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EXPERIMENTAL DESIGN AND AUTOMATED ANALYSIS OF GROUND LEVEL AND RAPID DECOMPRESSION PPB STUDIES.

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INTRODUCTION. Effective experimental design, automated data analysis, and statistical modelling can maximize the information collected during comparison of TLSS and CE. METHODS. 6 males and 1 female subject underwent 8 ten minute ground level exposures to PPB (TLSS & CE ensembles, 60, 70, 80, and 88 mm Hg PPB). Data was collected during the PPB exposures, 3 minute pre-control and 5 minute post control periods. 6 subjects were also exposed to 3 minutes of 60,000 ft simulated altitude and 60 mm Hg PPB following rapid decompression (RD) from 22,500 ft. wearing the two systems. Custom software coordinated all data processing, identified significant experimental events such as PPB onset, and performed error and out-of-bounds checking on all data. Multivariate analysis of covariance (MANCOVA) was used to analyze all collected data for the PPB and RD trials. RESULTS. Comparisons of the changes in cardiovascular and performance function with garment type, exposure duration and PPB levels were possible with this experimental design. CONCLUSION. The experimental and statistical designs of both the ground level and altitude experiments allow for subject by subject comparison of the cardiovascular effects of TLSS and CE systems and their effectiveness in protection against rapid decompression

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THE EFFECT OF INCREASED G-SUIT COVERAGE ON THE CARDIOVASCULAR EFFECTS OF POSITIVE PRESSURE BREATHING AT 60,000 FT.

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INTRODUCTION. The ground level PPB study discussed previously showed that 3 minute exposures to 60 mmHg PPB with either TLSS and CE systems would not lead to cardiovascular collapse. This study compared the cardiopulmonary responses of subjects wearing the two systems to 60,000 ft. rapid decompressions. METHODS. HR, SV, CO, and oxygen saturation (SaO_2) of 6 subjects were measured during 3 minutes of exposure to 60,000 ft as described earlier. RESULTS. There were significant effects due to garment type on SV ($P < 0.004$) and CO ($P < 0.04$) with a greater decrement using CE. There was a significant effect of time at altitude on SaO_2 ($P < 0.02$) with a rapid fall SaO_2 over the three minutes but no differences between the garments. CONCLUSIONS. Both TLSS and CE provided sufficient physiological support to maintain oxygen saturations above 65%. during the three minute exposures to 60,000 ft altitude. As in the ground level studies, increased G-suit coverage resulted in improved cardiovascular function. Short term physiological support at higher altitudes with greater PPB levels or longer duration excursions at 60,000 ft may not be possible without the greater g-suit bladder coverage provided by TLSS type garments.

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CARDIOVASCULAR FUNCTION DURING POSITIVE PRESSURE BREATHING AT GROUND LEVEL.

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INTRODUCTION. The use of positive pressure breathing (PPB) is limited in part by the cardiovascular collapse that eventually occurs with sustained PPB. The effects of prolonged exposure to high levels of PPB were compared in subjects wearing the TLSS and CE g-suit/jerkin/mask ensembles. METHODS. Heart rate (HR), stroke volume (SV), and mean arterial pressure (MAP) were collected during 8 PPB exposure periods as described earlier. RESULTS. All 7 subjects completed ten minute exposures at all 4 levels of PPB while wearing the TLSS ensemble. Mean durations for the same subjects wearing the CE ensemble were 9.3 ± 0.7, 8.3 ± 1.0, 6.0 ± 0.9, and 6.3 ± 1.3 minutes at 60, 70, 80, and 88 mm Hg PPB. There was a significant increase in HR ($P < 0.0001$) and a decreased SV ($P < 0.02$) with PPB duration, a fall in SV ($P < 0.002$) and an increase in MAP ($P < 0.01$) with increasing PPB levels. There was significant interaction between duration and garment type for HR ($P < 0.001$), SV ($P < 0.004$), and MAP ($P < 0.001$) and significant interaction between duration, garment type, and PPB level for SV ($P < 0.004$) and MAP ($P < 0.002$) and between PPB level and garment type for SV ($P < 0.0001$). There was a greater fall in stroke volume and corresponding increases in heart rate with the CE system. Subjects were unable to complete 10 minutes of the higher levels of PPB while wearing the CE ensemble. CONCLUSIONS. An increased g-suit coverage provides improved cardiovascular support during PPB at ground level.

