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6 A MANUAL FOR THE BRIEF VESTIBULAR DISORIENTATION TEST.

10 Rosalie K./Ambler Fred E./Guedry, Jr.

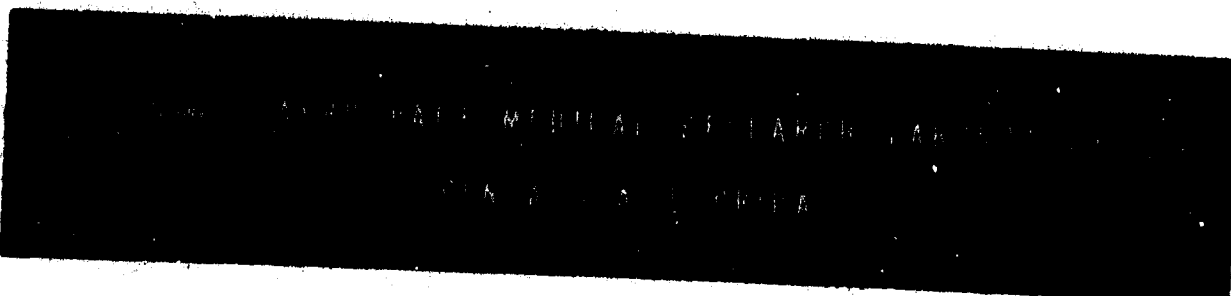
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A MANUAL FOR THE BRIEF VESTIBULAR DISORIENTATION TEST

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Naval Medical Research and Development Command
M0096-PN.001-3012

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I. INTRODUCTION

This report introduces procedures for implementing the Brief Vestibular Disorientation Test (BVDT). It describes in detail the procedures for administering, scoring, and interpreting this test. To guarantee that every examinee is tested with the proper standardized procedures, all personnel responsible for the supervision and administration of the test must read the entire contents of this report with care. Improper observance of any step in the test and scoring procedures penalizes both the examinee and the aviation training programs.

A. PURPOSE OF THE BVDT

The test is intended to assess the reactions of the prospective flight trainee to disorientation stress similar in kind to stresses often experienced in aircraft. Its primary purpose is to screen out those examinees who have little chance of adjusting effectively to the motion environment of flight and the stress associated with this environment. The BVDT was designed primarily as a brief, inexpensive prediction device, and this report addresses the implementation of the BVDT as such a selection tool. The test was not designed for post hoc clinical evaluations of individual patients who might have developed motion sickness. This subsidiary use of the BVDT, though recognized, must be considered within the context of a variety of other clinical and diagnostic procedures. For this reason, the subsidiary uses of the BVDT are addressed briefly in Appendix A.

B. DEVELOPMENT OF THE BVDT

The BVDT was developed, validated, and standardized under sponsorship of the Bureau of Medicine and Surgery at the Naval Aerospace Medical Research Laboratory. The rationale underlying this test is that high reactivity to motion stimuli in flight training will decrease the probability of learning the flight task and increase the probability of developing either disabling motion sickness or anxiety. Most normal individuals have some reactivity, and there is a wide range of differences among individuals in their reactions and tolerances for unusual motion environments. This test procedure was designed to reveal those individuals with extreme reactivity to the unusual types of disorientation similar to events that occur in flight but not commonly encountered on the ground. The object here is not to simulate a particular inflight disorientation event, but rather to introduce disorientation stress involving some of the characteristics of inflight disorientation and to determine how the individual reacts. The stimulus selected is a simple, inexpensive way to do this.

An important consideration in constructing the BVDT was to arrive at a procedure that was brief, simple to administer, and not disabling to the great majority of test persons. Research on several hundred flight trainees has indicated that those who demonstrate extreme reactivity on this test have little chance of completing flight training.

A bibliography of technical reports that document in detail the development of the BVDT is included at the end of the appendices. All data from operational use of the

BVDT are monitored at NAMRL in order to assure continuing standardization and utility of the test.

C. IMPORTANCE OF STANDARDIZED PROCEDURES

Strict adherence to the procedures outlined herein must be observed by all persons involved in supervising, administering, and interpreting the BVDT for the following reasons:

1. The validity, reliability, and objectivity of the test were obtained under prescribed procedures. These procedures must be observed if the effectiveness of the test is to be preserved.
2. In order to be equally fair to every flight examinee, conditions and procedures for testing must be constant from day to day.
3. The clarity of the instructions has been pretested to assure effectiveness. Deviation from standard procedures can cause confusion among both examiners and examinees and thus affect the accuracy of the test procedures.

D. HOW THE BVDT WORKS

The motion stimulus which the examinee experiences in this test involves tilting the head while the whole body is rotating. This rotation of the head about an axis which is itself being rotated introduces inertial torques which stimulate the semicircular canals of the inner ear as though the head were turning about a third axis. The effect is that the examinee when he tilts his head in one direction is surprised by a sensory input signaling that the head (and body) are doing something other than the intended movement. In addition, other sources of the sensory feedback are in conflict with this unexpected signal from the semicircular canals. This exact form of stimulation can occur in flight, but it would typically be of low magnitude. However, there are many situations in flight that are similar in kind in that they give sensory feedback other than expected feedback, and they also produce conflicts among senses concerning the orientation and state of motion of the aircraft. The stimulus used for the BVDT is a simple, inexpensive way to introduce this kind of conflict and to observe how the individual reacts to what may be regarded as a threat to his control of his own motion.

