STRESS, BODILY CHANGE AND BEHAVIOR (Selected Bibliography)

The bibliography surveys the entire field of stress and fatigue, and the accompanying behavior and bodily changes. A total of 883 references are alphabetized. A complete topical index concludes the bibliography, with classification under a wide scatter of headings.

Project & Task: 6335-63614 Contract No. AF 33(616)-3745
ASTIA No. AD-118091

(180)
TR 57-136 April 1957

Slechta, R. F.; Wade, E. A. (Tufts University)

COMPARATIVE EVALUATION OF AIRCRAFT SEATING ACCOMMODATION

Three inter-related purposes were accomplished: (1) A series of seats currently in use in operational aircraft were comparatively tested for adequacy in limiting pilot and crew fatigue and discomfort. (2) Several subjective methods of comfort testing were devised and evaluated to determine efficient and economical means of seat evaluation. (3) The test data were analyzed for basic information about the nature and progression of seating discomfort. The approach was experimental, using techniques and orientations of an inter-disciplinary research team. Eighteen subjects, selected to represent a wide range of the body sizes in the Air Force population, were seated in each of six seats for tests up to 7 hours in duration. Six by six Latin Squares were utilized for purposes of counterbalancing. Summaries of data and discussions of statistical techniques are presented in appendices. Results are summarized in an introductory overview and in the conclusions section. Results of several comfort testing techniques were found consistent one with the others. Statistical separation of the seats was demonstrated in analyses of data from voluntary sitting time and other techniques. Statistical treatment of sitting time data from twelve subjects gave essentially the same results as those obtained with 18 subjects. Localized discomfort in the back and buttocks was found more important than discomfort in the thighs, neck, shoulders and lower legs in producing general discomfort. Seat parts were analyzed for their relative importances in achieving comfortable seating.

Project & Task: 7215-71724 Contract No. AF 33(616)-3068
ASTIA No. AD-118097

(181)
TR 57-197 April 1957

Churchill, Edmund; Bernhardi, Katherine (Antioch College)

WAF TRAINEE BODY DIMENSIONS: A CORRELATION MATRIX

Correlation coefficients expressing the degree of relationship between the 1830 pairings of 61 WAF basic trainee body dimensions are presented in the report. Slightly over two thousand multiple correlation coefficients expressing the degree of relationship between each of these dimensions and 36 pairs of them are also given. Regression equations for estimating all other dimensions from specified values of stature, of weight, and of stature and weight together are listed. Values computed from most of these equations are tabulated for the most frequently occurring values of stature, weight, and stature-weight combinations. This correlation material supplements the basic dimensional data given in Anthropometry of WAF Basic Trainees, WADC TR 53-12, (AD-20542) and, with these data, provides a basic for the planning and execution of design programs involving the body dimensions of these individuals.

Project & Task: 7214-71728 Contract No. AF 18(600)-30 and
ASTIA No. AD-118161 Contract No. AF 33(616)-3841

(182)
TR 57-198 April 1957

Churchill, Edmund; Kuby, Alma; Daniels, G. S. (Antioch College & AML)

NOMOGRAPH OF THE HAND AND ITS RELATED DIMENSIONS

The design of equipment which must fit closely a part of the users' body calls for a knowledge both of the actual dimensions of this part of the body and of the interrelationships among these dimensions. This report brings together both types of information for the hand. Dimensional data for the hands of both male and female USAF personnel are summarized in tabular and graphic form. Intensities of the interrelationships within each of the two groups of dimensions are given in the form of tables of correlation coefficients. A series of tables supply estimates of the other dimensions for the appropriate ranges of values of hand length, hand breadth at metacarpale, hand breadth at thumb, and first circumference. Nomographic charts are presented for estimating the related dimensions for all likely combinations of values of the hand lengths and breadths for both USAF flying personnel and WAFs. The basic data used for the men are those obtained from a survey of USAF flying personnel; for women the data are those obtained from a survey of WAF basic trainees. Data obtained from other surveys of military personnel are summarized; these data suggest the applicability of the tables and charts presented here to the design of articles intended for almost any group of USAF personnel.

Project & Task: 7214-71728 Contract No. AF 18(600)-30 and
ASTIA No. AD-118162 Contract No. AF 33(616)-3841

(183)
TR 57-204 April 1957

Lafferty, R. E.; Graetzer, R. (Aerospace Medical Laboratory)

A STRAIN GAUGE METHOD OF MEASURING WINDBLAST ON FLIGHT HEADGEAR

The headgear, such as helmets, oxygen masks, etc., worn by pilots must be able to withstand the windblast conditions encountered during emergency ejection from a moving aircraft. During the course of the tests herein described, strain gauges were used to measure the forces exerted by the windblast. When plotted, the data obtained gave qualitatively consistent graphs, and when correlated with high speed motion pictures of the test runs, indicated this method of instrumentation to be a feasible means for windblast force measurement.

Project & Task: 7218-71717, 71722
ASTIA No. AD-118169

(184)
TR 57-260 April 1957

Barter, James T. (Aerospace Medical Laboratory)

ESTIMATION OF THE MASS OF BODY SEGMENTS

A reanalysis of the existing data on the mass of segments of the human body was carried out to provide engineers and designers with more reliable figures. Where the lack of agreement between total body weight and the sum of all the parts was 2 or more pounds the original total body weight was generally disregarded, and a new total weight was calculated by summing the individual values of the segments. Then the masses of corresponding segments from W. Braune and O. Fischer (The center of gravity of the human body as related to the equipment of the German infantry. Treatises of the Mathematical-Physical Class of the Royal Academy of Sciences of Saxony, no. 7, Leipzig, 1889) and Dempster(WADC TR55-159, AD-87892) were tabulated. From these tabulations, means, standard deviations, and correlations with weight were calculated; regression equations were calculated for each segment along with a standard error of estimate. Utilization of the regression equations for the various body segments should provide the engineer with a better means of estimating the masses of segments.

Project & Task: 7214
ASTIA No. AD-118222

(185)
TR 57-432 July 1957

Emanuel, Irvin; Alexander, Milton (Aerospace Medical Laboratory)

HEIGHT-WEIGHT SIZING AND FIT-TEST OF A CUTAWAY G-SUIT, TYPE CSU-3/P

Body size data from the 1950 Air Force Anthropometric Survey have been reanalyzed to yield a statistical sizing program based on height and weight. This six-size program was incorporated into the Type CSU-3/P Cutaway Anti-g Garment, which was tested from the standpoint of fit and comfort. Suit selection was accomplished simply by asking each subject his height and weight. Of seventy-three subjects fitted, seventy-two were comfortably accommodated by the size indicated by height and weight values. It is concluded that this sizing procedure will result in the saving of time and money because of the ease of fitting, reduction of individualized tailoring and simplification of procurement.

Project & Task: 7214-71739 Contract No. AF 18(600)-30
ASTIA No. AD-130912

(186)
TR 57-477, Pt. 1 October 1957

Madson, Raymond A. (Aerospace Medical Laboratory)

HIGH ALTITUDE BALLOON DUMMY DROPS. PART I. THE UNSTABILIZED DUMMY DROPS

The characteristics of instrumented dummies carried aloft to predetermined altitudes were studied during the free fall in unstabilized situations. These dummies were observed to assume an attitude permitting spins about a transverse axis, and the angular velocities recorded on accelerometers exceeded rates compatible with human tolerance. This study justifies further tests to develop a method of stabilizing a man descending from high altitudes.

Project & Task: 7218-71719
ASTIA No. AD-130965

(187)
TR 57-510 May 1958

Adams, O. S. (Lockheed Aircraft Corporation)

AIRCREW FATIGUE PROBLEMS DURING EXTENDED ENDURANCE FLIGHT. (PHASE I: PLANNING)

A plan is outlined for an experimental program designed to determine the effects of confinement-induced stresses on a five-man crew isolated in a flight station for a period of 120 hours. The experimental crew compartment is described and illustrated, and the performance tasks, programming and recording instrumentation, together with the laboratory techniques planned for use in the experiment, are explained.

Project & Task: 6335-63614 Contract No. AF 33(616)-3745
ASTIA No. AD-130983

(188)
TR 57-586 December 1957

Hunsicker, Paul A. (University of Michigan)

A STUDY OF MUSCLE FORCES AND FATIGUE

The first phase of the research deals with the strength test results taken on 30 subjects, covering 120 strength tests. The subjects were seated in a simulated pilot-seat, and six movements were tested. The results are presented in percentile tables and graphic form. The next part of the study involves data on 25 subjects who were tested to determine the amount of strength possible in wrist pronation and wrist supination. The final phase of the research gives information on the strength-decrement over a 42-hour period in which the subjects were tested hourly. Several recommendations are offered.

Project & Task: 7214-71727 Contract No. AF 33(616)-3461
ASTIA No. AD-131089

(189)
TR 57-590 October 1957

Geer, R. L. (Aerospace Medical Laboratory)

OPERATIONAL REGIONS AND BIO-AERODYNAMIC LIMITATIONS OF FUTURE AIRCRAFT ESCAPE SYSTEMS

The boundaries and conditions for practical flight within the atmosphere are delineated. The region where flight is practical is divided into areas of different escape requirements. Three figures are included to illustrate the various flight regions as a function of altitude and Mach number.

Project & Task: 7218-71719 & 71750
ASTIA No. AD-131089

(190)
TR 58-60 March 1958

Sonnenschein, R. R. (University of California)

THERMOELECTRIC MEASUREMENT OF CEREBRAL BLOOD FLOW

Regional cerebral blood flow was measured thermoelectrically, utilizing a heated thermistor probe. It was found that blood flow varied independently with arterial pressure and local vasomotion. Tissue oxygen tension was shown to be correlated with blood flow, oxygen saturation of the blood, and oxygen utilization of the tissue. A local change in cortical blood flow accompanied spreading cortical depression. During the latter phenomenon, a change in surface pH occurred which was parallel to the changes in surface d.c. potential. It was concluded that the change in pH was intimately related to the mechanism of depression and constituted a major factor in the genesis of the d.c. potential shift.

Project & Task: 7215-71713 Contract No. AF 33(616)-2247
ASTIA No. AD-151033

(191)
TR 58-67

February 1958

Hertzberg, H. T. E.; Dupertuis, C. W.; Emanuel, Irvin (Western Reserve University & AML)

STEREOPHOTOGRAMMETRY AS AN ANTHOROPOMETRIC TOOL

This paper briefly reviews previous biological applications of stereophotogrammetry, and outlines with illustrations the present procedures used to draw human body contours at 1/2-inch intervals. It compares the dimensions derived from plotted profiles with those taken by hand on the subjects themselves. It discusses the utility of stereo data for special anthropometric purposes, and mentions further applications for other biological sciences.

Project & Task: 7214 and 6333-71728
ASTIA No. AD-151964

(192)
TR 58-101

May 1958

Chapman, K. M. (Aerospace Medical Laboratory)

TRANSIENT RESPONSE STUDIES OF THE BLOOD VOLUME RECEPTOR SYSTEM IN DOGS

Transient responses of the left atrial stretch receptors in dogs have been studied with the use of indwelling atrial balloons in which stepfunction volume changes were produced. Receptor transients have been described in terms of the parameters of a simple passive mechanical analog model. No consistent pattern is seen in the calculated parameters. A comparison of pressure and receptor response transients leads to the conclusion that sensory adaptation of the end organs probably exists.

Project & Task: 7216-71712
ASTIA No. AD-155584

(193)
TR 58-156

April 1958

Bondurant, S.; Clarke, N. P.; Blanchard, W. G. (Aerospace Medical Laboratory)

HUMAN TOLERANCE TO SOME OF THE ACCELERATIONS ANTICIPATED IN SPACE FLIGHT

Selected studies of human tolerance to the linear accelerations which are anticipated in space flight have been reviewed. As defined in these studies, tolerance limit is determined by the loss of a critical faculty, i.e., ability to see, think, or exercise at least finger control. Tolerance times at g levels between 2 and 12 in various body positions are presented. The capacity of subjects to stand repeated peaks of acceleration similar to those encountered in multistage rocket vehicles has been explored. Tolerance times longer than any previously reported are obtained by immersion of the subject in water in the semi-supine position.

Project & Task: 7216-71712
ASTIA No. AD-151172

(194)
TR 58-193

September 1958

Hollister, N. R.; Jolley, W. P.; Horne, R. G.; Friede, R. (Applied Research Inc. & AML)

BIOPHYSICS OF CONCUSSION

Methods were developed for effecting a reproducible experimental "concussion." Three principal factors thought to cause "concussion" were studied: (1) rapid deceleration, (2) total force imparted to the skull, and (3) stretch of the cervical region. A test drop rig was developed and instrumentation was used to measure the various force vectors. The following conclusions were drawn: (1) Total force applied to the skull is not a factor in "concussion" under the test conditions; (2) acceleration concussion is not a factor under the test conditions; (3) stretch of the cat's neck or some unknown factor, which can be altered by applying a muscle-tetanizing current, accounts for the "concussion" produced. Neurohistopathological studies were done and are discussed in Part II ov this report.

Project & Task: 7220-71752
ASTIA No. AD-203385

Contract No. AF 33(616)-2894

(195)
TR 58-263 June 1958

Bondurant, S.; Finney, W. A. (Aerospace Medical Laboratory)

THE SPATIAL VECTORCARDIOGRAM DURING ACCELERATION

Electrocardiographic and spatial vectorcardiographic effects of several patterns of positive, negative, and transverse acceleration have been studied. The observed effects essentially confirm previous observations with the exception that no dangerous arrythmias were observed with prolonged positive acceleration.

