



# Coast Guard AERO Technical Bulletins

(Revised 1 Jan 2010)

**ATB: AEROMEDICAL ADAPTABILITY**Aeronautically Adaptable (aviation candidates).

a. “Having the potential to adapt to the rigors of the aviation environment by possessing the temperament, flexibility, and appropriate defense mechanisms necessary to suppress anxiety, maintain a compatible mood and devote full attention to flight and successful completion of a mission.”

2. Aeronautically Adapted (designated aviation personnel).

a. “Those having demonstrated the ability to utilize long term appropriate defense mechanisms, and displaying the temperament and personality traits necessary to maintain a compatible mood, suppress anxiety and devote full attention to flight safety and mission completion.”

3. Determination of Aeronautical Adaptability.

a. A determination of aeronautical adaptability (AA) is required for all flying duty examinations. An unsatisfactory AA as the cause of medical unfitness for flying duty for any flight class (1, 1R, and 2), is due to an assessment of unsatisfactory aptitude or psychological factors, or otherwise being considered not adaptable for military aeronautics.

b. An unsatisfactory AA is mandatory if any of the following conditions are present:

(1) adjustment disorders, psychological factors affecting physical condition and conditions not attributable to a mental disorder that are a focus of attention or treatment and Axis II conditions (personality traits and disorders) as a primary diagnosis;

(2) concealment of significant and/or disqualifying medical conditions on the history form or during interviews;

(3) presence of any psychiatric condition which in itself is disqualifying;

(4) an attitude toward military flying that is clearly less than optimal: e.g., the person appears to be motivated overwhelmingly by the prestige, pay, or other secondary gains rather than the flying itself;

(5) clearly noticeable personality traits such as immaturity, self-isolation, difficulty with authority, poor interpersonal relationships, impaired impulse control, or other traits which are likely to interfere with group functioning as a team member in a military setting, even though there are insufficient criteria for a personality disorder diagnosis;

(6) review of the history or medical records reveal multiple or recurring physical complaints that strongly suggest either a somatization disorder or a propensity for physical symptoms during times of psychological stress;

(7) history of arrests, illicit drug use or social “acting out” which indicates immaturity, impulsiveness, or antisocial traits. Experimental use of drugs during adolescence, minor traffic violations, or clearly provoked isolated impulsive episodes may be acceptable but should receive thorough psychiatric and psychological evaluation;

(8) significant, prolonged and/or currently unresolved interpersonal or family problems (for example, marital dysfunction, significant family opposition or conflict concerning the member's aviation career), as revealed through record review, interview, or other sources, which would be a potential hazard to flight safety or would interfere with flight training or flying duty.

c. An unsatisfactory AA may be given for lower levels (signs and symptoms) than those mentioned above if, in the opinion of the FS/AMO/APA, the mental or physical factors might be exacerbated under the stresses of military aviation or the person might not be able to carry out his or her duties in a mature and responsible fashion. Additionally, a person may be disqualified for any of a combination of factors listed above and/or due to personal habits or appearance indicative of attitudes of carelessness, poor motivation, or other characteristics that are unsafe or undesirable in the aviation environment.

**ATB: AEROMEDICAL GRADED EXERCISE TEST (AGXT)**

1. The indications for the Aeromedical Graded Exercise Test (AGXT), also called graded exercise treadmill (GXT), are described in [AR 40-501](#), Standards of Medical Fitness, paragraph 4-15, and various APLs where cardiac health is an issue, most often from conditions referenced in the Cardiology Chapter of the APLs, in particular the [Cardiovascular Screening Program](#). The guidelines for performing an aeromedical GXT are outlined below to apply a uniform standard in the performance and interpretation of this test on aircrew members.
2. Prior to the AGXT, the aircrew member should be briefed by the local flight surgeon as to the indications for the test, the procedure, and the significance of the results. The patient should sign an informed consent statement.
3. The following conditions should be assured prior to testing:
  - a. Minimum of four hours fasting prior to test.
  - b. No tobacco or caffeine products one hour prior to test.
4. The aeromedical GXT must be a maximal effort, limited only by symptoms, exhaustion, or objective signs (medically significant ectopy, dysrhythmia, ischemia, or blood pressure response). Exercise should not be halted on attainment of a predicted maximal heart rate. Often, testing should proceed to 100% of predicted HR or beyond. Clinical decision-making may override termination.
5. A final report of the AGXT including date of study, interpretation, patient's activity level and attained workload should be annotated with the FDME/FDHS and /or AMS for review and disposition. Actual tracings do not need to be sent, and if required, will be requested by USAAMA.
6. A copy of [Aeromedical Graded Exercise Test Report Form \(enclosure 1\)](#) and [Letter to the Attending Physician \(enclosure 2\)](#) of this ATB should be forwarded with the patient to the attending physician conducting the AGXT.
7. Aeromedical standards for interpretation of treadmill exercise tests in Army aircrew members.
  - a. Baseline: The location of three consecutive coplanar ST segments, measured 80 milliseconds after the "J" junction, following 30 seconds of standing hyperventilation. This baseline may be on, above, or below the PQ segment, but must be parallel to it.
  - b. Definition of Abnormal tracing: **1.0** or more millimeters of ST depression in three (3) consecutive coplanar complexes, measured 80 milliseconds after the "J" junction, irrespective of slope. Other causes for an abnormal result include: atrial flutter or fibrillation, supraventricular or ventricular tachycardia (three or more consecutive premature beats including multifocal atrial tachycardia), supraventricular or ventricular pairs (couplets), multiform ventricular premature ectopy, ventricular premature R wave on preceding T wave, or hypotensive or excessive hypertensive response of any degree. Chest pain/pressure, angina, infarction, or the suspicion of significant peripheral vascular disease, likewise, constitutes an abnormal result requiring further evaluation and management. If abnormal, apply follow-up guidelines from the [Abnormal Cardiac Function Testing APL](#).

## ENCLOSURE 1:

**Aeromedical Graded Exercise Test Report Form**

Patient Name:				SSAN:		DATE:	
Rank:		Age:		Gender:		Race:	
HT/WT ( in/lbs)							
Medications:						Facility:	
LDL:		HDL:		Chol/HDL ratio:		Tot Chol:	
FRI:							
<b>Bruce Protocol</b>							
Pre-Exercise:		Sitting Heart Rate:		Sitting BP		Resting EKG Analysis	
		Hypervent HR:		Hypervent BP:			
		Supine HR:		Supine BP:			
<b>EXERCISE</b>	<b>Minutes</b>	<b>MPH</b>	<b>%Grade</b>	<b>Heart Rate</b>	<b>BP</b>	<b>Comments (Sxs, EKG Changes, etc.)</b>	
	0	1.7	10				
	1						
	2						
	3	2.5	12				
	4						
	5						
	6	3.4	14				
	7						
	8						
	9	4.2	16				
	10						
	11						
	12	5	18				
	13						
	14						
15	5.5	20					
<b>Post Exercise</b>	Immediate	-	-				
	2	-	-				
	5	-	-				
	8	-	-				
<b>ANALYSIS</b>							
Total Exercise Time:				Max. BP:			
Peak Exercise Heart Rate:							
Total Mets:							
Reason for Termination:							
<input type="checkbox"/> Exhaustion <input type="checkbox"/> Chest Pain/Angina <input type="checkbox"/> Dysrhythmia <input type="checkbox"/> ST Seg changes <input type="checkbox"/> Hypertensive BP Response <input type="checkbox"/> Fatigue <input type="checkbox"/> Joint/Muscle Pain <input type="checkbox"/> Poor Conditioning <input type="checkbox"/> Other							
Physician Interpretation:							
<input type="checkbox"/> Normal <input type="checkbox"/> Abnormal							
Comments:							
Physician Stamp:				Physician Signature:			

ENCL 1 ATB 11-01

ENCLOSURE 2:

**AGXT: Letter to the Attending Physician**

TO: ATTENDING PHYSICIAN

FROM: FLIGHT SURGEON'S OFFICE

SUBJECT: Aeromedical Graded Exercise Test

1. A graded exercise test has been requested by the US Army Aeromedical Activity on this US Army aircrew member to explore the possibility of aeromedically significant coronary disease and other cardiac abnormalities. Please follow the definitions and diagnostic criteria listed below in the interpretation of this test. Since this study has occupational medicine importance, these criteria are intended to yield maximal sensitivity. Please do not apply other criteria.
2. The following conditions should be assured prior to testing:
  - a. Minimum of four (4) hours fasting prior to test.
  - b. No tobacco or caffeine for one (1) hour prior to test.
3. The aeromedical GXT must be a maximal effort, limited only by symptoms, exhaustion, or objective signs (medically significant ectopy, dysrhythmia ischemia, or blood pressure response). Exercise should not be halted on attainment of a predicted maximal heart rate. Often, testing may proceed beyond 100% of predicted maximal HR, and clinical decision-making should be used for termination.
4. Determination of abnormal exercise tolerance tests for US Army aircrew members:
  - a) Baseline: The location of three (3) consecutive coplanar ST segments, measured 80 milliseconds after the "J" junction following 30 seconds of standing hyperventilation. This baseline may be on, above, or below the PQ segment, but must be parallel to it.
  - b) Abnormal: 1.0 or more millimeters of ST depression in three (3) consecutive coplanar complexes, measured 80 milliseconds after the "J" junction, irrespective of slope. Other causes for an abnormal result include: atrial flutter or fibrillation, supraventricular or ventricular tachycardia (three or more consecutive premature beats including multifocal atrial tachycardia), supraventricular or ventricular pairs (couplets), multiform ventricular premature ectopy, ventricular premature R wave on preceding T wave, or hypotensive or excessive hypertensive response of any degree. Chest pain/pressure, angina, infarction, or the suspicion of significant peripheral vascular disease, likewise, constitutes an abnormal result requiring further evaluation and management.

**ATB: VISUAL ACUITY TESTING – DISTANT VISION**(DD Form 2808, Block 61, 'DISTANT VISION')**Purpose/Indications: Distant vision.**

Mandatory for all classes and types of flight physicals. This measures the best visual acuity at distance (20 feet or 6 meters) **WITHOUT** any kind of correction whatsoever, **followed by** best-corrected visual acuity at distance **WITH** spectacle prescription (if the patient wears any). **NO** contact lenses allowed during testing and must be removed at least 24 hours prior to examination.

This measures the clarity of vision or the ability of the visual system to resolve detail at distance. A patient's visual acuity at distance depends upon the accuracy of retinal focus, the integrity of the eye's neural elements, and the interpretive faculty of the brain.

It is important to conduct distant visual acuity testing on all patients before near acuity testing. Testing for near visual acuity before distant visual acuity may disadvantage the patient, depending on accommodative (focusing) ability.