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MINIATURIZED NUCLEAR PROBE TO MEASURE CARDIAC PERFORMANCE DURING PPB.

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INTRODUCTION. Detailed measurement of cardiac function during PPB is required to determine the relationship between venous return, G-suit coverage, and pressure breathing syncope. This study examined: (a) the feasibility of using a miniaturized nuclear probe (MNP) to study cardiac function during PPB; (b) the differences in cardiovascular protection against PPB afforded by TLSS vs. Combat Edge (CE) PPB ensembles. METHODS. Six experienced subjects were labled with Technesium99m, and and exposed to 70 mmHg PPB from an air source and regulator, wearing both CE and TLSS ensembles for 3 minutes. The MNP (Cardioscint™), positioned over the left ventricle, measured: ejection fraction (EF,%), left ventricular filling rate (LVfr) and relative end-diastolic volume (EDVr) every 10 s. RESULTS. EF increased by 9% from control for TLSS, but decreased by 8.5% from control with CE ($P < .05$). LVfr was decreased (-0.25) with CE, but was increased (+ 0.85 EDVcounts/s; $P < .05$) with TLSS. EDVr was reduced by -25 vs. -57 counts/10 ms for TLSS vs. CE, respectively ($P < .05$). CONCLUSION. MNP's rapidly and reliably measure cardiac function during PPB. An increase in leg bladder coverage results in greated protection against the PPB-induced reduction in cardiac filling .

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PANEL: PSYCHOLOGICAL FACTORS IN ASTRONAUT SELECTION AND TRAINING: AN INTERNATIONAL PERSPECTIVE. P.A. Santy.* UTMB, Galveston, TX 77550.

INTRODUCTION. From 1988-1991 an international working group of psychologists and psychiatrists examined the empirical literature and research findings from isolated and demanding environments for the purpose of developing optimal psychiatric select-out and psychological select-in procedures for astronaut selection. This same committee discussed psychological training methods for astronauts. Select-out procedures were implemented operationally in the U.S. Space Program in the 1989 selection. Also at that time, a study to validate select-in psychological criteria was initiated. In Japan and Europe, astronaut selection will be completed at the end of 1991. Panel members from the U.S., Japan, and Europe will present the results of the psychological selection and training procedures used in each country. The results of work on the validation of astronaut psychological selection criteria will also be presented. CONCLUSIONS. This panel will present the most recent data on the psychological selection and training of astronauts in the U.S., Japanese, and European Space Programs.

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RESULTS OF THE PSYCHIATRIC, "SELECT-OUT" EVALUATION OF U.S. ASTRONAUT APPLICANTS. D. M. Faulk,* P. A. Santy,* A. W. Holland,* and R. Marsh.* UTMB, Galveston, TX and NASA Johnson Space Center, Houston, TX.

INTRODUCTION. The psychiatric exclusion criteria for astronauts are based on NASA Medical Psychiatric Standards for Space Flight. Until recently, there were no standardized methods to evaluate disqualifying psychopathology in astronaut applicants. METHOD. One hundred and six astronaut applicants who had passed initial screening were evaluated for Axis I and Axis II DSM-III-R diagnoses using the NASA structured psychiatric interview. The interview consisted of three parts: (1)An unstructured portion for obtaining biographical and historical information; (2)The Schedule for Affective Disorders-Lifetime version (SADSL), specially modified to include all disqualifying Axis I mental disorders; and (3)The Personality Assessment Schedule (PAS), also modified to evaluate for Axis II disorders. RESULTS. Nine of 106 candidates (8.5%) met diagnostic criteria for six Axis I disorders (including V-code) or Axis II disorders. Two of these disorders were disqualifying for the applicants. "Near" diagnoses (where applicants met at least 50% of the listed criteria) were assessed to demonstrate that clinicians using the interview were able to overcome applicants' reluctance to report symptomatomatology. CONCLUSIONS. The use of the NASA structured interview was effective in identifying past and present psychopathology in a group of highly motivated astronaut applicants. This was the first time a structured psychiatric interview had been used in such a setting for this purpose.

