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MONTHLY PROGRESS REPORT NO. 7

CONTRACT NO. DA18-108-AMC-228(A)

DYNAMIC MEASUREMENT OF PROTECTIVE MASKS

This report covers the period from 6 January through 7 February 1964.

Work to be Performed During the Period

During the period the major effort was concentrated on completing the fabrication, assembly and test of the first set of portable equipment including a completely instrumented mask set and back-pack. The submodules for the puck were assembled, welded, potted, and tested. A set of submodules were tested with transducers and data was acquired on the performance of the subsystem over the range of specified pressures and environmental temperature. In general the performance was within expected limits of accuracy except for the temperature sensitivity of the transducers, a problem which is discussed in detail below. Design details involving the treatment of mask wiring, scale factor and bias adjustment, and mask battery switching were worked out in trial assemblies. Certain difficulties were encountered which were solved by the best compromises possible. The following detail treatments summarize the results of the work accomplished during the period:

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A. Pressure Transducer

All 20 of the Hidyne pressure transducers were submitted to inspection tests including operation over the environmental temperature range. The results of these tests showed that the transducers do not meet the manufacturer's published specifications with respect to zero offset, hysteresis, and scale factor stability over the temperature range. Two transducers among the 20 were selected for the prototype tests and the remaining 18 units were rejected and returned to the vendor for rework.

The most serious deficiency is the change of scale factor (output voltage per unit input differential pressure) over the temperature range. The manufacturer's specifications placed tolerances on this change of 0.03%/°F which would result in approximately a 3% change in scale factor over the required temperature range of 0-90°F. The selected two transducers (one 0.25 psi unit and one 0.1 psi unit) exhibited a total change of approximately 10% over the temperature range. The supplier was contacted and assurances were received from him that every effort would be made on his part to correct the difficulties in the shortest time possible.

B. Mask Battery Supply

A number of life tests were conducted on various types of batteries to determine suitability for use in the mask. From the outset alkalyn cells had been planned on for use in the mask. Life tests indicated, however, that the ampere-hour capacity of random sample groups of cells was unpredictable. Because of the difficulty of installing replacement batteries, a decision was made to abandon alkalyn cells in favor of rechargeable nickel cadmium units. Nickel cadmium cells have two important advantages for this application. They may be permanently installed in the mask and recharged repeatedly if the recharging procedure is done with care. Secondly, the low temperature ampere-hour capacity does not reduce as severely as in alkalyn cells. There may be some objection to the installation of the cells since a total of eight units are required for the 10 volt supply to the puck. The cells are fitted into the mask around the filters on both sides, and in the chin pocket. Every attempt has been made to arrange the batteries for minimum interference with the flow of air through the filters and to the eye lenses.

C. Wiring

The interwiring among the components installed in the mask has been accomplished with short cables terminated in miniature Cannon connectors. One of the two cables attached to the back face of the puck connects to the battery supply and the other to the transducer mounted on the oronasal mask. Provision has been made to energize the mask battery circuit by the insertion of a small filister head screw into a small hole in the outside face of the puck. This will permit a completely outfitted mask to be donned and worn without unnecessary drain.

D. Alternate Installation

All possible measures have been taken to permit modification of the mask and back-pack installation for a hardwire link between mask transducers and a puck mounted on the back-pack. With care, the mask compartment pressure transducer can be removed from the puck assembly and mounted on an adaptor which will fit the voicemitter plate. A cable can then be installed between the adaptor and the puck. Provision has been made for mounting the puck on one edge of the back-pack assembly.

E. Back-Pack

The first back-pack assembly has been completed and readied for system acceptance tests. A voltage regulator has been added internally to provide the required +10 volts d.c. supply for the puck when hardwire operation is employed. The 14 volt bias supply required by the puck is supplied from the alkalyn cell mounted inside the transmitter compartment. An additional connector has been installed to provide for hardwire connection to the puck.

F. Ground Receiving Station

The EMR discriminators were received and testing during the period was found to be satisfactory. The entire ground receiving station was tested. Performance was found satisfactory except for one (1) Nems-Clarke receiver which exhibited subnormal gain. The unit was returned to the vendor for repair under warranty.

G. Acceptance Test Plan

A test procedure was prepared in two sections and forwarded to the Project Officer for approval in advance of the acceptance tests scheduled for the next period.

Work to be Performed During the Next Reporting Period

A demonstration and acceptance test has been scheduled for 17 February 1964. In the time prior to that date the first mask set will be completed and subsystem tests conducted. Subsequently, the complete system tests will be conducted to establish the performance capability of the equipment. Subject to successful completion of the acceptance tests, production will be initiated on the remaining mask systems.