Individual differences in reactions to this kind of stimulus are extensive among apparently normal people. Some individuals enjoy such experiences, while others are greatly disturbed by them. It is an empirical fact that those individuals who are exceptionally disturbed by this form of stimulus seldom succeed as pilots of high performance aircraft.

While it is true that individuals who show extreme immediate reactions are prone to become nauseated if this stimulus is repeated, the test is not intended primarily as a predictor of motion sickness, but rather as a means of assessing an individual's immediate

reaction to disorientation stress. The test is primarily a way of assessing individuals for incapacitating reactions due to disorientation stress. The reaction may manifest itself in susceptibility to motion sickness. However, tension, poor motor coordination, and poor headwork are other reactions which may be of greater immediate significance to the aviator. Though an understanding of these individual differences is theoretical and complex, the tendency to think of differences of this kind as only psychological is not very meaningful. It appears likely that neurophysiological mechanisms for integrating sensory feedback and adjusting the level of arousal necessary to control whole-body motion in emergency conditions are more disrupted in some individuals than in others. These same extreme reactions to threatened loss of control of motion can adversely affect the proficiency of the pilot. This is the common sense basis of this test.

II. RESPONSIBILITY

A. GENERAL RESPONSIBILITY

It is the responsibility of the Bureau of Medicine and Surgery to direct the implementation of the BVDT and to specify the standards to be used in screening prospective flight personnel. This responsibility is carried out by BUMED directives. Aviation Medical Examiners and Flight Surgeons involved in processing prospective flight trainees should keep themselves apprised of current directives in this area.

B. SPECIFIC RESPONSIBILITIES

1. The Aviation Medical Examiner charged with implementing the BVDT as a screening procedure is responsible for assuring the accuracy and precision of the procedures outlined in the manual. Although the total procedure is his responsibility, Sections IV and V of this report are of particular importance to him.

2. The Hospital Corpsmen and other technical personnel assigned by the Senior Aviation Medical Examiner to the task of administering the BVDT procedure should have detailed knowledge of the equipment and procedures as described in Section III of this manual.

III. DESCRIPTION OF TEST

The Brief Vestibular Disorientation Test involves assessments by three examiners of examinees' reactions to self-controlled head tilt during slow, whole-body rotation around an Earth-vertical axis.

The ratings of examinees' reactions are made according to a standardized procedure which is described in detail in this section of the report.

A. APPARATUS

The rotation is accomplished by means of a motorized chair, whose specifications

are given in Appendix B of this report. Briefly, it consists of an ordinary straight arm-chair mounted on a platform which is driven by an adjustable speed electric motor. Examiners should insure that the chair and platform are properly secured to prevent capsizing and that the examinee is secured in the chair by a lap belt. It is important also to be sure that the axis of rotation is vertical and that speed setting of the chair is accurate and in calibration. These checks should be made before examinees are placed in the chair. This is especially important if equipment has not been in use for a while. Calibration is carried out by simply counting the revolutions per minute and then adjusting the speed control knob until the proper speed is attained.

Different forms or versions of the BVDT require different speeds of rotation. Examiners are cautioned to pay close attention to specific guidelines for the different forms of the test.

B. ADDITIONAL MATERIAL

1. Examiner rate sheet. Reproduce copies of Form 1 from Appendix C.
2. Examinee's self-rate sheet. Reproduce copies of Form 2 from Appendix C.
3. Computation and Summary Sheet for Individual Examinee. Reproduce copies of Form 3 from Appendix C.
4. Ammonia Inhalants and paper bags. These should be concealed from the examinees' view so that no expectation of sickness is suggested. The need for these is a very remote possibility, but they should be available if syncope or vomiting occurs. (See Section III.E on Safety and Special Problems.)
5. Pencils.
6. Tape player.
7. Taped BVDT Instructions to examinee.

C. RATER PERSONNEL

Three examiners are required for proper administration of the BVDT. All three are to rate the examinee's reactions without referring to the other examiners. In addition, each examiner has a specific role as follows:

1. Spokesman: Gives necessary oral instructions to the examinee and answers the examinee's questions. He is considered the leader of the examiner group and directs others as needed. He signals when to throw the switch to start and stop the chair or the tape player. He is also responsible for all material aspects of the test session. This includes prior assembly and checking of materials and equipment. He assumes responsibility for stopping the test if the examinee seems unable to continue.
2. Clerk: Is responsible for a) assembling all completed rating sheets, b) computing the proper BVDT score for each examinee, and c) entering this BVDT score in the proper official record. Guidelines for these procedures are described in Section III.F of this report.

3. **Equipment Operator:** Assists the spokesman in checking equipment before the session. This should include calibration of rotation speed of the chair and checking tape position and volume level of tape player. During the test session he operates the control switches for the chair and tape player. He must remain alert to the possibility that the chair may have to be stopped if the examinee overreacts and wishes to abort the procedure.

D. PROCEDURE IN GIVING TEST

1. The Rotating Chair Sequence

a. **Briefing.** As examinee enters room, spokesman directs him to chair and helps him to position feet properly in footrest and to fasten lap belt. Put him at ease by saying: "Sit in a comfortable upright position and listen carefully to the taped instructions. If you do not understand something, there will be pauses on the tape so I can answer your questions."

