

Japanese Aerospace Literature

This month: *The Human Factor in Space Sciences*

A89-13939 Responses in muscle sympathetic activity to acute hypoxia in humans. MITSURU SAITO, TADAAKI MANO, SATOSHI IWASE, KAZUO KOGA HIROSHI ABE et al., *Journal of Applied Physiology* (ISSN 0161-7567), Vol. 65, Oct. 1988, pp. 1548-1552. 26 Refs.

The effect of hypobaric hypoxia on the muscle sympathetic activity (MSA) in humans was investigated using a direct recording technique to monitor sympathetic nerve activity in subjects participating in a mountaineering training to high altitude. Postganglionic MSA was recorded with the use of a tungsten microelectrode inserted percutaneously into the muscle nerve fascia of the tibial nerve of subjects exposed to hypoxic conditions at simulated altitudes of 4000, 5000, and 6000 m. The average values of the MSA burst rate and total MSA activity (burst rate times mean burst amplitude) at these altitudes were significantly higher than the values recorded at sea level, indicating that MSA is activated under hypoxia. Heart rate also was found to increase significantly. At 6000 m, there were large interindividual differences in the MSA responsiveness to hypoxia. It is suggested that central controlling mechanisms that would be affected by hypoxia may also influence the MSA responsiveness under severe hypoxia.

A88-45352 Slowing effects of alcohol on voluntary eye movements. ZOJIRO KATOH, *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 59, July 1988, pp. 606-610. 16 Refs.

The effect of a moderate dosage of alcohol on the latency and saccadic velocity of eye movements was assessed by three kinds of task complexities such as the 'simple', 'comparison', and 'addition response tasks' to displayed stimuli. Six male subjects volunteered for the study. For each subject, a total of 570 trials were made on four consecutive days. In terms of absolute alcohol, the dose was 1.0 ml/kg of body weight. The slowing effect of alcohol on the latency ranged from 8.4 to 16.8 percent (mean 12.7 percent) corresponding to the task complexity. The impairment of the saccadic velocity ranged from 17.4 to 25.5 percent (mean 18.6 percent). It was suggested that the task complexity reflected on the latency, but not on the saccadic velocity.

A88-40986 Crew workload in JASDF C-1 transport flights. I - Change in heart rate and salivary cortisol. YUKIKO KAKIMOTO, AKIO NAKAMURA, HIDEO TARUI, YUKO NAGASAWA, and SHIGEYUKI YAGURA, *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 59, June 1988, pp. 511-516. 24 Refs.

The physiological responses of heart rate and salivary cortisol for six paired captains and copilots during JASDF scheduled transport flights were compared to assess crew workload. The relative change of both responses showed similar patterns; the responses were influenced significantly by whether pilots were controlling the aircraft. Moreover, differences in flying experience and responsibility of captains and copilots influenced the two physiological responses, heart rate and salivary cortisol measures increased more for both captains and copilots while they were in control of the aircraft than when they were not. Compared to captains, copilots showed much higher activation and variability in relative change of heart rate and salivary cortisol between periods of controlling and noncontrolling the aircraft. On the other hand, captains showed relatively constant responses comparing aircraft controlling and noncontrolling periods, especially in the cruise phase of flight. Salivary cortisol may be a useful, noninvasive method of assessing crew workload.

A88-44297 An output regulation model of human input adaptability in the manual control system. MAKOTO YOSHIZAWA and HIROSHI TAKEDA, *IEEE Transactions on Systems, Man, and Cybernetics* (ISSN 0018-9472), Vol. 18, Mar-Apr 1988, pp. 193-203. 27 Refs.

In experiments, some phenomena have been derived from the operator's open-loop frequency response when a random exponential signal generated by a simple linear system has been used as a reference input. These phenomena cannot be described by any usual isomorphic models. As the parameter included in the reference input generator has changed, these phenomena have changed their features in such a complicated manner that usual interpretations of human input adaptability are no longer useful. Here, it is shown that the phenomena are closely related to the inherent dead time included in the human operator and can be represented systematically by introducing an algorithmic model that realizes output regulation with internal stability for linear systems with a dead time.

A88-15824 On dependable intelligent system in the space. HIROKAZU IHARA, SATOSHI MOHRI, and SADAHARU KAWAI, *IAF, 38th International Astronautical Congress*, Brighton, England, Oct. 10-17, 1987. 9 pp. 6 Refs. (IAF Paper 87-32).

Artificial intelligence (AI) techniques and the concept of autonomous decentralization are examined as the key approaches to the development of a dependable intelligent computing system which could minimize the spacecraft crew and the number of mission specialists. The discussion covers a new design philosophy for an autonomous decentralized control system based on a biological analogy for controlling a distributed system; examples of autonomous decentralized systems, a problem solving model based on AI techniques, and the problem of AI dependability.