**Equipment:**

- Occluder (to cover one eye at a time)
- Standard **PROJECTED** Snellen Distance Acuity Chart [IAW [AR 40-501](#), para 4-12a(1)] -or-
- AFVT (Armed Forces Vision Tester) or the OPTEC 2300 [both considered projected systems]

**Set-up:**Projected Snellen Distance Acuity Chart:

- Patient is 20 feet (or 6 meters) from acuity chart with center of chart at approximately eye-level for patient (intention is not to have any extreme angle between the patient and the chart).
- Patient holds occluder and covers eye as directed by tester. Patient may use palm of hand, if necessary, but ensure patient is using the palm, not the fingers, to preclude seeing between the fingers. Patient must keep both eyes open, must not press on either eye, and must not squint.

AFVT or OPTEC 2300:

- Patient is seated comfortably at the AFVT or OPTEC 2300.
- Far letter acuity slide(s) set correctly (see manual).
- Patient must push forehead against bar for internal light to work.

**Step-By-Step Procedure.**Uncorrected Distant Vision:

- **TEST UNCORRECTED VISUAL ACUITY FIRST!** (This is important because a patient may be able to memorize the letters on the chart with corrected vision and, intentionally or unintentionally, say aloud the smaller letters on the chart when uncorrected, whether or not actually seen by the patient.)
- Observe the patient during testing to ensure no squinting (or at least attempt to observe the patient behind the AFVT/OPTEC 2300).
- Instruct the patient to cover one eye (or occlude the non-tested eye with the appropriate buttons on the AFVT/OPTEC 2300) and direct patient not to squint. By convention, it is best to test the right eye first, then left eye for consistency.

- **IMPORTANT NOTE ABOUT 20/20 DISTANT VISUAL ACUITY STANDARD FOR FDMEs/FDHSs!** Per [AR 40-501](#), paragraph 4-12a(1), "...no more than 1 error per 5 presentations of 20/20 letters, in any combination, on either the Armed Forces Vision Tester (AFVT) or any projected Snellen chart set for 20 feet."
- Issue: AFVT line has 10 letters but is split into two sets of five letters positioned next to each other on the same line. Test the entire line, if desired, but the patient is still only required to get 4 out of 5 letters that are on a 20/20 line to be considered a 'pass' for a flight physical. Therefore, entries of 20/20 or 20/20<sup>-1</sup> are both passing entries. Most projected Snellen charts have 6 letters (some have 4, 5, 7, or 8 letters) per line. The regulation allows for presentation of 5 letters "in any combination" so you may meet the requirement. If in question, refer to the Eye Clinic for verification.

- Instruct the patient to, “read the smallest line of letters you can, without squinting” (or words to that effect).
- If the patient reads at least 4 or 5 out of 5 letters on a 20/20 line, record 20/20<sup>-1</sup> or 20/20 for that eye, whichever is applicable. Repeat testing for other eye.
- If the patient misses two letters or more out of 5 letters on a 20/20 line, ask patient to read the next larger line of letters; continue this process until patient reads at least 4 out of 5 letters on a line of letters. Then, encourage the patient to read any letters on the next smallest line if they can. Record visual acuity based on standard methods. Repeat testing for other eye.
- For example, if patient reads the entire 20/30 line easily, but can only read two of the letters on the 20/25 line, then record the visual acuity as 20/30+2.

**REFERRAL CRITERIA – Uncorrected Distant Vision:**

- Class 1 FDME – refer if either eye is worse than 20/50 uncorrected.
- All other classes of FDME/FDHS – refer if either eye is worse than 20/400 uncorrected.

Corrected Distance Vision:

- TEST CORRECTED VISUAL ACUITY AFTER UNCORRECTED.
- For Class 1 FDME, perform the visual acuity WITH spectacle prescription (if wears any) before instilling any drops for the cycloplegic refraction (under separate ATB) to ensure current spectacle prescription is adequate. If patient is not corrected to 20/20 (or 20/20<sup>-1</sup>), it is advisable to have the Eye Clinic refract the patient to ensure he/she is correctable to standard before the cycloplegic refraction. However, do not record these results in block 61 since all Class 1 FDMEs will receive a cycloplegic refraction by an Optometrist or Ophthalmologist who will enter the patient’s cycloplegic refraction acuity there. Therefore, record the results in block 60 or block 73, if desired, but ensure these results to not get confused with the cycloplegic results! Leave the ‘Corr. to 20/\_\_\_’ in block 61 blank if Class 1 FDME.
- For all other classes of FDMEs/FDHSs, repeat the distant visual acuity procedure for the right eye WITH distance spectacle correction if patient wears any (NO contact lenses!). Patient should be wearing the glasses he/she uses with aviation duties. For bifocal wearers, be certain patient is looking through the distance portion of the spectacles. For progressive bifocal wearers, also ensure patient is angled correctly for optimal visual acuity. Ensure the spectacles worn are not a “reading only” prescription before proceeding with distant visual acuity testing. If patient was at least 20/20<sup>-1</sup> at distance without correction, this test can be skipped and a horizontal line drawn next to “Corr. to 20/--“.
- Repeat procedure for the left eye for corrected distant visual acuity.

**REFERRAL CRITERIA – Corrected Distant Vision:**

- Class 1 FDME – must see Optometrist or Ophthalmologist for cycloplegic refraction.
- All other classes of FDME/FDHS – refer if either eye is worse than 20/20-1 with correction.



**ATB: VISUAL ACUITY TESTING – NEAR VISION**

(DD Form 2808, Block 63, 'NEAR VISION')

**Purpose/Indications: Near vision.**

Mandatory for all classes and types of flight physicals. This measures the best visual acuity at near (14 inches, 16 inches, or 40 cm, depending on test used\*) WITHOUT any kind of correction whatsoever, followed by best-corrected visual acuity at near WITH spectacle prescription (if the patient wears any). NO contact lenses allowed during testing and must be removed at least 24 hours prior to examination.

This measures the clarity of vision or the ability of the visual system to resolve detail at near. A patient's visual acuity at near depends upon the accuracy of retinal focus, the integrity of the eye's neural elements, and the interpretive faculty of the brain. Near visual acuity also depends upon the eye's ability to focus clearly for objects at closer distances (accommodation).

It is important to conduct near visual acuity on all patients after distant acuity testing. Testing for near visual acuity before distant visual acuity may disadvantage the patient, depending on accommodative (focusing) ability.

**Equipment:**

- Occluder (to cover one eye at a time)
- Standard **PROJECTED** Snellen Distance Acuity Chart [IAW [AR 40-501](#), para 4-12a(1)] -or-
- AFVT (Armed Forces Vision Tester) or the OPTEC 2300 [both considered projected systems]

**Set-up:**Standard Reduced Snellen Acuity Card:

- Patient is at the designated test distance from the Reduced Snellen Acuity Card (test distances may vary so ensure the test distance is correct; typically they are set for 16 inches, 14 inches, or 40 cm\*). There should be adequate illumination, with the light source either above or slightly behind the patient. Care should be taken so that the light is not directed toward the patient's eyes.
- Patient holds occluder and covers eye as directed by tester. Patient may use palm of hand, if necessary, but ensure patient is using the palm, not the fingers, to preclude seeing between the fingers. Patient must keep both eyes open, must not press on either eye, and must not squint.

AFVT or OPTEC 2300:

- Patient is seated comfortably at the AFVT or OPTEC 2300.
- Near letter acuity slide(s) set correctly (see manual).
- Patient must push forehead against bar for internal light to work.

**Step-By-Step Procedure.**Uncorrected Near Vision:

- TEST UNCORRECTED VISUAL ACUITY FIRST! (This is important because a patient may be able to memorize the letters on the chart with corrected vision and, intentionally or unintentionally, say aloud the smaller letters on the test when uncorrected, whether or not actually seen by the patient.)
- Observe the patient during testing to ensure no squinting (or at least attempt to observe the patient behind the AFVT/OPTEC 2300).
- Instruct the patient to cover one eye (or occlude the non-tested eye with the appropriate buttons on the AFVT/OPTEC 2300) and direct patient not to squint. By convention, it is best to test right eye first, then left eye for consistency.

- **IMPORTANT NOTE ABOUT 20/20 NEAR VISUAL ACUITY STANDARD FOR FDMES/FDHSs!** Per [AR 40-501](#), paragraph 4-12a(2), "...no more than 1 error per 5 presentations of 20/20 letters, in any combination, on the AFVT or any Snellen near visual acuity card."
- **Issue:** AFVT line has 10 letters but is split into two sets of five letters positioned next to each other on the same line. Test the entire line, if desired, but the patient is still only required to get 4 out of 5 letters that are on a 20/20 line to be considered a 'pass' for a flight physical. Therefore, entries of 20/20 or 20/20<sup>-1</sup> are both passing entries. Most Snellen cards have 8 letters (some have 5, 6, or 7 letters) per line. The regulation allows for presentation of 5 letters "in any combination" so you may meet the requirement. If in question, refer to the Eye Clinic for verification.

- Instruct the patient to, "read the smallest line of letters you can, without squinting" (or words to that effect).
  - If the patient reads at least 4 or 5 out of 5 letters on a 20/20 line, record 20/20<sup>-1</sup> or 20/20 for that eye, whichever is applicable. Repeat testing for other eye.
  - If the patient misses two letters or more out of 5 letters on a 20/20 line, ask patient to read the next larger line of letters; continue this process until patient reads at least 4 out of 5 letters on a line of letters. Then, encourage the patient to read any letters on the next smallest line if they can. Record visual acuity based on standard methods. Repeat testing for other eye.
  - For example, if patient reads the entire 20/30 line easily, but can only read two of the letters on the 20/25 line, then record the visual acuity as 20/30+2.

**REFERRAL CRITERIA – Uncorrected Near Vision:**

- Class 1 FDME - refer if either eye is worse than 20/20<sup>-1</sup> uncorrected at near; patient requires cycloplegic exam also but must be no worse than 20/20<sup>-1</sup> uncorrected at near.
- All other classes of FDME/FDHS – refer if either eye is worse than 20/400 uncorrected.

Corrected Near Vision:

- **TEST CORRECTED VISUAL ACUITY AFTER UNCORRECTED.**
- For Class 1 FDME, normally there is no need to perform near visual acuity WITH spectacle prescription at all because Class 1 FDMES should all have 20/20 or 20/20<sup>-1</sup> uncorrected near visual acuity in each eye. If this is not the case, an ETP will be necessary.
- For all other classes of FDME/FDHS, repeat the near visual acuity procedure for the right eye WITH near spectacle correction if patient wears any (NO contact lenses!). Patient should be wearing the glasses he/she uses with aviation duties. For bifocal wearers, be certain patient is looking through the near portion of the spectacles. For progressive bifocal wearers, also ensure patient is angled correctly for optimal near visual acuity. If patient was at least 20/20<sup>-1</sup> at near without correction, this test can be skipped and a horizontal line drawn next to "Corr. to 20/--".
- Repeat procedure for the left eye for corrected near visual acuity.