IMPORTANT NOTE: Do not test sick examinees or those who are experiencing either chilling or fever reactions from immunization shots. Since vision is not involved, examinees whose eyes have been recently refracted may be tested.

Examiners should avoid any unnecessary conversation with each other or with the examinee. Remember, the objective is to maintain a uniform atmosphere for all examinees. Also remember that the ratings given are of symptoms observed, and the examiner should not think in terms of comparing individuals, but only of rating magnitudes of different symptoms observed.

After examinee is settled in chair, spokesman says: "Are you ready? Let's begin the taped instructions."

Equipment operator begins tape. A complete transcript of the tape is contained in Appendix E, and this should be read by all three examiners, but it is particularly important information for the spokesman and the equipment operator. If questions occur during the pauses, the operator should stop the tape until questions are resolved. The spokesman should answer questions by repeating the appropriate words or phrases from the tape. It rarely will be necessary to improvise answers.

b. **Symptom Observation.** In the taped instructions to examinees, it is mentioned that perspiration level will be checked. At this point, each examiner should touch one of the palms and the forehead of the examinee. The reason for this is to determine if the examinee is perspiring for reasons not associated with the rotation stimulus.

When rotation has begun, the examiners should observe the examinees closely in preparation for assigning ratings. Following are the reactions to be rated on a scale from 1 to 10:

Sweating: Examiners should compare pre- and post-rotation sweat levels by touching palm and forehead again just after rotation stops. If there is absolutely no change or a decrease in moisture after rotation, the rate should be 1. If there is an increase, it should be graded in the judgment of the examiner from 2 to 10. A rating of 2 would indicate a very slight increase. A rating of 10 would indicate that the examinee was sweating as much as it would be possible to sweat.

Pallor: Observe the examinee's skin tone carefully before rotation. During rotation, particularly after head tilt, look for changes in coloration. Some examinees alternately flush and turn pale. Some are pale only around the mouth area. With black examinees, look particularly at this area. Others grow progressively paler. A few do not change at all. Grade the change in pallor from 1, no change, to 10, which would mean the examinee became as pale as he or she could possibly become, considering the complexion.

Facial Expression: Emotional reactions to the rotation experience can be reflected in a variety of facial changes, although some persons show no change at all. A few individuals register a mild pleasure reaction. Most show some kind of a change. Some begin with a self-conscious smile or grin that disappears after tilt. A smile can dissolve into a fixed or intermittent frown or a wince-like reaction, or these latter reactions can occur without a smile preceding. Lip and tongue reactions are sometimes evidenced. It is important to watch the examinee carefully before, during, and after the run in order to judge his facial reaction within the total context of the person. A rating of 1 means no reaction could be detected in facial changes; a rating of 10 means maximum reaction displayed.

Unsteadiness: If present, unsteadiness is most likely to be evidenced at the end of the run. Occasionally, however, an examinee may appear to be unable to hold his head still during rotation, or he may execute head movements imprecisely. Typically, unsteadiness is demonstrated by a slight bobbing or swaying of the head during the postrotational recovery period. Also observe the hands, particularly when the examinee accepts the self-rate sheet to be filled out. Also observe steadiness on feet when examinee alights from chair. No discernible unsteadiness is rated 1, and maximum is rated 10.

Slow Recovery: The rate at which reactions to the rotation stimuli subside after stopping also varies among individuals. Some individuals recover immediately, while some actually show an increase in symptoms during the recovery period. Observe examinee closely after the chair stops, as he moves from the chair, and during the time he is filling out the self-rate check sheet. No signs of recovery after 10 minutes (reactions may actually increase) should be rated 10.

Over-all Reaction: The examinee is to be evaluated in terms of his total behavior. This impression is influenced not only by the elements listed above, but by any behavioral cues that might reveal that the examinee was or was not disturbed by the experience. For example, some examinees tilt their heads quite rapidly at first in spite

of the 3-second instruction, and then slow down considerably as the sequence of tilts continues. Some actually speed up their motions, some are constant throughout, and some become very tentative in their tilting motions and move slowly through a very small arc. Voluntary remarks made by the examinee are also clues to reactions. Respiration changes, such as frequent, deep breaths, gasps, or fast, shallow breaths, should also be noticed. A voluntary verbal report of nausea is, of course, another symptom that would influence this over-all rating. If an examinee actively vomits during or after rotation, or if he asks that the chair be stopped before the run is completed, he is to be assigned a maximum over-all reaction rating of 10. In the case of an aborted run, the other elements, pallor, sweating, facial expression, unsteadiness and slow recovery, are to be rated in the regular manner and to the degree decided by the examiner.

c. Recovery Period. After the examinee opens his eyes he should be allowed to sit quietly in the chair. Examiners should not speak unless the examinee asks a question. The spokesman should respond to any questions. The examinee may leave the chair on his own initiative after a few moments. If he does not do so, the spokesman should say: "You may leave the chair now."

2. The Self-Rate Check Sheet

After the examinee is standing, spokesman should hand him the Self-Rate Check Sheet (Form 2 in Appendix C) and say: "Please give us your reactions to the run by filling out this check sheet." Spokesman directs examinee to a nearby table or desk to use in filling out the Self-Rate Check Sheet.

