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VISUAL INFORMATION TRANSFER: I. ASSESSMENT OF
SPECIFIC INFORMATION NEEDS II. THE EFFECTS OF
DEGRADED MOTION FEEDBACK III. PARAMETERS OF
APPROPRIATE INSTRUMENT SCANNING BEHAVIOR

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TRANSFER. 1: ASSESSMENT OF SPECIFIC
INFORMATION NEEDS. 2: THE EFFECTS OF
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VISUAL INFORMATION TRANSFER:

I. ASSESSMENT OF SPECIFIC INFORMATION NEEDS

Research Objective:

Experiment 1 concerns the assessment of transfer of visual information from cockpit displays to the flight crew as measured by oculometric techniques. Given that the time spent viewing a display may vary depending on the nature of the information sought by the pilot examining the display, this experiment permits an evaluation of time on the display in response to varied tasks requiring the pilot (1) to confirm indicator or needle position, (2) to determine if the indicated value is changing or not, or (3) to determine change of rate of the indicated value. The design of the function of new displays and display technologies can only be facilitated through an understanding of the nature of the information presented in displays.

Approach:

The initial experiment was conducted using the ATC-510 desk-top fixed-base simulator located at the NASA Langley Research Center. In addition to the primary flight instruments employed in the simulation, a secondary task was employed using an additional electromechanical display situated along the right side of the simulator panel. For the test subjects, the task was to fly the simulator on a heading of 60 degrees and at an altitude of 3160 feet, while simultaneously performing the secondary task. The secondary task involved extracting selected information from the secondary task display, and responding by a pushbutton located on the simulator "wheel".

Progress to Date:

The initial quarter of the grant period was devoted to the creation of computer programs necessary for the generation of the task and on-line data recording. Task generation and data recording were done on an Apple/Isaac System located at the NASA Langley Research Center. Data collection for experiment 1 is estimated to be 80 percent complete.

Future Plans:

Current plans call for the continuation of data collection and concurrent data analysis for this initial experiment.

II. THE EFFECTS OF DEGRADED MOTION FEEDBACK

Research Objective:

The second experiment extends the findings of a series of three experiments on aircraft and simulator motion by incorporating motion conditions with degraded motion feedback. This is an important research area as prior experimentation suggests that motion serves an alerting function resulting in consistent and significant changes in fixation time. Addressed by the second experiment is the question of the effects of degraded and uncorrelated motion feedback. Hypothetically, degraded motion may disrupt the alerting function of "true" motion and cause such motion to have disruptive effects. Measurement of fixation time distributions under such conditions will permit addressing this question.

Approach:

The test site planned for Experiment 2 is the Visual Motion Simulator (VMS) a six degree-of-freedom motion base simulator located at the NASA Langley Research Center. The task for the subject will be to fly a precision flight simulation task, such as a series of Instrument Landing System (ILS) approaches under conditions of no-motion, three-axis motion, and six axis motion. In addition to these conditions, test trials using uncorrelated motion (on one or more axes) will be presented.

Progress to Date:

Data collection has not started on Experiment 2. The data collection computer programs developed and used in the first experiment will be employed (with only minimal changes) in this Experiment.

Future Plans:

It is estimated that data collection on this experiment will begin during the Fall of 1984. The exact starting date is dependent on VMS simulator availability and scheduling and availability of an oculometer system for use in the data collection process.

III. PARAMETERS OF APPROPRIATE INSTRUMENT SCANNING BEHAVIOR

Research Objective:

The purpose of the third experiment is to develop an understanding of what constitutes good and poor instrument scanning on the part of pilots. The initial phase of the research involves the development of a suitable task that is representative of that performed by pilots, yet has the necessary characteristics to make research on instrument scanning feasible. The second phase of the research involves data collection to refine the task and to collect standardization data. The third phase is to consist of data collection with simultaneous measurement of task performance and scanning behavior (using oculometer and other physiological measurements as appropriate) as initially naive subjects practice the task and develop skill.

Approach:

The task to be performed by the subjects is presented on a desk-top computer, Heathkit H-89, and is a simulation of some of the tasks performed by aircraft pilots. Subjects monitor and control the heading, altitude, rate of ascent/descent, speed, and attitude (pitch and roll) of the simulated aircraft. At varying times during each ten-minute trial, instructions are given to approach a new heading, a new altitude, or to land the aircraft. Data are recorded at each 1/10th second on the state of the aircraft on each relevant variable throughout each trial. After standardization of the task is complete, the third phase involving data collection on the task while oculometer recordings are being taken will begin.

Progress to Date:

The design of the task has been completed, data collection to refine the components of the task and make necessary adjustments has been completed -- though future discovery of further needed refinements is always a possibility. Collection of standardization data is now underway. To date, eleven subjects have been tested on the task.

Future Plans:

Plans for the immediate future are to complete collection of standardization data and to complete plans for reducing the raw data into appropriate performance metrics. Specific arrangements for setting up and using the oculometer are to be initiated within a month.