Project & Task: 7216-71712
ASTIA No. AD-155653

(196)
TR 58-267 July 1958

Clarke, N. P.; Bondurant, S. (Aerospace Medical Laboratory)

HUMAN TOLERANCE TO PROLONGED FORWARD AND BACKWARD ACCELERATION

Optimal body positions for forward and backward acceleration are defined. Plateaus between 2 and 12 g were maintained with optimal positioning, until subjective loss of a critical faculty occurred. Forward acceleration of the seated subject with trunk inclined 25° in the direction of acceleration was limited above 10 g by blackout and below 10 g by inspiratory dyspnea and substernal pain. Using an especially designed restraint suit, backward acceleration of the seated subject with trunk and head erect was limited above 10 g by discomfort of restraint and increases in vascular pressure in the legs, and below 10 g, by these factors as well as dyspnea. Three-stage rocket-like profiles of forward acceleration, calculated to give orbital velocity, were found tolerable by selected subjects at peak accelerations of 8, 10, and 12 g.

Project & Task: 7222-71746
ASTIA No. AD-155749

(197)
TR 58-290 July 1958

Bondurant, S.; Blanchard, W. G.; Clarke, N. P.; Moore, F. (Aerospace Medical Laboratory)

EFFECT OF WATER IMMERSION ON HUMAN TOLERANCE TO FORWARD AND BACKWARD ACCELERATION

Accepted physical principles suggest that immersion of subjects in water should constitute effective protection against some of the effects of acceleration. This premise has been evaluated in a study of the duration of tolerance of immersed subjects to forward accelerations of 6 through 14 g. Respiration was maintained by the use of skin diver's breathing equipment. With proper positioning, acceleration time tolerances were observed which were in excess of twice any previously reported.

Project & Task: 7222-71746
ASTIA No. AD-155808

(198)
TR 58-307 December 1958

Duddy, J. H.; Dempsey, C. A. (Tufts University)

LIGHT-WEIGHT SEATING: DESIGN RESEARCH AND DEVELOPMENT OF A NET SEAT FOR PROJECT MANHIGH

This report describes the design research and development of a light-weight nylon net aeat for project MANHIGH. Experiments were conducted to determine the ways in which the complex contours of a continuous body supporting surface could be generated with nylon net. Three independent factors, found to affect the curvature of the surface, were varied empirically to develop an experimental seat design for submission to the Project MANHIGH contractor. Contractor forces developed an aluminum and nylon net facsimile of the proposed seat for installation in the balloon gondola. An evaluation of the seat was conducted by the pilot during OPERATION MANHIGH II.

Project & Task: 7222-71747 Contract No. AF 33(616)-3068
ASTIA No. AD-206922

(199)
TR 58-308 December 1958

Bennett, E. M.; Kemler, D. K.; Allen, P. S. (Tufts University)

THE POLYDIAGNOSTIC METHOD OF MULTIPLE FORCED-CHOICE RANKINGS IN DESIGN ANALYSIS

This report outlines one of the newer psychophysical methods, the polydiagnostic method of forced-choice rankings, and its applications to the area of design analysis and prediction of product acceptability. Three examples of the method are included. The first example considers one of the most commonly used industrial designs - the telephone handset. The second and third examples consider one of the more vital elements of the crew station- the seat on which a man might be expected to remain for many hours during many days or weeks in the course of extraordinary flights of long duration.

Project & Task: 7222-71747 Contract No. AF 33(616)-3068
ASTIA No. AD-210120

(200)
TR 58-309 December 1958

Forrest, J.; Wade, E. A. (Tufts University)

LIGHT-WEIGHT SEATING: DESIGN RESEARCH ON A NYLON SEAT

This report describes a design research program for a light-weight aircraft seat made from nylon netting. An empirical approach was used to evaluate a series of exploratory designs and to modify solutions on the basis of subjective reports by individuals occupying the seats. A number of specific design problems were investigated with the results indicating that human factors requirements of a seat for long term occupancy can be met by a nylon net seat.

Project & Task: 7222-71747 Contract No. AF 33(616)-3068
ASTIA No. AD-209380

(201)
TR 58-312 March 1959

Slechta, R. F.; Forrest, J. (Tufts University)

COMFORT EVALUATION OF THE C-118 PILOT SEAT (AEROTHERM)

This study was undertaken in order to evaluate certain design characteristics of the C-118 Pilot Seat (Aerotherm) in terms of their adequacy for the maintenance of human comfort. The method of evaluation consisted primarily of subjective and behavioral laboratory tests administered by means of hourly questionnaires presented to seventeen subjects during a voluntary sitting period of seven hours maximum duration. On the basis of test data and specific comments made by the subjects, recommendations for seat design improvements were made.

Project & Task: 7215-71724
ASTIA No. 212559 Contract No. AF 33(616)-3068

(202)
TR 58-332 November 1958

White, W. J.; Riley, M. B. (Aerospace Medical Laboratory)

THE EFFECT OF POSITIVE ACCELERATION ON THE RELATION BETWEEN ILLUMINATION AND INSTRUMENT READING

This study concerns the manner in which the accuracy of quantitative scale readings varies as a function of illumination and acceleration. The following basic findings resulted from an analysis of the data from this experiment: 1. At the higher levels of instrument illumination, increasing acceleration and decreasing luminance produce relatively small increases in reading errors. 2. At marginal levels of illumination, acceleration and luminance interact to produce a relatively large increase in error. 3. Intensity of illumination can compensate for the decline in visual performance at stress levels above 1 g.

Project & Task: 7216-71712
ASTIA No. AD-206663

(203)
TR 58-333

November 1958

White, W. J. (Aerospace Medical Laboratory)

ACCELERATION AND VISION

This report is a review and evaluation of research pertaining to the effects of acceleration on human vision. Studies of gross qualitative changes in vision such as "blackout" and loss of peripheral vision in headward (positive) acceleration and the less dramatic effects in other body orientations to the acceleration vector are discussed first, together with the physiological basis of these symptoms. Then the quantitative and analytic studies of the influence of acceleration on vision are reviewed including the use of electrophysiological techniques and the application of the threshold method of psychophyics. Finally a number of areas are pointed out where there is a need for more investigation.

Project & Task: 7216-71712
ASTIA No. AD-208147

(204)
TR 58-453

April 1959

Tolles, Walter E.; Carbery, William J. (Airborn Instruments Laboratory)

A SYSTEM FOR MONITORING THE ELECTROCARDIOGRAM DURING BODY MOVEMENT

This investigation was undertaken to develop a system for monitoring the electrocardiogram during body movement. Two new lead systems were devised that produced interpretable electrocardiograms and were insensitive to moderate body movements. A new stainless-steel mesh electrode designed for this investigation provided technically satisfactory electrocardiograms during all body movements. The best method of applying these electrodes to the skin was with adhesive tape. Good electrode-to-skin contact was obtained for as long as 6 hours. For monitoring of the electrocardiogram with the new lead system, a recording frequency band pass of 0.1 to 20 cps produced interpretable electrocardiograms during moderate body movement. With more strenuous activities, a recording frequency band pass of 0.8 to 10 cps produced interpretable electrocardiograms; however, the amplitude and shape of the characteristic waves were modified.

Project & Task: 7222-71751
ASTIA No. AD-215538

Contract No. AF 33(616)-5473

(205)
TR 58-505

March 1959

Emanuel, I.; Alexander, M.; Churchill, E. (Antioch College & AML)

ANTHROPOMETRIC SIZING AND FIT-TEST OF THE MC-1 ORAL-NASAL OXYGEN MASK

A sizing program for oral-nasal oxygen masks, based on total face length and lip length, has been developed through a reanalysis of the 1950 USAF Anthropometric Survey head and face data. Face forms, based on this sizing program, have been constructed for use in the preparation of such masks. The MC-1 Oxygen Mask, an oral-nasal, pressure-demand type mask, has been fabricated in accordance with the sizing system and through the use of these face forms. In the fit-tests, 149 of 150 subjects fit-tested were satisfactorily fitted in their indicated sizes. This report includes a discussion of the theoretical and practical aspects of the sizing procedure. Design limits and related statistical material and suggested procurement tariffs, for each of the six sizes proposed are given. The MC-1 mask is described and the fit-test procedure and results are presented.

Project & Task: 7412-71728
ASTIA No. 213604

Contract No. AF 33(616)-3841

(206)
TR 58-578 November 1958

Clarke, N. P.; Zuidema, G. D.; Prine, J. R. (Aerospace Medical Laboratory)

STUDIES OF THE PROTECTIVE QUALITIES OF CLOTHING AGAINST THERMAL RADIATION

Studies of the protective characteristics of twelve representative fabrics against thermal radiation revealed that color, weight, thickness, and permeability all strongly influence the degree of burn injury incurred when animals covered by these materials are exposed to thermal energy from a carbon arc lamp. Because of wide variations in these factors, it is not possible to evaluate adequately fabric composition with respect to protection. A method of mathematical summation of the physical characteristics of fabrics to predict their protective character is proposed.

Project & Task: 6311-63352
ASTIA No. AD-206909

(207)
TR 58-616 December 1958

Burns, H. L.; Stockman, R. E. (Alar Products, Inc.)

DESIGN AND DEVELOPMENT OF A PRESSURE AND CYCLE CONTROL FOR DYNAMIC SEAT CUSHIONS

The advent of long range aircraft has created a requirement for maximum long term seating comfort. Research and development have evolved an 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.

Project & Task: 7222-71747 Contract No. AF 33(600)-31721
ASTIA No. AD-209386

(208)
TR 58-635 November 1958

Miller, H.; Riley, M. B.; Bondurant, S. (Aerospace Medical Laboratory)

THE DURATION OF TOLERANCE TO POSITIVE ACCELERATION

Human tolerance to prolonged positive (headward) accelerations of sub-blackout magnitude has been investigated in this study. The data indicate that man is able to withstand the forces of positive g for durations much longer than previously supposed. Exposures as long as an hour at 3.0 g appear well tolerated by most subjects. Except for moderate tachycardia no pathologic abnormalities were observed in the electrocardiographic tracings recorded continuously on all subjects. Explored were the durations of tolerance at g levels varying from 3.0 to 6.0 g. The effects of anti-g suits upon tolerance are also reported.

Project & Task: 7222-71746
ASTIA No. AD-208151

(209)
TR 58-665 January 1959

Meehan, John P.; Jacobs, Howard I. (University of Southern California)

RELATION OF SEVERAL PHYSIOLOGICAL PARAMETERS TO POSITIVE G TOLERANCE

A series of experiments was undertaken in an attempt to relate several physiologic parameters to positive g tolerance. Blood pressure, blood volume, and physical condition as measured by both the Harvard Step Test and a modified physical fitness test were the parameters studied. Subjects were studied at the end of one month of enforced rest and again at the end of one month of supervised physical training. It can be concluded that considerable change in the physical condition of an individual does not affect his tolerance to positive acceleration.

Project & Task: 7216-71712 Contract AF 33(616)-2952
ASTIA No. AD-209387 Contract No. AF 33(616)-2952

(210)
TR 59-66 February 1959

Krendel, E. S. (The Franklin Institute)

SHORT DURATION HARMONIC ANALYSIS OF EEG DATA

Amplitude spectra were computed from 0.85 second samples of EEG data obtained from bipolar electrodes positioned at the left parietal and left occipital locations. Differences were obtained between these spectra as a function of the state of consciousness of the subject. The implications of these differences for an electronic discrimination scheme are discussed.

Project & Task: 7215-71713 Contract No. AF 33(616)-5181
ASTIA No. AD-212318

(211)
TR 59-165 April 1959

Eisen, L; Zeigen, R. S. (Aerospace Medical Laboratory)

A SUPINE SEAT FOR HIGH-STRESS TESTING OF PRIMATES

This study summarizes the design rationale of a supine seat and restraint harness, with surrounding inclosure, for high stress bioscience experiments with a Macaca cynomolgus monkey (Macaca iris). This configuration is intended for test under various abnormal stresses including high g centrifuge runs. Testing and feeding of the subject in the inclosure will be accomplished to determine his reaction to these stresses. With minimum modification, The Macaque supine seat and restraint harness could accept any primate for ground tests or bio-experiments in space flight. A brief description of an earlier supine test seat and restraint harness for low-stress experiments using a squirrel monkey is included.

Project & Task: 7222-71749
ASTIA No. AD-219894

(212)
TR 59-175 April 1959

Du Toit, Charles H., M.D. (Massachusetts General Hospital)

A STUDY OF CHEMICAL METHODS FOR QUANTITATIVE MEASUREMENTS OF CATECHOL AMINES

A method for the estimation of adrenaline and noradrenaline in urine is presented. This method employs an ion exchange resin, Amberlite XE-64, for purification. The simultaneous estimation of the two hormones is accomplished by a multiple filter technique of fluorometry. The selection of appropriate sets of filters is based on a careful study of the fluorescence spectra of the compounds concerned. The method has been subjected to careful scrutiny as to factors affecting reproducibility and precision of the measurements. Evidence is presented that a high degree of specificity has been attained.

Project & Task: 7216-71712 Contract No. AF 33(616)-5003
ASTIA No. AD-220081

(213)
TR 59-226 June 1959

Geer, R. L.; Rayfield, J. F. (Aerospace Medical Laboratory)

DEVELOPMENT AND TEST OF A BALLOON BORNE MANNED VEHICLE

Balloon borne vehicles are well suited for use as a means of lifting parachutists to a very high altitude for test jumping. The design, fabrication, and testing of a vehicle, developed at the Wright Air Development Center for this purpose, are discussed in this report. Included are presentations of novel designs for a pressure-retaining hatch and an energy-absorbing parachute landing device.

Project & Task: 7218-71719
ASTIA No. AD-227244

(214)
TR 59-347

June 1959

Cherniack, N. S.; Hyde, A. S.; Zechman, F. W. (Aerospace Medical Laboratory)

THE EFFECT OF TRANSVERSE ACCELERATION ON PULMONARY FUNCTION

The effect of forward acceleration on different respiratory factors was tested in 15 subjects during accelerations of 2 and 3 min durations at 3 and 5 g. Vital capacity was reduced significantly at 3 and 5 g. Maximum breathing capacity was significantly reduced at 5 g. One-half second timed vital capacity represented an increasing fraction of total vital capacity as acceleration increased. Minute volume and respiratory rate also increased significantly at 5 g while tidal volume was essentially unchanged. Results are obtained which indicate that the nature of the predominant respiratory defect during forward acceleration is restrictive.

