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Revision _____

NASA CLASS I
MEDICAL EVALUATION AND STANDARDS
FOR
ASTRONAUT SELECTION
(PILOT ASTRONAUT)

PRELIMINARY

LIFE SCIENCES DIRECTORATE

National Aeronautics and Space Administration

LYNDON B. JOHNSON SPACE CENTER

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SECTION I

INTRODUCTION

This document details the medical evaluation and standards to be used by NASA in the process of pilot astronaut selection. The medical evaluation and standards for pilot astronaut selection are described in the following sections:

Section II. "Administrative Considerations" notes the time required to complete the medical examination and the activities of the NASA Space Medicine Review Board for Astronaut Selection (SMRB).

Section III. "Medical Evaluation" covers the medical evaluation required for pilot astronauts selection. In addition to a thorough physical examination, the applicants will be evaluated in regard to their ability to adapt to and work in the null gravity space environment.

The objective of the NASA medical examinations and special testing as applied to the selection of astronauts is twofold: (1) the early detection and prevention of diseases which may interfere with the ability to perform in the capacity of an astronaut; and (2) the evaluation of the applicant's ability to adapt to and perform work in the null gravity space environment. The examination procedures include exercise test, orthostatic tolerance, as well as an evaluation of the vestibular system for determination of motion sickness susceptibility.

Section IV. "Medical Standards" covers those parameters which can be evaluated against a clinically accepted scale.

SECTION II

ADMINISTRATIVE CONSIDERATIONS

The medical evaluation of each applicant for astronaut selection will take approximately 10 days. Each applicant will be notified well in advance (minimum of 30 days) of the medical evaluation by NASA, who will provide the necessary forms, instructions, and data requirements.

All data resulting from the medical evaluations for astronaut selection will be reviewed by the NASA Space Medicine Review Board (SMRB). The SMRB is composed of NASA physicians who are supported as appropriate by consultants. The SMRB will make its recommendations to the Astronaut Selection Board.

Upon request to the SMRB, and in compliance with the Privacy Act, the applicant will be provided with a review of his current health status. Where deviations from the NASA medical selection standards occur, the examining physician will notify the SMRB and arrange a review of the applicant's examination within 10 days. Personnel found to be medically disqualified will be notified by an official letter from the SMRB and advised if further diagnostic and/or therapeutic measures are indicated. All appeals by applicants will be directed to the SMRB for further evaluation and appropriate action.

In case the examining physician recommends disqualification for medical reasons, the applicant may request the SMRB for certification with waiver. Waivers must be approved by the JSC Director of Life

Sciences, and the NASA Director for Life Sciences, NASA Headquarters, Washington, DC.

Medical consultants representing the various medical specialties will be utilized during the medical evaluations. In addition, consultants are available to the SMRB to assist in evaluation of special medical problems. For the purposes of some evaluations to be done in conjunction with selection an appropriate "Consent Form - Human Test Subject" shall be completed prior to the test being performed.

Upon selection, astronauts are expected to fulfill flight certification (FAA or DOD) requirements for their aviation related activities. However, they shall also comply with the following two additional requirements: (1) a complete NASA medical examination to be performed on an annual basis; and (2) appropriate specific flight mission medical evaluations to be detailed in accordance with specific mission requirements.

NASA Medical Boards

Two separate NASA Medical Boards composed of NASA physicians experienced in spaceflight operations and general aviation are responsible for the supervision and implementation of the basic space related medical standards. The functions of each Board are as follows:

a. Space Medicine Review Board - This Board will convene on regular basis at Johnson Space Center, Houston, Texas, and will consist of physicians appointed by the JSC Director of Life Sciences. The primary responsibility of the Space Medicine Review Board is to recommend selection or rejection of applicants and/or

issue of waivers.

b. Space Medicine Policy Board - This Board will convene at least once every calendar year and will consist of physicians appointed by the NASA Director for Life Sciences (NASA Headquarters). The primary responsibilities of the Space Medicine Policy Board are making medical policies and periodic review of the spaceflight related medical standards for currency and relevance.

SECTION III

MEDICAL EVALUATION

1. Objectives

The medical evaluation of astronaut applicants is designed to insure the selection of astronauts with maximum career longevity and to identify those applicants who by current standards can be classified as having unacceptable potential medical risk factors. It also serves as a model against which future astronaut selections can be more effectively conducted.

2. Approach

— SHOULD BE REWRITTEN — BETTER ORGANIZED — LESS REDUNDANT — MORE TO THE POINT.

This section identifies protocols for the medical evaluation of applicants referred to NASA for the position of astronaut. The aero-medical evaluation provides an input to the Medical Boards for the selection of astronauts. The purpose of such a program is to identify potential medical problems which could interfere significantly with the ability of an individual to perform in the capacity of an astronaut. Although it is often not possible to predict pathology, certain predisposing risk factors are contraindications for selection of an applicant.

WHY THIS ??? SEEMS REDUNDANT.

The NASA screening procedure emphasizes the predictability of the occurrence of future disqualifying diseases. For this reason, a number of blood studies recently developed and other well-known assays are included in this document. Subspecialty evaluations of the applicants have the same emphasis. Thus, the dental, otorhinolaryngologic, and ophthalmologic evaluations look for specific clues to a potentially

acute or incapacitating disorder. The psychiatric evaluation, including clinical psychological testing, identifies those applicants most likely to perform effectively under the stresses of spaceflight and to establish productive relationships with their supervisors, peers, and subordinates. The general medical evaluation and physical examinations search for obvious or subtle indications of any clinical, subclinical, or latent pathological process.

Although it is true that an effective screening protocol should have both a high degree of specificity and sensitivity, it will be noted that, as in daily medical practice, many procedures do not have clearly defined predictive boundaries. However, when viewed in light of the overall medical evaluation, they provide valuable clues to overall health, physical condition, and potential performance as well as diagnostic information.

3. Implementation

Each applicant will be supplied in advance with Medical Forms 88 and 93 to be completed and mailed directly to the SMRB, together with a release of all past medical records, at least 90 days prior to the scheduled selection process. On the basis of provided information the SMRB will make preliminary recommendations on the medical status of each applicant to the Astronaut Selection Board.

Applicants found to be qualified to undergo the NASA medical evaluation and testing will be supplied with a survey questionnaire in advance. Each applicant will be assigned a specific schedule for examination. Instructions will be given in advance regarding activities prior to and

during the examination period. On the first day the applicant will be given a general medical interview and physical examination. A detailed series of evaluations will follow during the next few days.

The components of the selection protocol are as follows:

a. NASA Medical Survey

The completed NASA Medical Survey will be made available to the examiner at least one week prior to the scheduled examination date. The questionnaire covers the following areas:

(1) General background information

(2) Family history

(3) Habits

(4) Military and aviation history

(5) Review of systems

b. General history and physical examination

c. Laboratory

(1) HEMATOLOGY

WBC/Diff	Hemoglobin
RBC/Indices	Hematocrit
Reticulocyte count	Hemoglobin electrophoresis
Platelets	Blood Group

(2) COAGULATION PROFILE

Clotting time
Prothrombin time
Partial thromboplastin time (Activated)
Fibrinogen level

(3) BLOOD CHEMISTRY

Fasting glucose	Calcium
BUN	Phosphorus
Creatinine	Uric Acid
Sodium	Bilirubin
Potassium	SGOT
Chloride	SGPT
CO_2 combining power	CPK
Albumin	Alkaline Phosphatase
Total protein	LDH (isoenzymes)
Cholesterol	Triglycerides

(4) URINE

Urinalysis including S.G., pH, bile, wbc's, casts, protein, sugar, acetone, blood.
24-hour collection for creatinine clearance and endocrine assays.

(5) STOOL

3 specimens
~~1~~ specimen for occult blood
Morphological, and parasite studies
Screen test for stool fat

(6) OTHER TESTS

VDRL
Erythrocyte sedimentation rate (ESR)
Protein electrophoresis
Immunoglobulin electrophoresis
Fluorescent anti-nuclear antibody (ANA)
Australia antigen

Drug screen urine and blood
Purified protein derivative skin test (PPD), intermediate strength (5 TU) if indicated
Other skin tests: histoplasmin, coccidioidin, blastomycin

(7) ENDOCRINE ASSAYS

Serum T_3, T_4
Plasma renin, angiotensin I, and cortisol
3-hour GTT after three days of 300 GM carbohydrate diet, insulin level
24-hour urine collection for calcium and phosphorus
24-hour urine collection of 17-KS, 17-OHKS, aldosterone, testosterone, and estrogen
Pregnancy test*

*This test will be obtained on the first day of examination.