**REFERRAL CRITERIA – Corrected Near Vision:**

- Class 1 FDME—must see Optometrist or Ophthalmologist for cycloplegic refraction. Class 1 FDME's with a spectacle prescription for near visual acuity require an AMS for ETP consideration.
- All other classes of FDME/FDHS – refer if either eye is worse than 20/20<sup>-1</sup> with correction.

**ATB: DEPTH PERCEPTION TESTING**

(DD Form 2808, Block 67. 'DEPTH PERCEPTION')

**Important note concerning the current DD Form 2808 with HARDCOPY (paper) submissions.**

The current DD Form 2808 has a pre-printed 'AFVT' in block 67. Although this is convenient for entering in the results of the Armed Forces Vision Tester (AFVT) depth perception test, it is not intended to exclude other authorized depth perception testing, such as the OPTEC 2300, the Random Dot (RANDOT) Circles Test, or the Titmus Graded Circles Stereoacuity Test. If not using the AFVT, line through the pre-printed entry and record the test used with the proper score. If using the AFVT and then also another depth perception test, record the AFVT in block 67 and then record the additional depth perception test findings in block 60 (Other Vision Test) or block 73 (Notes). With use of the AERO DD Form 2808, annotate results on page 2A and additional results/comments in Remarks on page 2B.

**Purpose/Indications.**

Mandatory for all flight physicals. This measures fine depth perception through the ability to fuse stereoscopic targets.

**Equipment.**

AFVT (Armed Forces Vision Tester) or OPTEC 2300

- or -

RANDOT (Random Dot Circles Test) - with polarized glasses (included with test)

- or -

Titmus (Titmus Graded Circles Stereoacuity Test) - with polarized glasses (included with test)

**Set-Up.**

AFVT (Armed Forces Vision Tester) or OPTEC 2300:

- Patient seated comfortably at the AFVT (or OPTEC 2300).
- Patient wears habitual spectacle prescription (if applicable).
- May test without corrective prescription, but if fails, retest with corrective prescription.
- Test emulates distance test (optical infinity).
- Refer to manual for correct settings for model being used.

RANDOT (Random Dot Circles Test) or the Titmus (Titmus Graded Circles Stereoacuity Test):

- Patient wears habitual spectacle prescription (if applicable).
  - May test without corrective prescription, but if fails, retest with corrective prescription.
- Polaroid spectacles worn (over habitual prescription if also worn).
- Test distance is 40 cm (16 inches).
- Provide adequate light but avoid reflections from the test's surface.
- Hold test upright to maintain the proper axis of polarization.
- Do not permit the patient's head to tilt during testing.

**Step-By-Step Procedure.**

AFVT (Armed Forces Vision Tester) or OPTEC 2300:

- Refer to manual for correct settings for model being used.
- Group A is for demonstration purposes ONLY and should not be used as part of the actual test (see manual).
- Group B is at the level of the new overall standard of 40 seconds of arc; there are three presentations of five circles each within Group B.
- Patient identifies the circle within each presentation that appears 'closest'.
- Patient must correctly identify all presentations within Group B to pass.
- You may test beyond Group B if desired, but it is not necessary.
- Record as "AFVT Group B – 40 arc sec PASS" or words to that effect.

- If fails any in Group B, retest using RANDOT and/or Titmus below.

RANDOT (Random Dot Circles Test):

- There are ten presentations of three circles each in the RANDOT.
- You must test ALL ten presentations; do not stop after number seven.
- You must test all presentation IN ORDER; do not jump around since each level is progressively more difficult.
- Patient identifies the circle that appears 'closest'.
- Test until the patient misses two levels in a row.
- Record the last level passed successfully.
- For RANDOT, a minimum passing score is correctly identifying presentations 1 THROUGH 7 which equals 40 seconds of arc.
- Record as the number missed over the number possible.
  - For example, 'RANDOT 3/10 – 40 arc sec PASS' or words to that effect.
- If fails the RANDOT, may retest using AFVT/OPTEC 2300 or Titmus.

Titmus (Titmus Graded Circles Stereoacuity Test):

- There are nine presentations of four circles each in the Titmus.
- You must test ALL nine presentations.
- You must test all presentations IN ORDER; do not jump around since each level is progressively more difficult.
- Patient identifies the circle that appears 'closest'.
- Test until the patient misses two levels in a row (or the last presentation).
- Record the last level passed successfully.
- For Titmus, a minimum passing score is correctly identifying ALL of the presentations 1 THROUGH 9 which equals 40 seconds of arc.
- Record as the number missed over the number possible.
  - For example, 'Titmus 0/9 – 40 arc sec PASS' or words to that effect.
- If fails the Titmus, may retest using AFVT/OPTEC 2300 or RANDOT.

**Note: Refer to Eye Clinic if subject fails any depth perception testing for more formal evaluation, i.e.:**

- misses any presentations within Group B of the AFVT or OPTEC 2300;
- or, misses any of presentations 1 through 7 of the RANDOT;
- or, misses any of the nine presentations of the Titmus.

**Note:** The Verhoeff Testing Apparatus is no longer authorized for depth perception screening on any flight physical. 'Grandfathering' this test for such personnel has expired with this update. Personnel previously passed with Verhoeff must pass current testing methods, or apply for waiver after full optometric/ophthalmologic evaluation.

**ATB: COLOR VISION TESTING**(DD Form 2808, Block 66, 'COLOR VISION')**Important note concerning the current DD Form 2808 for HARDCOPY (paper submissions).**

The current DD Form 2808 has a pre-printed 'PIP' and a pre-printed '/14' in block 66. Although this is convenient for entering in the results of the Pseudo-Isochromatic Plate (PIP) color test, it is not intended to exclude other authorized color vision testing, such as the Farnsworth Lantern (FALANT) or the OPTEC-900 Color Vision Tester. If not using the PIP, line through the pre-printed entries and record the test used with the proper score. If using the PIP and then also another color vision test, record the PIP in block 66 and then record the additional color test findings in block 60 (Other Vision Test) or block 73 (Notes). For use of AERO's DD Form 2808, enter results on page 2A and additional tests or comments on page 2B in "Remarks." Annotate PIP2 or F2 PASS in remarks until made available in AERO.

**Purpose/Indications.**

Mandatory for all initial, comprehensive, and post-mishap FDMEs. This screens for color vision deficiencies. See note at the end of section. PIP is done first. FALANT is only done if failing PIP.

**Equipment.**PIP Series (Pseudo-Isochromatic Plates, PIP1 AND F2/PIP2):

- Only the PIP test which contains 14 test plates with numbers is authorized at this time (no traced lines). Most tests with 14 test plates also contain one or two 'demonstration' plates that can be seen readily, even in the presence of a color vision deficiency. Once the examinee understands the test with these demonstration plates, present the other 14 plates. Do not count the demonstration plates.
- F2 is a single test plate, used for assessing blue-yellow weakness or deficiency and some red-green deficiencies. PIP2 is a 10-plates series that should be administered with an eye specialist. Blue-yellow deficiency is normally rare without other deficits in the red-green axis, but may present with age, ocular diseases, or medication side-effects (such as Viagra®).
- The recommended source of illumination is the Macbeth Easel Lamp. However, the Daylight HRR Illuminator, "daylight" fluorescent bulb, other standard illuminant "C" light source, or other source providing a light source rating of C.R.I. 90 and 6200° Kelvin, may be used instead. If none of these are available, see the PIP Set-Up section below.

FALANT (Farnsworth Lantern) or the OPTEC 900-Color Vision Tester:

- The Farnsworth Lantern and the OPTEC-900 Color Vision Tester are equivalent for FDME test purposes.

**Set-Up.**PIP Series (Pseudo-Isochromatic Plates, PIP1 and F2/PIP2):

- Place the light source (Macbeth Easel Lamp, Daylight HRR Illuminator, "daylight" fluorescent bulb, or other standard illuminant "C" light source) on a table or shelf so that the subject's line of sight is at right angles to the plates, and so his/her eyes are at a distance of approximately 30 inches.
- If subject wears glasses for flight, test with glasses on.
- The subject should not face an open window or other strong light. Nearby incandescent lights (those with any yellow wavelengths) should be shielded (or off) so they do not illuminate the plates. Cover any nearby windows.
- If none of the recommended light sources are available, use regular room lighting but avoid any incandescent lights (yellow wavelengths). If the examinee fails in this case, you may do any of the following:
  - Retest using the FALANT or OPTEC-900 instead
  - Retest using light reflected from the north sky (sunny day) or refer to the optometry clinic

FALANT (Farnsworth Lantern) or the OPTEC-900 Color Vision Tester:

- Test distance is eight (8) feet with the aperture facing the subject.
- If subject wears glasses for flight, test with glasses on.
- Give the test in a normally lighted room; screen from glare; exclude sunlight. Subject should not face the source of room illumination.

**Army Aeromedical Standard.**

PIP: 0-2 errors and passes PIP2 series/F2 single plate

FALANT: no errors in one run (9 pairs)

**Step-By-Step Procedure (see APL for algorithm).**

PIP Series (Pseudo-Isochromatic Plates) is **DONE FIRST**:

- Examiner instructs subject to, “Please read the numbers aloud” (or words to that effect). The subject is not allowed to trace the numbers or touch the test plates.
- Examiner must show the demonstration plate(s) first, then show the remaining 14 test plates, showing each for approximately 2-4 seconds. Do not count the demonstration plate(s) in scoring.
- With the exception of always showing the demonstration plate(s) first, the examiner may change the order of the plates if there is suspicion of memorization. However, do not ‘mix and match’ test plates from multiple tests. (In a multiple-subject environment, do not allow those waiting to test to overhear the responses to the PIP.)
- A patient fails PIP testing if there are three (3) or more errors on the PIP or fails PIP2 series/F2 single plate. Proceed to FALANT testing.
- Record the results as the number MISSED over the number possible. For example, a perfect score on the PIP would be:
  - ‘PIP 0/14 PASS’

FALANT (Farnsworth Lantern) or the OPTEC-900 Color Vision Tester (**done only if failed PIP series**):

- Instruct the patient that he/she will be seeing sets of two lights in combinations of the colors red, green, and/or white. The lights are oriented vertically and the subject is to respond with the colors seen in order from top to bottom.
- It is advisable to provide the subject with a ‘trial set’ to allow the patient to understand the test before proceeding; do not record this set.
- Present nine (9) pairs of light sets. The first set presented should be a RED-GREEN or GREEN-RED combination but the remaining eight sets should be in random order. Each set of lights should be presented for approximately two (2) seconds.
- An error is considered the miscalling of one or both of a pair of lights. If an examinee changes the response before the next light is presented, record the second response only.
- A patient is qualified if he/she makes no errors in the nine (9) presentations. IF A CLASS 1 or CLASS 2 aviator, an ophthalmologic evaluation assessing for any color discrimination weakness or abnormality is required and the results must be reported on FDME. See APL on Color Vision Deficiencies.
- A patient is disqualified if he/she misses any of the nine (9) presentations.
  - Retest with an additional 18 light pairs is no longer authorized for FDMEs
- Record the results as the number MISSED over the number possible. For example, a perfect score on the FALANT or OPTEC 900 would be:
  - ‘FALANT 0/9 PASS’ or ‘OPTEC-900 0/9 PASS’