Project & Task: 7222-71746

(215)
TR 59-534

September 1959

Meehan, J. P.; Jacobs, Edith (University of Southern California)

PHYSIOLOGIC PRODUCTION OF CATECHOL AMINES IN RESPONSE TO SEVERAL PHYSICAL STRESSES

Measurements of the physiologic production of adrenaline and noradrenaline in response to four standardized physical stresses were undertaken on young adult male subjects. Plasma levels of noradrenaline were found to increase significantly in exercise and the increase appears to bear a positive relationship to the physiologic severity of the exercise. Plasma levels of noradrenaline did not change as the result of the cold pressor test or as the result of exposure to positive accelerations of 3 g for 5 minutes. Renal plasma flow was not altered as the result of similar exposure to acceleration lasting for 10 minutes.

Project & Task: 7220-71742

Contract No. AF 33(616)-5591

(216)
TN 57-16 January 1957

Furlong, N. Burr (Aerospace Medical Laboratory)

MODIFIED BLENDER CUP FOR HOMOGENIZING SMALL TISSUE SAMPLES

This report describes a device which adapts a standard tissue blender motor for the homogenization of tissue samples from 1 to 20 grams in weight. The homogenizer cup is airtight and incloses approximately 100 cc of gases when sealed.

Project & Task: 7159-71803
ASTIA No. AD-110720

(217)
TN 57-55 February 1957

Mock, Ronald O. (Aerospace Medical Laboratory)

SANDWICH WRAPPERS FOR USE IN AIRCRAFT

Sandwiches packaged in the commonly used glassine paper sandwich bags are not provided with adequate protection against drying in the low pressures and humidities in aircraft cabins during flight. The purpose of this study is to determine the least expensive sandwich bag which will maintain the acceptability of sandwiches to be eaten in flight. A large number of commercially available wrapping materials were considered. The most promising materials were tested in a low pressure chamber which approximated conditions found in aircraft cabins during flight. The wet waxed paper sandwich bag was found to be a very satisfactory and economical wrapper for use in aircraft.

Project & Task: 7156
ASTIA No. AD-118057

(218)
TN 57-63 February 1956

Mock, Ronald O. (Aerospace Medical Laboratory)

ACCEPTABILITY TEST OF LIQUID MEATS

A field test was conducted at the Air Force Flight Test Center to determine the acceptability of liquid meats and to obtain information for improving acceptability to guide future development. Two experimental liquid chicken and two experimental liquid ham formulations were tasted by the test pilots on the ground. Saltiness, thickness and flavor were "about right" in most of the formulations and only a small minority rated the items as having an objectionable aftertaste. A number of subjects stated that the chalky or grainy texture was objectionable. All four liquid meats rated high enough in acceptability to be considered for further testing in high performance aircraft at extreme altitudes.

Project & Task: 7156
ASTIA No. AD-118066

(219)
TN 57-73 March 1957

Taylor, Albert A.; Costilow, Ralph N. (Aerospace Medical Laboratory)

BACTERIOLOGICAL STUDY OF FOIL PACK-IN-FLIGHT MEALS DURING REFRIGERATED STORAGE

The total numbers of mesophilic, psychrophilic, and coliform organisms do not increase significantly in the meat, vegetable, and potato items of Foil Pack Meals during refrigeration below 40°F, between 8 to 24 and up to 120 hours. Foil Pack Meals can be prepared containing low populations of mesophilic, psychrophilic, coliform, and the gram-positive coccus types of bacteria. Food spoilage will not be a problem when the perishable components of Foil Pack Meals are stored for five days at temperature below 40°F. The food poisoning potential of Foil Pack Meals consumed within five days after packaging should be no greater than that of meals served in Air Force dining halls if routine sanitation practices and refrigeration below 40°F are used.

ASTIA No. AD-118096

(220)
TN 57-183 May 1957

Jackson, Margaret M. (Aerospace Medical Laboratory)

PASSENGER OXYGEN REQUIREMENTS FOR JET TRANSPORT AIRCRAFT

A guide for computing the total amount of oxygen required for the passengers on military and civilian jet transport aircraft is presented. The oxygen supply requirements based on flight profiles for three oxygen systems, "100% Oxygen", "Normal Oxygen", and "Continuous Flow" are given. Pertinent supplementary data essential for calculating the oxygen requirement figures are included.

ASTIA No. AD-118284

(221)
TN 57-217 May 1957

Finkelstein, Beatrice (Aerospace Medical Laboratory)

NUTRITION STUDY FOR LONG RANGE AIRCRAFT (INITIAL PHASE)

A preliminary nutrition study designed to investigate feeding requirements for long range, high performance aircraft is described. A group of five men participated in this five day study. All food was stored in an experimental crew compartment galley. Meals simulating those which would be served in flight were consumed. Between meals, snacks were available. The adequacy and acceptability of the feeding program are evaluated. In addition, an evaluation is made of the functional utility of the experimental galley. Suggestions for certain design improvements in future prototypes of this galley are included.

Project & Task: 7156
ASTIA No. AD-130756

(222)
TN 57-353 October 1957

Hall, F. G.; Sappenfield, L. C., Jr. (Duke University)

THE INFLUENCE OF GRADED IMPEDANCE TO TRACHEAL AIR FLOW ON TIMED VITAL CAPACITY MEASUREMENTS OF NORMAL HUMAN SUBJECTS

Timed vital capacities have been determined on nine healthy young men ranging in age from 21 to 28 years. Their normal vital capacities were determined and found to vary on the average only 1% from predicted values. Subsequently, four different resistances were interposed between mouthpiece and vitalometer and the volume of air which could be expelled into the vitalometer determined. The reduction in time capacities varied proportionally with resistances imposed. It is suggested that this test gives a value which can be used to determine the degree of breathing obstruction in pulmonary efficiency tests. Moderate exercise during the tests does not appreciably affect the results.

ASTIA No. AD-142041 Contract No. AF 33(616)-3821

(223)
TN 58-6 January 1958

Glover, Harold C.; Conklin, Robert E. (Aerospace Medical Laboratory)

ELECTRICAL REQUIREMENTS: MA-2, MA-3 HELMET VISORS

The electrical requirements for the MA-2 and MA-3 altitude helmet visors are presented. The manual heat control is discussed and illustrated; and the control settings and corresponding electrical values are tabulated.

Project & Task: 6333-63617
ASTIA No. AD-142278

(224)
TN 59-27

April 1959

Hill, W. F.; Cox, C. M. (Aerospace Medical Laboratory)

BACTERIAL AEROSOL SAMPLER EVALUATION

The urgency for an interim bacterial aerosol detection device is reflected in the need for an adequate means of defense against biological warfare attack. This study was set up as a preliminary survey to evaluate several existing bacterial aerosol sampling devices in regard to their ability to consistently and reliably detect the presence of an artificially induced bacterial aerosol in the atmosphere. The candidate sampling devices evaluated in this study included several slit-samplers, millipore filter samplers, all-glass impingers, and multi-stage Anderson Samplers. The results of this study indicated that, of the different sampling devices evaluated, the 6-stage Andersen Sampler and the 4-stage modified "Andersen" Sampler were superior in terms of consistency and reliability to detect the presence of the artificially induced bacterial aerosol in the atmosphere.

Project & Task: 7165-71837
ASTIA No. AD-213600

(225)
TN 59-148

June 1959

Lutz, C. C. (Aerospace Medical Laboratory)

DEVELOPMENT OF AN EMERGENCY PRESSURE SUIT (COVERALLS, HIGH-ALTITUDE, TYPES CSU-4/P)

This report describes the various features evaluated during the development of Coveralls, High-Altitude, Type CSU-4/P. Each progressively improved prototype garment is described and test results are reported. The final model of this coverall is considered physiologically adequate to meet the specified requirements. Comfort and mobility features of this garment are considered superior to previous partial pressure suits. Preliminary flight tests indicate that this suit is favored over previous types. An operational evaluation of the final model will be accomplished.

Project & Task: 6336-63619

(226)
TN 59-153

June 1959

North American Aviation, Inc.

WEIGHT AND BALANCE DATA LIFE SUPPORT SYSTEM

The weight and balance data contained herein represent the results of a comprehensive weight analysis designed to seek the optimum weight for the specified mission requirements. A very large percentage of component and system weights was computed directly from design layouts and schematic diagrams to further enhance these data. To insure that minimum weight would be realized, purchased parts and subcontracted equipment were scrutinized for weight as well as system function and reliability.

Project & Task: 7164-71840 Contract No. AF 33(616)-6048

(227)
TR 55-16, Vol. III

June 1959

Negherbon, William O., Dr. (The National Academy of Sciences)

HANDBOOK OF TOXICOLOGY, VOLUME III: INSECTICIDES

This report presents data on the physical, chemical, biological, and toxicological properties and insecticidal effectiveness of 188 compounds, compiled from more than 3400 references. Each page of data has been exhaustively reviewed and authenticated by the contributors. The compilation is very extensive, covering such subjects as the pharmacological, pharmacodynamic, physiological, and biochemical effects on insects, higher animals, and plants, where applicable and available. A comprehensive bibliography is keyed to the text by numerical marginal text references on each page. Two indexes, "Index of Scientific and Common Names" and "Index of Chemical Compounds," supplement the text. This Handbook is as authentic and reliable as could be procured but, nevertheless, it is a survey, and the values presented herein should be considered as "yardsticks" of activity rather than as absolute and definite.

Project & Task: 7165-71836 Contract No. AF 33(616)-2973
ASTIA No. AD-216529

(228)
TR 55-16, Vol. IV

March 1959

Grebe, R. M. (National Academy of Sciences)

HANDBOOK OF TOXICOLOGY-VOLUME IV, TRANQUILIZERS

This report presents data on physical, chemical, biological, and toxicological properties of 26 tranquilizers, compiled from extensive literature references. The material is as up-to-date as possible at the time of publication. To enhance reliability and, consequently, usefulness, each page of data has been exhaustively reviewed and authenticated by the contributors. The compilation is as complete as the rapidly changing state-of-the-art in the field of tranquilizer development will permit. Wherever possible, data are presented on molecular formula and weight, structure, physical and chemical properties, pharmacology, clinical aspects, toxicity, and mode and site of action for each compound. This report is a survey and the values presented herein should be considered as "yardsticks" of activity rather than as absolute and definitive.

Project & Task: 7165-71836
ASTIA No. AD-211697

(229)
TR 55-16, Vol. V

March 1959

Dittmer, D. S. (National Academy of Sciences)

HANDBOOK OF TOXICOLOGY-VOLUME V, FUNGICIDES

This report summarizes data on 196 fungicides with regard to their physical, chemical, biological, and toxicological properties. An additional 500 compounds having fungicidal activity are listed in an appendix. These compounds have been compiled from an extensive review of 320 literature references. To enhance reliability and, consequently, usefulness, each page of data has been exhaustively reviewed and authenticated by the contributors. The compilation is as complete as the rapid development of fungicides will permit. Wherever possible, data are presented on molecular formula and weight structure, physical and chemical properties, fungicidal tests, toxicity, and use. This report is offered not as a definitive work, but as the preliminary structure for a more exhaustive and better documented report. Corrections, suggestions, and additions would therefore be welcomed.

Project & Task: 7165-71836
ASTIA No. AD-211698

Contract No. AF 33(616)-2873

(230)
TR 55-304, Pt. 2

April 1957

Boynton, Robert M.; Bush, William R. (University of Rochester)

LABORATORY STUDIES PERTAINING TO VISUAL AIR RECONNAISSANCE

This is the second part of a three-stage program concerning the investigation of relevant variables involved in visual air reconnaissance. Using the apparatus and procedures developed during the first stage, experimentation has been conducted to determine the effects of (a) brightness contrast, (b) an extended range of distances, (c) response tendencies of the subjects, (d) numbers of figures in an array, (e) exposure time, and (f) experience with an array, on the ability of human subjects to detect and correctly identify a rectilinear form among a group of curvilinear forms. Results are presented as percent correct recognition (i.e., correctly identifying a "target"), although some data for detection and error responses are also given. Recognition is found to increase with (a) increased contrast, (b) decreased distance, (c) decreased numbers of figures, and (d) increased exposure time, but does not significantly change with either (a) response tendencies, or (b) experience with arrays. Both detection and errors are affected by response tendencies.

Project & Task: 7157-71810
ASTIA No. AD-118250

Contract No. AF 33(616)-2565

(231)
TR 55-304, Pt. 3 April 1958

Boynton, Robert M.; Elworth, Charles; Palmer, Richard M. (University of Rochester)

LABORATORY STUDIES PERTAINING TO VISUAL AIR RECONNAISSANCE

This is the third and final part of a three-stage report on a program concerning the investigation of relevant variables involved in visual air reconnaissance. A mathematical relationship is worked out which yields the contrast required for 60% correct recognition as a function of subject-target distance, exposure time, and number of confusion forms (struniforms) among which the critical target may be located. By translating altitude into experimental distance, aircraft velocity into viewing time, and conditions of viewing (including meteorological conditions) into contrast, predictions are made about how performance should vary as a function of altitude, from 500 to 30,000 ft. General statements are given which attempt to summarize the results of these calculations. Further studies are reported in which a preliminary attempt is made to understand individual differences in searching ability as they relate to parafoveal form recognition, visual acuity, and eye movements.

Project & Task: 7157-71810 Contract No. AF 33(616)-2565
ASTIA No. AD-142274

(232)
TR 56-312 December 1956

Ferguson, Iain D.; Christensen, Margaret L. (St. Louis University)

FACTORS IN, VARIABILITY IN AND PREDICTION OF REGIONAL SWEATING RATES OF HUMANS

Two factors affecting regional sweating rates were isolated. These factors vary in their amount of contribution to sweating rates of different regions on the body surface, and also in their amount of contribution to sweating rates of different individuals. Factors affecting magnitudes of sweating are probably not the same as those affecting variability. Individualistic patterns of sweating may be clearly identifiable only on the forehead, abdomen and lower extremity. Prediction of regional sweating rates from two regions to others on the body surface is both possible and practical, through the use of weighted magnitudes of regional sweating rates, the weightings being obtained from a factorial analysis. A large number of experiments under constant environmental conditions would be required, either to represent adequately one individual's normal regional sweating variations on different days, or to represent adequately normal regional sweating variations among individuals. The reported results, especially in regard to factors affecting regional sweating rates and a practical method of predicting regional sweating rates, may have important applications in the optimal design and use of ventilated clothing.

