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Development and Use of Mark Sense Record Cards
For Recording Medical Data on Pilots
Subjected to Acceleration Stress

Captain Harald A. Smedal, USN, MC and C. Dewey Havill

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Development and Use of Mark Sense Record Cards
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Subjected to Acceleration Stress

CAPTAIN HARALD A. SMEDAL, USN, MC and C. DEWEY HAVILL

A time-honored system of recording medical histories and the data obtained on physical and laboratory examination has been that of writing the information on record sheets that go into a folder for each patient. In order to have information which would be more readily retrieved, a program was initiated in 1952 by the U. S. Naval School of Aviation Medicine in connection with their "Care of the Flyer" study to place this information on machine record cards. In 1958, a machine record card method was developed for recording medical data in connection with the astronaut selection program. Machine record cards were also developed by the Aero Medical Laboratory, Wright-Patterson AFB, Ohio, and the Aviation Medical Acceleration Laboratory, Naval Air Development Center, Johnsville, Pennsylvania, for use in connection with a variety of tests including acceleration stress. Therefore, a variety of systems resulted in which data of a medical nature could easily be recalled.

During the NASA, Ames Research Center centrifuge studies, the pilot subjects were interviewed after each centrifuge run, or series of runs, and subjective information was recorded in a log book by the usual history taking methods referred to above. After the methods were reviewed, it was recognized that a card system would be very useful in recording data from our pilots after they had been exposed to acceleration stress. Since the acceleration stress cards already developed did not meet our requirements, it was decided a different card was needed.

DESIGN

The regular machine record card with its coded information punched does not have the capability of yielding information directly from the card unless the person using the card is very familiar with the code. This disadvantage is overcome by the mark sense card method described by others. On the mark sense card, the questions are written in abbreviated form. The answers are marked with an electrographic pencil in an adjacent oval-shaped space. The space used will indicate the correct answer either in the form of a specifically provided choice of answers or a Yes or No answer. An example of this card is shown in Figure 1.

An IBM card layout form for an inclined mark sense card (Fig. 2) gives maximum space for writing and printing. This form can present all the information desired for one pilot during one run or a series of runs on a single card. Through our past experience with subjective complaints during and after acceleration stress, we were able to compile a list of the most common items that occur. Visual symptoms that are of interest during the acceleration include blurring, changes in visual field, loss of vision, and pain about the eyes. Other general symptoms of interest are chest pain, headache, dizziness, nausea, abdominal pain, difficulty in breathing, and pain in the extremities. We were also interested in information as to whether or not any of these symptoms persisted after the exposure to acceleration.

Another card layout was made in order to have a history type card which could be filled once a year at the time of the annual physical

Mr. Havill is a research scientist.
From the National Aeronautics and Space Administration, Ames Research Center, Moffett Field, California.

OCTOBER, 1962
<table>
<thead>
<tr>
<th>Disease</th>
<th>General Medical History</th>
<th>Significant Ear History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles Any Kind</td>
<td>Blood Poisoning Severe Infection</td>
<td>Loss of Consciousness Any Cause</td>
</tr>
<tr>
<td>Chicken Pox</td>
<td>Intestinal Parasites</td>
<td>Severe Headaches</td>
</tr>
<tr>
<td>Mumps</td>
<td>Tuberculosis</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Whooping Cough</td>
<td>Pneumonia Other Than Food</td>
<td>Tumors of Any Kind</td>
</tr>
<tr>
<td>Influenza Any Kind</td>
<td>Encephalitis (Brain Fever)</td>
<td>Major Operation Any Type</td>
</tr>
<tr>
<td>Strept Throat</td>
<td>Mononucleosis (Glandular Fever)</td>
<td>Recent Significant Weight Gains</td>
</tr>
<tr>
<td>Serious Accident</td>
<td>Penicillin or Other Drug Reaction</td>
<td>Recent Weight Loss</td>
</tr>
<tr>
<td>Accident Prone</td>
<td>Immunization or Serum Reaction</td>
<td>Non-specific Urethritis</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>Malaria</td>
<td>Diarrhea</td>
</tr>
</tbody>
</table>

Fig. 1. General medical history mark sense record card (Lovelace Foundation).
### Fig. 3. Ames mark sense record card (series card).

<table>
<thead>
<tr>
<th>NAME</th>
<th>AGE</th>
<th>TYPE OF ACCELERATION</th>
<th>SIMULATOR TIME COVERED BY THIS CARD</th>
<th>TYPE OF ACCELERATION</th>
<th>SIMULATOR LOCATION</th>
<th>DID YOU HAVE ANY OF THE FOLLOWING SYMPTOMS DURING OR SUBSEQUENT TO THE SIMULATOR TIME COVERED BY THIS CARD</th>
<th>SYMPTOMS DURING SIMULATOR OPERATION</th>
<th>SYMPTOMS DURING OR SUBSEQUENT TO SIMULATOR OPERATION</th>
<th>SUBSEQUENT TO SIMULATOR OPERATION</th>
<th>INTERFERENCE FROM SUBSEQUENT SYMPTOMS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES NO</td>
<td>BLURRED VISION</td>
<td>HEADACHE</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES NO</td>
<td>CHANGES IN VISUAL FIELD</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES NO</td>
<td>LOSS OF VISION</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES NO</td>
<td>CHEST PAIN</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES NO</td>
<td>DIFFICULTY IN BREATHING</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES NO</td>
<td>LOSS OF CONSCIOUSNESS</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES NO</td>
<td>PAIN IN THE EXTREMITIES</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES NO</td>
<td>OTHER</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES NO</td>
<td>OTHER (COMMENT IF YES)</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
</tbody>
</table>