**Refer to Eye Clinic if subject fails color vision testing:**

- misses three (3) or more of 14 test plates with PIP and/or fails F2 single plate or PIP2 series
- misses any of nine (9) test light pairs with the FALANT or OPTEC 900

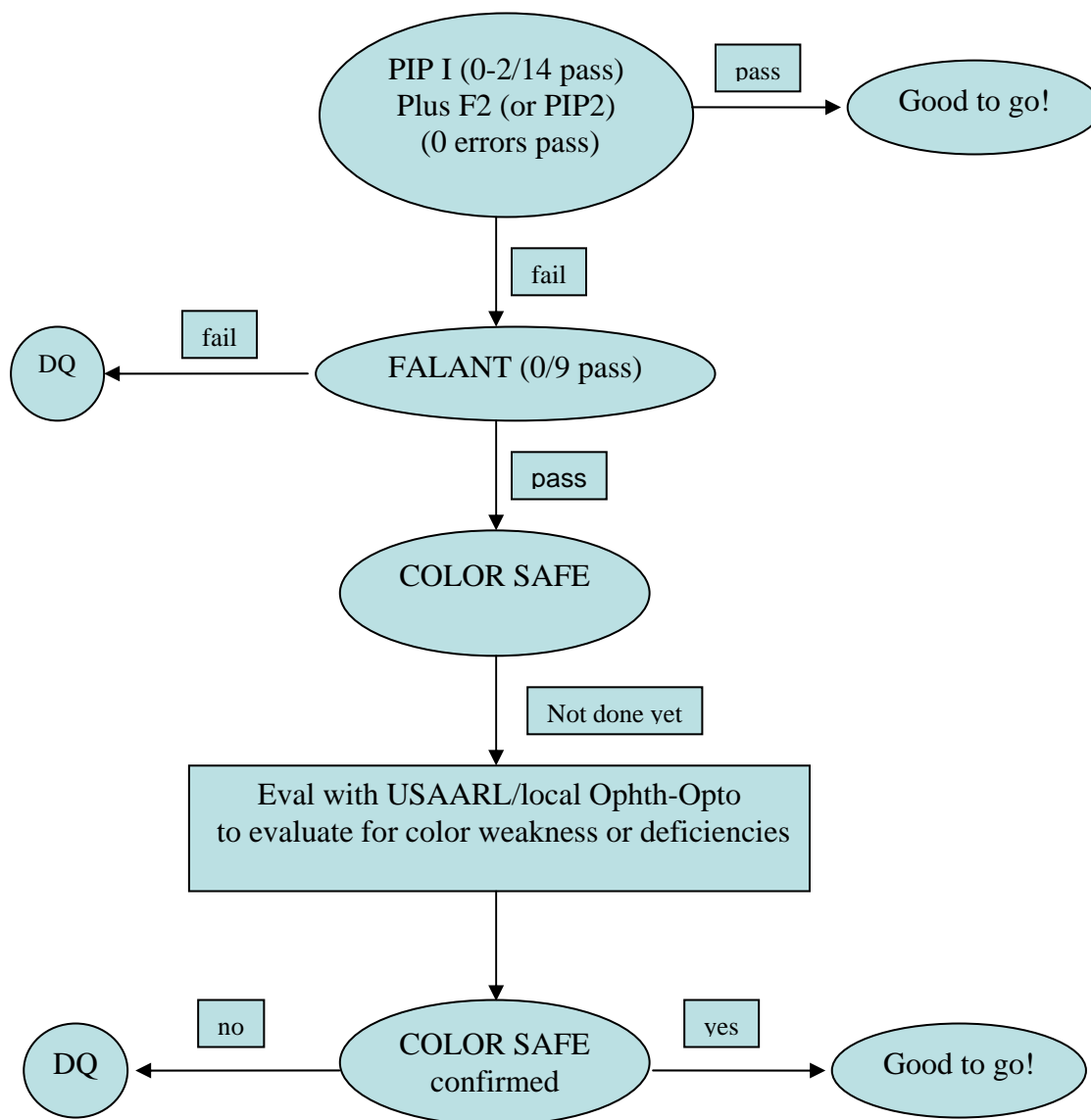
**DISCUSSION:** The importance of color vision has been a recent focus of tri-service attention with more advanced cockpit designs incorporating color symbology. More conditions and medications are being waived which may affect color vision (i.e., Viagra). The pilot population is also aging, which increases the small risk of acquired color vision deficiencies. Previously, color vision testing was only done on initial FDMEs. The requirement for color vision testing has been revised and updated. Color vision testing is now required for all initial, comprehensive, and post-mishap FDMEs. The standards have been tightened for PIP testing to 2 or less errors allowable and passing the PIP2/F2 single plate. Any more than 2 errors on PIP or failing the PIP2/F2 plate requires passing of FALANT (0/9) and a comprehensive ophthalmology/optometry evaluation to better define color discrimination tendencies and weaknesses. Aircrew passing FALANT are still deemed “color safe” which parallels the US Navy aeromedical standard. The USAF aeromedical standard is “color normal.” Passing FALANT, the second screen test, is the acceptable standard for “color safe” determination **after** optometric/ophthalmologic evaluation for better defining color vision weaknesses, if any exist.

Those rated aviators failing both tests would require further evaluation IAW the APL with the note that rated aircrew would more than likely receive waivers based on demonstrated ability. Those applicants failing both tests may be offered further evaluation IAW the APL to rule-out false results, and if confirmed, most would not be recommended for exception to policies. Applicants passing the initial Class 1 FDME but failing during the Rucker RW/RO FDME would follow similar evaluation as above with the addition of anomaloscope evaluation with USAARL Vision Sciences Division to best define color vision anomalies.

The ultimate goal of this change is to be able to continue to assess, train, and maintain Army aviators with current airframes that are color normal and mildly weak (but “color safe”) but able to perform the current Army aviation mission while knowledgeable and prepared for the future changes and advance in cockpit design.

The addition of the PIP2 or F2 is new. Most optometry clinics will not have this plate at the time of posting and will need to order it. With isolated blue-yellow deficiencies being rare, unless clinically evident, FS/APA/AMNP/AMEs may annotate the lack of PIP2 or F2 plate availability during the completion of FDMEs.

**Algorithm:**



**ATB: CYCLOPLEGIC REFRACTION**(DD Form 2808, Block 62, 'REFRACTION BY AUTOREFRACTION OR MANIFEST')**Important note concerning the current DD Form 2808 for HARDCOPY (paper) submissions.**

Unfortunately, the pre-printed wording of block 62, "REFRACTION BY AUTOREFRACTION OR MANIFEST" may be very confusing. It is VERY important that anyone conducting testing for any FDME understand that an 'autorefraction' of any kind is NOT authorized and should NEVER be entered on the DD Form 2808 unless it is in block 60 (Other Vision Test) or in block 73 (Notes) for reference only. **Autorefraction results should NEVER be entered into block 62!** With AERO, enter information on page 2A of DD Form 2808 with additional notes on page 2B.

We highly recommend lining through the entire "BY AUTOREFRACTION OR MANIFEST" wording and utilize the blank next to the refraction to enter the type of refraction utilized. For example:

By -0.50 S. -0.25 CX 180 (type of refraction here)



All 'autorefraction' entries on FDME's in block 62 will be returned as incomplete.

**Purpose/Indications: Cycloplegic Refraction ("Cyclo"):**

Testing is MANDATORY for all Class 1 FDMEs. This measures a patient's refractive error in the absence of accommodation (focusing ability), which is useful in confirming the presence of latent hyperopia ("hidden farsightedness"). This is accomplished through the use of a cycloplegic topical ophthalmic solution, an anticholinergic solution that is used to block the responses of the iris sphincter muscle and the accommodative muscle of the ciliary body to cholinergic stimulation, producing pupillary dilation (mydriasis) and paralysis of accommodation (cycloplegia).

***An Optometrist or Ophthalmologist must conduct the cycloplegic refraction*** in a very specific manner outlined under the step-by-step procedure below. Conduct the cycloplegic refraction after all other eye testing.

**Note:** there is additional mandatory testing with the cycloplegic refraction as outlined on the last page.

**Equipment/Supplies: Cycloplegic Refraction.**

- Slit lamp biomicroscope
- Facial tissue(s)
- Mydriatic spectacles (disposable sunglasses)
- Topical anesthetic: (Proparacaine Hydrochloride Ophthalmic Solution, USP, 0.5%)
- Cycloplegic agent: (Cyclopentolate Hydrochloride Ophthalmic Solution, USP, 1.0%)
- Retinoscope (for objective start point or objective verification; an autorefractor may be used for an objective start point but in no instance will any autorefraction be entered onto an exam form.)
- Phoropter
- Projected Snellen distance visual acuity chart [must be projected IAW [AR 40-501](#), paragraph 4-12, a(1)].  
Projected sources for a cycloplegic refraction include, but are not limited to:
  - Traditional projector with screen
  - Binocular Visual Acuity Tester (BVAT), or similar system
  - Refraction system with projected image (i.e. the Marco Nidek COS-1000 Compact Ophthalmic System, the Marco Nidek EPIC-2100, or similar system)
- Method for keratometry and/or topography (for new mandatory testing)

**Set-up: Cycloplegic Refraction.**

- Conduct a cycloplegic refraction after completing all other eye testing and verifying any disqualifying parameters from other tests. Highly recommend a brief review of the physical exam form to ensure all other eye



testing is complete and that no re-testing is necessary (i.e. meets standards). One more check in the process will only help to ensure the physical is correct when finally forwarded to AAMA for review.

- Highly recommend using a slit-lamp biomicroscope to ensure patient has open anterior chamber angles before instilling any drops.

If an angle estimation is less than 0.25:1 (or ¼:1), or a Van Herick angle estimation of '1', perform gonioscopy prior to instilling cycloplegic drops. If corneal epithelial disruption occurs with gonioscopy, confirm angles are open and have patient return in 24 hours for the cycloplegic refraction. If angles are narrow, refer to Ophthalmology for evaluation before proceeding.

- Ask patient about allergies, adverse reactions to any anesthetics (Proparacaine being utilized), or adverse reactions to any preservatives (Proparacaine is preserved with Benzalkonium Chloride, 0.01%).