Project & Task: 7155 Contract No. AF 33(616)-3357
ASTIA No. AD-118055

(233)
TR 56-640 May 1957

Hall, F. G.; Zechman, Fred, Jr. (Duke University)

EFFECTS OF RESPIRATORY IMPEDANCES ON PULMONARY VENTILATION, PATTERN OF BREATHING, AND PULMONARY GAS EXCHANGE IN DOGS

This report covers three series of experiments conducted on 22 dogs to determine the respiratory effects of increased tracheal impedance to air flow. The influence of four different size orifices on respiratory frequency, tidal volume, tracheal air flow and pressure, heart rate, blood pressure and arterial gas tension is presented. Additional experiments are reported which suggest the relative roles of the chemical and mechanical factors controlling the respiratory response to air flow impedance.

Project & Task: 7160 Contract No. AF 33(616)-377
ASTIA No. AD-118297

(234)
TR 57-9

January 1957

Hale, F. C.; Westland, R. A.; Taylor, C. L. (University of California)

THE INFLUENCE OF BAROMETRIC PRESSURE AND VAPOR PRESSURE ON INSENSIBLE WEIGHT LOSS IN NUDE RESTING MAN

To determine the dependency of human insensible weight loss on barometric and water vapor pressure, two nude subjects were exposed to barometric pressures of 760, 506, and 253 mm Hg in combination with water vapor pressures of 6, 16, and 26 mm Hg. Chamber temperature was kept constant at 28°C and air movement was kept at measured low levels. The subjects were free from sweating under these conditions. Total weight loss was measured directly. Under these conditions, using an orthogonal square design technique, it was found that total body weight loss in a sweatfree subject is inversely dependent on both water vapor pressure and barometric pressure. This affirms the hypothesis that insensible weight loss is dependent on physical factors. The calculated skin insensible weight loss is also inversely dependent on barometric pressure, but is not clearly related to vapor pressure.

Project & Task: 7155
ASTIA No. AD-110730

Contract No. AF 33(616)-3338

(235)
TR 57-88

July 1957

Devries, John E. (Stanford Research Institute)

ALIPHATIC HYDROCARBON DETECTOR

A simple device is required for detecting and measuring aliphatic hydrocarbons in the air around aircraft, hangars, and other military equipment. Complex instrumentation is routinely used for precise analysis of such air samples. An investigation of possible hydrocarbon reactions has been completed, with the result that a simple, inexpensive, easily operated squeeze-bulb detector has been developed which is capable of measuring aliphatic hydrocarbons in air in concentrations of 0 to 5000 parts per million within a few minutes. Higher ranges of concentration can be measured by reducing the volume of air taken into the reaction tube. The reagent is iodine pentoxide and fuming sulfuric acid on silica gel. This report furnishes all the information necessary to make and use the hydrocarbon detector. Data are given which indicate that the detector is accurate within ±20 percent.

Project & Task: 7159
ASTIA No. AD-118040

Contract No. AF 33(600)-31904

(236)
TR 57-118 (I)

June 1958

Barbiere, Robert E.; Sweeton, Richard F.; Sakalosky, George P.; Klatt, Paul E. (RCA Service Company, Inc.)

A RADIOBIOLOGY GUIDE

The USAF Radiobiology Guide discusses radiobiology pertinent to power and research applications of nuclear energy. The following topics are treated: nuclear physics, observed biological effects of radiation, shielding methods, monitoring instruments, medical evaluation of personnel, treatment of injuries, and permissible doses. Ionizing radiation constitutes high-energy particulate and photon radiation emanating from both natural and artificial nuclear reactions. When radiation strikes matter, it imparts energy to it; when that matter is living tissue, biological changes may result. Shielding presents a means of blocking these radiations and reducing the energy which they can transmit. Monitoring equipment detects radiation so that hazardous conditions can be avoided. Medical evaluations indicate radiation injury. These injuries are most effectively treated by special techniques. Permissible doses define the quantity of radiation that a worker may be allowed to receive. The understanding of radiobiology to be derived from study of this manual will indicate to the worker his personal responsibilities in avoiding injury by observing all safety precautions that have been devised for his benefit.

Project & Task: 6335-63614
ASTIA No. AD-118082

Contract No. AF 33(616)3665

(237)
TR 57-118 (II) May 1959

Kay, F. DeWitt, Jr.; Hobson, Warren, Jr. (RCA Service Company, Inc.)

A RADIOBIOLOGY GUIDE, PART II

Part II of the USAF Radiobiology Guide examines the practical aspects of radiation protection and radiological health. The following topics are treated: biological effects of radiation, monitoring instruments and techniques, health physics, radiation exposure control, facility design, protective devices, decontamination, permissible doses, emergency procedures, medical treatment of radiation injury, handling and shipping radioactive material, and disposal of radioactive waste. Both military and nonmilitary sources were used in compiling this volume. A typical radiological laboratory has been assumed, and discussions have been directed to its requirements relating to radiation protection. A detailed table of radioisotope data also is included.

Project & Task: 7165-71838 Contract No. AF 33(616)-5491
ASTIA No. AD-226672

(238)
TR 57-142 March 1957

McGuire, Thomas J. (Aerospace Medical Laboratory)

HEALTH-PHYSICS PROCEDURES FOR AN AEROMEDICAL RADIOISOTOPES LABORATORY

Radioisotopes will be utilized in tracer work involving studies on the effect of simulated altitude on laboratory animals. Iodine-131, Sodium-24, and Chromium-51 are the isotopes to be handled. The handling of radioactivity by any installation requires that specific Health-Physics procedures be followed to adequately insure the health and safety of the personnel involved. In order to achieve conditions where hazards are minimal; it is necessary to recognize the hazards, define safe working conditions, and to maintain these conditions. The latter point is critically important, and it involves training personnel in the necessary techniques, as well as educating them or at least impressing them with the importance of the imposed regulations. It is also necessary to provide adequate physical facilities for protection and monitoring and to enforce the necessary regulations. Recommendations are applicable to the installation setup, equipment selection, health monitoring, isotopes handling, personnel protection, waste disposal and decontamination.

Project & Task : 7160-71812
ASTIA No. AD-118113

(239)
TR 57-261 April 1957

Finkelstein, Beatrice; Pippitt, Robert G. (Aerospace Medical Laboratory)

EFFECT OF ALTITUDE AND OXYGEN UPON TASTE

Effects of breathing 100% aviator's oxygen at a simulated altitude of 25,000 feet upon the taste sensitivity of young, adult males are presented. The study was performed to determine whether taste perception levels, taste identification levels, or ability to identify tastes are affected by altitude or breathing pure oxygen. Motivation for this study was derived from differences noted in food acceptability on the ground and in high altitude flight situations. No effects of either altitude or breathing pure oxygen on primary taste sensations were found which could account for these differences. An inability to identify tastes both on the ground and at altitude was observed. From the results of this study, one can conclude that field taste test procedures should not include questions that assume a subject's ability to identify the primary tastes. This is particularly true of sour and bitter. For a true evaluation of these two tastes, a trained taste panel is necessary.

Project & Task: 7156
ASTIA No. AD-118245

(240)
TR 57-291 March 1958

Sturrock, Peter E.; Kitzes, George (Aerospace Medical Laboratory)

AN ESTIMATION OF EXPOSURE TO CARBON MONOXIDE BY BREATH ANALYSIS

A semiquantitative screening method for determination of carbon monoxide poisoning in human subjects is presented. The method is based upon measurement of the carbon monoxide concentration of the breath with the National Bureau of Standards' colorimetric carbon monoxide-indicating gel. The results of a "smoker-nonsmoker" survey of 54 Aerospace Medical Laboratory personnel are included to show the significance of the method in measuring incipient carbon-monoxide-exposure levels. The method has an accuracy of ± 2% blood-carbon monoxide saturation. It is rapid, easy to use, and supplements the use of blood specimens.

Project & Task: 7159-71803
ASTIA No. AD-118274

(241)
TR 57-304

Note: Completion of this report has been suspended.

(242)
TR 57-336 May 1957

Bausch & Lomb Optical Company & AML

MODIFICATION OF IMAGE STABILIZED BINOCULAR BY THE USE OF GYROSCOPES

In order to increase the stability of a previously developed image stabilized binocular containing an internal opto-mechanical movement, gyroscopes were introduced to filter out the one cycle per second resonant frequency. With the gyroscopes operating, the anticipated result of stabilization of the instrument movement was not realized. It was concluded that use of present day gyroscopes in the image stabilized binocular is not sufficiently promising to warrant further development.

Project & Task: 6332 Contract No. AF 33(600)-29069
ASTIA No. AD-130769

(243)
TR 57-419 April 1958

Chicago Aerial Industries, Inc.

DESIGN STUDY ON A RESEARCH PERISCOPE FOR PILOTING AIRCRAFT

Since the conventional windshield of subsonic aircraft is many times imcompatible with supersonic flight, a research piloting periscope encompassing the wildest possible range of visual requirements has been designed. Types of presentation and the optical design of this instrument are described. Pertinent mechanical and optical characteristics are summarized in Section I. Through testing of the periscope with various complements of performance parameters, characteristics needed in production instruments can be obtained. Section II relates the investigation of a method of optical field flattening using a bundle of transparent fibers. Different optical arrangements of field flatteners are proposed and discussed in detail. An improved type of field flattener which also acts as two Fresnel lenses has also been investigated. A gain in image quality and a weight reduction seem possible through the use of such a field flattener. The methods of fabrication and alignment are described, and a working model using 200-micron-diameter glass fibers is discussed.

Project & Task: 6334-63606 Contract No. AF 33(600)-31623
ASTIA No. AD-130885

(244)
TR 57-450

July 1957

Cohen, Melvin S.; Cox, Charles M.; Stanley, Alfred R. (Aerospace Medical Laboratory)

EFFECT OF ALTITUDE ON SUSCEPTIBILITY TO GB

This investigation was initiated to discover if exposure to GB, a nerve gas, at altitude would produce different effects from a similar exposure at ground level. Testing was conducted in three phases which included exposure of rats by intramuscular injection and respiratory exposure of rats and dogs. Atropine ampuls were found to be unsatisfactory for use at altitudes above 30,000 feet as they exploded when injection was attempted. Atropine syrettes were found to be satisfactory at altitudes up to 45,000 feet. No significant difference was found in LD50 for rats subjected to intramuscular injection of GB at altitude or at ground level. When the rats were continuously exposed to various vapor concentrations of GB in a dynamic gassing chamber at ground level or at 30,000 feet, there was a significant difference in the mean expiration period. However, the data were so variable that the best Least Square line shows very poor significance. Beagle dogs similarly exposed to a continuous vapor concentration of GB showed no significant difference in time to death between ground level experiments and those conducted at 30,000 feet.

Project & Task: 1081-71815
ASTIA No. AD-130932

(245)
TR 57-536, Part 2

August 1957

McGuire, Terence F.; Leary, Frank J. (Aerospace Medical Laboratory)

PHYSIOLOGY AND OPERATIONAL COMPARISON OF CURRENT PARTIAL PRESSURE SUITS. PART 2. TIME-ALTITUDE CAPABILITIES AND BENDS INCIDENCE OF MC-1 (AND X-90) AND MC-3 (MC-4) PARTIAL PRESSURE SUIT ENSEMBLES, WITH A DISCUSSION OF "GET-ME-DOWN" TYPE SUITS

This report was intended as an aid to those involved in operational planning, to acquaint them with the differences both in structure and capability of the currently available partial pressure suit ensembles. The "get-me-down" suit concept is also discussed at length because of recent interest in this area and because the problems of such equipment are not clearly understood by many people.

Project & Task: 6333
ASTIA No. AD-131006

(246)
TR 57-564

September 1957

Veghte, J. H. (Aerospace Medical Laboratory)

THE MA-2 VENTILATING SUIT AS A PROTECTIVE GARMENT IN COLD

To evaluate the possibility of utilizing the MA-2 ventilating garment, developed by the Aero Medical Laboratory, in heating aircrew members in cold environments, a series of exploratory experiments was undertaken at ambient temperatures of -30°C (-22°F) and -40°C (-40°F). The temperature of the ventilating air was varied from 50°C (122°F) to 60°C (140°F). The volume of the air varied from 290 liters per minute (10 cfm) to 430 liters per minute (15 cfm). Two metabolic levels were simulated: a sitting, resting subject representing an aircrew member; and a standing, working subject representing maintenance personnel. Heavy Air Force clothing was worn over the MA-2 garment. The results indicated a person was able to tolerate these cold exposures and remain in thermal balance for three hours while using the ventilating garment as a heating vehicle. All the skin temperature measurements of the body areas with the exception of the feet remained in the comfort zone. The minimum skin temperature of the toes was 5.6°C (42°F) in some of the exposures at the end of three hours. These toe temperatures were not a limiting factor in the experiments.

Project: 7155
ASTIA No. AD-131053

(247)
TR 57-603 February 1958

Clark, W.B.M. (Douglas Aircraft Company, Inc.)

DEVELOPMENT OF TYPE NS-2 AIRBORNE DATA RECORDER

The development of a small, direct-writing 20-channel data recorder designated Type NS-2, especially for airborne use, is described. Means of recording certain aircraft environmental conditions as well as physiological measurements of flight personnel are explained. The development of special transducers for measuring relative humidity and physiological temperatures is described. The influence of environmental changes on the accuracy of the recorder was determined and is reported. Operating, calibration and maintenance instructions are included.