(8) RADIOLOGY EVALUATION

Dental	Cervical spine
Chest film (PA and left lateral)	Oral Cholecystogram
Sinus films	Upper GI
Abdominal film (KUB)	Lower GI

KARIOTYPING - BASELINE GENETIC STUDIES

POSSIBLE SPERM COUNT.

d. DENTAL EVALUATION

Clinical examination of oral structures supplemented by a complete series of dental radiographs. All existing restorations, fixed and removable partial dentures will be evaluated. Emphasis is directed toward those conditions which may elicit painful manifestations.

e. OTORHINOLARYNGOLOGY EVALUATION

History and examination with supplemental data from sinus X-rays. Tests also include audiometry and special vestibular function.

f. OPHTHALMOLOGY EVALUATION

History and examination with specialty tests to include visual acuity, color vision, depth perception, phorias, tonometry, perimetry, fundoscopic examination, and photographic imaging as indicated.

g. NEUROLOGICAL EVALUATION

History and physical examination with specialty tests including EEG at rest, with photic stimulation, hyperventilation, valsalva maneuver, sleep, and vestibular test (cupulogram).

h. PSYCHIATRIC AND PSYCHOLOGICAL EVALUATION

Emphasis is placed on interpersonal relationships: the ability of crewmembers to form satisfactory and productive relationship with supervisors, peers, and subordinates; the capacity to function as a team member in various roles. Specialty test includes psychological testing and follow-up psychiatric interviews.

i. ENDOCRINE EVALUATION

History and physical examination. Specialty studies include various endocrine assays as specified

j. CARDIOPULMONARY EVALUATION

History and physical examination. In addition to the laboratory data specialty tests in this area will include: (i) pulmonary functions tests; (ii) maximal treadmill test; (iii) LBNP; (iv) ECG monitoring during a continuous 24-hour period.

k. GASTRO INTESTINAL EVALUATION

History and physical examination with supplemental information from various laboratory data.

l. RADIATION EXPOSURE EVALUATION

A radiation safety officer will interview the candidates and review the available past medical records for a complete radiation exposure history.

J COLLECT BASELINE DATA FOR LONG TERM POST FLIGHT FOLLOW UP FOR DETECTION OF POSSIBLE DELAYED EFFECTS FROM LOW DOSE EXPOSURES.

SECTION IV

MEDICAL STANDARDS

General

This section consists of the NASA standards adopted for the physical examination and procedures described in Section III, Medical Standards.

A. HEAD, FACE, AND NECK

Causes for rejection include:

1. Head injury or history of head injury (see A-13. Neurological Disorders).

2. Deformities of the skull, such as depressions or exostoses, which will interfere with wearing headgear.

3. Deformities of the skull of any degree associated with evidence of disease of the brain, spinal cord, or peripheral nerves.

4. Loss or congenital absence of bony substance of the skull.

5. All deformities (e.g., benign tumors, large birthmarks, large hairy moles, extensive scars or mutilations due to injuries or surgery, ulcerations, fistulae, and atrophy or paralysis of part of the face or head) which interfere with performance or wearing of equipment.

6. Chronic arthritis, complete or partial ankylosis, or recurrent dislocation of the temporomandibular joint.

7. Unrepairable congenital branchial cleft or thyroglossal duct cysts with or without fistulous tracts.

8. Chronic draining fistulae of the neck, regardless of cause.

9. Cervical lymphadenopathy of other than benign origin. Any benign tumors, if the enlargement is of such degree as to interfere with wearing of flight equipment.

10. Spastic contractions of the muscles of the neck, if persistent or chronic.

11. Nonspastic contraction of the muscles or contracted scars of the neck if there is interference with the wearing of equipment.

12. Cervical ribs, if there is a history of symptoms, or if symptoms or signs of arterial compression at the level of the thoracic outlet can be produced by hyperabduction, scalenus, and costoclavicular maneuvers.

B. NOSE, SINUSES, MOUTH, AND THROAT

Causes for rejection include:

1. Deformities, injuries, or destructive diseases of the mouth, nose, throat, pharynx, or larynx which interfere with breathing, with speech, or with mastication and swallowing of ordinary food.

2. Deviation of the nasal septum, enlarged turbinates, or other obstructions to ventilation which significantly embarrass nasal breathing, or which can be expected to require frequent or prolonged medical treatment.

3. Allergic rhinitis or vasomotor rhinitis, unless asymptomatic since puberty.

4. Atrophic rhinitis.

5. Perforation of the nasal septum, if a manifestation of organic disease, or progressive, or if respiration is accompanied by a whistling sound.

6. Nasal polyps or a history of nasal polyps, unless surgery was performed at least a year prior to examination, and there is no evidence of recurrence.

7. Anosmia or parosmia.

8. Acute upper respiratory infections or acute sinusitis, until recovered.

9. Chronic sinusitis. OR THE PRESENCE OF CLEARLY PREDISPOSING FACTORS (IMPAIRMENT OF DRAINAGE, INTRINSIC ALLERGY, etc.)

10. Harelip, unless satisfactorily repaired.

11. Loss of the whole or a large part of either lip, or mutilations of the lips from wounds, burns, or disease.

12. Partial loss, atrophy, hypertrophy, or other malformations of the tongue, if these conditions interfere with mastication, speech, or swallowing, or appear to be progressive.

13. Benign tumors of the tongue that interfere with function.

14. Marked stomatitis, leukoplakia, or ulcerations of the mouth.

15. Ranula, if extensive.

16. Salivary fistula.

17. Ulcerations, perforation, or extensive loss of substance of the hard or soft palate; extensive adhesions of the soft palate to the pharynx; or complete paralysis of the soft palate. Unilateral paralysis of the soft palate which does not interfere with speech or swallowing and is otherwise asymptomatic is not disqualifying OF ITSELF. Loss of the uvula which does not interfere with speech or swallowing is not disqualifying.

18. Chronic enlargement of the tonsils which interferes with speech or swallowing.

19. Adenoid hypertrophy which interferes with breathing or is associated with recurrent otitis media.

20. Chronic laryngitis.

21. Paralysis of either vocal cord.

22. Aphonia.

23. Functional tracheostomy or tracheal fistula.

24. Any surgical procedure involving the nose, sinuses, mouth, or throat, until recovery is complete and the structures are again functionally normal.

25. Recurrent calculi of any salivary gland or duct.

26. History of repeated hemorrhage from the nasopharynx unless benign lesion is identified and eradicated.

27. Occlusion of one or both Eustachian tubes which prevents normal ventilation of the middle ear.

28. History of recurrent laryngitis or hoarseness.

29. A history of recurrent aphonia or a single attack if the cause was such as to make subsequent attacks probable.

C. EARS

Causes for rejection include:

1. Agenesis or marked deformity of the auricle.

2. Atresia or severe stenosis of the external auditory canal, or tumors of the canal, except small exostoses.

3. Symptomatic external otitis, acute or chronic.

4. Mastoiditis, acute or chronic, or mastoid fistula.

5. Residual of mastoid surgery if there is marked external deformity which interferes with wearing of flight equipment.

6. Acute or chronic otitis media: suppurative or serous.

7. Persistent perforation of the tympanic membrane.

8. Adhesive otitis media associated with a 20 decibel or more hearing loss in either ear regardless of the hearing level in the other ear.

9. Meniere's syndrome.

10. History of surgery involving the middle ear, excluding myringotomy.

11. History of radical or modified radical mastoidectomy.

12. History or presence of abnormal labyrinthine function.

13. History of attacks of vertigo with or without symptoms.

14. Severe ear drum retraction.

15. Impacted cerumen until removed.

16. Postauricular fistula.

17. Recurrent or persistent tinnitus.

18. Tympanoplasty.

19. Hearing standards: maximum loss at the following decibel levels. (No more than a total of 260 dB loss for both ears at 3000, 4000, and 6000 Hz permitted.)

500	1000	2000 Hz	
30	25	25 dB	(International Standards Organization 1964)

20. Simple mastoidectomy until recovery is complete and the ear is functionally normal.

21. Scars or calcareous plaques which involve more than 50 percent of the pars tensa when associated with loss of auditory acuity or with immobility of the tympanic membrane.

22. Any infectious process of the ear until completely healed.

23. Any surgical procedure until healing is complete and the ear is functionally normal.

24. Occlusion or obstruction of the Eustachian tube.

25. Inability to perform Valsalva maneuver.

26. Tinnitus when associated with active disease (individual evaluation).

27. Any disease of the ear with subjective or objective evidence of residuals that interfere with the auditory or vestibular functions.

D. EYES

Causes for rejection include:

1. Lids:

a. Ingrowing eyelashes.

b. Destruction of the lids sufficient to impair protection of the eye from exposure.

c. Disfiguring scars and adhesions of the lids to each other or to the eyeball.

d. Blepharitis, chonic, unless mild and considered by the examiner unlikely to interfere with the performance of duty.

e. Blepharospasm.

f. Ptosis that interferes with vision.

g. Inversion or eversion of the eyelids.

h. Lagophthalmos.

i. Growths or tumors of the eyelid, except small, asymptomatic, and nonprogressive benign lesions.

j. Dacyrocystitis, acute or chronic.

k. Epiphora.

2. Conjunctiva:

a. Conjunctivitis, acute until recovered.

b. Conjunctivitis, chronic, including vernal catarrh.

c. Trachoma, unless healed without scarring.

d. Xerophthalmia.

e. Pterygium that enroaches on the cornea more than 3 mm, interferes with vision, or is progressive (as evidenced by marked vascularity or a thick elevated head). THEY ARE ALL PROGRESSIVE.

3. Cornea:

a. Keratitis, acute or chronic.

b. Corneal ulcer, history of recurrent corneal ulcers or corneal abrasions (including herpetic ulcers).

c. Vascularization or opacification of the cornea from any cause when it is progressive or interferes with vision.

d. Corneal dystrophy of any type, including keratoconus of any degree.

4. Inflammation of the uveal tract (iris, ciliary body, choroid), acute, chronic, or recurrent, or its residuals.

5. Retina:

a. History of detachment of the retina.

b. Degenerations of the retina, to include macular cysts, holes, and other degenerations (hereditary or acquired), and other conditions affecting the macula. All types of pigmentary degenerations (primary and secondary).

c. Retinitis or other inflammatory conditions of the retina.

d. Chorioretinitis, unless healed and not interfering with vision.

