



U. S. NAVAL AIR DEVELOPMENT CENTER

JOHNSVILLE, PA. 18974

MRPV

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6500 (Fleeman Volunteer))
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From: Commanding Officer, U.S. (Naval Air Development Center,
Johnsville, Warminster, Pennsylvania)
To : Secretary of the Navy, Washington 25, D.C.
Via : (1) Chief, Bureau of Naval Weapons
(2) Chief, (Bureau of Medicine and Surgery)
(3) Chief of Naval Personnel

Subj: Retinal Photography Project, Permission for Use of Human
Subjects in Connection with; request for

Ref : (a) Manual of the Medical Department, U.S. Navy, Chapter 1,
Section 2, Article 1-11.
(b) BuMed Subtask MR 005.13 - 0002.17 - Retinal Photography
during Acceleration.

Encl: (1) Experimental Design

1. Reference (a) states that experimental studies of a medical nature involving persons in the Naval Establishment are forbidden except when the experimental design in each case has received the prior approval of the Secretary of the Navy. Reference (b) is a Bureau of Medicine and Surgery Subtask which requires that research of a medical nature involving persons in the Naval Establishment be conducted. It is requested that approval be granted to use human volunteers for the subject investigation described below.
2. Enclosure (1) proposes the exposure of human subjects to acceleration on the dynamic flight simulator located at the Aerospace Medical Research Department (AMRD), U.S. Naval Air Development Center, Johnsville, Warminster, Pennsylvania. The purpose of this study is to obtain photographic records of the vascular system of the retina during acceleration stresses sufficient to produce visual black-out.
3. The subjects and observers will be the scientific and technical personnel who will be conducting the research studies. If additional subjects are required, volunteers will be requested from among local flight personnel. All subjects will be over twenty-one years of age and have normal vision.
4. During acceleration, all subjects will be monitored continuously by a qualified medical officer with television and electrocardiographic tracing to detect any indication of adverse physiologic responses. No adverse medical effects are anticipated.

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5. The result expected is a determination of the relationship between retinal blood supply and visual blackout during acceleration. This information will provide insights into the problem of blackout encountered by flight personnel, and direction for the development of measures to reduce the hazard of blackout.

6. This project is expected to be completed by 1 January 1967.

A. C. Benzel
A. C. BENZEL, R.

Experimental Design

A. Background

One of the consequences of flying is that changes in direction or speed produce acceleration forces, called g forces, which have significant physiologic effects on the pilots. Military maneuvers, such as bomb runs and steep inside turns, produce a characteristic group of symptoms culminating in black-out and unconsciousness. The term "black-out", as employed in aviation medicine, refers to the condition in which the subject cannot see, although he is still conscious and can respond to auditory and tactile stimuli. The question which has confronted investigators interested in determining the factors contributing to the black-out phenomenon is whether black-out results from ischemia of the retina, or from ischemia of some other portion of the visual system.

Extensive evidence has been gathered to support both possibilities. Most of the evidence has been indirect, and therefore, open to criticism. Some years ago, a study was conducted at the Aviation Medical Acceleration Laboratory in which the retinas of subjects exposed to acceleration stresses sufficient to produce black-out were ophthalmoscopically observed. (1) The subject was oriented so that the "positive" g forces ($+G_z$) were maximized while the observer was oriented so that the $+G_z$ forces were minimized. The observer, who was a medical illustrator, later made drawings of the retina as it appeared to him during the various stages of black-out. The investigation presently proposed is designed to obtain photographic records of the retinal vascular system during acceleration.

B. Apparatus

The apparatus used will be the dynamic flight simulator at the Aerospace Medical Research Department, Naval Air Development Center, Johnsville, Warminster, Pennsylvania, a fundus camera with a motion picture back, the associated lighting equipment necessary to obtain photographs of the retina, and the medical monitoring apparatus.

C. Procedure

The subject and the camera will be positioned in such a way that the $+G_z$ forces are maximized. An observer will be positioned so that he is exposed to minimum $+G_z$ and is able to operate the camera. The subject's pupil size will be controlled with mydriatic drugs. A response key will be provided so that the subject can indicate loss and return of visual sensitivity. He will be exposed to acceleration sufficient to produce black-out while motion pictures of the retina are made. With the successful completion of the study of $+G_z$ acceleration, television monitoring and servo-operation of the camera will be developed so that studies can be made of acceleration along other vectors.

D. Safety Procedures

All mydriatic drugs will be administered in standard pharmacological doses and only after examination of subjects by, and under the direction of, a qualified medical officer. Subjects will be monitored continuously with television and electrocardiographic tracing to detect any indication of adverse physiologic responses. Emergency "stop the run" buttons will be accessible to the medical monitor, the subject, the project officer and the centrifuge operator. No adverse medical effects are anticipated.

References

Duane, T.D. "Observations on the Fundus Oculi During Black-out,"
Arch. Opth., 51, 1954, 343-355.