Project & Task: 7155-71804 Contract No. AF 33(616)-3423
ASTIA No. AD-142012

(248)
TR 57-604 September 1957

Furlong, N. Burr (Aerospace Medical Laboratory)

A DISPOSABLE ANALYZER FOR SEMIQUANTITATIVE DETERMINATION OF CARBON MONOXIDE IN BLOOD

A disposable blood-carbon monoxide analyzer with which it is possible to make relatively accurate measurements has been developed. Use of this device requires no additional apparatus or training. The analyzer is described; and the method of operation is presented.

Project & Task: 7159-71803
ASTIA No. AD-142013

(249)
TR 57-685 November 1957

Rosenbaum, Donald A. (Aerospace Medical Laboratory)

EXPLOSIVE DECOMPRESSION STUDIES WITH ANIMALS WEARING FULL BLADDER SUIT AND HELMET

Studies on 17 dogs, wearing a full bladder suit and helmet while connected to an automatic oxygen regulator, show that no apparent residual pulmonary pathology results following explosive decompression (30 msec) through 10 psi and 14 psi.

Project & Task: 7160-71814
ASTIA No. AD-142149

(250)
TR 57-686 November 1957

Tamas, Anton, M.D.; McElroy, Jane (Aerospace Medical Laboratory)

POSTMORTEM CARBON MONOXIDE ANALYSIS: SIGNIFICANCE OF TISSUE BLOOD CONTENT

Proper interpretation of the results of a postmortem tissue analysis for carbon monoxide is essential to the Flight Surgeon investigating major aircraft accidents. The pitfalls and shortcomings of the present technique of extrapolating presumed human in vivo blood carbon monoxide levels from data obtained by rat experimentation are described. Data are presented which indicate the necessity for relating carbon monoxide tissue analyses to the tissue blood content.

Project & Task: 7159-71803
ASTIA No. AD-142150

(251)
TR 57-699

May 1958

Hall, F. G.; Zechman, F. W., Jr.; Salzano, John (Duke University)

EFFECT OF COOLING THE CERVICAL VAGI ON THE WORK OF BREATHING

Cooling the cervical vagi in a series of anesthetized dogs markedly increased total respiratory work. Elastic work increase was associated with large tidal volumes while increase in viscous work was related to change in rate and duration of air flow. Blood pressure and heart rate were not appreciably affected by vagal cooling. The observations in these experiments support the suggestion of other investigators that pulmonary receptors monitor the work of breathing, permitting the medullary centers to make the most appropriate choice of depth and frequency of breathing.

Project & Task: 7160-71811
ASTIA No. AD-155680

Contract No. AF 33(616)-3821

(252)
TR 57-700

June 1958

Reininger, Edward; Carter, E. T.; Hitchcock, Fred (Ohio State University)

CARDIOVASCULAR EFFECTS OF A PRESSURE SUIT ON THE DOG

The purpose of this study is to evaluate the efficiency of a specially constructed altitude suit for dogs. Thirteen animals were fitted with this suit and four of them served as controls. Control experiments were differentiated solely by the preclusion of pressurization of the suit. Physiological evaluation of this pressure suit was accomplished by observing the general hemodynamic effects of the device when activated. It was observed that even while the animals were at ground-level, pressure breathing with this particular suit resulted in a marked depression of cardiac output. This effect was associated with a decrease in systemic blood pressure and a rise in central venous pressure. It also appeared that, in spite of fairly efficient application of counter-pressure over the torso, poor pressurization of the neck and limbs probably limits the general efficiency of the suit. Certain modifications of the suit were recommended to improve its effectiveness as a counter-pressure garment.

Project & Task: 7163-71821
ASTIA No. AD-155662

Contract No. AF 33(616)-3825

(253)
TR 57-727

July 1958

Ferguson, I. D.; Hertzman, A. B. (St. Louis University)

REGULATION OF BODY TEMPERATURE DURING CONTINUOUS EXPOSURE TO HEAT

Three lean healthy resting nude young men were exposed twice to dry and wet bulb temperatures of 43.3° and 30.3°C for 32 hours. Body weight was maintained by food and water. Physiological regulation of body temperature was continuously successful as indexed (after initial thermal equilibration of the subject with the chamber) by essentially constant skin and oral temperatures, rates of water loss, and unweighted averages of regional sweating rates. Fatigue of the subject did not show in rates of total evaporation or in body temperatures. Forehead sweating rates tended to increase. Small diurnal variations seemed to appear in several of the regional sweating rates but may not have been statistically significant. The regional sweating pattern characteristic of the particular subject at T_A of 43.3°C was exhibited continuously during the entire exposure and in the repeat experiment. The mean rates of urine formation in the six experiments showed an inverse relation with the mean oral temperatures.

Project & Task: 7155-71804
ASTIA No. AD-155781

Contract No. AF 18(600)-3357

(254)
TR 57-740

December 1957

Electronics Corporation of America

A HIGH-INTENSITY LIGHT SOURCE

A high-intensity light source has been constructed for use in a study of flash blindness as the result of nuclear detonations. The radiant-energy source is a 24-inch Army searchlight modified to permit operation at a higher arc current. The normally divergent beam has been highly converged. A system of electronics has been integrated with the light source; and a slow-motion camera, to record effect on fundus during exposure, is provided. Details of the modification are discussed and illustrated; and a manual of operation procedures is included.

Project & Task: 6332-77653
ASTIA No. AD-142219

Contract No. AF 33(616)-3681

(255)
TR 57-742 November 1957

Shelanski, Morris V.; Gabriel, Karl L. (Industrial Biology Research & Testing Laboratories & AML)

CUTANEOUS TOXICITY EVALUATION OF AIR FORCE DEVELOPMENT MATERIALS - II

Two hydraulic fluids, two experimental impregnated cloths, one control cloth for both experimental impregnated cloths, three engine oils, one plastic coated natural rubber sheeting and two synthetic base stocks for high temperature fluid were studied via the prophetic patch test method on laboratory animals and volunteer human subjects to determine the primary irritant effect and the sensitization index of these materials. The fabrics were cotton duck cloth impregnated with the following materials: copper cellulose complex containing 0.86 - 0.88% copper, and 1.08% copper by weight of copper formate which was autoclaved leaving a copper impregnated cellulose complex containing 0.35% copper. The patch test studies with rabbits indicated that, except for WF165, an hydraulic fluid, there was no contra-indication to proceeding with the patch testing on the human subjects. Not withstanding the results obtained with WF165 in rabbits, this material was also patch tested on human subjects because of the importance attached to it. All of the materials including WF165 were found safe to use in contact with the human skin after the test with the human volunteer subjects.

Project & Task: 7159-71802 Contract No. AF 33(616)-5072
ASTIA No. AD-142220

(256)
TR 57-759 December 1957

Veghte, James H.; Webb, Paul (Aerospace Medical Laboratory)

CLOTHING AND TOLERANCE TO HEAT

A series of experiments has been conducted to determine the effect of clothing on human tolerance to hot environments (90° to 160° F). Exposures were made in five different clothing assemblies which were representative of permeable and impermeable, lightweight and heavily insulated AF clothing. The effect of the exposures was measured in terms of physiological strain. These experiments show to what extent impermeable clothing, as compared with permeable clothing, reduces human tolerance to heat, regardless of insulation value. Insulation alone serves a protective function in heat. However, a heavy permeable assembly by addition of several permeable layers proved to be functionally impermeable.

Project & Task: 7155-71804
ASTIA No. AD-142248

(257)
TR 57-769 May 1958

Hall, John F., Jr.; Kearny, Allan P.; Polte, Johannes W.; Quillette, Stanley (Aerospace Medical Laboratory)

EFFECT OF DRY AND WET CLOTHING ON BODY COOLING AT LOW AIR TEMPERATURES

Skin, rectal, and extremity temperatures of clothed subjects, immersed in cold water (0°C) for brief periods and then exposed, while occupying a life raft, to ambient air temperatures ranging from 4.4° to -28.9°C, were measured. Amount and partitioning of the water absorbed by the clothing and effects of water immersion upon metabolic level were determined. For comparative purposes, cooling rates of these subjects wearing dry clothing at the various air temperatures were also determined. On the basis of total body-heat-storage loss, a series of predictive curves for human tolerance for subjects clothed in wet and dry garments while exposed to various low air temperatures in a life raft is presented.

Project & Task: 7164-71830
ASTIA No. AD-155639

(258)
TR 58-24 April 1958

Hirsch, Jerome A. (Aerospace Medical Laboratory)

ACCOMMODATIVE FATIGUE IN THE AGING RADAR OBSERVER

Ocular fatigue in radar observers was studied to determine if an ophthalmic appliance for the observer or an optical magnifier for the scope presentation would aid in the alleviation of this problem. It was found that the accommodative mechanism, per se, would not fatigue after a one-hour period of observation at the near point of the observer. Ocular fatigue in radar observers was therefore not considered to be an accommodative fatigue but was probably due to other factors such as improper corrective lenses, infrequent rest periods, improperly functioning ocular mechanism, or poor physical and/or mental condition for job performance. In addition, a new insight into myodiopter relationship is brought forth.

Project & Task: 7157-71808
ASTIA No. AD-142297

(259)
TR 58-50 May 1958

Hirshon, Jack M. (Landsdale Tube Co.)

A DETECTION SYSTEM FOR OZONE-EMPLOYING POLYELECTROLYTE FILMS

A chemical film system for the detection and measurement of atmospheric ozone has been shown to be feasible. This system is based on the oxidizing power of ozone to produce ions in an otherwise essentially nonconducting system. The conductivity is then a measure of the oxidation reaction and hence the ozone concentration under suitable experimental conditions. Another system based on the change in potential of a suitable redox electrode has been shown to respond to ozone. The sensitivity and time response characteristics of both these systems still require additional development work before an ozone-sensitive film can be incorporated into a complete instrument.

Project & Task: 7159-71803 Contract No. AF 33(600)-35218
ASTIA No. AD-155667

(260)
TR 58-55 February 1958

Tamas, Anton (Aerospace Medical Laboratory)

A COLORIMETRIC ESTIMATION OF HEMOGLOBIN IN THE PRESENCE OF MYOGLOBIN

Determination of hemoglobin in the presence of myoglobin requires spectrophotometric estimation of both pigments. Instrumentation becomes complicated and cumbersome. A simple technique is presented for the estimation of tissue hemoglobin, where the interference from myoglobin is eliminated by differential solubilities. Converting the pigments to acid hematin renders the technique colorimetric. Through suitable simplfication, the method is applicable to body fluids.

Project & Task: 7159-71803
ASTIA No. AD-142347

(261)
TR 58-64 October 1958

McGuire, T. F.; Leary, F. J. (Aerospace Medical Laboratory)

TRANQUILIZING DRUGS AND STRESS TOLERANCE

Stress tolerance studies were performed on a group of ten healthy male subjects, ranging in age from 18 to 27, both in their normal state and while on therapeutic doses of the tranquilizers promazine hydrochloride (Sparine) or meprobamate (Miltown, Equanil). Stress tolerance was reduced while on tranquilizers. The limitation was more severe with the promazine hydrochloride than with the meprobamate. However, as the degree of stress increased, the limitation of response became marked with both groups of tranquilizing agents. Experiments with very high doses yielded even more severe limitations. The stress limitation apparently exists whether the subject is overtly anxious about the proposed experiment (when not on medication) or not. Psychological factors are also discussed. It is believed that if the situation demands tranquilizers, then the airman should be removed from flying status while on the drug.

Project & Task: 7160-71800
ASTIA No. AD-205542

(262)
TR 58-73 August 1958

Baltzer, D. H.; Dreyer, J. F. (Polacoat, Inc.)

DEVELOPMENT OF COATING MATERIALS AND METHOD FOR COATING PRESCRIPTION PLASTIC SPECTACLE LENSES TO PROVIDE ULTRAVIOLET AND NEAR INFRARED ABSORPTION

Coating techniques and materials for manufacture of uniform density plastic prescription sunglasses have been investigated. Coating by a spinning technique using a formulated nitrocellulose compound was found to give the best results. The properties of the final coated lens include a daylight transmittance of 15% ±3; neutrality represented by chromaticity coordinates: $x = 0.37$, $y = 0.36$; ultraviolet cut off at 390 millimicrons; near infrared spectral transmittance below 50% between 700 and 1200 millimicrons; good resistance to paper scratching with a pencil hardness of 2H to 3H.

Project & Task: 6332-63609 Contract No. AF 33(616)-5146
ASTIA No. AD-203902

(263)
TR 58-232

October 1958

Metcalf, R. D.; Horn, R. E. (Aerospace Medical Laboratory)

VISUAL RECOVERY TIMES FROM HIGH-INTENSITY FLASHES OF LIGHT

A high-intensity carbon arc was used as a light source to determine the course of visual recovery after exposure to a level of illumination comparable to that likely to be encountered during nuclear operations. The subjects in the experiment were exposed to a source subtending 3^{o} 58' at the eye and with a luminance of up to 15×10^{6} foot-lamberts. Exposure time was constant at 0.1 second. Recovery time plotted against illumination at the eye (and source brightness) produced a straight line curve in a semilog plot. Extrapolation to the estimated burn threshold indicates a maximum recovery time of 170 seconds to discriminate a brightness contrast comparable to reading red-lighted aircraft instruments. Recovery times to other brightness levels are also indicated.

Project & Task: 6332-77653
ASTIA No. AD-205543

(264)
TR 58-278

August 1958

Hirsch, Jerome A. (Aerospace Medical Laboratory)

DEVELOPMENT OF AN IMPROVED AIR FORCE SUNGLASS

The factors which rendered the F-2 and G-2 sunglasses unacceptable are briefly discussed. The experimental sunglass, designed for service testing, is described. Improvements resulting from field usage leading toward the ultimate standardization of a new sunglass, the HGU-4/P, are presented. A complete summary of improvements included in the new specification are outlined.

Project & Task: 6332-63609
ASTIA No. AD-155843

(265)
TR 58-319

June 1958

Hall, F. G.; Salzano, John, Zechman, Fred, Jr. (Duke University)

THE EFFECTS OF VENOUS INFUSION OF GASEOUS CARBON DIOXIDE INTO DOGS

Gaseous carbon dioxide was infused into the femoral veins of ten dogs at rates varying from 60 ml per minute to 160 ml per minute. In one dog gaseous carbon dioxide was infused at a rate of 90 ml per minute for several hours and until a total volume of 19.0 liters was infused without fatal results. No dog was killed by these infusions. Acute responses appear to arise through a partial blockade of small pulmonary vessels. This blockade disappears within a very few minutes after infusion is stopped. Practically all of the carbon dioxide infused was recovered in the expired air.