6. Optic nerve:

a. Optic neuritis, neuroretinitis, or a documented history of retrobulbar neuritis.

b. Optic atrophy (primary or secondary).

c. Papilledema.

7. Lens:

a. Aphakia, unilateral or bilateral.

b. Dislocation of a lens, partial or complete.

c. Opacities of the lens that interfere with vision or are considered to be progressive.

8. Other defects and disorders:

a. Asthenopia, if severe.

b. Tumors of the eye or orbit.

c. Exophthalmos, unilateral or bilateral.

d. Nystagmus.

e. Diplopia.

f. Hemianopsia.

g. Loss of normal pupillary reflexes. — EXCEPTIONS: ARGYL ROBERTSON PUPIL & HIPPUS

h. Retained intraocular foreign body.

i. Absence of an eye.

j. Anophthalmos or microphthalmus.

k. Any organic or congenital disorder of the eye or adnexa, not specified above, which threatens to impair visual function.

l. Coloboma of the choroid or iris.

9. Visual acuity and refraction:

a. Distant vision, uncorrected vision less than 20/50 each eye, corrected to 20/20 each eye.

b. Near vision, correctable to 20/20 each eye.

c. Refractive error:

(1) Refractive error of more than +1.75 or -0.25 diopters in any meridian.

(2) Astigmatism requiring more than 0.75 diopters of cylinder.

(3) Optional or required use of contact lenses.

d. Accommodative power, near point of accommodation less than the minimum for the age as given below:

Age	Diopters
17	8.8
18	8.6
19	8.4
20	8.1
21	7.9
22	7.7
23	7.5
24	7.2
25	6.9
26	6.7

(Cont.)	Age	Diopters
	27	6.5
	28	6.2
	29	6.0
	30	5.7
	31	5.4
	32	5.1
	33	4.9
	34	4.6
	35	4.3
	36	4.0
	37	3.7
	38	3.4
	39	3.1
	40	2.8
	41	2.4
	42	2.0
	43	1.5
	44	1.0
	45	.6

10. Visual fields:

a. Changes in the visual fields that significantly interfere with binocular visual function.

b. Contraction of the normal visual field in either eye of 15° or more in any meridian.

c. Any demonstrable scotoma other than physiologic.

11. Heterophoria:

a. Esophoria greater than 10-prism diopters.

b. Exophoria greater than 5-prism diopters.

c. Hyperphoria greater than 1.5-prism diopters.

d. Heterotropia.

e. Point of convergence (PC) greater than 70 mm.

f. Paralysis of ocular motion in any direction.

g. Absence of conjugate alignment in any quadrant.

h. Inability to converge on a near object.

i. Any diplopia or suppression in the red lens test which develops within 20 inches from the center of the screen in any of six cardinal directions. Failure of this test in the absence of other eye defects or disorders is not necessarily disqualifying. However, failure of this test should be cause for a complete evaluation of ocular mobility and motility by a qualified ophthalmologist with an opinion as to the reason for the failure.

12. Depth perception:

a. Any error in groups B, C, or D when using the VTA-ND.

b. When using the Verhoeff depth perception apparatus, DPA-V, and error in eight presentations during the first trial, or any error during a second or third trial if required.

c. Average error greater than 30 mm, using the Howard-Dolman apparatus (DPA-HD).

13. Unsatisfactory night vision as determined by history and confirmed by test.

14. Color vision: five or more incorrect responses including failures to make responses in reading the 14 test charts of the standard color vision test set (VTS-CV) unless the examinee makes a score of 50 or better on the color threshold tester (VTA-CTT).

15. Intraocular tension: glaucoma (as defined by tension above 30 mm Hg or the secondary changes in the optic disk or visual field associated with glaucoma) and preglaucoma as defined by the following: two or more determinations of 22 mm Hg, or higher, or a difference of more than 4 mm Hg between the tension in the two eyes may represent "preglaucoma" and warrants a thorough evaluation.

E. LUNGS AND CHEST

Causes for rejection include:

1. History of active pulmonary tuberculosis within the preceding five years.

2. Known tuberculous pleurisy or pleurisy of unknown etiology with positive tuberculin test or documented conversion of the tuberculin test, unless treated with antituberculous drugs for at least one year and subsequently inactive for at least two years.

3. Pleurisy with effusion of unknown etiology within the preceding five years, unless PPD intermediate strength is currently negative on at least two trials.

4. History of spontaneous pneumothorax.

5. Chronic bronchitis or pulmonary emphysema with evidence of disturbance of pulmonary function.

6. Bronchiectasis unless cured by surgical treatment, when recovery is complete, pulmonary function is normal, and hypobaric chamber flight has been successfully completed.

7. Asthma of any degree or a history of asthma, except a history of childhood asthma with a trustworthy history of complete freedom from symptoms since puberty.

8. Any pulmonary blebs or bullae.

9. Cystic disease of the lung.

10. Silicosis, suspected silicosis, or severe pulmonary fibrosis with impairment manifested by abnormal pulmonary function tests.

11. Abscess of the lung.

12. Chronic mycotic infection of the lung such as coccidioidomycosis, histoplasmosis, or blastomycosis. Residuals of infection, including cavitation, are disqualifying, except for scattered nodular parenchymal and hilar calcifications.

13. Foreign body in the trachea, bronchus, or lung.

14. Chronic adhesive (fibrous) pleuritis that produces any findings except minimal blunting of the costophrenic angles.

15. History of lobectomy or multiple segmental resections if there is significant reduction of vital capacity, timed vital capacity, or maximum breathing capacity, or if there is residual pulmonary pathology. Removal of more than one lobe is cause for rejection, regardless of the absence of residual.

16. History of intrathoracic surgery until recovery is complete, as indicated by normal pulmonary function studies and clinical absence of residual disability. A record of pulmonary function studies before intrathoracic surgery serves as a useful baseline for comparison with postoperative studies.

17. Any tumor, benign or malignant, of the trachea, bronchi, lungs, pleura, or mediastinum. (History of surgery for benign lesions is not necessarily disqualifying.)

18. Any malignant tumor of the breast or chest wall.

19. Suppurative periostitis, osteomyelitis, caries, or necrosis of the ribs, sternum, clavicle, scapulae, or vertebrae.

20. Benign tumor of the breast or chest wall of such a size or location as to interfere with the wearing of equipment or protective clothing.

21. Congenital malformation or acquired deformities that reduce the chest capacity or diminish respiratory or cardiac functions to a degree that interferes with vigorous physical exertion or wearing of equipment or protective clothing.

22. Acute mastitis or chronic cystic mastitis, if more than mild or symptomatic.

23. Mastectomy other than for benign causes and which does not interfere with the wearing of equipment or protective clothing.

24. History of pulmonary embolus.

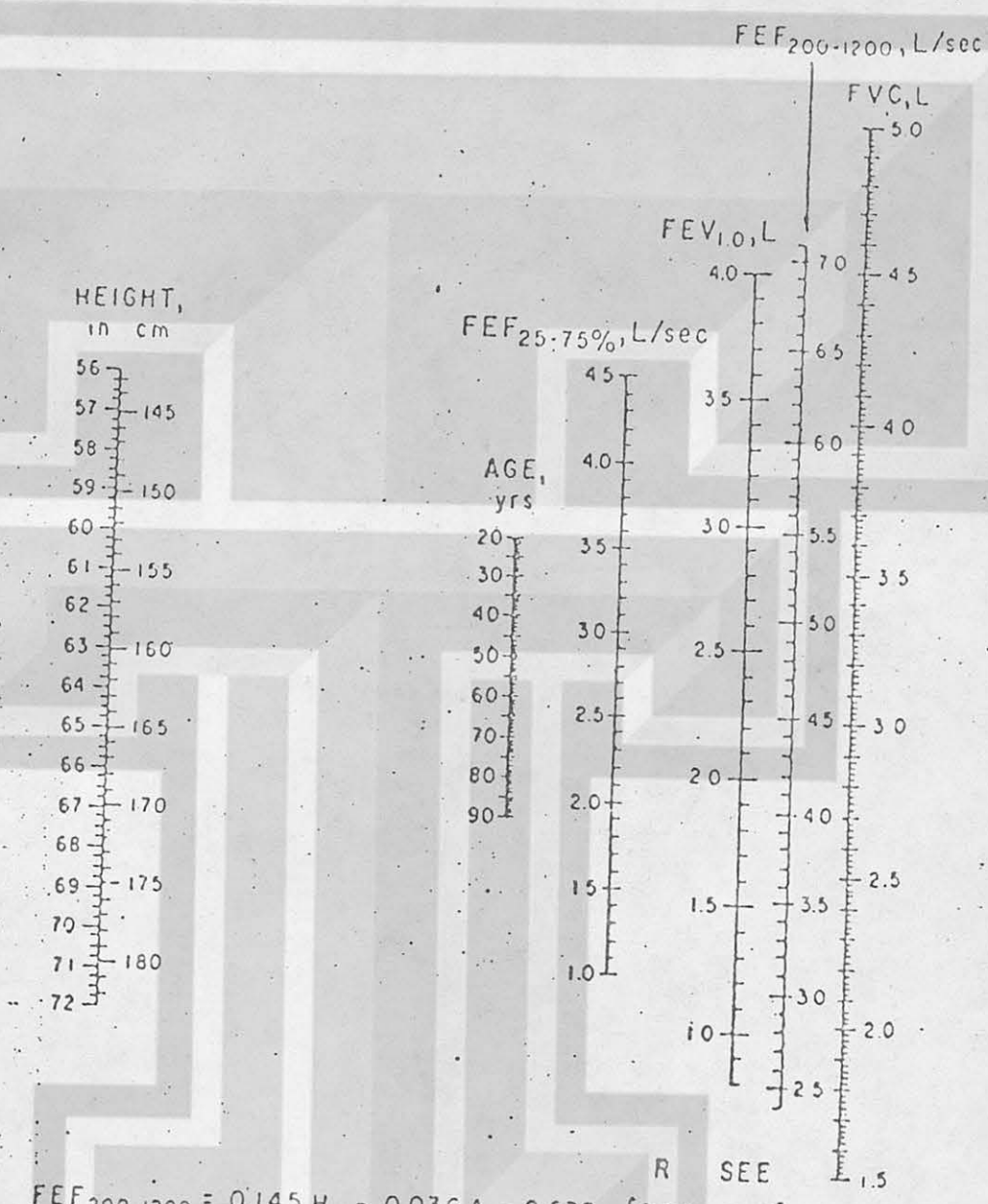
25. Old fractures of ribs with faulty union which interferes with function.

