

6500 (Human Volunteers)

OFFICE OF  
THE UNDER SECRETARY OF THE NAVY

12 July 1965

SPECIAL ASSISTANT TO THE UNDER SECRETARY

MEMORANDUM FOR SECRETARY BALDWIN

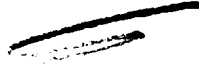
Subj: Research Project "Effects of Severe Air  
Turbulence Upon Pilot Performance,"  
permission for use of human subjects;  
request for

Attached is a routine request for permission  
to conduct subject tests.

This permission is required from you in  
accordance with Manual of the Medical Department  
of the Navy.

I see no problems involved; I recommend  
your signature.

Very respectfully,

  
R. T. Manning  
Commander, USN

5 JUL 1965

ROBERT H. B. BALDWIN  
Under Secretary of the Navy

6500 (Human Volunteers)  
OVJ

Pers-BL323-ble  
JUL 1 1965

THIRD ENDORSEMENT on NAVAIRDEVCEM ltr MLSH 2616 of 28 Apr 1965

From: Chief of Naval Personnel  
To: Secretary of the Navy

Subj: Research Project "Effects of Severe Air Turbulence Upon Pilot Performance", permission for use of human subjects; request for

1. Forwarded, recommending approval.

Copy to:  
NAVAIRDEVCEM, Johnsville  
BUMPS  
BUNED

Van V. EASON Jr.  
By direction

15 JUL 1965

~~APPROVED~~ \_\_\_\_\_

ROBERT H. B. BALDWIN

~~Under Secretary of the Navy~~

RETURNED TO ORIGINATOR FOR  
DISPOSITION THIS DATE 15 JUL 1965

G.P.

7/8 JSN-6

RA-15/102:RAB

FIRST ENDORSEMENT on NAVAIRDEVCEN ltr MLSH 2616 of 28 Apr 1965

From: Chief, Bureau of Naval Weapons  
To: Secretary of the Navy, Washington 25, D. C.  
Via: (1) Chief, Bureau of Medicine and Surgery  
(2) Chief of Naval Personnel

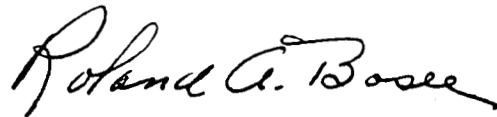
10 MAY 1965

Subj: Research Project "Effects of Severe Air Turbulence Upon Pilot Performance", permission for use of human subjects; request for

1. Forwarded, strongly recommending approval.

2. It is noted that the subject research project is in support of the Federal Aviation Agency. However, it is believed that the results obtained apply to Naval aviation as well. It is anticipated there will be a direct achievement accomplished in the Human Factors area as well as in the area of instrument displays and crew support equipment.

Copy to:  
NAVAIRDEVCEN, Johnsville



ROLAND A. BOSEE  
By direction



U. S. NAVAL AIR DEVELOPMENT CENTER

JOHNSVILLE, PA. 18974

MLSH

2616  
28 APR 1965

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: Research Project "Effects of Severe Air Turbulence Upon Pilot Performance", permission for use of human subjects; request for

Ref : (a) Manual of the Medical Department, U. S. Navy, Chapter I,  
Section II Research, Article 1-11, Experimentation on Personnel  
(b) BuWeps Problem Assignment No. 012-RA15-24, Effects of Severe  
Air Turbulence Upon Pilot Performance, WepTask No. RAE 13J  
012/2021/R005 01 01, Code RA-15/10, of 16 June 1964  
(c) Research Proposal, BuMed MR005.13-0005.10, Effects of Severe  
Air Turbulence Upon Pilot Performance, February 1964.  
Approved by BuMed ltr 711:mkf, of 13 Feb 1964

1. Reference (a) states that experimental studies of a medical nature involving persons in the Naval Establishment are forbidden except where the experimental design in each case has received the prior approval of the Secretary of the Navy. It is requested that approval be granted to use human volunteers for the subject investigation described herein.

2. The purposes of the subject investigation are defined by reference (b) and fall within the scope of reference (c). The stated purposes are:

a. The immediate provision of support to the Federal Aviation Agency in the performance of a closed-loop centrifuge simulation of a commercial jet aircraft under programmed turbulence conditions in order to quantitatively evaluate the contributions of the pilot to major aircraft upset under such conditions.

b. To study, as broadly as possible within the context of the immediate simulation program, those aspects of pilot performance which are general responses to the turbulence environment and thus constitute needed knowledge regarding all man/aircraft combinations with special reference to the operational problems of naval aircraft.

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c. To develop and verify within the course of the present study, those techniques of performance assessment and evaluation which will permit valid and reliable assessment of the effects of turbulence imposed forces upon piloting ability. Once obtained, these measures will then serve as a basis for continued study within this general problem area.

3. These objectives are to be met through the presentation of a dynamic simulation of the 720B swept wing transport aircraft under severe turbulence penetration conditions. Maximum utilization of actual flight hardware, seating, restraint, and support structures will be made. Only the command pilots station is to be simulated.

4. The standardized turbulence encounters to be presented are derived from direct atmospheric recordings of vertical and lateral gust velocities collected in support of the National Severe Storms Project. The pilot will have direct (closed-loop) control over the magnitude of his acceleration exposures associated with flight path variations.

5. Throughout all simulated turbulence penetrations, extensive recordings will be taken of aircraft and pilot performance. These records will be analyzed to determine the effects of turbulence upon the vehicle aerodynamics and the nature of pilot control functions. Particular attention will be directed toward a comparison between static (centrifuge stationary) and dynamic (centrifuge in motion) pilot performance patterns.

6. The subjects proposed for this investigation are approximately fifty airline pilots selected from the operational rosters of domestic carriers by the Federal Aviation Agency. In addition, naval flight personnel and civilian project engineers may be used as required during early stages of the simulation development and verification. All subjects will be volunteers, will have valid FAA Class I physical classifications (the visual requirements may be waived for the test engineers), and must conform to the physical standards imposed by the AMAL for centrifuge subjects.

7. The full complement of mechanical and electrical limits upon centrifuge performance will be used to insure that the accelerations exposures experienced by the subjects do not exceed the bounds dictated by the turbulence excitation and pilot command. The turbulence induced vibrations will have a RMS value of .35 to .40  $\pm G_z$  at approximately 4 cps (maximum jolt will be less than  $\pm 1.0 G_z$ ). Though this exposure is classed as "mildly annoying" to "annoying" by subjective report, it is well within established tolerance limits. The maximum exposures due to pilot command are limited by the structural limits of the 720B aircraft to  $-2 a_z$  and  $+5 a_z$ ; again these values are within accepted limits of tolerance.

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Emergency "stop the run" buttons will be provided to the subject pilot, the project officer, the medical officer, the computer operator, the centrifuge operator, and a performance monitor. Thus the expected exposures fall within the range of those which could be experienced by the subject pilots during conduct of their regularly assigned pilot duties.

8. Throughout all dynamic simulation runs, a Naval Medical Officer, assigned to the project, will be in attendance and will maintain constant surveillance over the subject by means of closed-circuit television, continuous electrocardiography and voice communications. No adverse medical effects are anticipated.

9. Where appropriate, the data obtained from this study will serve as the basis for recommendations for improvements in pilot training, flight procedures, instrument displays, and crew support equipment. In addition, the study will provide information regarding problems of disorientation associated with vibration and acceleration exposure within the operational environment.

10. The proposed study should be completed by 31 October 1965.

*A E Paddock*  
A. E. PADDOCK