Project & Task: 7160-71811
ASTIA No. AD-155810

Contract No. AF 33(616)-3821

(266)
TR 58-321

July 1958

Westlake, Edward F. (Aerospace Medical Laboratory)

SAFETY HANDLING INSTRUCTIONS FOR HEF-2

After a short introduction into the nature and properties of HEF-2, handling, storage, and shipping are discussed in detail. Fire and health hazards and their control are included. The problems of spillage and waste disposal of HEF-2 are stressed.

Project & Task: 7165-71836
ASTIA No. AD-155748

(267)
TR 58-322 October 1958

Furlong, N. B., Jr.; Schwarz, M. J. (Aerospace Medical Laboratory)

CHANGES IN CEREBRAL OXYGEN AVAILABILITY FROM INDUCED HYPOXIA IN CATS

The polarographic measurement of cerebral tissue oxygen availability in cats under a variety of environmental conditions has been made possible through permanent implantation of platinum electrodes in brain tissues. A linear relationship between decreased oxygen partial pressures and recorded cerebral oxygen availability was demonstrated in both nitrogen dilution and altitude pressure chamber experiments. Increased oxygen partial pressures raised the cerebral oxygen availability by a maximum of 50%. Changes in mean arterial blood pressure produced by centrifugal force resulted, after a short time lag, in closely correlated changes in the oxygen availability. Expected changes in oxygen availability were observed with carbon monoxide, sodium nitrite, and sodium cyanide-induced hypoxia. High concentrations of carbon dioxide in the inspired air produced indications of possible increases in oxygen availability.

Project & Task: 7159-71803
ASTIA No. AD-203904

(268)
TR 58-352 August 1958

Dittmer, D. S.; Grebe, R. M. (The National Academy of Sciences)

HANDBOOK OF RESPIRATION

This report presents data on respiration for man, other animals, and plants, arranged in tables, graphs, charts, and diagrams. The material is organized into fourteen categories. Contents of this report have been made available and authenticated by some 400 leading investigators in the fields of biology and medicine. The extended review process to which all tables have been subjected was designed to eliminate, insofar as possible, both errors and such strongly controversial or questionable material as tends naturally to inhere in a work of this scope and complexity.

Project & Task: 7158-71801
ASTIA No. AD-155823

(269)
TR 58-399 November 1958

Wulfeck, Joseph W.; Weisz, Alexander; Raben, M. W. (Jackson & Moreland, Inc. & Tufts College)

VISION IN MILITARY AVIATION

The requirements of vision in military aviation are analyzed in the light of the human observer. Practical problems of perception encountered in many phases of flying are analyzed and discussed. A comprehensive bibliography is included in each section of the report for those who are interested in a more detailed approach to a particular subject.

Project & Task: 7157-71808 Contract No. AF 33(616)-2906
ASTIA No. AD-207780

(270)
TR 58-412 September 1958

Veghte, J. H.; Webb, P. (Aerospace Medical Laboratory)

EXTENDING HUMAN TOLERANCE TO HEAT BY PRIOR BODY COOLING

A preliminary study has been completed to determine the effect of prior body cooling on tolerance to a high level of heat stress. Subjects were exposed to three levels of precooling—30-, 60-, and 90-minute exposures in a 60° F water bath—prior to entering the heat chamber at 160° F. As the time of precooling increases, the average tolerance time in heat is correspondingly greater. At tolerance, a narrow spread of terminal rectal temperatures is observed. Recruitment of sweating in heat is inhibited by prior body cooling. The causative factors for this phenomenon are discussed.

Project & Task: 7164-71830
ASTIA No. AD-205544

(271)
TR 58-417 August 1958

Friede, R. L., M.D. (Aerospace Medical Laboratory)

THE DEMONSTRATION OF SUCCINIC DEHYDROGENASE IN SINGLE TISSUE ELEMENTS OF THE CENTRAL NERVOUS SYSTEM

Succinic dehydrogenase was demonstrated by histochemical tetrazolium technique in single tissue elements obtained from different regions of the central nervous systems of rats and guinea pigs. Different, but characteristic, enzyme concentrations were found in neurons, neuropil, glia cells, axons, capillary vessels, and ependyma. The enzyme content of the neurons varies greatly, and neurons with enxyme activity weaker than the surrounding neuropil seem characteristic for some regions of the brain.

Project & Task: 7165-71836
ASTIA No. AD-155844

(272)
TR 58-471 April 1959

Williams, J.; Horvath, S. M. (State University of Iowa)

PULMONARY BLOOD VOLUME AND CIRCULATORY ALTERATIONS IN DOGS EXPOSED TO COMPENSATED HIGH INTRAPULMONARY PRESSURES

Dogs were placed in full pressure suits and helmets and exposed to pressures from 4 to 230 mm. Hg for periods ranging from 2 to 300 minutes. The measured cardiovascular alterations increased with prolonged exposure times. Pulmonary blood volume increased while the animal was breathing 100% oxygen at 4 to 8 mm. Hg. pressure. The pulmonary blood volume began to decrease at a pressure of 140 mm. Hg. All increased pressures caused a decreased cardiac index and increased systemic resistance. The pressure suit used in these studies does not offer complete and prolonged protection to the animal exposed to compensated high breathing pressures.

Project & Task: 7160-71814 Contract No. AF 33(616)-5173
ASTIA No. AD-215622

(273)
TR 58-608 March 1959

Webb, Paul; Klemm, F. K. (Aerospace Medical Laboratory)

DESIGN OF VENTILATED CLOTHING

The purpose of ventilation of clothing is reviewed and the functions of convective and evaporative cooling are described. How to achieve these functions is discussed in detail by describing the principles of proper air distribution, effective evaporation, and full utilization of convective cooling in ventilated clothing assemblies. A description of various ventilating garments is given to illustrate the evolution of principles, and, finally, an "ideal" ventilating system is defined for the difficult problem of ventilated pressure suit assemblies. Tests are described which demonstrate the validity of employing each of the design principles which go into the "ideal" system. The general subjects of low energy ventilating systems and of integration of ventilated clothing assemblies are discussed. Recommendations are made concerning the use and design of ventilation systems for protective clothing.

Project & Task: 7164-71831
ASTIA No. AD-213602

(274)
TR 58-625 March 1959

Middleton, R. H.; Comfort, E. (Aerospace Medical Laboratory)

BENDS AND DENITROGENATION IN HIGH-ALTITUDE FLIGHT OPERATIONS

Ascent to altitudes above 25,000 feet is accompanied frequently by symptoms of decompression sickness. The only consistently effective prophylaxis known to date is the lowering of the level of dissolved body nitrogen by breathing undiluted oxygen. Past experimental evidence is reviewed and presented with results of more recent investigations and incidental observations in conjunction with simulated ascents to high altitudes. Prebreathing undiluted oxygen for 2 hours will reduce the incidence of severe symptoms of decompression sickness to an operationally insignificant level when the mission includes the possibility of exposure for 30 minutes or longer to cabin altitudes above 35,000 feet. Shorter denitrogenation time offers adequate protection for lower altitudes or exposures of shorter duration. The relative efficiency of ground-level versus in-flight denitrogenation is discussed.

Project & Task: 7160-71812
ASTIA No. AD-212561

(275)
TR 58-643 March 1959

Weinberg, J. W., Ph.D. (Pioneer Scientific Corporation)

DOUBLE-WALLED FACEPIECES MA-IA ALTITUDE HELMET

The problem was the design and construction of a double-walled lens to prevent water vapor condensation on the inner surface under conditions prevailing in sustained flight at very high altitudes and to delay such condensation in emergency loss of plane canopy or ejection in such a way as to provide unimpeded vision to the flier during the probable duration of the emergency or of free fall through the upper atmosphere. The limitations on weight and size of such a device, and the requirements of optical excellence, of outstanding resistance to thermal, abrasive, chemical, and radiation damage, and of feasibility of production at reasonable cost are obvious. Laboratory tests at Wright Air Development Center appear to have demonstrated the general adequacy of the final samples submitted.

Project & Task: 7165-71834 Contract No. AF 33(616)-3774
ASTIA No. AD-212313

(276)
TR 59-32 March 1959

Finkelstein, Beatrice; McGhee, Bernice (Aerospace Medical Laboratory)

LIQUID DIETS FOR USE IN HIGH-ALTITUDE, HIGH-PERFORMANCE VEHICLES

The Aerospace Medical Laboratory, in its search for significant life sciences information which will enable crews of high-altitude, high-performance vehicles to function efficiently, recently conducted the preliminary phase of a liquid diet evaluation. Fifteen males, ranging in age from 21 to 29 years, participated in the study for a 5-day period while performing their usual laboratory activities. Food consumption was controlled by serving meals consisting of 2 or 3 beverages in the nutrition laboratory. Fruit juices and a chocolate drink were made available for between-meal snacks. Each day's meal provided approximately 2600 calories and 115 grams of protein. Criteria used to evaluate the diet included food consumption records, acceptability data, physiological effects, and psychological changes. Preliminary data indicate that a high protein liquid diet will be acceptable for crews flying high-altitude, high-performance vehicles for extended periods of time and will induce no adverse effects.

Project & Task: 7164-71833
ASTIA No. AD-209064

(277)
TR 59-59 April 1959

Friede, Reinhard L. (Aerospace Medical Laboratory)

NEUROPATHOLOGICAL AND HISTOCHEMICAL INVESTIGATIONS IN SUBACUTE BORON HYDRIDE INTOXICATION IN RATS

Neuropathological and histochemical studies were performed on rats receiving repeated skin applications of a decaborane-derivative, high-energy fuel, HEF-3. Hyperexcitation, aggressive behavior, and central depression were observed as a result of the intoxication. Slight changes of the nerve cells were histologically demonstrated, but the quality of the cell changes was not indicative of permanent damage.

Project & Task: 7165-71836
ASTIA No. AD-213591

(278)
TR 59-60 April 1959

Friede, Reinhard L., M.D. (Aerospace Medical Laboratory)

INVERSE HISTOCHEMICAL DISTRIBUTION OF FAT AND OXIDATIVE ENZYMES IN FATTY LIVERS PRODUCED BY CARBON TETRACHLORIDE

Histochemical investigations were performed on the distribution of fat, succinic dehydrogenase, and cytochrome oxidase in fatty changed livers of rats and dogs exposed to CCl_4. The distribution of fat in the fatty changed liver lobule was found inverse to the distribution of succinic dehydrogenase and probably also cytochrome oxidase. Changes in the extent of fat deposition were inverse to changes in the enzyme distribution. There seems a correlation between fat deposition and loss of certain respiratory enzymes.

Project & Task: 7165-71836
ASTIA No. AD-212572

(279)
TR 59-69 April 1959

Finkelstein, Beatrice; McGhee, Bernice (Aerospace Medical Laboratory)

NUTRITIONAL ASPECTS OF A HIGH-ALTITUDE BALLOON FLIGHT

The problem of satisfactorily feeding a man in space-equivalent conditions was explored during the Manhigh III Balloon Flight Project. Feeding programs for preliminary test phases of this project and for the balloon trial itself were evaluated with respect to acceptability, nutrition, and functional utility. Data indicate that nutrition support can be accomplished adequately for flights involving a period of days. Limited storage facilities create a need for packaging foods and liquids in lightweight, flexible containers which, after the removal of food, can be readily reduced in size. The possibility of extreme stress arising suddenly and unexpectedly suggests the need for scheduled consumption of food during all pre- and in-flight phases of unusually demanding missions. Such a need is based on the maintenance of an optimal physiological state at all times.

Project & Task: 7164-71833
ASTIA No. AD-213597

(280)
TR 59-114 May 1959

Wayne-George Corporation

HIGH-SPEED ELECTROMECHANICAL GOGGLE

High-speed, electromechanical goggles, which were developed and constructed to protect the eyes of the wearer from burns or flashblindness caused by exposure to high-intensity flashes, are described. A signal is generated by a photodetector at the onset of the flash. This signal is amplified by an electronic amplifier and actuates the shutters of the goggles to shut out all light. The goggles are closed in less than 500 microseconds after the flash.

Project & Task: 6332-77653 Contract No. AF 33(616)-5287
ASTIA No. AD-215828

(281)
TR 59-117 May 1959

Hill, W. F.; Cox, C. M. (Aerospace Medical Laboratory)

INFLUENCE OF STAPHYLOCOCCAL ENTEROTOXIN ON INFLUENZA VIRUS INFECTIVITY IN THE EMBRYONATED EGG

The influence of treating embryonated eggs with "cat positive" staphylococcal enterotoxin filtrate on the infectivity of PR8 influenza virus is described. (The production of the enterotoxin is also described.) This study was undertaken in an attempt to elucidate additional properties of staphylococcal enterotoxin whereby new avenues of approach might lead to developing simple and precise methodology for detecting this toxin in suspect food. Available assay procedures lack definitive reliability in that they are either indirect or one-sided. The results of this study indicate that pre- and post-treatment of embryonated eggs with "cat-positive" enterotoxin filtrate exerts an inhibitory influence upon virus infectivity. A statistically significant difference at the 0.05 probability level was found between the mean EID_{50} of enterotoxin-treated and control groups of embryonated eggs. The particular mechanism whereby staphylococcal enterotoxin antagonizes virus infectivity remains obscure at present, but probably involves the alteration of host-cell metabolism.

Project & Task: 7165-71837
ASTIA No. AD-220254

(282)
TR 59-123 April 1959

Miller, D. F.; Tamas, Anton, Dr., Robinson, L. (Aerospace Medical Laboratory)

A SIMPLE CLINICAL TEST FOR BORON HYDRIDE EXPOSURE

A simple, accurate test for the detection of boron-derivative, high-energy fuels in biological systems is presented. A preferential extraction of the serum eliminates the interference from dietary or background boron. The test, a colorimetric determination based on the curcumin reaction, has a sensitivity of 0.05 gamma of boron per milliliter of serum. The reproducibility is ± 5%. Pertinent biochemistry is discussed.