26. Empyema or residual sacculation of unhealed sinuses of the chest wall following surgical intervention.

27. Tracheoesophageal fistula.

28. The pulmonary function tests will consist of static and dynamic lung volumes (VC, RV, FEV, Flow Volume). If any of the pulmonary function tests is found to be less than 85% of the predicted value for sex, age, height, and weight, upon the acceptance of the SMRB the applicant shall undergo a thorough pulmonary evaluation. Spirometric standards as described by J. F. Morris, A. Koski, and L. C. Johnson in "Respiratory Disease," 1971; Vol. 103, pp 57-67, are as follows:

NORMAL FEMALES



		R	SEE
$FEF_{200\ 1200}$	$= 0.145\ H_{in} - 0.036\ A - 2.532$	[0.53	1.19]
$FEF_{25-75\%}$	$= 0.060\ H_{in} - 0.030\ A + 0.551$	[0.56	0.80]
$FEV_{1.0sec}$	$= 0.089\ H_{in} - 0.025\ A - 1.932$	[0.73	0.47]
FVC	$= 0.115\ H_{in} - 0.024\ A - 2.852$	[0.71	0.52]

Spirometric Standards (Continued)

Predicted Values for Pulmonary Function Tests: Men

1 Ht (cm)	2 Age (yrs)	3 VC	4 FRC	5 RV	6 TLC	7 $FEV_{.75}$ ×40 (l/min)	8 $FEV_{1.0}$ liters	9 MMFR (l/sec)	10 D_{CO} SS	11 $F_{I_{CO}}-F_{E_{CO}}$ / $F_{I_{CO}}$	12 D_{CO} SB	13 ME[illegible]
155	20	3.97	2.72	1.13	5.10	136	3.6	4.3	23.8	.56	26.7	70
	30	3.65	2.72	1.30	4.95	121	3.3	3.9	21.0	.52	23.7	65
	40	3.35	2.72	1.45	4.80	106	3.0	3.5	18.2	.49	20.7	60
	50	3.04	2.72	1.61	4.65	91	2.7	3.1	15.4	.45	17.7	55
	60	2.73	2.72	1.77	4.50	76	2.4	2.7	12.6	.42	14.7	50
	70	2.42	2.72	1.91	4.35	61	2.1	2.3	9.8	.39	11.7	45
160	20	4.30	2.98	1.27	5.57	141	3.8	4.4	24.1	.55	29.0	70
	30	4.00	2.98	1.42	5.42	126	3.5	4.0	21.3	.52	26.0	65
	40	3.70	2.98	1.57	5.27	111	3.2	3.6	18.6	.48	23.0	60
	50	3.40	2.98	1.72	5.12	96	2.8	3.2	15.8	.45	20.0	55
	60	3.10	2.98	1.87	4.97	81	2.5	2.8	13.0	.41	17.0	50
	70	2.80	2.98	2.02	4.82	65	2.2	2.4	10.1	.39	14.0	45
165	20	4.62	3.23	1.42	6.04	145	3.9	4.5	24.5	.55	31.3	70
	30	4.32	3.23	1.57	5.89	130	3.7	4.1	21.7	.52	28.3	65
	40	4.02	3.23	1.72	5.74	115	3.3	3.7	18.9	.48	25.3	60
	50	3.72	3.23	1.87	5.59	100	3.0	3.3	16.1	.44	22.3	55
	60	3.42	3.23	2.02	5.44	85	2.7	2.9	13.3	.42	19.3	50
	70	3.12	3.23	2.17	5.29	70	2.4	2.5	10.6	.38	16.3	45
170	20	4.94	3.48	1.57	6.51	150	4.1	4.6	24.9	.54	33.6	70
	30	4.64	3.48	1.72	6.36	135	3.8	4.2	22.1	.50	30.6	65
	40	4.35	3.48	1.86	6.21	120	3.5	3.8	19.3	.47	27.6	60
	50	4.05	3.48	2.01	6.06	105	3.2	3.4	16.5	.43	24.6	55
	60	3.74	3.48	2.17	5.91	90	2.9	3.0	13.7	.40	21.6	50
	70	3.44	3.48	2.32	5.76	75	2.6	2.6	10.9	.37	18.6	45
175	20	5.26	3.74	1.72	6.98	155	4.3	4.7	25.2	.53	35.8	70
	30	4.96	3.74	1.87	6.83	140	4.0	4.3	22.4	.50	32.8	65
	40	4.66	3.74	2.02	6.68	124	3.7	3.9	19.6	.47	29.9	60
	50	4.36	3.74	2.17	6.53	110	3.4	3.5	16.9	.43	26.9	55
	60	4.06	3.74	2.32	6.38	94	3.1	3.1	14.1	.39	23.9	50
	70	3.76	3.74	2.47	6.23	79	2.8	2.7	11.3	.36	20.9	45
180	20	5.58	3.99	1.87	7.45	159	4.5	4.8	25.6	.52	38.1	70
	30	5.28	3.99	2.02	7.30	145	4.2	4.4	22.8	.49	35.1	65
	40	4.98	3.99	2.17	7.15	129	3.9	4.0	20.0	.46	32.1	60
	50	4.68	3.99	2.32	7.00	114	3.6	3.6	17.2	.42	29.2	55
	60	4.38	3.99	2.47	6.85	99	3.3	3.2	14.2	.39	26.2	50
	70	4.08	3.99	2.62	6.70	83	2.9	2.8	11.6	.35	23.2	45
185	20	5.90	4.25	2.02	7.92	163	4.7	4.9	25.9	.53	40.4	70
	30	5.60	4.25	2.17	7.77	148	4.3	4.5	23.2	.48	37.4	65
	40	5.30	4.25	2.32	7.62	133	4.1	4.1	20.4	.46	34.4	60
	50	5.00	4.25	2.47	7.47	118	3.7	3.7	17.6	.42	31.4	55
	60	4.70	4.25	2.62	7.32	103	3.5	3.3	14.8	.38	28.4	50
	70	4.40	4.25	2.77	7.17	88	3.1	2.9	12.0	.35	25.5	45