### Step-By-Step Procedure: Cycloplegic Refraction (“Cyclo”).

- Recommend verifying anterior chamber angles (see Set-Up).
- Verify allergies and possible adverse reactions (see Set-Up).
- Give patient a facial tissue and a pair of mydriatic spectacles. Explain effects from cycloplegic drops (especially temporary loss of focus at near and light sensitivity) and ensure this will not interfere with anything of pending importance (i.e., patient has final exam that evening, patient is not performing any type of flight duties within the following 24 hours, etc.).
- Instill drops in this exact order:
  - Instill one (1) drop of topical anesthetic (Proparacaine HCl 0.5%) into each eye. RECORD THE DROP AND THE TIME (in block 60 or block 73). Wait one (1) minute. {Some think this is to make the patient more comfortable with the successive drops. Although this is a welcomed side effect, it is not the primary reason. The topical anesthetic helps ease the bonds between the corneal cell junctions, which allows increased permeability of the cycloplegic agent.}
  - Instill one (1) drop of cycloplegic agent (Cyclopentolate HCl 1.0%) into each eye. RECORD THE DROP AND THE TIME (block 60 or block 73). Wait five (5) minutes.
  - Instill one (1) drop of cycloplegic agent; wait a minimum of 45 minutes. RECORD THE DROP AND THE TIME (block 60 or block 73).
- Perform a cycloplegic refraction between 45 minutes and 75 minutes after the last drop instillation (the minimum wait time of 45 minutes ensures all iris colors are in maximal cycloplegia before refraction). If the cycloplegic refraction cannot be performed between 45 and 75 minutes, there are two courses of action:
  - Instill another drop of Cyclopentolate HCl 1.0% in each eye and wait a minimum of 30 minutes more; **-or-**
  - Patient can return after a minimum of 48 hours to repeat the drop series and cycloplegic refraction.
- Enter the ‘best corrected visual acuity’ in block 61 next to the pre-printed “Corr. to 20/” entries for each eye. [See ‘Important Note for Eye Care Providers’ on the last page.] Be aware of patients ‘memorizing’ the eye chart. Many clinics are limited to only a few 20/20 lines and must be creative in randomizing the letters (reading them backwards, etc.).
- Record the cycloplegic refraction findings for each eye in block 62:
  - The ‘sphere’ amount in the first blank (between the pre-printed entries of “By” and “S.”). If zero, use ‘0.’
  - The ‘cylinder’ amount in the second blank (between the pre-printed entries of “S.” and “CX”; if there is no cylinder amount, enter ‘sphere’, ‘sph’, ‘0’ or ‘DS’.)
  - The ‘astigmatism axis’ in the third blank (after the pre-printed entry of “CX”; if there is no astigmatism, enter a horizontal line here.)
  - After the astigmatism axis, write the word ‘cycloplegic’ (or ‘cyclo’) to indicate the refraction conducted.

A typical cycloplegic refraction entry on DD Form 2808:

		59. RED/GREEN (Army Only)	60. OTHER VISION TEST 1 x Proparacaine 0.5% @ 1200 1 x Cyclopentolate 1.0% @ 1201 1 x Cyclopentolate 1.0% @ 1206
61. DISTANT VISION		62. REFRACTION BY AUTOREFRACTION OR MANIFEST	
Right 20/20	Corr. to 20/20	By +0.25 S. -0.25 CX 180	by Cyclo
Left 20/25	Corr. to 20/20	By +0.75 S. -0.50 CX 180	by Cyclo
		63. NEAR VISION	

If the refraction amount is outside of qualifying standards for flight school, make a note to the Flight Surgeon in block 73 or on a separate note. This should be discussed with the Physical Exam Section and Flight Surgeon per local SOP. All Eye Care Providers and Flight Surgeons must know the most current standards and policies for entry to flight school.

### **ENTRY STANDARDS FOR CLASS 1 FLIGHT DUTY MEDICAL EXAMINATIONS.**

**Hyperopia** less than or equal to **+3.00** diopters of sphere (in any meridian by transposition in either eye)

**Myopia** less than or equal to **-1.50** diopters of sphere (in any meridian by transposition in either eye)

**Astigmatism** less than or equal to **+/- 1.00** diopter of cylinder in either eye

Must meet above standards in both plus-cylinder and minus-cylinder formats because of the ability to write a disqualifying cycloplegic refraction as a qualifying one as in the example below. So, to prevent this error, transpose to ensure patient meets standards (spherical equivalent method does not apply). AERO does this automatically, and Table 11 below provides this information. Note: “B” is disqualifying, but in the range to consider for an ETP (see the Decreased Visual Acuity APL).

**For example:** the cycloplegic refraction of -1.00 – 0.75 x 180 (in minus-cylinder format) might appear qualified at first glance. However, after transposition into plus-cylinder format of -1.75 + 0.75 x 090 (in plus-cylinder format), it is apparent that this refraction is disqualifying because the sphere amount exceeds -1.50.

**NOTE:** If everything else is normal on the applicant, an ETP may be requested and granted if the cycloplegic refraction is close to standard (within ¾ of a diopter) to assess the applicant into flight school. See the Decreased Visual Acuity APL.

#### Transposition Review:

1. Algebraically sum the sphere and cylinder powers
2. Change the sign of the cylinder power
3. Change the axis by 90 degrees.

**Table 11. Cycloplegic Transposition Table for Class 1 FDME**

		CYL -1.25	CYL -1.00	CYL -0.75	CYL -0.50	CYL -0.25	DS / SPH	CYL +0.25	CYL +0.50	CYL +0.75	CYL +1.00	CYL +1.25
SPH	-1.75	DQ	DQ	DQ	B	B	B	B	B	B	B	B
SPH	-1.50	DQ	DQ	B	B	B	Q	Q	Q	Q	Q	B
SPH	-1.25	DQ	B	B	B	Q	Q	Q	Q	Q	Q	B
SPH	-1.00	B	B	B	Q	Q	Q	Q	Q	Q	Q	B
SPH	-0.75	B	B	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	-0.50	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	-0.25	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	0.0/PLANO	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	+0.25	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	+0.50	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	+0.75	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	+1.00	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	+1.25	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	+1.50	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	+1.75	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	+2.00	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	B
SPH	+2.25	B	Q	Q	Q	Q	Q	Q	Q	Q	B	B
SPH	+2.50	B	Q	Q	Q	Q	Q	Q	Q	B	B	B
SPH	+2.75	B	Q	Q	Q	Q	Q	Q	B	B	B	DQ
SPH	+3.00	B	Q	Q	Q	Q	Q	B	B	B	DQ	DQ
SPH	+3.25	B	B	B	B	B	B	B	B	DQ	DQ	DQ

DQ = Disqualified

Q = Qualified

B = Disqualified but may be okay for ETP (see APL)

### **Important Note for Eye Care Providers**

A cycloplegic refraction is NOT necessarily equal to the refraction you would give for spectacle lenses. If a patient is “on the border” of being qualified or disqualified, it is best for the Army and for the patient to use the “least amount of prescription needed to see within standards” approach.

For example, if a patient has a cycloplegic refraction that is +/- 0.25 diopters outside of standard but can still read to the 20/20<sup>-1</sup> standard with the refraction amount that is WITHIN standards, enter the lesser amount.

Do NOT, however, try to “push” the 20/20<sup>-1</sup> on borderline cases for three reasons. First, the current APL on “Decreased Visual Acuity” addresses policies for Exception to Policy for those within ¾ of a diopter of standards. Second, these patients receive an entirely new cycloplegic exam once they come to Fort Rucker to enter flight school. If outside of standards on the RO/RW physical, they will be required to request an exception-to-policy prior to starting training. Use professional judgment, but do not allow someone to come to flight school knowing he/she has a good chance of failing their detailed cycloplegic exam upon arrival and being held up from starting training. The procedures for remedy are in place and too easy.

### **Additional MANDATORY Testing With Cycloplegic Refraction:**

Since the patient is dilated during a cycloplegic refraction, it is a prime opportunity to conduct a brief slit lamp exam to check any disorders of the anterior segment and optic nerve. A fully dilated fundus exam (DFE) is not required but highly encouraged. Note: for refractive surgery patients outside of the standards, a DFE is required as part of the ETP information. Due to the advent and popularity of refractive surgery, it is now **MANDATORY** for the Eye Care Provider conducting the cycloplegic exam to also provide the following information with all Class 1 FDMs:

#### **#1: EVIDENCE OF REFRACTIVE SURGERY (YES/NO):**

- Make an entry in block 73 (NOTES) indicating that there is no evidence of refractive surgery. (Highly advise that the patient also sign an entry stating he/she has not had refractive surgery.) This can easily be made part of the local overprint to DD Form 2808. This block is included on page 2A, DD Form 2808 on AERO.
- If patient has had refractive surgery, see the APL for Corneal Refractive Surgery (updated Feb 2007) and the required information listed in Table 6. Ensure the patient can supply all of the information required for an ETP or Qualified, Information Only. If the patient is missing the information or records, contact USAAMA to discuss the case to determine how to proceed. Allowable procedures include PRK, LASEK, and LASIK. All other forms of corneal refractive surgery are not authorized.

#### **#2: EVIDENCE OF CORNEAL CURVATURE: Provide evidence of corneal curvature with one of the following:**

- Manual or Automated Keratometry readings of each eye [enter in block 60 (OTHER VISION TEST) or block 73 (NOTES); or photocopy to full-size page and attach to physical with assessment annotated.
- And/or Topography of each eye (attach full-size page to physical) with assessment annotated.
- If abnormal or concerning (keratoconus, pre-keratoconus or suspect, or other), annotate and inform the aeromedical provider and physical exam clinic. Continue the evaluation per appropriate APL or discuss with the aeromedical provider or USAAMA findings and guidance for further evaluation.

### **Important Note for Eye Care Providers and Aeromedical Providers for Class 1 Applicant vision:**

With the advent and successful of the Corneal Refractive Surgery program, to include its adoption for most individuals as an Information Only disposition, this excluded otherwise qualified applicants whose visual testing was just outside of standards but not significant enough to warrant the risk, expense, or appropriateness of undergoing the CRS procedure. The Army aeromedical standards are and remain the following:

1. Distant visual acuity (DVA): 20/50 or better in each eye (and correctable to 20/20<sup>-1</sup>)
2. Near visual acuity (NVA): 20/20<sup>-1</sup> in each eye uncorrected.
3. Cycloplegic: Per Table 11

For Exception to Policy, in coordination with HRC waiver Authority, an applicant may be considered providing meeting all of the following: DVA 20/70 or better in each eye and correctable to 20/20<sup>-1</sup>, NVA 20/40 or better in each eye and correctable to 20/20<sup>-1</sup>, and cycloplegic refraction with 0.75 diopters of the aeromedical standards (noted as “B”). See the APL, Decreased Visual Acuity.

**ATB: FIELD OF VISION TESTING**

(DD Form 2808, Block 68. 'FIELD OF VISION')

**Purpose/Indications.**

Mandatory for all initial FDMs. This screens for gross visual field defects.