3. Dismissal of Examinee

Examiners should continue to observe examinee while he marks the check sheet. The spokesman dismisses the examinee after receiving the completed check sheet by saying: "You are finished here. You should now proceed to (next step in processing). Thank you for your cooperation."

EXCEPTION: If examinee exhibited an extreme reaction and his discomfort persists, he should be allowed a recovery period before dismissal. See Section III.E below on Safety and Special Problems.

4. The Ratings

The three examiners should not discuss the examinee among themselves until after they have assigned ratings on the six elements. A copy of the BVDI rating form is Form 1 of Appendix C. Under no circumstances are examiners to change a rating as a result of discussion. Discussion after ratings are assigned should be held to a minimum. Examiners should rely on their own judgment and not try to align judgment with that of someone else whom they feel may "know more about what is going on." Research has demonstrated that a reasonable person makes fair and accurate ratings

regardless of his or her background.

Since ten examinees can be rated on a Form 1 (Appendix C) rating sheet, each examiner retains the sheet until the last examinee has been run for that session, or until the rate sheet is full. He then checks his addition of his total rate for each examinee and turns the rating sheet over to the clerk.

E. SAFETY AND SPECIAL PROBLEMS

1. Safety Precautions

The motion stimulus used in this test is not a high-energy stimulus that could induce tissue damage from the magnitude of the forces and torques administered to the examinee. The magnitude of any one component of the stimulus does not exceed magnitudes encountered in many active natural body movements. It is, rather, the unusual patterning of sensory inputs associated with the voluntary movement which induces the exceptional reactions in some individuals. These reactions in extreme cases may involve compensating body movements and/or temporarily disabling physical symptoms. Safety requires that the test situation be structured to cope with either eventuality. Specifically:

- a) The examinee must be secured in the chair by a lap belt during motion.
- b) The chair must be securely mounted on platform which, in turn, must be securely mounted on floor.
- c) At least one member of the examining team must be trained in first aid procedures for syncope (fainting) and/or vomiting. (Note: About 2 out of 100 have vomited; 1 out of 500 have had mild, brief syncope.) This member must watch examinee closely and be prepared to signal "stop rotation" and to render aid. Another member of the team must be designated to summon medical aid if syncope occurs.
- d) Before running a group of examinees, the leader or spokesman must be certain that a medical doctor is in the building, prepared to give aid if summoned. He must be certain that this medical coverage will be available during the entire time course of the test series.

2. Temporal Position of BVDT Procedure in Relation to Physical Examination and Other Demands

a) Potential for disabling reactions: In general, the BVDT is a mildly disturbing experience, and recovery is rapid and complete. There should be no interference with other subsequent physical or psychological examination procedures. Approximately 2 to 3 percent of the Aviation Officer Candidate standardization population could be described as extreme reactors. (See Section III.E.1[c].) This proportion is not as great as that which experiences brief syncope or shock reactions during immunization shots or

blood sampling. It is recommended that after dismissal from the BVDT procedure, extreme reactions on the BVDT be handled in the same manner as extreme reactors to other aspects of the physical examination process. This recommendation assumes that procedures in Section III.E.4 have been followed.

b) Time of day or possible diurnal effects: The BVDT was standardized on test data gathered exclusively in the afternoon. Research findings on a small group of aviation trainees indicate that BVDT scores might be elevated during the early hours of the work day. It is recommended, therefore, that the test be used operationally only between 1200 and 1700 hours.

3. Procedure for Handling an Interrupted Run

a) If the examinee requests that the chair be stopped, the operator should respond immediately. The examiner designated to render aid must simultaneously watch the examinee closely for signs of syncope or vomiting. The examinee should be instructed to open his eyes if he has not done so and to keep his head still for at least 30 seconds. Most examinees recover quickly, but individuals vary. After a brief recovery period in the test room, it is wise to maintain close surveillance of a self-terminating examinee for at least an additional 15 minutes. He can be placed in an adjacent room or seated just outside the test room, and the testing of others can continue. The examinee should not be dismissed from the cognizance of his BVDT examiner (the team leader) until symptoms subside or until a medical doctor assumes responsibility for the examinee.

b) If the examiner or examining team leader directs that the chair be stopped because of extreme symptoms, the same procedures described in the preceding paragraph are to be observed.

c) In the event of equipment or procedural malfunction, the run can be terminated early in the time course (less than 90 seconds or before second lateral tilt) and restarted after a 1-minute rest. If termination occurs after second lateral tilt, the run should be rescheduled for at least 20 minutes later.

4. Special Treatment of Extreme Reactions

a) If syncope (fainting) occurs, a medical doctor must be summoned immediately, and simultaneously first aid measures must be implemented to prevent possible aspiration of vomitus. A doctor should be summoned in case of syncope, even if episode is momentary.

b) In cases of severe reactions involving vomiting but no syncope, quick action in presenting a bag or container to examinee are mandatory for two reasons: the wellbeing of the examinee and the necessary preclusion of olfactory cues for subsequent examinees in the testing room.

c) There is a tremendous range of individual differences in reactions and

recovery rates. Some individuals vomit, recover immediately, and are eager to go on. Some do not vomit but feel nauseous and exhibit other symptoms such as pallor and sweating for several minutes. Individual judgment must be exercised in handling extreme reactors. In general, no examinee should be dismissed until he is reasonably stabilized and symptoms have subsided. Reports of mild headache or drowsiness in the absence of any other symptoms would not prevent dismissal of an examinee from cognizance of the BVDT examining team.