PREDICTED VALUES FOR PULMONARY FUNCTION TESTS: WOMEN

1 HT (cm)	2 AGE (yrs)	3 VC	4 FRC	5 RV	6 TLC	7 $FEV_{1.0}$ ×40 (l/min)	8 $FEV_{1.0}$ LITERS	9 MMER (l/sec)	10 D_L SS	11 F_{25}–F_{75} F_{25}	12 D_L SB	13 MEF
145	20	2.81	1.96	1.00	3.81	88	2.6	3.6	20.7	.58	19.5	70
	30	2.63	1.96	1.08	3.71	80	2.4	3.3	18.2	.55	16.9	65
	40	2.45	1.96	1.16	3.61	72	2.1	2.9	15.7	.51	14.2	60
	50	2.27	1.96	1.24	3.51	64	1.9	2.5	13.2	.48	11.7	55
	60	2.09	1.96	1.32	3.41	56	1.5	2.2	10.7	.44	9.0	50
	70	1.91	1.96	1.40	3.31	48	1.4	1.8	8.2	.41	6.4	45
150	20	3.08	2.20	1.05	4.13	92	2.7	3.7	21.1	.57	21.7	70
	30	2.89	2.20	1.14	4.03	84	2.5	3.3	18.6	.54	19.1	65
	40	2.71	2.20	1.22	3.93	76	2.2	3.0	16.0	.51	16.4	60
	50	2.53	2.20	1.30	3.83	67	2.0	2.6	13.5	.47	13.7	55
	60	2.35	2.20	1.38	3.73	60	1.6	2.3	11.0	.43	11.1	50
	70	2.17	2.20	1.46	3.63	52	1.5	1.9	8.5	.40	8.5	45
155	20	3.34	2.43	1.19	4.53	95	2.8	3.8	21.5	.56	23.9	70
	30	3.15	2.43	1.28	4.43	88	2.6	3.4	18.9	.52	21.2	65
	40	2.97	2.43	1.36	4.33	79	2.4	3.1	16.4	.49	18.5	60
	50	2.79	2.43	1.44	4.23	71	2.1	2.7	13.9	.45	15.8	55
	60	2.61	2.43	1.52	4.13	63	1.7	2.3	11.4	.42	13.1	50
	70	2.43	2.43	1.60	4.03	55	1.6	2.0	8.9	.39	10.5	45
160	20	3.60	2.67	1.32	4.92	99	2.9	3.9	21.9	.55	26.0	70
	30	3.41	2.67	1.41	4.82	91	2.7	3.5	19.4	.52	23.3	65
	40	3.22	2.67	1.50	4.72	83	2.5	3.2	16.8	.48	20.6	60
	50	3.05	2.67	1.57	4.62	75	2.2	2.8	14.3	.45	17.9	55
	60	2.87	2.67	1.65	4.52	67	1.8	2.4	11.8	.41	15.2	50
	70	2.69	2.67	1.73	4.42	59	1.7	2.1	9.2	.39	12.5	45
165	20	3.88	2.90	1.44	5.32	103	3.1	4.0	22.2	.55	28.1	70
	30	3.68	2.90	1.54	5.22	95	2.8	3.6	19.7	.52	25.4	65
	40	3.50	2.90	1.62	5.12	87	2.6	3.3	17.2	.48	22.7	60
	50	3.32	2.90	1.70	5.02	79	2.3	2.9	14.6	.44	20.0	55
	60	3.14	2.90	1.78	4.92	71	1.9	2.5	12.1	.42	17.3	50
	70	2.96	2.90	1.86	4.82	63	1.8	2.2	9.6	.38	14.6	45
170	20	4.13	3.14	1.58	5.71	107	3.2	4.1	22.6	.54	30.3	70
	30	3.94	3.14	1.67	5.61	99	2.9	3.7	20.1	.50	27.6	65
	40	3.76	3.14	1.75	5.51	90	2.7	3.3	17.5	.47	24.9	60
	50	3.58	3.14	1.83	5.41	82	2.4	3.0	15.0	.43	22.2	55
	60	3.40	3.14	1.91	5.31	74	2.0	2.6	12.5	.40	19.5	50
	70	3.22	3.14	1.99	5.21	66	1.9	2.3	9.9	.37	16.8	45
175	20	4.38	3.37	1.80	6.18	111	3.3	4.1	22.7	.53	32.3	70
	30	4.20	3.37	1.90	6.10	102	3.0	3.8	20.0	.50	29.6	65
	40	4.02	3.37	2.00	6.02	94	2.8	3.4	17.7	.47	26.9	60
	50	3.84	3.37	2.10	5.94	86	2.5	3.1	15.2	.43	24.2	55
	60	3.66	3.37	2.20	5.86	78	2.1	2.7	12.7	.38	21.5	50
	70	3.38	3.37	2.40	5.78	70	2.0	2.3	10.2	.36	18.8	45

REFERENCES FOR PREDICTED VALUES FOR PULMONARY FUNCTION:

N.B. Subdivisions of lung volume were measured in seated subjects.
Ventilatory tests were performed with subjects standing.
Diffusing capacity tests were performed on seated subjects.

--- Values in Columns 3 to 7 are from Goldman, H. I. and Becklake, M. R.: Respiratory function tests: Normal values of median altitudes and the prediction of normal results. Am. Rev. Tuberc. 79:457, 1959.

--- Values in Column 8 are from Ferris, B. G., Jr., Anderson, D. O., and Zickmantel, R.: Prediction values for screening tests of pulmonary function. Am. Rev. Resp. Dis. 91:252, 1965.

--- Values in Column 9 are from Leuallen, E. C., and Fowler, W. S.: Maximal and mid-expiratory flow. Am. Rev. Tuberc. 72:783, 1955.

--- Values in Column 10 are corrected for smaller FRC in women and calculated from data for men.

--- Values in Column 12 calculated from McGrath, M. W., and Thomson, M. J.: The effect of age, body size and lung volume change on alveolar-capillary permeability and diffusing capacity in man, in which DL_{CO} SB is calculated using the residual volume measured from the single-breath helium dilution. J. Physiol. (London) 146:572, 1959.

--- Column 13 refers to the closed-circuit helium index, Bates, D. V., Woolf, C. R. and Paul, G. I.: Chronic bronchitis. A report on the first two stages of the co-ordinated study of chronic bronchitis in the Dept. of V.A. Affairs, Canada. Med. Serv. J. Canada 18:211, 1962.

F. CARDIOVASCULAR

Causes for rejection include:

1. Any degree of circulatory failure from any cause.

2. Pathologic hypertrophy or dilatation of the heart evidenced by clinical evaluation, X-ray findings, and supported by electrocardiographic examination.

3. Persistent tachycardia with a resting pulse rate of more than 100, unless the examiner determines that the cause is a psychic reaction and not due to any disease condition.

4. Elevated blood pressure (measured in the recumbent position) evidenced by preponderant systolic pressure of 140 mm Hg or greater and/or preponderant diastolic pressures of more than 90 mm Hg, regardless of age.

5. Hypotension, including orthostatic,

unless there are no associated symptoms and a complete evaluation reveals no abnormalities.

6. Pericarditis, myocarditis, or endocarditis, or history of these conditions. History of a single acute idiopathic or Coxsackie pericarditis with no residuals is not disqualifying after six months.

7. History or findings of major congenital abnormalities of the heart and vessels. Uncomplicated dextrocardia and other minor asymptomatic abnormalities may be acceptable.

8. Any evidence of coronary heart disease.

9. Evidence of cardiac arrhythmia, conduction defect or any other electrocardiographic abnormality unless proven to be of a benign nature.

10. History of recurrent thrombophlebitis or thrombophlebitis with persistent thrombus, evidence of circulatory [illegible]

11. Varicose veins, if more than mild in degree, or if associated with edema, skin ulceration, or scars from previous ulceration.

12. Peripheral vascular disease unless proven to be of a benign nature.

13. Neurocirculatory asthenia (effort syndrome).

14. Cardiac tumors of any type.

15. Symptomatic vagotonia.

16. All valvular disorders of the heart.

17. Exercise Stress Test Standards

The clinical exercise ECG test is performed using a motor driven treadmill and the level of work employed is the maximal aerobic capacity for the individual.

Electrocardiographic Criteria.

a. Arrhythmias and conduction defects,(other than occasional, unifocal PAC's or PVC's.

b. S-T Segment Criteria.

Criteria for significant S-T segment depression with maximal exercise indicative of a positive test.

Resting ST-T configuration	Exercise or postexercise S-T configuration	Maximal allowable S-T depression in mm and point of measurement
Normal	Horizontal	1.0 mm at 60 msec from J point
	Downsloping	1.0 mm more depressed than at rest

Hemodynamic Criteria.

a. Evidence of Regional Ischemia During Exercise.

b. Failure of Heart Rate to Increase Appropriately with Workload increments.

c. Failure of Systolic Blood Pressure to Increase Appropriately with Workload Increments.

d. Systolic Blood Pressure > 220 mm Hg at any Workload.

e. Diastolic Blood Pressure > 100 mm Hg at any Workload.

Clinical Criteria.

a. Inappropriate Dyspnea.

b. Signs of inappropriate affect, mental confusion, syncope, ataxia, or incoordination during exercise.

c. Angina pectoris with testing.

d. Cyanosis during exercise.

e. Lack of sweating with rapid buildup of body temperature.

f. Presence of a pathologic gallop.

18. Orthostatic Tolerance Test (LBNP) Standards

Each candidate will undergo lower body negative pressure as described under the Selection Section. The response of the candidate is evaluated according to the following criteria:

Electrocardiographic Criteria.

The criteria are the same as those described under "Exercise Stress Test Standards."

Hemodynamic Criteria.

a. Three consecutive(*) blood pressure readings at any level of negative pressure such that one or more of the following is obtained:

(*) Each blood pressure reading is taken at 30 second intervals.

(i) Systolic BP $\leq$ 70 mm Hg.

(ii) Diastolic BP $\leq$ 50 mm Hg.

(iii) Pulse Pressure $\leq$ 10 mm Hg.

b. Inappropriate Heart Rate Response (High or Low) for a Period of 60 seconds.

Clinical Criteria.

a. (Pre-) Syncope.

b. Chest Pain.

c. Shortness of Breath.

d. Other inappropriate synmptomatology.

The finding of these abnormalities in two consecutive trials warrants further evaluation for qualification.

19. Holter Monitoring Standards

Candidates will wear a portable monitoring apparatus for a period of 24 hours. They will note exercise levels and any abnormal symptomatology. The resulting traces will be evaluated according to the electrocardiographic criteria listed under "Exercise Stress Test standards."

G. BLOOD, BLOOD-FORMING TISSUES, AND THE RETICULOENDOTHELIAL SYSTEM

Causes for rejection include:

1. Anemias of any cause. Loss of 200 cc or more of blood is disqualifying for at least 72 hours. Sickle cell trait and heterozygous hemoglobin abnormalities.

2. Hemorrhagic states of any cause.

3. Any myeloproliferative or reticuloendothelial system disease.

4. Dysglobulinemias unless proven to be of a benign nature.

5. History or presence of malignant blood dyscrasias.

6. Hemolytic disorder regardless of etiology.

H. ABDOMEN AND DIGESTIVE SYSTEM

Causes for rejection include:

1. Wounds, injuries, scars, or weakness of the muscles of the abdominal wall that are sufficient to interfere with function.