PSYCHOLOGICAL EVALUATION OF EUROPEAN ASTRONAUT APPLICANTS:
RESULTS OF THE 1991 SELECTION CAMPAIGN. C. Fassbender, & K.-M.
Goeters. German Aerospace Research Establishment (DLR), Hamburg,
Germany.
 INTRODUCTION. In summer 1991 the European Space Agency (ESA)
performed its second selection campaign since 1977 in order to
find 10 astronaut candidates (laboratory specialists and space
plane specialists). An integral part of this selection process
was the psychological evaluation according to the principals laid
down in the study report "Definition of Psychological Testing of
Astronaut Candidates". METHODS. After national preselections, 59
applicants participated in the psychological evaluation which
consists of the assessment of operational aptitudes (basic
cognitive and psychomotor functions) and personality traits
(motivation, social capability, stress resistance). The test
program included a diverse number of tests, questionnaires,
behavioral ratings, biographical data, and semi-structured
interviews. About 50 scores were available for each subject.
RESULTS. A comparison of the test scores with the original
normative data, culture-fairness of the psychological selection,
and discriminant functions analyzing the assessment decisions will
be presented and discussed. CONCLUSIONS. Since the psychological
evaluation was finished just before the deadline of the abstract,
quantitative results and conclusions cannot be given in this
abstract but will be reported in the conference paper.

THE PSYCHOLOGICAL RESULTS OF THE JAPANESE ASTRONAUT
SELECTION. C. Sekiguchi, M.D[*1]., S. Yumikura, M.D[*1]., M. Kume,
Ph.D[2]., and N. Okada, Ph.D[3]. 1) National Space Development Agency of
Japan (NASDA), 2) Waseda University, 3) National Univ. of Yokohama.
Japan
 NASDA has started the recruitment of Japanese Mission Specialist (MS)
candidates who will join the NASA MS training course in 1992. Finally, two
MS candidates will be selected. Our selection schedule is as follows:
1) Recruitment period   July 1 to August 31, 1991
2) Phase I selection   September, 1991
                           English exam. General intelligence,
                           Some psychological exams.
3) Phase 2 selection   November 1991
                           Medical exams at hospital
                           Psychological and general Interviews
4) Phase 3 selection   March or April 1992
                           Special medical exams (LBNP, Rotary
                           Chairs etc),   Interviews,
                           NASA Class II medical exams
 Announcement of final Japanese MSs will be on May 1992. As the
psychological exams, NASDA will use the anxiety test, mental activity test,
psychosocial personality test, aptitude test, and semi-structured
psychological interviews based on the psychological criteria which is
determined by the international psychological working group. Since the
selection process is in progress, the results will be presented and
discussed at the panel.

N95- 16762

VALIDATION OF ASTRONAUT PSYCHOLOGICAL "SELECT-IN" CRITERIA.
R. M. Rose, R.L. Helmreich, T. McFadden, P. A. Santy*, and A. W.
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Austin, TX; UTMB, Galveston; and NASA Johnson Space Center.
 INTRODUCTION. A optional astronaut selection strategy would
select-in individuals on the basis of personality attributes
associated with superior performance. METHOD. A test battery, the
Astronaut Personal Characteristics Inventory (ASTROPCI) was
developed which assesses positive and negative components of
achievement motivation and interpersonal orientation and skills.
The battery was administered to one hundred three Astronaut Can-
didates and sixty-six current U.S. Shuttle Astronauts. To deter-
mine performance, a series of conceptual areas related to space-
flight performance were defined. Astronauts rated their peers on
each of these dimensions. Ratings were obtained on all eighty-four
current Astronauts (excluding those selected in 1990). In addition
to peer ratings, supervisor assessments of the same dimensions
were obtained for each Astronaut. RESULTS. Cluster and factor
analytic techniques were employed to isolate subgroups of Astro-
nauts. Those astronauts with both high achievement needs and
interpersonal skills were most often rated among the top five by
their peers and least often rated among the lowest five. A number
of scales discriminated between Astronauts rated high and low on
one or more performance dimensions. CONCLUSIONS. The results
parallel findings from the personality assessment of individuals
in other demanding professions, including aircraft pilots and
research scientists, suggesting that personality factors are
significant determinants of performance in the space environment.