F. SCORING AND RECORD-KEEPING PROCEDURES

1. Checking for Completeness

The first thing the clerk does upon receipt of completed rating sheets (Forms 1 and 2) is to scan each sheet for completeness - names, date, examiner identification, entries in rating spaces, et cetera. Omitted information must be retrieved at once before examiners and examinee disperse and forget.

2. Computation of the BVDT Score by the Clerk

The BVDT scores for an individual examinee should be calculated on Form 3 of Appendix C, the Calculation Sheet for Individual BVDT Scores. The examiner score is derived by combining or adding together the three summed ratings and dividing by 3:

	(Spokesman) Examiner 1	(Clerk) Examiner 2	(Equipment Op.) Examiner 3	Sum
Pallor	3	2	4	9
Sweating	4	4	3	11
Facial Expression	3	2	4	9
Unsteadiness	2	2	1	5
Slow Recovery	2	3	3	8
Over-all Reaction	3	2	4	9
SUM	17	15	19	51

$$\text{BVDT Score} = \frac{17 + 15 + 19}{3} = 17.0$$

3. Computation of Self-Rate Scores on Form 2, Appendix C

The minimum score is 5, and the maximum score is 35. The score is

determined by performing a cumulative count of positions checked. An example of a scored Form 2 is presented here. In this example, the score is 30, which can be obtained by adding the numbers at the right side, which indicate position checked in each row, or by doing a cumulative count of positions checked. This score should also be entered by the clerk on Form 3 of Appendix C.

1	Like	X	Dislike	6
2	No stomach effects	X	Strong effects	7
3	No dizziness	X	Strong dizziness	5
4	No sickness feelings	X	Strong feelings	6
5	Steady	X	Very unsteady	6
			SUM	30

Enter sum onto Form 3 on line, "BVDI Self-Rate Score."

4. Entry of Scores into Record

The clerk should enter the computed BVDI Examiner Score and Self-Rate Score onto the individual's medical record. Completed Appendix C Forms 1, 2, and 3 should be deposited in a box for delivery to NAMRL.

IV. SELECTION AND TRAINING OF EXAMINERS

A. SELECTION OF REASONABLE INDIVIDUALS

1. Guidelines

- a) Capacity to read and understand this report as evidenced by passing brief oral test.
- b) Reputation for getting along with others and having good 'common sense.'
- c) A "positive" attitude as judged by immediate supervisor.
- d) Acceptable profile on the Guilford-Zimmerman Temperament Survey.

(Refer to NAMRL Code L51 for this test service.)

B. TRAINING OR INDOCTRINATION OF EXAMINERS

1. This report must be read and understood as specified above.
2. Examiner should go through entire test procedure as if he were an examinee.
3. Examiner should rate at least ten examinees as a training exercise before he rates for the record. During this training period, a NAMRL scientist or other person experienced in the BVDT procedure should be on hand to answer trainees' questions and give guidance as needed. An important concept for the examiner to grasp is to rate the magnitude of the symptoms observed in the given examinee and to avoid making judgments relative to other examinees. The basis for the rating should be along the 10-point continuum from no manifestation to extreme manifestation. Ratings must never be assigned in terms of comparing individuals or attempting some ordinal arrangement within a group of examinees.

Appendices D and E have been prepared as supplementary material to Section III of this report, and all prospective examiners should understand thoroughly the contents of these appendices.

V. INTERPRETATION

A. USE OF BVDT AS A PRIMARY SCREENING DEVICE

At the admissions level, it is recommended that only the most extreme reactors be excluded from training on the basis of this test alone. Other extreme reactors should be judged in relation to their aptitude potential as measured by the Flight Aptitude Rating (FAR). Specific standards and qualifying scores are defined by BUMED Note or Instruction. The responsible Aviation Medical Examiner or Flight Surgeon must keep apprised of appropriate directives in this regard.

B. USE OF BVDT AS A SECONDARY SCREENING DEVICE

Because of the significant interaction between the BVDT and other indices of later flight performance, it is recommended that:

1. BVDT scores for all entrants be forwarded to NAMRL for entry into the Human Factors Data Bank.
2. NAMRL incorporate the BVDT into the Student Prediction Systems as implemented by CNATRA INST. 1610.5E.

Research has shown that these steps will increase the validity of the student predictor score which is used in the Student Disposition Board process.

C. RATIONALE

The practicality of the BVDt as a predictor is illustrated in the following tables which show the interaction between the BVDt and the Flight Aptitude Rating (FAR). If all students below the broken line had been rejected, a group that had over twice the attrition rate of the remainder of the group would have been eliminated (52.3 percent versus 24.5 percent). Stated more conservatively, the over-all attrition rate for this entire group would have been reduced from 26.5 percent to 24.5 percent. In a 2,000 man-per-year input situation, this would mean 40 individuals at a savings of about \$30,000 per case, or \$1,200,000 per annum. The BVDt would cost from \$50,000 to \$60,000 to implement; therefore, the net savings effected would be \$1,140,000.