**Equipment.**

- Occluder (and/or use palm of hand to cover respective eye).
- Examiner's fingers.

**Set-Up.**

- Patient removes glasses (if applicable).
- Adequate lighting.
- Ideal lighting is bright illumination between patient and examiner with dim room illumination; avoid patient facing any direct source of light.
- Examiner is 60-80 centimeters (cm) from patient.
- Examiner must have full visual fields to be able to properly conduct this test.

**Step-By-Step Procedure.**

- *This is a monocular test*; ensure you are testing only one eye at a time.
- Instruct the patient to cover his/her left eye first; you, as the examiner, cover your right eye (mirror-imaging patient).
- Tell the patient, "I want you to keep looking at my open eye and, without looking anywhere else, use your 'side vision' and tell me how many fingers I am holding up." (Or, words to that effect.)
- Place your closed fist in the peripheral visual field in a location where you will be able to distinguish the number of fingers exposed.
- Present one, two, or five fingers in the plane mid-way between you and the patient; the fingers should not point toward the patient and you should not wiggle or move.
- Repeat the presentation of fingers in the appropriate eight locations in the field (on each side of the four visual field meridians).
- Repeat the entire procedure for the patient's left eye.
- If the patient successfully answers all presentations within the field, record the findings for each eye even though there is no longer a separate entry block on the new DD Form 2808 for each eye.

- For example:

OD FTC    OS FTC  
[FTC = "Full To Confrontations"]

- or -

Right NTC    Left NTC  
[NTC = "Normal To Confrontations"]

**Refer any deficiencies or abnormal findings to the Eye Clinic for verification and possible further testing.**

**ATB: MANIFEST/SUBJECTIVE REFRACTION**(DD Form 2808, Block 62, 'REFRACTION BY AUTOREFRACTION OR MANIFEST')**Important note concerning the current DD Form 2808 for HARDCOPY (paper) submissions.**

Unfortunately, the pre-printed wording of block 62, "REFRACTION BY AUTOREFRACTION OR MANIFEST" may be very confusing. It is VERY important that anyone conducting testing for any flight physical understand that an 'autorefraction' of any kind is NOT authorized and should NEVER be entered on the DD Form 2808 unless it is in block 60 (Other Vision Test) or in block 73 (Notes) for reference only. **Autorefraction results should NEVER be entered into block 62!** With AERO, enter information on page 2A of DD Form 2808 with additional notes on page 2B.

We highly recommend lining through the entire "BY AUTOREFRACTION OR MANIFEST" wording and utilize the blank next to the refraction to enter the type of refraction utilized. For example:

By -0.50 S. -0.25 CX 180 (type of refraction here)



All 'autorefraction' entries on FDME's in block 62 will be returned as incomplete.

The terminology of 'cycloplegic', 'subjective', and 'manifest' can be confusing when it comes to FDME/FDHSs. For standardization, this guide explains how these entries are commonly utilized:

Terminology	Class of Physical	When Indicated
'Cycloplegic'	Class 1 only (drops given)	Class 1 FDME only [See <a href="#">ATB-Cycloplegic Refraction</a> ]
'Subjective' or 'Manifest'	All classes except Class 1 (no drops given) (phoropter used)	Corrected vision with current glasses (HxRx) or uncorrected vision with no previous use of glasses worse than 20/20 <sup>-1</sup> in either eye at distance <u>or</u> near.
'Hx Rx' * [Hx = 'habitual' or 'historical'] = current glasses	All classes except Class 1 (no drops given) (lensmeter used)	Corrected vision with current glasses (HxRx) at least 20/20 <sup>-1</sup> in each eye at distance <u>and</u> near.

\* Some use the term 'manifest' to mean 'HxRx' also. See 'Notes About Manifest Refraction' on the last page of this ATB.

**Purpose/Indications**

Needed for all classes of FDME/FDHS, other than Class 1 (requires cycloplegic refraction), if the patient is not 20/20<sup>-1</sup> in each eye uncorrected in both near and far vision. This measures a patient's refractive error without the use of a cycloplegic agent (no drops) as well as obtains the eyeglass prescription needed to bring the corrected vision to 20/20<sup>-1</sup> in each eye. This is often missed or omitted on FDHSs and comprehensive FDMEs, despite AERO reminders.

**Equipment/Supplies**

- Phoropter
- Projected Snellen distance visual acuity chart [must be projected IAW [AR 40-501](#), paragraph 4-12, a.(1) and b.(1)]. Projected sources for a subjective or manifest refraction include, but are not limited to:
  - Traditional Projector with screen
  - Binocular Visual Acuity Tester (BVAT), or similar system
  - Refraction system with projected image (i.e. the Marco Nidek COS-1000 Compact Ophthalmic System, the Marco Nidek EPIC-2100, or similar system)
- Standard Reduced Snellen near visual acuity card (needed if uncorrected near vision is worse than 20/20<sup>-1</sup> in either eye.)

**Set-up**

A subjective refraction should only be conducted after completing all other eye testing and verifying any disqualifying parameters from other tests. However, it can be done at any time in the physical exam procedure. Highly recommend a brief

review of the physical exam form to ensure any other eye testing completed at that time does not require re-testing (i.e. meets standards). One more check in the process only helps ensure the physical is correct when sent to AAMA for review.

### Step-By-Step Procedure

- This is NOT for any Class 1 FDME (cycloplegic refraction will be used for eyeglass prescription if needed).
- Perform a subjective refraction for either distance and/or near depending on the referral criteria and findings in blocks 61 and 63.
- Enter the 'best corrected distance visual acuity' in block 61 and the 'best corrected near visual acuity' in block 63 next to the pre-printed "Corr. to 20/" entries for each eye.
- Record the subjective refraction findings for each eye in block 62:
  - The 'sphere' amount in the first blank (between the pre-printed entries of "By" and "S." If zero, enter '0' or 'plano'.
  - The 'cylinder' amount in the second blank (between the pre-printed entries of "S." and "CX"; if there is no cylinder amount, enter 'sphere', 'sph', '0' or 'DS.'
  - The 'astigmatism axis' in the third blank (after the pre-printed entry of "CX"; if there is no astigmatism, enter a horizontal line here.)
  - After the astigmatism axis, write the word 'subjective' (or 'subj') [or the word 'manifest' if using this term interchangeably with 'subjective'] to indicate the type of refraction conducted.
  - If the patient's best-corrected near visual acuity utilizes the same prescription as the best-corrected distance visual acuity, simply enter the word 'lens' next to the pre-printed entry of 'by' under block 63 (NEAR VISION). If the best-corrected near visual acuity utilizes an 'Add' (bifocal), enter the amount of the 'Add' ONLY which will always be a number preceded by a '+' sign.
  - If you know the refraction still does not correct patient to qualifying standards at distance and/or near, perform a full eye exam to try and determine the cause. If undeterminable, refer to Ophthalmology.

A typical ideal subjective refraction entry on DD Form 2808:

		59. RED/GREEN ( <i>Army Only</i> )		60. OTHER VISION TEST	
61. DISTANT VISION		62. REFRACTION BY <del>AUTOREFRACTION OR MANIFEST</del>		63. NEAR VISION	
Right 20/25	Corr. to 20/20	By PLANO S. -0.50 CX 180	by Subj	Right 20/30	Corr. to 20/20 by +1.00
Left 20/30	Corr. to 20/20	By +0.25 S. -0.75 CX 180	by Subj	Left 20/30	Corr. To 20/20 by +1.00

#### REFERRAL CRITERIA – Subjective/Manifest Refraction:

Class 1 FDME – ALL Class 1 FDMEs receive a cycloplegic exam.

All other classes of FDME/FDHS – refer if either eye's best corrected vision is worse than 20/20<sup>-1</sup> at distance or near.

#### Notes About "MANIFEST REFRACTION"

Over time, with physicals, many have come to use 'manifest refraction' to identify the patient's current spectacle prescription (the glasses the patient is wearing). However, most eye care providers utilize the words 'subjective' and 'manifest' interchangeably and instead use terms such as, 'Hx Rx' or 'Spec Rx' to identify the current spectacle prescription. Therefore, ideally, if the patient meets standards in each eye with his/her current spectacle prescription, it should be entered on the physical in a clear manner as to show that the visual acuity was tested with the current spectacle prescription. This would never be entered for a Class 1 FDME and should be verified by subjective refraction if the prescription is older than one year.

## **ATB: NIGHT VISION**

(DD Form 2808, Block 69. 'NIGHT VISION')

### **Important note concerning the current DD Form 2808 for HARDCOPY (paper) submission.**

The current DD Form 2808 has a pre-printed '(Test used and score)' in block 69. However, there is no established test for night vision and therefore no score. This part of the physical is still conducted through history only. If doubt or concern, refer to optometry/ophthalmology for further evaluation.

### **Purpose/Indications.**

Mandatory for all initial FDMs. Determines history of night vision problems.

### **Equipment.**

None.

### **Set-Up.**

Patient privacy.

### **Step-By-Step Procedure.**

- Ask the patient, "Have you ever had any night vision problems?" (or words to that effect.)
- If the response is negative, record 'NIBH' for 'Not Indicated By History'.
- Any positive responses are ABNORMAL and must be referred to the Eye Clinic for further evaluation and investigation.

**ATB: OCULAR MOTILITY**

(DD Form 2808, Block 64. 'HETEROPHORIA')

**Important notes concerning the current DD Form 2808 for HARDCOPY (paper) submissions.**

Unfortunately, there is some confusion about the pre-printed entries in block 64. A quick comparison of the old SF 88 entries and the current DD Form 2808 entries might be useful here:

Old SF 88 Entry	New DD Form 2808 Entry	
ESO	ES°	has degree symbol; do NOT record in degrees
EXO	EX°	has degree symbol; do NOT record in degrees
R.H.	R.H.	no change
L.H.	L.H.	no change
PRISM DIV.	Prism div.	no change except from all capital letters
PRISM CONV.	Prism Conv.	no change except from all capital letters
CT	CT	no change; this is a <u>separate, stand-alone</u> entry even though it is somewhat 'hidden' on the form
PC	NPR	this is a <b>typographic error</b> and should be 'NPC'
PD	PD	no change

**Purpose/Indications.**

Block 64 includes several sub-tests for ocular motility along with true 'heterophoria' testing, even though the title of the block is 'Heterophoria'. Therefore, each sub-test will be covered separately below. Abnormalities must be evaluated per the APLs to include the Ocular Motility Worksheet.

Heterophoria Testing ['ES°', 'EX°', 'R.H.', 'L.H.']:

Mandatory for all Class 1 and comprehensive FDMes. This measures the latent or relative deviation between the eyes that occurs when fusion is interrupted. A 'phoria' can be lateral ['ES' for 'esophoria' (in), and 'EX' for 'exophoria' (out)] and/or vertical ['R.H.' for 'right hyperphoria', and 'L.H.' for 'left hyperphoria' (do not use 'hypo' entries)]. A 'phoria' does not apply to one eye or the other. It is basically a resting position of the eyes. Everyone has a phoria! But, it might be so small as to come out to zero (0) on testing.