HUMAN FACTORS TRAINING OF SCIENCE ASTRONAUTS IN GERMANY: CONCEPT
AND METHODS. D. Manzey & A. Schiewe. German Aerospace Research
Establishment (DLR), Hamburg, Germany.
 INTRODUCTION. Even though the significance of psychological
issues of manned space flights is widely acknowledged, up to now
very few attempts have been made in America or Europe to integrate
some kind of psychological training within the normal training
syllabus of astronauts. A human factors training program for
science astronauts has been developed by the German Aerospace
Research Establishment and approved as an integrated part of the
biomedical training of five German astronaut candidates. METHODS
The training program consisted of several elements: (1)Psycholo-
gical training consisting of 4 two day-sessions with the topics
"Communication and Cooperation","Stress-Management","Coping with
Operational Demands" and "Effective Problem Solving in Groups."
Training methods included lectures, group exercises, individual
exercises, and group discussions.(2)Problem-oriented team super-
vision (POTS),integrated within the psychological training ses-
sions and in the weekly "monday meetings" of astronauts. (3)In-
dividual stress-management training during parabolic flights. (4)
Training of psychomotor coordination under 0-G conditions during
parabolic flights. RESULTS AND CONCLUSIONS. The empirical results
of the psychomotor training showed considerable improvement in O-G
psychomotor performance. The predominant positive feedback of the
astronauts who participated in this training program as well as an
obviously improved team-efficiency which became evident during two
follow-up POTS-meetings with the astronauts points to the success
of this training approach.

N95- 16763

PSYCHOLOGICAL TRAINING OF NASA ASTRONAUTS FOR EXTENDED MISSIONS.
A. W. Holland,* Behavior and Performance Laboratory, NASA Johnson
Space Center, Houston, TX.
 INTRODUCTION. The success of operational teams working in
remote and hostile environments rests in large part on adequate
preparation of those teams prior to emplacement in field settings.
Psychological training, directed at the maintenance of crew health
and performance, becomes increasingly important as space missions
grow in duration and complexity. METHODS. Topics to be discussed
include: the conceptual framework of psychological training; needs
analysis; content and delivery options; methods of assessing
training efficacy; use of testbeds and analogs; and the
relationship of training to crew selection and real-time support
activities. RESULTS AND CONCLUSIONS. This paper will discuss the
psychological training approach being developed at the NASA/JSC
Behavior and Performance Laboratory. This approach will be
compared and contrasted with those underway in the U.S. Department
of Defense and in other space agencies.

N95- 16764

HUMAN PERFORMANCE IN THE MODERN COCKPIT. R. K. Dismukes and M. M.
Cohen.* NASA Ames Research Center, Moffett Field, CA 94035
 This panel was organized by the Aerospace Human Factors Committee to
illustrate behavioral research on the perceptual, cognitive, and group
processes that determine crew effectiveness in modern cockpits. Earl Wiener
will report on crew reactions to the introduction of highly automated systems
in the cockpit. Automation can improve operational capabilities and efficiency
and can reduce some types of human error, but may also introduce entirely new
opportunities for error. Judith Orasanu will discuss the problem-solving and
decision-making strategies used by crews led by captains with various
personality profiles. Kevin Corker will present computational approaches to
modeling the cognitive demands of cockpit operations and the cognitive
capabilities and limitations of crew members. Asaf Degani and Earl Wiener
will examine factors contributing to aircrew deviations from standard
operating procedures and misuse of checklist, often leading to violations,
incidents, or accidents. Walter Johnson, Mary Kaiser, and David Foyle will
discuss the mechanisms of visual perception pilots use in aircraft control and
the implications of these mechanisms for effective design of visual displays.