Project & Task: 7165-71836
ASTIA No. AD-213593

(283)
TR 59-124

June 1959

Shelanski, Morris V.; Gabriel, Karl L. (Industrial Biology Research and Testing Laboratories, Inc.)

CUTANEOUS TOXICITY EVALUATION OF AIR FORCE DEVELOPMENT MATERIALS - III

Three crystalline substituted phenyl ethers, three DORK flame-resistant cotton fabrics, one untreated cotton sateen fabric, and four fungicidal-treated (fluorinated diphenyl sulfide) cotton sateen fabrics were studied via the prophetic patch test method on laboratory animals and volunteer human subjects to determine the primary irritant effect and the sensitization index of these materials. The patch test studies with rabbits indicated that there were no contraindications to proceeding with the patch testing on the human subjects. All of the materials were found safe to use in contact with the human skin after the test with the human volunteer subjects.

Project & Task: 7165-71836
ASTIA No. AD-215535

Contract No. AF 33(616)-5595

(284)
TR 59-125

May 1959

Hegnauer, Albert H.; Angelakos, E. T. (Boston University)

PHARMOCOLOGIC CONTROL OF HYPOTHERMIC VENTRICULAR FIBRILLATION

Investigation has been made into pharmacologic control of hypothermic ventricular fibrillation (VF). Two tests were employed for evaluation of antiarrhythmic activity: one against spontaneous VF during progressive cooling and the other against VF during ventriculotomy at 26°C. with circulatory stasis. Results indicate that activity in each of these two tests may depend upon different pharmacologic effects. More than 30 compounds were tested. The nine most promising were tested more rigorously. Quinidine, effective in preventing spontaneous VF and in lowering mean lethal temperature, was made the standard of reference for evaluating other compounds. Certain antihistaminics were found more effective, while doxylamine and antergan were found approximately equal to quinidine in effectiveness. In experimental hypothermic ventriculotomy with controlled pH and inflow occlusion, quinidine, antazoline, and chloromethapyrilene exhibited definite antifibrillatory action, with survival limited by development of acute heart failure. The latter could be surmounted by administering inotropic agents. Quabain did not alter the incidence of hypothermic VF.

Project & Task: 7164-71830

Contract No. AF 33(616)-3805

285)
TR 59-128

March 1959

Hall, F. G.; Salzano, John (Duke University)

EFFECT OF BODY POSTURE ON MAXIMAL INSPIRATORY AND EXPIRATORY STROKE VOLUME

Timed maximal expiratory and inspiratory stroke volumes have been measured in 18 normal young men ranging in age from 19 to 30 years. During these tests, subjects were placed in four postures: standing, supine, head up and body axis at 45 degrees from horizontal, and head down and body axis 45 degrees from horizontal. The percentage of maximal stroke volume recorded in each case was at rates unrelated to body posture. Flow rates were nearly linear during the first one-half second of flow. A method for measurement of both inspiratory and expiratory stroke volumes is described.

Project & Task: 7164-71832
ASTIA No. AD-212319

Contract No. AF 33(616)-3821

(286)
TR 59-232 May 1959

Biesele, R. L., Jr. (Fenwal Incorporated)

AUTOMATIC TEMPERATURE CONTROLLERS FOR THE MA-1 ALTITUDE HELMET VISOR

This report covers the technical aspects of a contract for the development of automatic temperature controllers for the MA-1 Altitude Helmet Visor. The controllers were designed to mount inside a new high-altitude helmet and to maintain the interior surface temperature of the helmet visor by control of the power supplied to an electrical heating coating provided in the visor. A single controller has been designed which is suitable for operation from either a 28-volt DC supply, or, by means of a separately mounted rectifier power supply, from a 115-volt, 400-cycle supply. The controller, as designed, is transistorized and uses only static switching elements. It was designed for minimum size, weight, and power drain. It can be installed in helmets already provided by the Air Force by relatively minor modifications of the helmet.

Project & Task: 6336-63619 Contract No. AF 33(616)-5250
ASTIA No. AD-226518

(287)
TR 59-246 June 1959

Moller, Fred D. (The Berger Brothers Company)

HIGH-ALTITUDE, PARTIAL PRESSURE SUITS DESIGNED WITH DOUBLE CAPSTANS, VENTILATION LAYERS, AND PARTIAL PRESSURE AND FULL PRESSURE SOCKS

This report deals with the resizing of the Type MC-4 suit (partial pressure, high-altitude, with g-bladder protection) to meet fitting requirements when selection is made by "Stature-Weight" selection charts. The resized suit is known as Type MC-4A. The design and construction of three prototypes of partial pressure suits having various features requiring evaluation in the effort to overcome certain problem areas are discussed. The development of pneumatic socks (both partial pressure and full pressure) for pressurizing the feet is also discussed.

Project & Task: 6336-63619

(288)
TR 59-326 June 1959

McCutchan, J. W.; Isherwood, J. D. (University of California)

PREDICTION OF THERMAL TOLERANCE WHEN USING AN MA-2 VENTILATING GARMENT WITH A MODIFIED MK-IV ANTI-EXPOSURE SUIT

The physiological responses of human subjects have been investigated in the thermal environments ranging from 120° to 240° F while wearing the MA-2 ventilating garment, and MK-IV exposure suit, and other garments comprising 2.15 clo of thermal resistance. The ventilating garment was given air inputs ranging from 2 to 14 ft^3 per minute in volume, and from 50° to 90° F in temperature. The thermal responses of the subjects are shown graphically in terms of heat storage, heart rates, sweat rates, and composite indices of these variables. The results of these experiments have been prepared in terms of an equation which is presented graphically as a nomograph. This nomograph predicts the cooling power of the MA-2 ventilating garment and is to be used in conjunction with the tolerance chart available in the HIAD. The tolerance data, which were determined on steady exposures in a preheated chamber, are used to predict human tolerance for conditions where the air and wall temperatures are not constant.

Project & Task: 7164-71830
ASTIA No. AD-226520

(289)
TR 59-350 September 1959

Veghte, J. H.; Webb, P. (Aerospace Medical Laboratory)

INFLUENCE OF PRIOR BODY COOLING WITH AIR ON HUMAN HEAT TOLERANCE

This study was conducted with three experienced subjects to determine the feasibility of using a ventilating suit as a vehicle for body cooling prior to heat exposures. Various ventilating air temperatures, flows, and time durations were explored. The results confirm the applicability of this approach for prior body cooling and extension of tolerance times to a heat stress. Optimal air temperature for air cooling in terms of subjective comfort appears to be approximately 45°F. for 60 minutes or longer. Maximum airflow rate recommended with the ventilating garment is 25 c.f.m. Heavy insulation should be worn over the ventilating garment while cooling and may be worn throughout the heat or flight situation with no tolerance impairment.

Project & Task: 7164-71830

(290)
TR 59-378 July 1959

Hall, F. G.; Salzano, John (Duke University)

THE INFLUENCE OF VENOUS INFUSION OF GASEOUS CARBON DIOXIDE ON OXYGEN SATURATION OF ARTERIAL BLOOD AND CARDIAC OUTPUT IN THE ANESTHETIZED DOG

The formation of gas bubbles in the blood stream has been a problem of high-altitude flight. When gaseous bubbles of oxygen and nitrogen are infused into the venous system, profound injury results. Gaseous CO_2 however may be infused at rates of 100 ml. per minute without irreversible damage. A notable feature of the procedure is reduction of arterial oxygen saturation of hemoglobin. Cardiac output was measured in dogs before, during, and after intravenous infusion of gaseous CO_2. Slight decreases in output occurred but not great enough to indicate a significant impairment in blood flow through the pulmonary system. Infused CO_2 moves rapidly into the expired gas. Lowered oxygen saturation of blood following infusion of CO_2 can be explained in part by Bohr effect. However, this does not account entirely for level of oxygen unsaturation and something more than Bohr effect seems involved.

Project & Task: 7164-71832 Contract No. AF 33(616)-3821
ASTIA No. AD-226830

(291)
TR 59-398 July 1959

Hertzman, A. B.; Ferguson, I. D. (St. Louis University)

FAILURE IN TEMPERATURE REGULATION DURING PROGRESSIVE DEHYDRATION

During exposure to an ambient temperature of 43.3° C. (110° F.) without food or water, the body weights of young male subjects decreased at the rate of 0.5 per cent per hour of exposure, their body temperatures rose 0.1° C. per hour, but the total sweat production changed little despite the increase in body temperature. Calculations indicated that the latter was due to a slightly inadequate sweating which in turn was attributed to a rising thermal threshold for sweating. Regional sweating rates varied widely during the exposure, particularly on the upper parts of the body. Cutaneous conductances, thermal circulatory indices and the pad pulses in the finger and toe changed very little; there was no evidence of peripheral circulatory failure in these experiments. The theoretical implications are discussed.

Project & Task: 7164-71830 Contract No. AF 33(616)-3357
ASTIA No. AD-227237

(292)
TN 56-526 February 1957

Michel, Edward M. (Aerospace Medical Laboratory)

SURVIVAL SPACE REQUIREMENT FOR INDIVIDUAL AIRCRAFT ESCAPE CAPSULES

In aircraft with an escape capsule, clothing will be part of the survival gear. Studies were made to determine space requirements and the minimum of clothing and survival equipment for survival under extreme conditions. Items were selected, measured, and weighed; and a pack was designed to carry the gear. A minimum of 3700 cubic inches was required to stow the survival items, which weighed 70 pounds.

Project & Task: 6363-63283
ASTIA No. AD-110649

(293)
TN 57-306 December 1957

Slingland, C. E. (Aerospace Medical Laboratory)

THE FITTING OF OUTER CLOTHING OVER THE MC-3 AND MC-4 PARTIAL PRESSURE SUITS

A fitting problem has developed in the integration of partial pressure suits with outer clothing. Outer clothing normally worn will become much too tight for effective manipulation of the limbs when worn over an inflated partial pressure suit. Therefore, tests were conducted to determine the upgrading of sizes necessary to allow adequate room for inflation of the partial pressure suit. No fixed relationship between the size outer clothing normally worn and the size necessary over partial pressure suits could be determined from these tests. Therefore, this note cannot serve as a precise guide to the proper fitting of outer clothing and the procurement of stocks to meet the needs of aircrewmen, but it will give some insight into the fitting problem and how to best determine the size outer clothing necessary for wear over partial pressure suits.

Project & Task: 6325-62751
ASTIA No. AD-131005

(294)
TN 57-331 October 1957

Stuckelman, Tina L. (Aerospace Medical Laboratory)

A GUIDE TO AIRCREW PERSONAL AND AIRCRAFT INSTALLED EQUIPMENT

This technical note is a catalog of new and old Aero Medical Laboratory and items of special interest to aircrews and includes information on special high altitude and long range flight clothing, personal and aircraft installed oxygen equipment, survival kits, life rafts and preservers, in-flight food packets, survival rations, and aircraft installed food service equipment. Each listing includes a photograph and brief description of the item. This technical note is intended as a supplement to Air Force supply catalogs.

ASTIA No. AD-131085

(295)
TN 58-26 February 1958

Hanselman, N. K.; Metzger, C. A.; Horns, E. A. (Aerospace Medical Laboratory)

OPERATION, INSPECTION AND MAINTENANCE PROCEDURES FOR CUSHION, SEAT, OXYGEN AND SURVIVAL EQUIPMENT

The major components of the contractor furnished cushion, seat, oxygen and survival equipment are described; and the function of each component is outlined. Inspection procedures and necessary equipment are defined to serve as a guide for squadron and depot maintenance.

Project & Task: 6325-63282
ASTIA No. AD-142304

(296)
TN 58-259

August 1958

Bogart, Betty K. (Aerospace Medical Laboratory)

GUIDE TO AIRCREW PERSONAL AND AIRCRAFT INSTALLED EQUIPMENT

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

Project & Task: 6325
ASTIA No. AD-155895

(297)
TN 59-61

March 1959

Randle, R. J., Jr. (Aerospace Medical Laboratory)

VIBRATIONS IN HELICOPTERS: TRAINING CONSIDERATIONS

Helicopter instructor pilots were interviewed individually to analyze in detail the role that vibrations play in piloting helicopters. Information was gathered which indicated that vibrations are utilized as cues in both normal control and the detection and diagnosis of system malfunctions. Training considerations are discussed and recommendations made for a relatively gross simulation of each of the several classes of vibrations in a proposed helicopter instrument trainer.

Project & Task: 7197-71640
ASTIA No. AD-212314

(298)
TR 56-260, Vol. I

November 1956

Roach, C. G.; Moon, M. A. (Aerospace Medical Laboratory)

HANDBOOK OF LIQUID OXYGEN SYSTEMS: AIRCRAFT LIQUID OXYGEN SYSTEMS

"A brief history of the work of the Air Force with oxygen covering the years from 1921 to the present is presented. Liquid oxygen and gaseous systems are compared, giving the advantages and disadvantages of each. Appended to the report are a number of previously published reports, together comprising a survey of the field and covering the problem from several angles."

Project & Task: 6385
ASTIA No. AD-110533

(299)
TR 56-260, Vol. II

November 1956

Roach, C. G.; Moon, M. A. (Aerospace Medical Laboratory)

HANDBOOK OF LIQUID OXYGEN SYSTEMS

A brief discussion of the precautions in the handling and storage of liquid oxygen is presented. Evaporation losses of liquid oxygen storage tanks of various sizes are also included. Appendices to the report are a number of previously published specifications covering the oxygen generating equipment, liquid oxygen storage tanks, and allied equipment.