'Tropia' Testing ['CT' (then measured as 'Prism div.' or 'Prism Conv.' if needed)]:

Mandatory for all Class 1 and comprehensive FDMes. A 'tropia' is a manifest deviation of ONE eye and can be lateral and/or vertical with the same prefix identifiers as a 'phoria' ['eso', 'exo', and 'hyper']. 'Tropia' is also known by the names 'heterotropia', 'strabismus', and 'squint'. A tropia applies to only ONE eye or the other at any given time. It can be constant or intermittent; unilateral or alternating. Not everyone has a tropia!

The 'CT' (Cover Test) is required for all Class 1 FDMes. When the 'cover-uncover' (or 'unilateral') cover test is performed properly, this test can detect the presence of a tropia. This is important because the presence of a tropia could lead to lack of fusion, reduced or no stereopsis (affecting depth perception), suppression of vision in one eye, or diplopia (double vision). Obviously, these are all disqualifying conditions for flight school. Passing the previous 'phoria' testing does not necessarily mean a person is without a 'tropia'. But, if a person fails the 'phoria' testing or has difficulty with it, it could be an indicator that the patient may have a 'tropia'. Do not confuse this 'cover-uncover' (or 'unilateral') cover test that tests for 'tropia' with the 'cross-cover' (or 'alternating') cover test, which is utilized by Optometry/Ophthalmology to verify a 'phoria'.

This test is conducted at both distance and near. If any 'tropia' is detected, the patient must be referred to Optometry or Ophthalmology for verification and measurement of the amount of 'tropia' to be entered by the 'Prism div.' (prism divergence) and 'Prism Conv.' (prism convergence) entries. If no 'tropia' is detected, the word "Ortho" is placed next to the preprinted entry of 'CT' [one entry presumes the test was conducted at both distance and near but the proper entry would be "Ortho @ distance and near" (or words to that effect)]. The 'Prism div.' and 'Prism Conv.' entries are left blank if no tropia detected.

NPR [(typo error on DD Form 2808 - should be 'NPC' (Near Point of Convergence))]:



Mandatory for all Class 1 FDMs. This is the 'NPC' (Near Point of Convergence) test which determines the patient's ability to converge the eyes while maintaining fusion. [Note: there is a test called the 'NPR' (Near Point of Recovery) but that test is NOT utilized in any flight physical.]

PD (Pupillary Distance):

This test is not utilized for flight physicals. However, it is the measurement of the patient's inter-pupillary distance and can be included if known. Otherwise, leave blank.

**Equipment:**

Heterophoria Testing (ES°, EX°, R.H., L.H.):

- Armed Forces Vision Tester (AFVT) or OPTEC 2300
- (Note: the 'cross-cover' (or 'alternating') cover test and/or the von Graefe method of measuring phorias should only be used for verification of 'phoria' by Optometry/Ophthalmology. Do not confuse the 'cross-cover' test with the 'cover-uncover' (or 'unilateral') cover test that detects 'tropia'.)

'Tropia' Testing (CT – Cover Test):

- Occluder (for 'cover-uncover' (or 'unilateral') cover test)
- Distance and near visual acuity charts (or appropriate targets).
- (Ideally, an appropriate target is an isolated letter on a visual acuity line that is one to two lines larger than the patient's best-corrected visual acuity of the poorer seeing eye. So, if the patient is 20/20, then utilizing a 20/25 or 20/30 isolated letter at both distance and near would be ideal.)

NPR [(typo error on DD Form 2808- should be 'NPC' (Near Point of Convergence))]:

- Any instrument having an appropriate target that is one to two lines larger than the patient's best corrected near visual acuity in the poorer seeing eye; instrument or device must be easy for examiner to manipulate and not interfere with the testing method.
- Metric ruler for measuring in millimeters (mm).

**Set-up.**

Heterophoria Testing (ES°, EX°, R.H., L.H.):

- Patient seated comfortably at the AFVT (or OPTEC 2300).
- Test emulates distance test (optical infinity).
- Refer to manual for correct settings for model being used.

Tropia' Testing (CT – Cover Test):

- Patient wears habitual spectacle prescription (if applicable) for the distance being tested (distance spectacle prescription when testing distance; near spectacle prescription when testing near).
- Set up the target:
  - Distance (tested at 20 feet or 6 meters) – isolated letter, one to two lines larger than the visual acuity in the patient's poorer seeing eye (with correction). For FDMs, this will almost always be a 20/25 target.
  - Near (usually tested at 16 inches or 40 cm) – reduced Snellen letter one to two lines larger than visual acuity in the patient's poorer seeing eye (with correction). For FDMs, this will almost always be a 20/25 target. The patient may hold the target but verify the test distance.
- The examiner holds the occluder.
- Sufficient room illumination to see the patient's eye movements.
- The examiner must be in a position to be able to see the patient's eyes easily without interfering with the patient's view of the target.

NPR [(typo error on DD Form 2808 - should be 'NPC' (Near Point of Convergence))]:

- Patient wears habitual near prescription (if applicable).
- If spectacles interfere with testing, attempt testing without spectacles.
- Sufficient room illumination to see the patient's eyes and for the patient to see the target.

**Step-By-Step Procedure.**

Heterophoria Testing (ES°, EX°, R.H., L.H.):

- Test distance vertical phoria and lateral phoria in accordance with manual for AFVT or OPTEC 2300.
- Use associated scoring key to determine amount of phoria in prism diopters.
- Vertical phoria must be 1 or less. If a subject has a number other than zero in 'RH', then the 'LH' entry must be zero (and vice-versa).
- Lateral phoria must be 8 or less. If a subject has a number other than zero in 'ES', then the 'EX' entry must be zero (and vice-versa).
- Refer to the Eye Clinic if vertical phoria is greater than 1 or if lateral phoria is greater than 8.

'Tropia' Testing (CT – Cover Test):

- This is the 'cover-uncover' (or unilateral) cover test to test for 'tropia', NOT to test for 'phoria'.
- Test at distance (20 feet) and then near (40 cm).
- Cover and uncover the right eye three times while you:
  - Watch behind the occluder for eye movement
  - Watch for eye movement after occluder is removed
- Repeat for left eye.
- Repeat entire procedure for near.
- No movement detected is recorded as "Ortho" (distance and near).
- Refer to the Eye Clinic for verification if any movement detected.
- Eye Clinic will verify 'tropia' and measure to enter amount into the 'Prism div.' or 'Prism Conv.' entries.

NPR [(typo error on DD Form 2808 - should be 'NPC' (Near Point of Convergence))]:

- This is a binocular test; ensure test is performed with both eyes open.
- Start the fixation target at 40 cm from the patient and ensure he/she sees only one image at that start point before proceeding.
- Explain to the patient to tell you when the target appears 'double' or when it 'splits' into two images; further explain that it does not matter if the target appears 'blurry', only when it 'doubles'.
- Bring the fixation target toward the patient slowly to allow him/her to maintain fixation on the target.
- Observe patient's eyes until the patient reports that the target appears 'double' or 'split'; or until it is apparent that one eye loses fixation (turns in or out).
- Record this distance from the patient's eyes in millimeters (mm).
- Passing is 100 mm or less.
- If greater than 100 mm, first carefully retest with repeat explanation to the patient of reporting only when the image is 'double' or 'splits', not only when the image is 'blurry'. If still greater than 100 mm, refer to Eye Clinic for verification.

**ATB: READING ALOUD TEST****Background:**

Administer the reading aloud test (RAT) to aviation training applicants as a standardized assessment of an individual's ability to communicate clearly in the English language, in a manner compatible with safe and effective aviation operations. Current communication systems degrade speech intelligibility. The radio environment separates the speaker and the listener from the benefits of watching lips and body language cues. Those with marginal English skills have problems communicating effectively in the operational aviation environment.

Failure of the screening RAT by applicants with English as their native language may indicate undiagnosed or concealed learning disabilities. Administration of the RAT occasionally reveals immature, indecisive, careless, or excessively introverted personalities, which may indicate a high risk for aviation training failure.

When administered to aviation personnel, to include ATC personnel, the RAT will be used to determine the individual's ability to clearly enunciate, in the English language, in a manner compatible with safe and effective aviation operations.

The RAT appears to be a nonsense story, but was designed as a phonetic exercise. Assessment by the flight surgeon is subjective. Applicants should read the RAT clearly, deliberately, without hesitation, error, or stuttering. The test is scored as "RAT-PASS" or "RAT-FAIL." The examining physician will consult with a local instructor pilot or ATC supervisor in questionable cases. Clear failure may warrant evaluation with a speech pathologist for further testing. Any failure requires an AMS for ETP or waiver consideration with pertinent information.

**Procedure:**

Have the examinee stand erect, face the examiner across the room and read aloud, as if he/she were confronting a class of students.

If he/she pauses, even momentarily, on any phrase or word, the examiner immediately and sharply says, "What's that?" and requires the examinee to start again with the first sentence of the test. The true stammerer usually will halt again at the same word or phonetic combination and will often reveal serious stammering.

Have the applicant read aloud as follows:

"You wished to know all about my grandfather. Well, he is nearly 93 years old; he dresses himself in an ancient black frock coat, usually minus several buttons; yet he still thinks as swiftly as ever. A long flowing beard clings to his chin giving those who observe him a pronounced feeling of the utmost respect. When he speaks, his voice is just a bit cracked and quivers a trifle. Twice each day he plays skillfully and with zest upon our small organ. Except in winter when the ooze of snow or ice is present, he slowly takes a short walk each day. We have often urged him to walk more and smoke less, but he always answers, "Banana oil!" Grandfather likes to be modern in his language."

**ATB: VALSALVA MANEUVER**

This is a very simple and quick physical exam technique used to assess gross Eustachian tube function. While the aeromedical provider views the crewmember's tympanic membrane (TM) through an otoscope, the crewmember pinches his nostrils and keeps his mouth closed while exhaling. Since the mouth and nose are closed preventing any air from escaping, the pressure in the nasopharynx increases. If the Eustachian tubes function properly, this increased pressure will open the collapsed Eustachian tubes and this increased pressure will be transmitted to the middle ear cavity. The visible result will be a bulging of the TM during the maneuver. The crewmember will also report he "felt his ears clear." This maneuver is repeated while the FS/APA/AMNP/AME views the contralateral side. Visualization of good TM movement is taken as evidence of good Eustachian tube function.

The crewmember must be coached until he learns this maneuver. One will be surprised how difficult it can be to explain this maneuver to an applicant who has never flown in an airplane and has not had the need to clear his ears previously. Always caution the crewmember to perform the maneuver gently and to stop once he/she feels his ears clear. Too forceful a maneuver could "over inflate" the middle ear cavity and leave the TMs bulging making it impossible to visualize movement of the contralateral TM upon repetition.