SEPARATION RATES FOR VARIOUS BVDt SCORE LEVELS AND FLIGHT APTITUDE RATINGS

BVDt Scores	FAR 4 or 5		FAR 6 to 9	
	Input	% Separating	Input	% Separating
6.0-8.0	27	18.5	82	20.7
9.0-14.9	105	27.6	265	22.3
15.0-42.9	38	47.4	93	32.3
43.0 or above	1	100.0	5	80.0
TOTAL	171	31.0	445	24.7

COMPARATIVE COSTS OF SEPARATION PER 1,000 INPUT FOR TWO SELECTION CONDITIONS

Selection Conditions	N Separation		Est. Cost per Separation		Separation Costs
Present Standards	265	x	\$30,000	=	\$7,950,000
Present Standards plus BVDt	245	x	\$30,000	=	\$7,350,000
		DIFFERENCE			\$600,000*

*For 2,000/yr. input, cost reduction would be \$1,200,000.

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APPENDIX A

Subsidiary Applications of the BVDT

EVALUATION OF PROBLEM CASES

The test has also been used occasionally in the evaluation of pilots or flight crew who have had problems with aircraft control, disorientation or airsickness which have been prominent enough to bring the examinee under evaluation by a flight surgeon or a special board. This application involves subtle clinical interpretations, and it is preferable that the test be used along with an additional set of tests for evaluating visual and vestibular function singly and in various combinations. Since an experienced flight officer represents a considerable financial investment by the Navy, it is "cost effective" to invest additional time in testing and rehabilitating such personnel. There are procedures which have been effective in returning such individuals to flight status. However, optimization of rehabilitation training is a matter of ongoing research in several countries, and hence it is not feasible to set forth a simple set of instructions for these procedures. Such individuals should be referred to NAMRL for additional testing and for possible application of rehabilitation procedures. The procedures for additional testing and rehabilitation are not described in this manual. In the case of student pilots whose presenting symptom is airsickness, there is no more certain test of airsickness than the presence or absence of continued airsickness in the real situation, and so it is a question of what the BVDT can add to the evaluation of such a person. The test was not initially developed for this purpose, but additional information accrues from determining whether or not the person exhibits unusual reactivity in this "safe" test situation and also from the fact that the examiner score versus the self-rate score provides clues about the motivation of the individual. Both of these bits of information contribute to psychiatric evaluations. Some 'airsick cases' are poorly motivated to be pilots, and airsickness is a way out. The primary question is whether the student will eventually adjust satisfactorily to the flight environment. The BVDT by itself cannot answer this, but the additional information it generates can contribute to the over-all evaluation of a problem case. When the presenting problem involves exceptional difficulty with disorientation, poor aircraft control, or "poor headwork" associated with disorientation stress, then additional performance and physiological tests are recommended, and the case should be referred to NAMRL. There are sometimes organic causes for these difficulties which should be detected if possible.

EVALUATION OF 'PROBLEM CONDITIONS'

The BVDT has also been used occasionally as a means of estimating individual "susceptibility" to air or motion sickness in order to have some advance assessment of individuals participating in some form of motion sickness study. This kind of assessment might be especially important if a small N were being used to evaluate some condition or vehicle suspected of being provocative of motion sickness. There is a significant correlation between scores on the BVDT and failure in the flight program attributable to motion sickness. However, there are some people who seem to have excessive problems with airsickness who do not have high scores on the BVDT, and there are also people who have fairly high scores on the BVDT who do not have excessive problems with airsickness. In other words, this test is not a perfect predictor of individual differences in susceptibility to seasickness or airsickness in a given exposure condition.

Neither is any other brief, single test. If time permits, the BVDt should be used in combination with other means of assessment, including interviews, tests introducing conflictual visual and vestibular stimuli, motion sickness questionnaires, measures of adaptation rates and retention of adaptation, and personality assessments, in order to have an adequate advance assessment of individuals participating in a study of potentially troublesome motion conditions. Questionnaires may be especially useful in situations in which the results do not determine the future occupation of the individual; in other words, when the test person has nothing to gain by flavoring his answers on the questionnaire.

APPENDIX B

Description of Rotating Chair

The device is simply a straight-arm chair securely mounted on a rotatable platform with an Earth-vertical axis of rotation. A footrest and lap belt are provided for the safety and comfort of the examinee. Since brief syncopal episodes have occurred in about .02 percent of individuals tested, the lap support should be sufficient to support the examinee while the chair is being stopped. The center of the chair seat is directly over the axis of rotation, and the rotation rate does not exceed 15 rpm, so that the examinee will experience only low levels of centripetal acceleration. For these reasons and because the examinee is continuously under direct observation, there is no need for an elaborate safety harness. However, the chair should be securely locked to the floor by a system that permits alignment of the rotation axis with gravity. Verticality of the rotation axis is important because even a slightly tilted axis will increase the incidence of motion sickness and invalidate the test. Secure fastening of the chair to the rotating base and of the latter to the floor to prevent the device from capsizing is, of course, a necessary safety practice which must be followed.

An adequate bearing and drive system for the rotation device consists of a 1/4 horsepower, shunt-wound DC motor and a worm gear speed reducer equipped with vertical output and thrust bearings capable of supporting the man and rotating structure. A suitable drive and transmission system consists of:

Browning Mfg. Co. SCR drive 1/4 HP 43.7 to 1.46 output rpm's consisting of: 25 DC5-6E C-2 motor, MWX S-1 reversing kit, 154C1-LR40 reducer, VMK 154 floor mount kit, and MWP3 operation panel. The cost of these components in 1974 was \$420.00.