**Legend:**
- NAME
- AGE
- TYPE OF ACCELERATION
- SIMULATOR TIME COVERED BY THIS CARD
- TYPE OF ACCELERATION
- SIMULATOR LOCATION
- DID YOU HAVE ANY OF THE FOLLOWING SYMPTOMS DURING OR SUBSEQUENT TO THE SIMULATOR TIME COVERED BY THIS CARD
- SYMPTOMS DURING SIMULATOR OPERATION
- SYMPTOMS DURING OR SUBSEQUENT TO SIMULATOR OPERATION
- SUBSEQUENT TO SIMULATOR OPERATION
- INTERFERENCE FROM SUBSEQUENT SYMPTOMS
- COMMENTS

**Other:**
- IS THIS CARD FOR A SINGLE RUN OR ONE SERIES OF RUNS
- MORE THAN ONE TYPE (COMMENT)

**Column Values:**
- YES
- NO
<table>
<thead>
<tr>
<th>NAME - LAST, FIRST, MIDDLE INITIAL</th>
<th>SERIAL NO.</th>
<th>2S5 OR REG NO.</th>
<th>RANK</th>
<th>S</th>
<th>M</th>
<th>E</th>
<th>C</th>
<th>SERV (MONTH)</th>
<th>AGE</th>
<th>DATE OF BIRTH</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>NAME - LAST, FIRST, MIDDLE INITIAL</th>
<th>SERIAL NO.</th>
<th>2S5 OR REG NO.</th>
<th>RANK</th>
<th>S</th>
<th>M</th>
<th>E</th>
<th>C</th>
<th>SERV (MONTH)</th>
<th>AGE</th>
<th>DATE OF BIRTH</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Did you have any of the following symptoms during or subsequent to your simulator work?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms During Simulator Operations</strong></td>
</tr>
<tr>
<td><strong>Symptoms During or Subsequent to Simulator Operations</strong></td>
</tr>
<tr>
<td><strong>Symptoms During or Subsequent to Simulator Operations</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SYMPTOMS DURING</strong></th>
<th><strong>SYMPTOMS DURING OR SUBSEQUENT TO SIMULATOR OPERATIONS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BLURRED VISION</strong></td>
<td><strong>HEADACHE</strong></td>
</tr>
<tr>
<td><strong>CHANGE IN VISUAL FIELD</strong></td>
<td><strong>PAIN IN OR ABOUT THE EYES</strong></td>
</tr>
<tr>
<td><strong>LOSS OF VISION</strong></td>
<td><strong>DIZZINESS</strong></td>
</tr>
<tr>
<td><strong>CHEST PAIN</strong></td>
<td><strong>NAUSEA</strong></td>
</tr>
<tr>
<td><strong>DIFFICULTY IN BREATHING</strong></td>
<td><strong>ABDOMINAL PAIN</strong></td>
</tr>
<tr>
<td><strong>LOSS OF CONSCIOUSNESS</strong></td>
<td><strong>PAIN IN THE EXTREMITIES</strong></td>
</tr>
<tr>
<td><strong>OTHER</strong></td>
<td><strong>OTHER</strong></td>
</tr>
</tbody>
</table>

Fig. 4. Ames mark sense record card (history card).
examination of the pilot. This allows the examiner to keep a year-to-year record of the total acceleration stress encountered over the year, both as to total time as well as type of acceleration, i.e., linear, angular, impact, or vibratory. It also permits the evaluation of any sign or symptom that might be accumulative and related to repeated acceleration stress.

A final example of the two cards, one called the series card, and the other called the history card, is shown in Figure 3 and Figure 4, respectively.

RESULTS AND DISCUSSION

The series cards were used in collecting data on 22 test pilots used as subjects during a centrifuge program conducted at the Naval Air Development Center, Aviation Medical Acceleration Laboratory, Johnsville, Pennsylvania, during the months of March, April, and May of 1961. The cards proved to be readily understood and easily filled out by the pilots. A few items were found to be unsatisfactory in the first form of the sense card. For example, the simulator time columns which were three in number were found to be one too many since the time resulting from any one run or a series of runs was always less than 9 minutes, and two columns which would show the time in nine or fewer minutes plus a question were all that was required. It was also found that with a series of runs it was difficult to relate the symptoms to a specific run. The vector of the applied g often differed in each of the runs in a series and the pilot would not leave the cockpit. As a result, he was unable to fill out a card after each different run in the series. In general, however, the sense card when used for the single run was quite adequate. Modifications of these cards will be made from time to time as is found necessary.

The history cards have been forwarded to the Lovelace Foundation where they are currently being used as a part of their large series of cards that cover test pilot type examinations.

SUMMARY

This report presents the design format of two machine record cards of the mark sense card type which have been developed for use in connection with recording medical data on test pilots who are subjected to various acceleration stresses. One is a series card used to record subjective data from pilots after a single or a series of runs on a motion simulator during which acceleration stress is encountered. The other is a history card intended for use once a year at the time of the pilot's annual physical examination. The history card is intended to provide information regarding accumulative effects of repeated acceleration stress on the pilot. The series card has been used during one centrifuge program conducted by the NASA, Ames Research Center at the Naval Air Development Center, Aviation Medical Acceleration Laboratory, Johnsville, Pennsylvania, during March, April, and May of 1961, and has proved very successful. Although the population group was small and so not ideally suited for mark sense card data acquisition, some valuable accurate subjective information was obtained, particularly in regard to vision. This information would not have been obtained by simply keeping a log.

REFERENCES


Human Performance Branch