Current aeromedical policy requires documentation of the Valsalva on all initial FDMs for all crewmembers except ATC and UAS operators. Clearly, it is most critical to document good function in the pilot applicant. If not seeing good TM movement during the Valsalva maneuver or the applicant states he/she is unable to clear his ears, a tympanogram should be ordered and if necessary, referral to ENT for further evaluation.

## **ATB: ANTHROPOMETRIC MEASUREMENTS & STANDARDS**

*During the initial implementation of AERO, the CGPSC requires the submission of the Coast Guard Anthropometric measurements as well as the Army measurements as described below. After enough data has been collected and analyzed, a single set of anthropometrics will be established.*

### **Coast Guard Anthropometrics:**

Height. Candidates for Class 1 training must also satisfy the following requirements:

- (a) sitting height not less than 33 inches nor more than 40.9 inches. Record in block 73, of the DD-2808 (see figure 1-1 for proper measurement technique);
- (b) sitting eye height (SEH) must be 28.5 inches or greater (see figure 1-2 for proper measurement technique);
- (c) thumb tip reach (TTR) must be 28.5 inches or greater (see figure 1-3 for proper measurement technique);
- (d) sitting eye height + thumb tip reach (SEH + TTR) must be greater than 57.0 inches;
- (e) buttock-knee length (BKL) not less 21 inches nor more than 27.9 inches (see figure 1-4 for proper measurement technique).
- (f) Record to the nearest ¼ inch in block 73, of the DD-2808 as, “BKL\_\_\_\_\_, SEH\_\_\_\_\_, etc.”
- (g) Note: Candidates who meet above standards yet have a TTR of less than 29 inches and/or BKL of less than 22.5 inches may be restricted from assignment to some Coast Guard fleet aircraft.

### **Army Anthropometrics:**

**Crotch Height** (Leg Length) - The subject must stand completely erect against a wall, heels together, weight evenly distributed, and knees locked. The measurement is taken parallel with the wall from the floor to a point where light contact is made with the perineum in the midline.

**Total Arm Reach** - The subject must stand erect against a wall, arms outstretched at a 90 degree angle and parallel with the wall. The elbows must be locked. The fingertips of one hand must be in contact with the adjacent wall in the corner of the room. The horizontal distance between fingertips is recorded.

**Sitting Height** - The subject must sit on a hard, flat surface, facing forward, feet flat on the floor, with buttocks, shoulders, and back of head against the wall. Using a right angle on the head, the distance between the sitting surface and the top of the head is recorded in centimeters.

#### **Measurement**

#### **Class 1/1A, RW/RO**

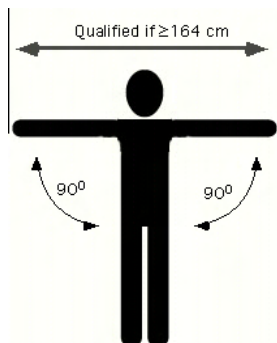
#### **OH-58 Pilot or Aeroscout -**

CROTCH HEIGHT  
TOTAL ARM REACH  
SITTING HEIGHT

*Qualified if:*  
≥ 75.0 cm.  
≥ 164.0 cm.  
≤ 102.0 cm.

*Qualified if*  
≥ 75.0 cm.  
≥ 164.0 cm.  
≤ 95.0 cm.

## Anthropometric Diagrams

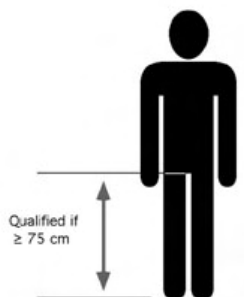
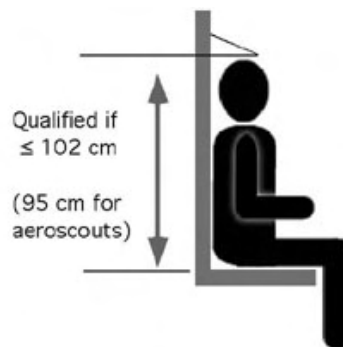


**TOTAL ARM REACH (TAR)**—The aviator candidate must stand erect against a wall, arms outstretched at a 90 degree angle and parallel with the wall. The elbows must be locked with the fingertips of one hand in contact with the adjacent wall in a corner of that room. The horizontal distance between fingertips is recorded in centimeters.

**TAR** \_\_\_\_\_ **cm** (std  $\geq 164$  cm)

**SITTING HEIGHT (SH)**—The aviator candidate must sit on a hard flat surface, facing outward, feet flat on the floor, with the buttocks, shoulders, and back of head against the wall. Using a straight angle ruler on the head, the distance between the sitting surface and the top of the head is recorded in centimeters.

**SH** \_\_\_\_\_ **cm** (std  $\leq 102.0$  cm)



**CROTCH HEIGHT (CH)**—The aviator candidate must stand completely erect against a wall in bare feet, heels together, weight evenly distributed, and knees locked. The measurement is taken parallel with the wall from the floor to a point where light contact is made with the perineum in the midline. Results are recorded in centimeters.

**CH** \_\_\_\_\_ **cm** (std  $> 75$  cm)

# Sitting Height

---

## Purpose

This measurement is important in the design and layout of work stations occupied by Navy personnel. Controls must be placed in numerous locations, and the minimum acceptable space between the helmet and the canopy of cockpits must be considered.

---

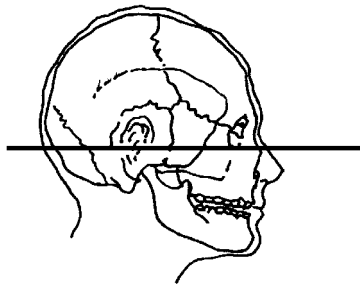
## Equipment Required

Anthropometer

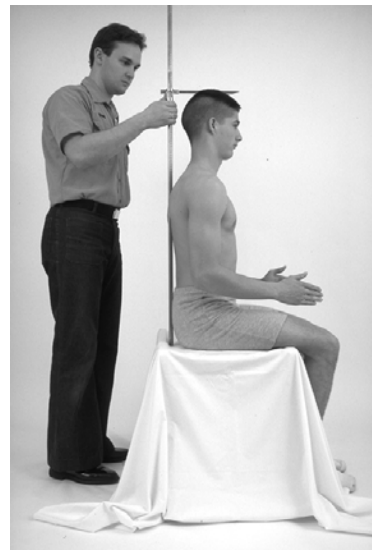
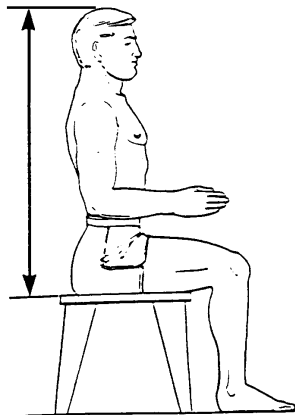
---

## Measurement Procedure

1. The subject sits erect facing forward with the head level (see illustration below), the shoulders and upper arms relaxed, and the forearms and hands extended forward horizontally with the palms facing each other. The thighs are parallel, and the knees are flexed 90° with the feet in line with the thighs.



2. Measure the vertical distance between the sitting surface and the top of the head with an anthropometer. The shoulders and upper extremities should be relaxed. Measure at the maximum point of quiet respiration.



**NOTE:** Measurements are to be taken to the nearest eighth of an inch. The measurement should be taken at least twice. If there is a large variation between the two measurements, recheck the body position and repeat measurements.

# Eye Height, Sitting

---

## Purpose

Sitting Eye Height plays a decisive role in instrument panel layout, viewing angles, and seat adjustment, since the pilot must have optimum vision both inside and outside of the cockpit.

---

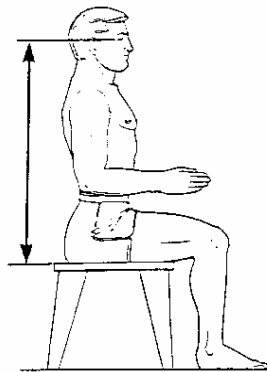
## Equipment Required

Anthropometer

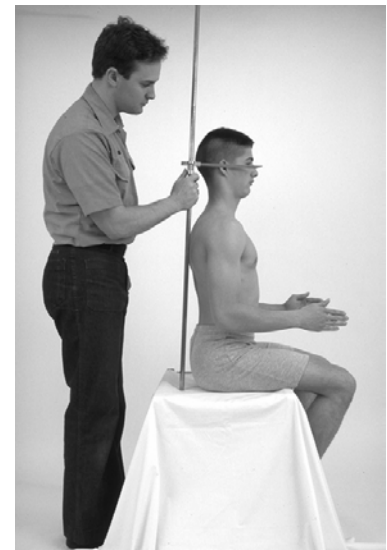
---

## Measurement Procedure

1. The subject sits erect facing forward with the head level (see illustration below), the shoulders and upper arms relaxed, and the forearms and hands extended forward horizontally with the palms facing each other. The thighs are parallel and the knees are flexed 90° with the feet in line with the thighs.



2. Measure the vertical distance between the sitting surface and the corner or angle formed by the meeting of the eyelids on the outer corner of the right eye with an anthropometer.



**NOTE:** Measurements are to be taken to the nearest eighth of an inch. Measurements should be taken at least twice. If there is a large variation between the two measurements, recheck body position and repeat measurements.



# Thumbtip Reach

---

## Purpose

This measurement is important in the design and layout of work stations occupied or used by Navy personnel. Thumbtip reach is particularly useful for the placement of controls in various locations within cockpits.

---

## Equipment Required

Wall--mounted linear scale.

---

## Measurement Procedure

1. The subject stands erect in a corner looking straight ahead with the feet together and heels 7.87 inches (20 cm) from the back wall.
2. With the buttocks and shoulder placed against the wall, the right arm and hand (palm down) are stretched horizontally along the scale while the thumb continues along the horizontal line of the arm with the index finger curving around to touch the pad at end of the thumb.
3. The subject's right shoulder is held against the rear wall. The horizontal distance from the back wall to the tip of the right thumb is measured.



**NOTE 1:** Measurements are to be taken to the nearest eighth of an inch. Measurements should be taken at least twice. If there is a large variation between the two measurements, recheck body position and repeat measurements.

# Buttock-Knee Length

---

## Purpose

This measurement is usually associated with ejection seat clearance and threshold values between the knee and the glare shield (or canopy bow).

---

## Equipment Required

Anthropometer

---

## Measurement Procedure

1. While the subject sits erect, draw a landmark on the bottom tip of the right knee cap. The subject's thighs should be parallel, with the knees flexed at 90°. The feet should be in line with the thighs, and lying flat on the surface of a footrest or the floor.



2. The anthropometer is placed flush against the buttock plate at the most posterior point on either buttock, and the anterior point to the right knee is measured with an anthropometer.