This system includes a tach generator on the motor with a readout meter on the operation panel and a speed knob which permits manual adjustment of speed to the desired level in a sufficiently uniform manner for conducting the test. The chair should be brought to speed in about 3 seconds. For automatic control of acceleration to desired speeds, an MW 25/75 in-line acceleration modification is available for \$440.00, which would bring the total price to \$860.00.

APPENDIX C

Rating and Computational Forms 1, 2, and 3

Form 1

Examiner's Name _____

Date _____

Check One: (Spokesman/Clerk/Equip. Opr.) _____

Command Sequence*	Examinee's Name	Pallor	Sweating	Facial Expression	Unsteadiness	Slow Recovery	Over-all	TOTAL	Remarks
R L R C U C U									
R L R C U C U									
R L R C U C U									
R L R C U C U									
R L R C U C U									
R L R C U C U									
R L R C U C U									
R L R C U C U									
R L R C U C U									
R L R C U C U									

*When a tape is not used, spokesman marks each command after it is given so that he gives commands in correct sequence.

Form 2

Examinee's Self-rate Sheet

NAME _____ DATE _____

Check the following items at the appropriate point according to how this
ride affected you:

1	Like	_____	_____	_____	Dislike	_____
2	No stomach effects	_____	_____	_____	Strong effects	_____
3	No dizziness	_____	_____	_____	Strong dizziness	_____
4	No sickness feelings	_____	_____	_____	Strong feelings	_____
5	Steady	_____	_____	_____	Very unsteady	_____

SUM

Enter Sum onto Form 3 on line
"BVD Self-rate Score."

Form 3

Computation and Summary Sheet for Individual Examinee

NAME OF EXAMINEE _____ DATE _____

	Spokesman	Clerk	Equip. Opr.	
Pallor				
Sweating				
Facial Expression				
Unsteadiness				
Slow Recovery				
Over-all Reaction				
SUM				TOTAL

$$\text{BVDT Examiner Score} = \frac{\text{Sum Total}}{3} =$$

BVDT Self-rate Score =

APPENDIX D

Supplementary Instructions to Examiners

You will be rating individuals on how much they are being affected by motion to which they are exposed. You will use a form to make ratings on specific items, and you will also make an over-all rating based on several points described below. Before you go on to read the instructions on the specific ratings and the over-all rating, it is important that you understand two points: 1) Many people feel that they cannot make reliable ratings. However, experience has shown that anyone of average personality and intelligence who applies himself to the job can do it. This is because differences among people in their reactions to motion are sufficiently great that examiners generally agree with one another, even though the ratings are made independently. 2) The second point to remember is that ratings should be made primarily on the items listed and that attempts at deep psychological interpretations of comments or "body language" should be avoided. In other words, use common sense interpretations of comments and signs instead of attempting some special psychological interpretation.

On the specific rating forms, you will rate the following items: Pallor, sweating, facial expression, steadiness, and over-all performance. You are to rate each man separately and not relative to other men. For example, a rating of 10 on Pallor would mean that the man is as pale as he can be considering his complexion, i.e., extremely pale; a rating of 10 on Sweating would mean that the man was sweating profusely. Ratings of 1 on these items mean no pallor or no sweating, respectively. Steadiness is a rating of the coordination of movements, i.e., head movements made smoothly and accurately, as opposed to clumsy, inaccurate movements.

The over-all rating is included to allow for an over-all impression of how much the man was affected. However, specifically included in this over-all rating are estimates of self-imposed limitations on movement, spontaneous comments, behavior upon leaving the chair (e.g., unsteadiness of gait, swallowing, burping, sweating, et cetera).

Remember, rate each man separately like an umpire calling balls and strikes, and believe that you can do the job. You can.

APPENDIX E

Transcript of Tape

Supplementary Instructions to Spokesman and Equipment Operator

It is important for the spokesman to maintain a professional demeanor and to give instructions authoritatively. Examiners should not indulge in levity and joking with test persons before, during, or after tests. After examinee is seated in the chair, the spokesman says: "Are you ready? Let's begin the taped instructions." Equipment operator starts tape: "You are about to receive a test of your reactions to head movements made while you are rotating in a chair. (Pause) The lap belt being secured is used because of regulations, but you won't spin fast enough to really need it. We also are required to check you for temperature and sweating before we start. (Pause) It is important for you to make each head movement as accurately as possible. Make each head movement slowly, taking about 3 seconds. You will be rotated with your eyes closed, so we want you to practice making head movements. I am now going to demonstrate exactly how we want you to move your head, then we'll practice the movements." (Stop tape.) (Examiner demonstrates: head right 45°, head upright, head left, upright, head forward, upright. The figure at the end of Appendix E illustrates the kind of right and left head movements desired.) The examiner then gives commands about 5 seconds apart for head right, upright, head left, upright, head forward, upright, making sure that the head movements are executed properly. Inaccuracies in following instructions should be corrected by a repeat demonstration. Any continued inaccuracies should be noted, but the test should then proceed.