2. Hernia, other than small asymptomatic umbilical or hiatal. Surgical repair of a hernia is disqualifying for at least 60 days while physical activity is limited. A relaxed inguinal ring without herniation is not disqualifying.

3. Sinus or fistula of the abdominal wall.

4. Malformations, injuries, or diseases of the esophagus.

5. Chronic gastritis.

6. History or diagnosis of ulcer of the stomach or duodenum.

7. History of gastrointestinal surgery for conditions other than a benign or non-recurrent nature.

8. Tumor of any part of the gastrointestinal system unless removed and shown to be benign and resulting in no postoperative dysfunction.

9. History of intestinal obstruction if due to any chronic or recurrent disease. Surgery to relieve childhood pyloric stenosis or intussusception is not disqualifying if there are no residuals.

10. Regional enteritis.

11. Malabsorption syndromes.

12. Irritable colon.

13. History or presence of ulcerative colitis.

14. Chronic diarrhea or constipation regardless of cause.

15. Megacolon.

16. Diverticulitis or diverticulosis.

17. History of gastrointestinal bleeding, regardless of cause.

18. Hepatitis within the preceding 12 months, persistence of symptoms after 6 months, or presence of Australia antigen.

19. Any chronic liver, gall bladder, or pancreatic disorder.

c. Pseudogout.

d. Hyperlipedemias.

e. Renal tubular dysfunction.

f. Inborn or acquired errors of metabolic pathways.

g. Other disorders of amino acid, purine, carbohydrate lipids, fluid electrolytes, and acid-base balance metabolism.

h. Nutritional deficiency diseases.

7. Any endocrine or metabolic disorders which require supportive or replacement therapy.

J. GENITOURINARY AND PELVIC DISORDERS

Causes for rejection include:

1. Significant anatomical abnormalities of one or both kidneys and associated urinary tract (congenital or acquired).

2. Acute or chronic nephropathies.

3. Autoimmune parenchymal and vascular renal disorders.

4. Primary or secondary neoplastic disorders of the urinary tract.

5. History of tubular neurosis from any cause.

6. History of urinary tract calculus formation.

7. History of recurrent infections of the urinary tract.

8. Albuminuria, hematuria, crystalluria, myoglobinuria, and any other findings in the urine indicative of renal or urinary tract disease.

9. Any renal vascular disorders.

20. History of cholecystectomy, if there are postoperative signs or symptoms indicative of residual dysfunction, such as postoperative stricture of the common bile duct, reforming of stones in the ducts, or incisional hernia.

21. Chronic enlargement of the spleen.

22. Splenectomy, for any reason except the following:

a. Trauma to an otherwise healthy spleen.

b. Disease involving the spleen when correction is followed by no sequelae for a period of at least two years.

23. Superior mesenteric artery syndrome.

24. Visceroptosis of any degree.

25. Colostomy.

26. Acute or chronic diseases of the rectum or anus. External or internal hemorroids that cause marked symptoms.

I. ENDOCRINE AND METABOLIC

Cause for rejections are:

1. Diseases of hypothalamus and pituitary glands, congenital or acquired.

2. Diseases of the thyroid gland.

3. Diseases of the parathyroid gland.

4. Diseases of the adrenal medulla and cortex.

5. Diseases of the gonads, congenital or acquired, including endometriosis.

6. Metabolic disorders.

a. Diabetis Mellitus and prediabetic states.

b. Assymptomatic hyperuricemia or gout.

10. Evidence of prostatic hypertrophy or other significant prostatic diseases.

11. Hydrocele or left varicocele, if large or painful. Any right varicocele.

12. Any disorders of the testis or associated anatomical structures other than of benign etiology.

13. Any acute or chronic disorders of the uterus and adnexa other than of benign etiology.

14. Dysmenorrhea and other gross irregularities of the menstrual cycle interfering with performance of duties.

15. Pregnancy.

16. Acute or chronic infections and inflamations of the endo pelvic organs.

17. Acute or chronic disorders of vagina, vulva, and associated anatomical structures which would interfere with performance of duties.

K. MUSCULOSKELETAL SYSTEM

Causes for rejection include:

1. History or presence of acute or chronic arthritis regardless of etiology and anatomical location.

2. Active infectious disorder of bone or joint.

3. Malignant tumor or authentic history of malignant tumor.

4. Benign tumor, solitary or multiple if sufficiently large to interfere with performance of duties.

5. Osteochondromatosis or multiple cartilaginous exostoses.

6. Disease or injury of any bone or joint healed with such residual deformity or rigidity that function is significantly impaired.

7. Any congenital anomaly with residual deformity interfering with function.

8. Unreduced dislocation, instability of a joint, substantiated history of recurrent dislocations or subluxations of a joint, if not satisfactorily corrected by surgery.

9. Demonstrable loose bodies in any joint (osteocartilaginous or metallic foreign objects).

10. Ununited or malunited fractures that interfere significantly with function.

11. Any fracture in which a plate, pin, or screw was used for fixation, if the fixation devices remain in place and are easily subject to trauma.

12. Metabolic and degenerative disorders of bone and joints.

13. Myopathies and other muscular paralysis, paresis, contracture and atrophy, if progressive and/or of sufficient degree to interfere with the performance of duties.

14. Less than full range of motion and stability of all joints. The minimum range of motion limits are given below (see plates I and II):

a. Shoulder:

(1) Forward elevation to 180°

(2) Abduction to 180°

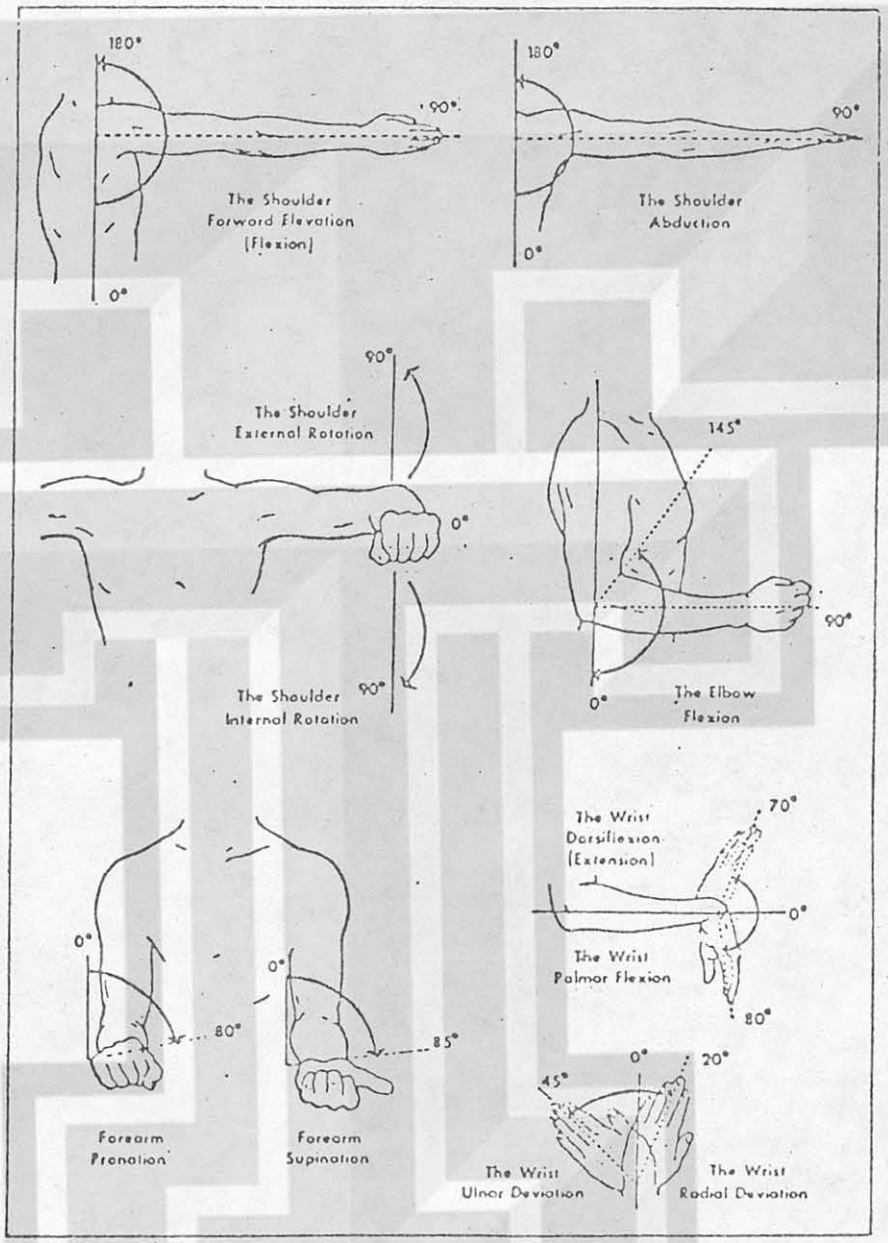


PLATE I

This plate provides a standardized description of ankylosis and joint motion measurement of the upper extremities. The anatomical position is considered as 0° with two major exceptions: (1) in measuring shoulder rotation, the arm is abducted at 90° and the elbow is flexed to 90° so that the forearm reflects the midpoint (0°) between internal and external rotation of the shoulder; and (2) in measuring pronation and supination, with the arm next to the body and the elbow flexed to 90°, the forearm is in mid-position (0°) between pronation and supination when the thumb is uppermost.