Project & Task: 6385
ASTIA No. AD-110534

(300)
TR 56-632 December 1956

Seeler, Henry (Aerospace Medical Laboratory)

DESIGN PROPOSALS FOR ARMED FORCES RESUSCITATOR KITS

Design proposals for Armed Forces Resuscitator Kits are submitted by the Aero Medical Laboratory, Wright Air Development Center, the result of many years development work in this field. If efficient use is expected, the kits must be small, lightweight, rugged, safe under toxic gases and gunfire, and should be unlimited in application time. Such resuscitators need to be usable in the open battlefield, in ambulances, in aircraft, on navy vessels, and in the operating room with air, air-oxygen mixture, or pure oxygen supply. Further extended proposals are submitted for mask-to-mask, and a mass resuscitation device for Army use or Civil Defense.

Project & Task: 6331-63605
ASTIA No. AD-110647

(301)
TR 57-6 January 1957

Stingely, Norman E. (Aerospace Medical Laboratory)

AEROMEDICAL EVACUATION LITTER PATIENT SAFETY HARNESS

An aeromedical evacuation litter patient safety harness has been developed by New York University. WADC TR 55-333 "Aeromedical Evacuation Litter Patient Safety Device Study" (AD-104851) which resulted from the above contract has been included as an Appendix to give medical and operational requirements for a satisfactory litter harness, and also to give design data for a harness to fit the standard rigid aluminum pole folding litter. The standard pole litter was determined as not capable of withstanding the required g loads and was therefore modified. The harness developed by New York University was modified to function with the modified litter. The psychotic restraints were deleted from the harness and it is suggested a modification of the standard wrist and ankle restraint be used in conjunction with the harness for psychotic-neurotic patients. The modified harness was dynamically tested to determine the capability of restraining a patient to the litter during controlled crash landing. Dynamic litter tests indicated that the harness would restrain the patient up to at least 7.2 g and that the patient will better withstand the impact force if he is loaded head forward in relation to the aircraft.

Project & Task: 6354-63150
ASTIA No. AD-110695

(302)
TR 57-73 February 1957

Gibson, Curtis A. (Aerospace Medical Laboratory)

ALUMINUM TUBING REQUIREMENTS FOR AIRCRAFT LIQUID OXYGEN SYSTEMS

Tests were conducted to determine temperatures at various distances from liquid oxygen converters in warming vaporized liquid oxygen by means of passage through several types of aluminum tubing. Comparison of the various types of tubing are shown in the tables and charts. Less one-half inch tubing is required to warm the oxygen than 5/16-inch tubing. It was found that, generally, less plain aluminum tubing was required than alumalized tubing. It was also found that heat transfer was more efficient through straight tubing than through tubing coiled around the converter.

Project & Task: 6370
ASTIA No. AD-118031

(303)
TR 57-152

March 1957

Gibson, C. A. (Aerospace Medical Laboratory)

EVAPORATOR PLATES FOR WARMING OXYGEN FOR BREATHING

Tests have been conducted on sample liquid oxygen heat exchangers, Reynolds Metals Company Part No. 5018-301, in warming vaporized liquid oxygen to breathing temperatures. In warming vaporized liquid oxygen at gaseous flows of 20 or 30 liters per minute, two of these evaporator plates are sufficient to bring the temperature of the oxygen to near ambient temperature. At a gaseous oxygen flow of 40 liters per minute, three of these plates are required, and at a gaseous flow of 50 liters per minute, five of these plates are required to warm the oxygen to near ambient temperature. Six or more of these plates are required to warm oxygen to near ambient temperature at gaseous flows of 60 liters per minute or more. The pressure drop through one of these evaporator plates is approximately equivalent to that through 10 feet of 5/16-inch aluminum tubing, and these plates were pressure tested to 500 psi with no evident expansion or failure. The weight of one of these evaporator plates is approximately 0.56 pounds, while the weight of 10 feet of aluminum tubing is approximately 0.42 pounds.

Project & Task: 6370
ASTIA No. AD-118120

(304)
TR 57-397

June 1957

Hogan, G. W. (Aerospace Medical Laboratory)

AN ELECTRICAL INCINERATOR TOILET FOR AIRCRAFT

An improved model of the United Machine Company's IT-100-1 electric incinerator toilet was submitted for evaluation. The design characteristics have been greatly improved over the original model tested by this Center in March 1955. This model experienced no failure in the vibration tests. The mechanics of the improved model remain the same. These tests show no substantial improvement in incineration time. Certain changes are evident and will be discussed with the manufacturer for inclusion. It is planned to revise MIL-T-25332 accordingly. The improvements already made and those which can yet be worked out should thoroughly satisfy the exceptions thus far taken to MIL-T-25332 by several airframe manufacturers. The performance limitation of this toilet limits its usefulness to that of bomber and cargo crew facility. In its present form, the toilet may be installed and used to advantage and is considered an improvement over the chemical type (bucket) toilet now in use. However, there are certain needed improvements.

Project & Task: 6356-63158
ASTIA No. AD-130846

(305)
TR 57-545

August 1957

Slingland, C. E. (Aerospace Medical Laboratory)

THE MC-1 HOOK BLADE-SNAP BLADE POCKET KNIFE

A survival knife that combines safety and accessibility has been in demand by aircrewmen for some time. This knife, a hook blade-snap blade pocket knife, has now been standardized. The hook blade is for the cutting of shroud or riser lines should a man become entangled in them when landing in water; and the switch blade is for general survival purposes and for the deflation of life preservers and rafts in those rare instances when they accidently inflate while in the aircraft. It is intended that this knife will be carried in a special knife pocket located on the inner left thigh of the outer flight clothing.

Project & Task: 6325-63751
ASTIA No. AD-131023

(306)
TR 57-635

December 1958

Miller, L. (D. K. Manufacturing Company)

DESIGN AND DEVELOPMENT OF ONE QUART INSULATED RECTANGULAR BEVERAGE CONTAINER

The problem of design and development of a one quart insulated rectangular container can be resolved into two integrated parts; that of materials and weight and that of heat loss. The geometry of the subject container demands a material with a very high elastic limit and a very high stiffness to weight ratio. Since the combination of both of these properties is not found in engineering materials, it was necessary to design a container of heavier weight than called for by the contract exhibit. In regard to the problem of heat loss, because of the relatively high surface to volume ratio, the rectangular shape called for by the exhibit represents a less than ideal design shape for obtaining minimum heat loss. A prototype stainless steel vacuum insulated rectangular container, meeting the requirements of the exhibit except for weight and heat loss, was submitted.

Project & Task: 6331-63604
ASTIA No. AD-142085

Contract No. AF 33(616)-3574

(307)
TR 57-652

March 1959

Daunt, J. G. (Ohio State University)

APPARATUS FOR MEASUREMENT OF THE MAGNETIC THRESHOLD CURVES FOR SUPERCONDUCTORS

An apparatus for measurement of the magnetic threshold curves for superconductors in the liquid helium temperature range is described in Section I. With this apparatus, the resistive transition from the superconducting to the normal state and vice versa can be measured as a function of temperature and magnetic field. Section II describes results of experimental investigations of the magnetic behavior of superconducting Ti-Sn alloys. The magnetic threshold curves were measured for three Ti-Sn alloys of Sn content 4, 8, and 10 atomic per cent. The transition temperatures for the three alloys were 1.25°K, 1.90°K, and 1.86°K, respectively, and the slopes of the threshold curves were approximately 23 kilogauss per degree for all three. A discussion is given of the interpretation of the results.

Project & Task: 6364-63250
ASTIA No. AD-142301

Contract No. AF 33(616)-5083

(308)
TR 57-739

August 1958

Nelson, R. D.; Sullivan, W.; Tubbs, R.; Buchanan, D. (Ohio State University)

ELECTRICAL GENERATION OF OXYGEN (LITERATURE SURVEY)

A bibliography concerned with the electrical generation of oxygen and related fields which will aid future work in providing breathing oxygen for long term, etra-atmospheric flight is compiled. A total of 691 references is presented as well as a complete subject index. A brief summary of the current status of development in this field is included.

Project & Task: 6364-63390
ASTIA No. AD-155900

Contract No. AF 33(616)-3966

(309)
TR 58-154 September 1958

Ashe, W. F.; Wright, C. C.; Anderegg, J. W. (Ohio State University)

HISTORICAL SURVEY OF INHABITABLE ARTIFICIAL ATMOSPHERES

Unclassified world literature on production and control of artificial atmospheres for living organisms was surveyed; literature in the fields of human biology and medicine, microbiology, botany and zoology was covered. All pertinent articles were abstracted. These abstracts, authors, title, and source of each article make up the body of this report. Abstracts were arranged under the following groups: Carbon Dioxide, Carbon Dioxide Removal Systems, Carbon Dioxide at High Partial Pressure, Electromagnetic (Including Cosmic) Radiation, Variation of "G" Forces, Heat-Cold and Temperature Regulation, Noise, Oxygen, Oxygen Generation, Oxygen Low, Pressure Explosive Decompression, Sealed Cabins or Containers, Toxic Substances, Water and Moisture Control, Miscellaneous Factors. Each abstract has a five-unit code symbol for cross reference among the four major fields. No conclusions are made by the authors as to potential value of any abstract in the production of any desired atmosphere.

Project & Task: 6350-63112 Contract No. AF 33(616)-5103
ASTIA No. AD-155901

(310)
TR 58-397 May 1959

Miller, A. E.; Replogle, E. H. (Scott Aviation Corporation)

DEVELOPMENT OF AN EMERGENCY PRESSURIZATION SYSTEM FOR AN ESCAPE CAPSULE

An Emergency Pressurization System for an Escape Capsule was developed. It included its own "bottled" high pressure air supply and a sequential system of controls whereby, after being armed either manually or by separation from the aircraft, the system automatically (as a result of the sensing of the drop of cockpit pressure) releases its air at the rate required for fast repressurization. It then cuts short the fast repressurization as soon as the capsule pressure has again returned to a safe level, and directs the air through an absolute pressure regulator which maintains this level, compensating for capsule leakage. It was found that the second aneroid triggering device could be set off prematurely by shock waves formed by the too sudden release of unrestricted pressure when attempts were made to pressurize in time considerably shorter than 5 seconds. The pressure waves were recorded and means devised to avoid them. The reasons for choice of the types of mechanical elements provided and the effects of acceleration and environment on their satisfactory operation are discussed. A brief review of the test results is included, and the report is concluded with recommendations to writers of future specifications for equipment of this nature.

Project & Task: 6352-63105 Contract No. AF 33(616)-5005
ASTIA No. AD-216307

(311)
TR 58-552 August 1959

Gibson, C. A. (Aerospace Medical Laboratory)

OPTIMUM FILLING OF LIQUID OXYGEN CONVERTERS

Tests were conducted using combination fill-buildup-vent valves in filling liquid oxygen converters. The converters were connected for filling to simulate, as nearly as possible, the aircraft connections in servicing aircraft in the field. This series of tests indicates that the optimum filling condition of liquid oxygen converters is obtained when a combination fill-buildup-vent is used to control flows of oxygen in the converter fill and buildup circuits.

Project & Task: 6358
ASTIA No. AD-206910

(312)
TR 59-247, Pt. I

June 1959

Kearney, A. P.; Mills, B. J.; Huey, R. S. (Aerospace Medical Laboratory)

EMERGENCY ESCAPE CAPSULE STUDIES. PHASE I: PRELIMINARY LABORATORY FLOTATION STUDIES

Preliminary studies using aircraft canopy escape-type capsules are described. Design of capsule clothing, donning of clothing in confined space, stowage of emergency survival items, air exchange requirements, flotation, inhabitation and communication studies were conducted as individual facets of the program. The studies were culminated with a test in which a human subject remained in a closed capsule for 72 hours. Findings from these preliminary studies are presented. The capsule with an air exchange system successfully served as a temporary shelter while floating in a test pool for a period of 72 hours. Throughout the test, the hatch was closed to simulate a situation which might be necessary operationally only as a result of the most severe environmental conditions.

Project & Task: 6325-63750
ASTIA No. AD-226055

(313)
TR 59-380

June 1959

Beher, J. T.; Hankins, D. (Bendix Aviation Corporation)

A STUDY OF LIQUID OXYGEN CONVERTERS AT ELEVATED (700°F) TEMPERATURES

This report is based upon a design study of liquid oxygen converters in elevated temperature environments and upon actual testing of representative converters in elevated temperature environments to determine the temperature limitations of presently available liquid oxygen converters and their components. The program consisted of four major phases of endeavor; (a) a design investigation of presently available converters to enable selection of the best representative converters for testing at elevated temperatures, (b) the test phase, (c) a literature survey of information pertinent to the design, construction and manufacturing processes of liquid oxygen converters, and (d) an analysis of the information compiled in the first three phases to provide design recommendations for building converters capable of operating at elevated temperatures. The author finds that the converters investigated and tested as representative samples of currently available equipment at the time of the study cannot be recommended for use above a range from 250°F to 300°F. All of these converters should be capable of sustained operation up to 300°F with very minor changes. Changes required for operation up to approximately 450°F would be more numerous and almost complete redesign of all major components would be required for temperatures from approximately 500°F to 700°F.

Project & Task: 6358-63215
ASTIA No. AD-227156L

Contract No. AF 33(616)-3967

(314)
TR 59-382

August 1959

David Clark Company, Inc.

INTEGRATION OF PERSONAL EQUIPMENT

This report covers the efforts, methods of approach and solutions to some of the problems of integrating items of aircrew personal equipment. The major problem of integration is combining the various individual items which have specific functions with each other without complicating these combinations beyond their effectiveness limits. Practical solutions were achieved in some areas, but additional work is required in others.

Project & Task: 6325
ASTIA No. AD-228499

Contract No. AF 33(616)-3329

(315)

August 1959

Gibson, C. A. (Aerospace Medical Laboratory)

HANDBOOK OF CAPACITANCE-TYPE LIQUID OXYGEN CONVERTERS

This handbook is a compilation of specifications for reference covering: liquid oxygen converters; capacitance-type indicators; valves used in converter systems; test procedures applicable for checking this equipment prior to installation in an aircraft; installation procedures; and procedures for checking the equipment after installation in an aircraft.

Project 6385

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*Refers to number within parentheses identifying each abstract.

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