(Start tape.) "Make each movement and wait for a command before making the next movement. The test is about to begin. Remember, throughout the test, keep your eyes closed and your head still except when you hear commands for head movements. Commands for head movements will be about 30 seconds apart instead of 5 seconds apart as in the demonstration. O.K., we are about to begin. Your head should be upright now, and keep your eyes closed...." (Start chair now.)

(Pause on tape for 15 seconds while chair holds speed for 15 seconds.) "Remember to keep your eyes closed while making head movements, and hold your head in each position until you receive the next command." At 30 seconds, the tape commands:

"Tilt your head 45 degrees right."

at 60 sec: "Return to upright."

at 90 sec: "Tilt your head 45 degrees left."

at 120 sec: "Return to upright."

at 150 sec: "Tilt your head 45 degrees right."

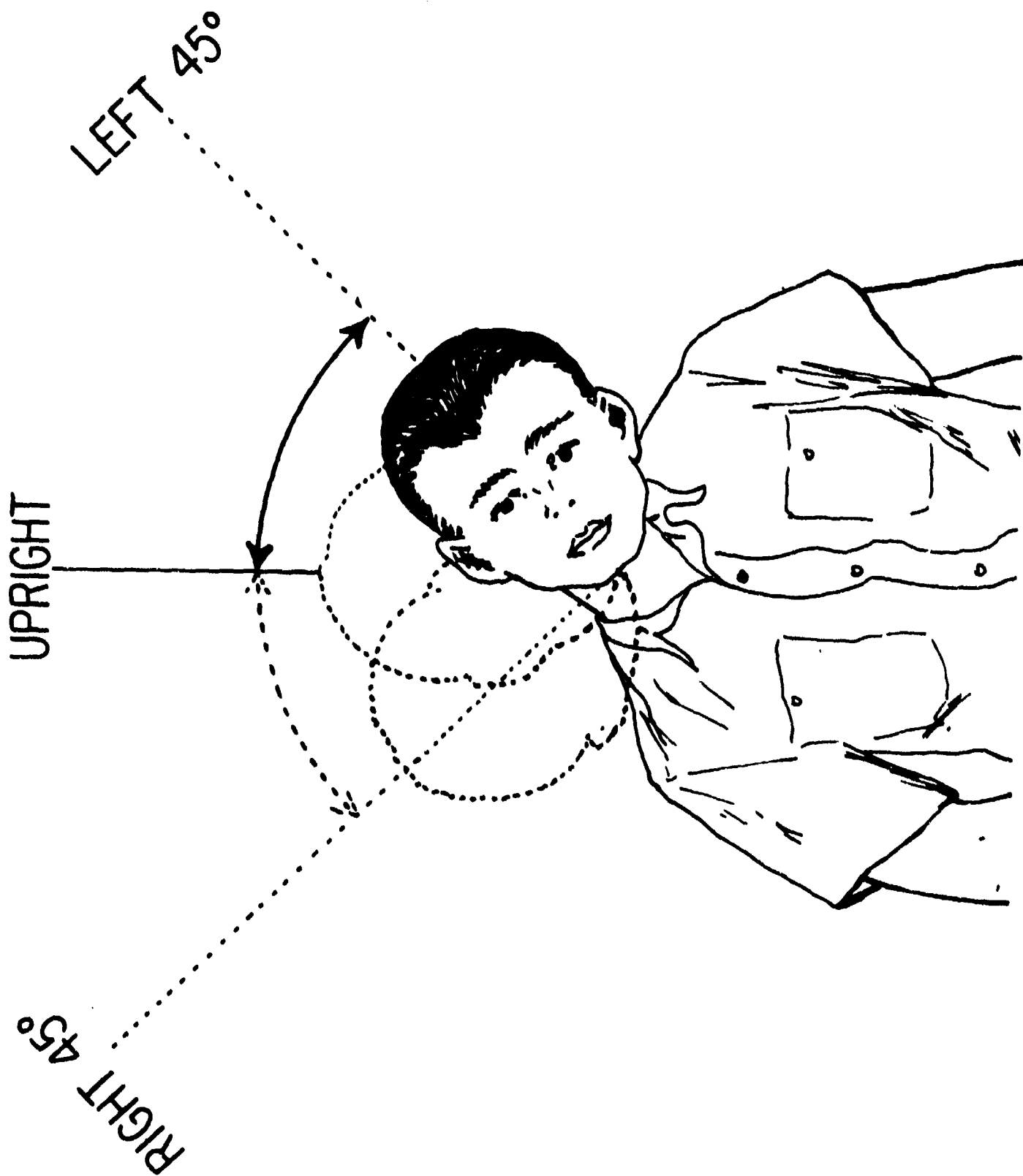
at 180 sec: "Return to upright."

at 210 sec: "Tilt your head 45 degrees left."

at 240 sec: "Return to upright."

- at 270 sec: "Tilt your head 45 degrees forward."
- at 300 sec: "Return to upright."
- at 315 sec: "The chair will be stopping in a few seconds, but keep your eyes closed and your head still until you feel as though you have stopped rotating."
- at 330 sec: (Chair is stopped.)
- at 360 sec: "O.K., you can leave the chair now."

If a tape is not available, the spokesman can give the instructions and commands. The commands require a timing device which accumulates at least to 360 seconds. This device should be used by the spokesman. Small errors (± 5 sec) in time will not invalidate the test, but should be avoided. Since the test should not be repeated on the same day, larger errors must be avoided.



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