MEASUREMENT OF ANKYLOSIS AND JOINT MOTION
LOWER EXTREMITIES

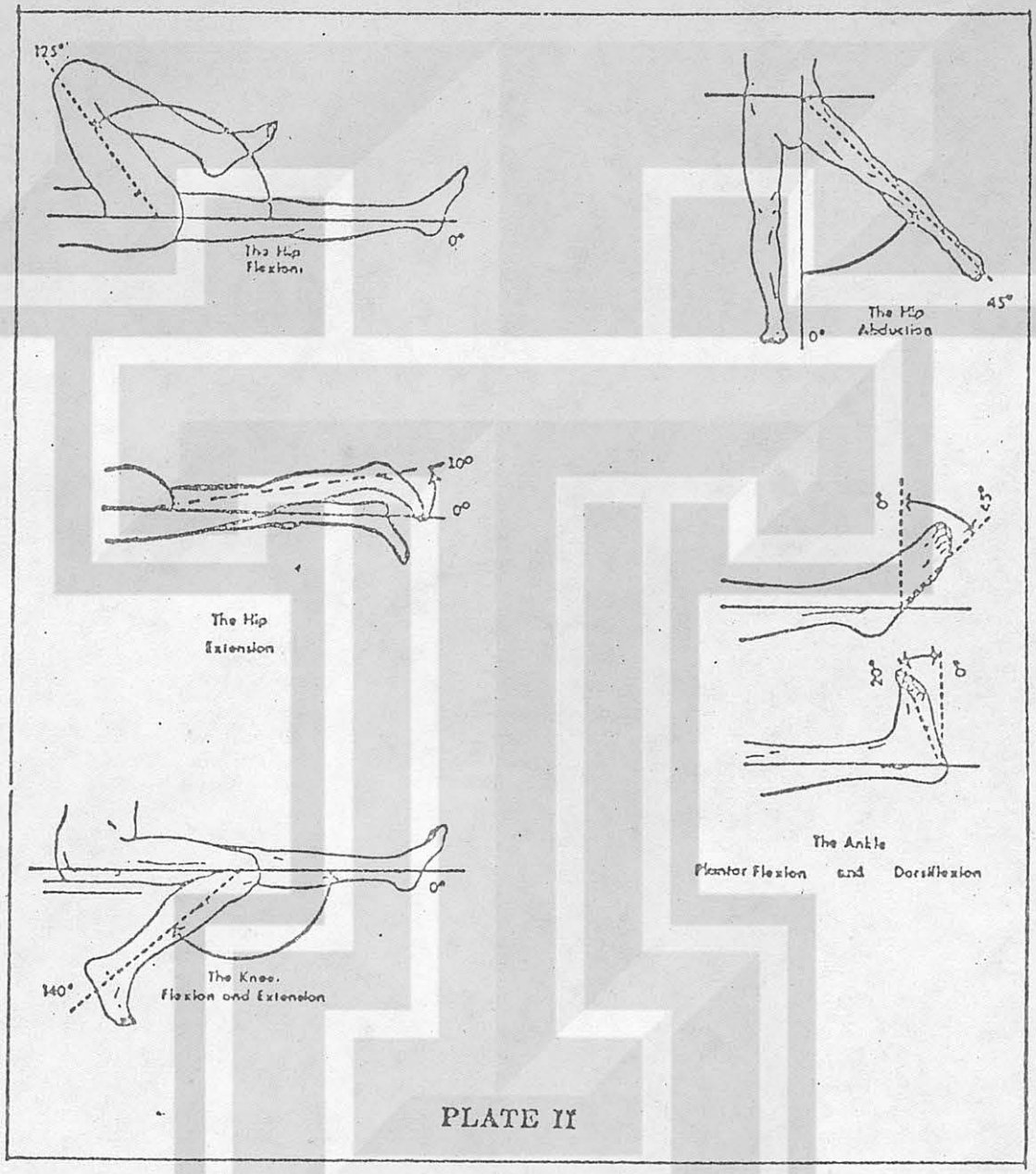


PLATE II

This plate provides a standardized description of ankylosis and joint motion measurement of the lower extremities. The anatomical position is considered as 0°.

b. Elbow:

(1) Flexion to 135°

(2) Extension to 0°

c. Wrist - a total range of 70° extension plus 80° flexion; ulnar deviation 45° plus 15° radial deviation.

d. Hand - pronation and supination to 80°.

e. Fingers - ability to clench fist and to oppose fingers to thumb.

f. Hip:

(1) Flexion to 125°.

(2) Extension to 10°.

(3) Abduction to 45°.

g. Knee:

(1) Extension to 0°.

(2) Flexion to 140°.

(3) Hyperextension not greater than 5°.

h. Ankle:

(1) Dorsiflexion to 20°.

(2) Plantar flexion to 45°.

15. History of disease or injury of the spine or sacro-iliac joints, either with or without objective signs, which preclude the performance of duty.

16. Abnormal curvature of the spine where pain or interference with function is present or where the process is progressive.

17. Spondylolisthesis, spina bifida, spina bifida occulta.

18. Herniated nucleus pulposus, or history of surgery for that condition. Treated fractures or dislocations of the vertebrae and healed spinal fusion.

19. Cervical rib with demonstrable neurologic or circulatory deficit.

20. Disease or injury of the sacroiliac and lumbosacral joints which is chronic and associated with muscle spasm, postural deformities, and/or significant limitation of motion of the spine or pelvis.

21. A history of disabling episode of back pains, especially when associated with significant objective findings.

22. Any major amputation.

23. Resection of a joint, other than fingers if symptomatic.

24. Absence or loss of the distal phalanx of either thumb or index finger.

25. Absence or loss of more than the distal phalanges of any 2 of the following fingers of either hand: middle or ring irrespective of the absence of the little finger.

26. Hyperdactylia.

27. Scars and deformities of the fingers or hand which impair circulation, are symptomatic, interfere with the performance of duty, or preclude the wearing of equipment.

28. Adherent or united fingers (webbed fingers).

29. Old or recent tendon injuries with residual stiffness and/or significant loss of flexion or extension.

30. Excessive curvature or shortening of long bones which materially interferes with function.

31. Ankylosis and chronic or recurrent bursitis, tendinitis, and synovitis sufficient to interfere with function.

32. Loss of either great toe or loss of any two toes of the same foot. Stiffness of toes which interferes with ordinary movement.

33. Clubfoot of any degree.

34. Weak foot with demonstrable eversion of the foot, valgus of the heel, or marked bulging of the inner border due to inward rotation of the astragalus, regardless of the presence or absence of symptoms.

35. Elevation of the longitudinal arch if of sufficient degree to cause subluxation of the metatarsal heads and clawing of the toes.

36. Hammer or claw toes of such degree as to interfere with function or wearing of footwear.

37. Hallux valgus, if sufficiently marked to interfere with ambulation or when accompanied by a symptomatic bunion.

38. Bunions, if symptomatic or sufficiently large to interfere with function.

39. Hallux rigidus, if X-ray reveals degenerative joint changes.

40. Plantar wart, if symptomatic.

41. Ingrowing toenails.

42. Corns, calluses, if symptomatic or interfere with performance of duty.

43. Overriding of any of the toes, if symptomatic or sufficient to interfere with the wearing of footgear.

44. Difference in leg length of more than 2.5 cm (from the anterior superior iliac spine to the distal tip of the medial malleolus).

L. SKIN

Causes for rejection include:

1. Extensive, deep, or adherent scars that interfere with muscular movements, or with the wearing of equipment, or that show a tendency to break-down.

2. Severe acne, atopic dermatitis, dermatitis factitia, and eczema if there is extensive involvement that would be aggravated by or interfere with the wearing of equipment.

3. Cysts and benign tumors of the skin of such size or location as to interfere with the wearing of equipment.

4. Dermatitis herpetiformis.

5. Infections of the skin, systemic or superficial, if communicable, extensive, or not amenable to treatment.

6. Furunculosis which is extensive, recurrent, or chronic.

7. Hyperhidrosis, if chronic or severe.

8. Keloid formation, if the tendency is marked or interferes with the wearing of equipment.

9. Malignancies of the skin primary or secondary, or cutaneous manifestations of systemic malignancies, except that basal cell carcinoma that has been adequately excised is not disqualifying.

10. Lichen planus.

11. Connective tissue disorders and other dermatosis aggravated by sunlight.

12. Neurofibromatosis.

13. Nevi or vascular tumors, if extensive, or exposed to constant irritation.

14. Pilonidal cyst, if there is a history of inflammation or discharging sinus in the 2 years preceding examination, or a history of surgery within 1 year.

15. Psoriasis or a verified history of same.

16. Sarcoid, if more than mild, or if other organs are involved.

17. Xanthoma, if symptomatic or accompanied by hypercholesterolemia or hyperlipemia.

18. Generally, any skin disorder, acute or chronic, which is severe enough to cause interference with duties or wearing of flight equipment.

M. NEUROLOGICAL DISORDERS

Causes for rejection include:

1. Disorders of the peripheral nervous system and cranial nerves which interfere with performance or if progressive or recurrence would cause such interference.

2. Any disorders of the spinal cord.

3. Any vascular disorders of the central nervous system symptomatic or by history.

4. Primary or secondary neoplastic disorders of the central nervous system.

5. Pyogenic or viral infections of the central nervous system within one year prior to examination, or if there are residual neurological defects which would interfere with performance of duty.

6. Demyelinating or degenerative diseases of the nervous system.

7. Metabolic, toxic, and nutritional disorders of the nervous system, if progressive or recurrent within the past 5 years.