A88-36632 A mathematical analysis of human-machine interface configurations for a safety monitoring system. TOSHIYUKI INAGAKI and YASUHIKO IKEBE, *IEEE Transactions on Reliability* (ISSN 0018-9529), Vol. 37, April 1988, pp. 35-40. 14 Refs.

Two human-machine interface configurations for safety monitoring systems are discussed. (1) A conventional fault-warning configuration, which gives an alarm message on detecting plant failure and (2) a safety-presentation configuration introduced here, which can give a safety message as well as an alarm message. It is proved mathematically that the safety-presentation configuration is superior to the fault-warning configuration in the well-defined sense of avoiding catastrophic accidents.

A88-33587 USAF take-off and landing ejections, 1973-85. GEOFFREY W. MCCARTHY, *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 59, April 1988, pp. 359-362. 11 Refs.

This paper presents a review of ground-level ejection data from 1973 through 1985 for cases of ejections occurring during take-off and landing that clearly involved a decision between ground egress and ejection. Survival rate and the rate of major injuries were compared (by the chi-square analysis) to all ejections above 500 ft and to other ejections below 500 ft during the same period. There were 15 aircraft with 25 crewmembers, 22 of whom ejected. It was found that survival and injury rates for ground-level ejection did not differ significantly from those above 500 ft, indicating that ejection during take-off and landing phases is as safe as ejection above 500 ft, and safer than other ejections below 500 ft. Compared to ground egress, ejection offered greatly increased chances for survival (in only 33 percent of cases the ground egress would have been possible).

A88-49935 Some human aspects in man-machine systems. YOSHIRO SAKAI, *Yamaguchi University, Faculty of Engineering, Memoirs* (ISSN 0372-7661), Vol. 38, March 1988, pp. 39-44.

A man-machine interface plays an important role in the whole of a man-machine system. Vagueness is one of the major problems in developing it, and involves various factors mainly caused by the human side - individual difference, skill, psychological effects, etc. Clues to some of these questions will be discussed, employing the results of experiments arranged under the hypotheses proposed by the author.

A88-15849 Automation and robotics technology application to JEM (Japanese Experiment Module). M. SAITO, K. SHIRAKI, I. IIZUKA, and T. YOSHIOKA, *IAF, 38th International Astronautical Congress*, Brighton, England, Oct. 10-17, 1987. 6 pp. (IAF Paper 87-74).

Japan's contribution to the Space Station program will be the Japanese Experiment Module in which various space utilization experiments will be performed. In the present paper, consideration is given to the application of automation and robotics technologies to JEM. The JEM is composed of a pressurized module, an exposed facility, and an experiment logistics module. The automation and robotics technology can be used to increase JEM productivity, reduce the operation cost, improve the reliability/availability, eliminate perilous conditions, and perform tasks unsuited to crew.

A88-46573 A study on visual information processing under multi-task condition. I - Display density and search time. ZOJIRO KATOH, YUKO NAGASAWA, and ATSUSHI KADDO, *Japan Air Self Defence Force, Aeromedical Laboratory, Reports* (ISSN 0023-2858), Vol. 28, Sept. 1987, pp. 63-77. 7 Refs.

An experimental study of the relationship between time of search for a simple target and display density under dual-task conditions is reported. It was found that the search time and its standard deviation increased under both single- and dual-task conditions as the number of stimuli of the same display size increased. Under dual-task conditions, increment ratios of search time and standard deviation markedly changed at 0.06 and 0.08 of display density compared to the single-task condition. The increment of the number of stimuli within the same display size had a linear relationship to the increment of search time under the dual-task condition. It is suggested that when the same number of stimuli is presented at a different density, the function relating visual search time increment and display density is U-shaped. Scanning time per element decreased as the number of displayed stimuli increased.

A88-17077 An overview of Japanese CELSS research activities. KEIJI NITTA, (COSPAR and International Academy of Astronautics, 26th Plenary Meeting, 2nd Workshop on Controlled Ecological Life Support Systems, Toulouse, France, June 30-July 11, 1986) *Advances in Space Research* (ISSN 0273-1177), Vol. 7, no. 4, 1987, pp. 95-103. 33 Refs.

Controlled Ecological Life Support System (CELSS) efforts in Japan have thus far extended to gas recycling systems, water recycling systems, approaches to waste management, plant and algae physiology and cultivation studies, and CELSS bioreactor design studies. In addition, research has been undertaken in animal and fish physiology and breeding in outer space and on the effects of weightlessness on plant and animal life. Gas recycling technologies will be applied to the Japanese Experiment Module associated with the NASA Space Station.