8. Congenital or developmental abnormalities of the nervous system significant enough to interfere with performance of duty.

9. Personal or family history of diseases of hereditary origin such as neurofibramatosis, Huntington's chorea, hepatolenticular degeneration, acute intermittent porphyria, spino cerebellar ataxia, peroneal muscular atrophy, muscular dystrophy, and familial periodic paralysis. A family history of diseases of known hereditary origin are cause for rejection even in the absence of clinical symptoms or signs since the onset of these diseases occur later in adult life.

10. Functional disorders of the central nervous system such as: migraine, narcolepsy, cataplexy, neurasthenia, and similar states.

11. History of convulsive disorders including petit mal. A seizure before the age of 5 years is not disqualifying if there have been no recurrences and if the neurological examination and electroencephalogram are normal.

12. History of craniotomy or skull defects.

13. History of head injury resulting in any of the following:

a. Intracranial hemorrhage or subarachnoid hemorrhage.

b. Penetrating injuries or laceration of the brain.

c. Any skull fracture, linear or depressed, with or without penetration of the dural mater.

d. Radiographic evidence of retained metallic or bony fragments.

e. Absence of bony substance of skull.

f. Transient or persistent neurological deficits indicative of parenchymal central nervous system injury, such as hemiparesis.

g. Cerebral spinal fluid rhinorrhea or otorrhea, leptomeningeal cysts, aerocele, brain abscess, traumatic CNS infections, or arteriovenous fistula.

h. Any post-traumatic syndrome, as manifested by changes in personality, deterioration of higher intellecutal functions, anxiety, headaches, or disturbances of equilibrium.

i. Unconsciousness for more than 1 hour.

j. Unconsciousness for more than 15 minutes, but less than 1 hour, unless 2 years have elapsed since the injury and a complete neurological evaluation is normal in all respects.

k. Unconsciousness for less than 15 minutes, unless 12 months have elapsed since the injury and a complete neurological evaluation is normal in all respects.

m. Craniocerebral injury associated with amnesia is disqualifying automatically unless the amnesia is less than 4 hours duration.

n. Cranial cerebral injury associated with focal neurological signs such as significant paralysis, weakness, disturbance of sensation, or convulsive seizure.

o. Persistent focal or diffuse abnormality of the EEG.

p. Craniocerebral injury associated with post-traumatic headache unless shorter than 3 months duration.

14. Craniocerebral injury if associated with depressed fracture or absence of bony substance of the skull.

15. Evidence or history of involvement of the nervous system by a disease process if there is any indication that such involvement is present at the time of examination, whether progressive or recurrent, if it is likely to interfere with performance of duty.

16. Any abnormalities of the EEG.

N. PSYCHIATRIC DISORDERS

Causes for rejection include:

1. Psychosis or authenticated history of a psychotic episode other than those of brief duration associated with a toxic or infectious process.

2. Psychoneurosis or authenticated history of a psychoneurotic episode which requires professional care.

3. Character and behavior disorders which are evident by history and objective examination such that the degree of immaturity, instability, personality inadequacy or dependency will seriously interfere with performance of duty.

4. History of "fear of flying" in trained personnel.

5. History of psychosis in two or more members of the family of origin (father, mother, or siblings).

6. History of psychogenic amnesia.

7. Obsessions, compulsions, aerophobia, and phobias which influence behavior materially.

8. Tic, habit spasm, stammering or stuttering, or other marked mannerisms after age 10 years.

9. Any drug addiction or chronic abuse of alcohol.

10. Mental disorders requiring continued or intermittant medication.

11. Any current evidence or past history of irresponsibility, impulsiveness, poor judgment, or ineffectiveness will be cause for rejection.

12. Any psychiatric conditions that in the opinion of the examiner makes the candidate a hazard to flying safety or mission completion.

0. MISCELLANEOUS

Causes for rejection include:

1. Any acute or chronic infectious, parasitic, or communicable disease.

2. Chronic metallic poisoning.

3. History of heat stroke or heat exhaustion if a reliable history indicates an abnormally lowered heat tolerance threshold or residua which interfere with performance of duty.

4. History of sensitivity or demonstrated allergy of sufficient severity as to require permanent exemption from any immunization requirements.

5. Evidences of physical characteristics of congenital asthenia, such as slender bones; weak, poorly developed thorax; visceroptosis; constipation; if marked in any degree.

6. Chronic use of any medication, whether or not prescribed by a physician.

7. History of motion sickness if of such chronicity or severity as to interfere with performance of duties.

8. Any acute or chronic venereal disease.

9. Any history of syphilis ~~provided that~~ unless adequate medical evaluation rules out active disease and any residua.

10. Malignancy, all types, or a verified history of same, except that basal cell carcinoma that has been adequately excised is not disqualifying.

11. Any history of radiation exposure greater than 5 rems per year since age 18 warrants further evaluation for qualification.

12. Any foreign body unless considered not to be a hazard during performance of duties.

P. DENTAL

Causes for rejection include:

1. Insufficient natural healthy teeth or lack of serviceable prothesis to permit adequate mastication of a normal diet.

2. Diseases and abnormalities of the jaws or associated structures, including malocclusion, which are not easily remedied and which may be expected to interfere with performance of duty.

3. Orthodontic appliances for continued treatment, attached or removable. Retainer appliances are permissible, provided all orthodontic treatment has been satisfactorily completed.

4. Any significant dental defect unless correctable.

Q. Pilot Astronaut applicants must be within 60 to 76 inches in height. obesity or emaciation is disqualifying.

LABORATORY STANDARDS

WBC		4300 - 10,000/mm^3
	Neutrophils:	0 - 21%
	Juvenile and band segmented	25 - 62%
	Eosinophils:	3 - 8%
	Basophils:	0.6 - 1.8%
	Lymphocytes:	20 - 53%
	Monocytes:	2.4 - 11.8%
RBC	Females:	4.8 $\pm$ 0.6 millions/mm^3
	Males:	5.4 $\pm$ 0.9 millions/mm^3
Indices:		
	MCV	90 $\pm$ 7 cu
	MCH	29 $\pm$ 2 $\mu\mu$g
	MCHC	34 $\pm$ 2 g/100 ml
	MCD	7.5 $\pm$ 0.3 μm
Reticulocyte count		0.5 - 2.0% of red cells
Platelets		140,000 - 440,000/mm^3
Hemoglobin	Females:	14.0 $\pm$ 2.0 g/100 ml
	Males:	16.0 $\pm$ 2.0 g/100 ml
Hematocrit	Females:	42.0 $\pm$ 5.0 ml/100 ml
	Males:	47.0 $\pm$ 5.0 ml/100 ml
Hemoglobin fetal		$<$2%
Methemoglobin		$<$1.7%

Clotting time (Lee-White)		2 - 19 min. (glass tube)
		20 - 60 min. (siliconized tube)
Prothrombin time		11 - 16 sec.
Partial prothrombin time (activated)		32 - 46 sec.
Fibrinogen level (plasma)		160 - 415 mg/100 ml
Fasting glucose (plasma)		75 - 105 mg/100 ml
Urea nitrogen (blood)		10 - 20 mg/100 ml
Creatinine (serum)		1 - 1.5 mg/100 ml
Sodium (serum)		136 - 145 mEq/L
Potassium (serum)		3.5 - 5.0 mEq/L
Chloride (serum)		98 - 106 mEq/L
Carbon dioxide content (plasma)		21 - 30 mEq/L
Albumin (serum)		3.5 - 5.5 g/100 ml
Total protein (serum)		5.5 - 8.0 g/100 ml
Cholesterol (serum)		180 - 240 mg/100 ml
Calcium (serum)		9 - 11 mg/100 ml
Phosphorus (serum)		3 - 4.5 mg/100 ml
Uric acid (serum)		3 - 7 mg/100 ml
Bilirubin, total (serum)		0.3 - 1.0 mg/100 ml
Transaminase, serum glutamic oxalacetic (SGOT)		6 - 18 IU/L
Transaminase, serum glutamic pyruvic (SGPT)		3 - 26 IU/L
Creatinine phosphokinase (Serum) (CPK)	Female:	5 - 25 U/ml
	Male:	5 - 35 U/ml

Phosphatase alkaline (serum)	21 - 91 IU/L at 37° incubation
Lactic dehydrogenase (serum)	25 - 100 IU/L
Triglycerides (serum)	50 - 150 mg/100 ml
Creatinine clearance (per 1.73 m^2 body surface area)	91 - 130 ml/min.
Stool fat, on diet containing at least 50g fat	<7.0 g/day
Erythrocyte sedimentation rate	
Female:	0 - 20 mm/1 hr.
Male:	0 - 9 mm/1 hr.
Protein fractions (serum)	
Albumin	50 - 60%
Globulin	40 - 50%
α_1	4.2 - 7.2%
α_2	6.8 - 12%
β	9.3 - 15%
γ	13 - 23%
Thyroxine (T_4) binding displacement	4 - 11 µg/100 ml
Resin T_3	25 - 35%
Cortisol (plasma) 8 a.m.:	9 - 24 µg/100 ml
4 p.m.:	3 - 12 µg/100 ml
Glucose tolerance test:	Blood sugar not more than 180 mg/100 ml "true glucose" after 1/2 hour; return to normal by 2 hours; sugar not present in any urine specimen.
24-hour urinary calcium:	200 mg calcium diet, <150 mg/24 hr.

24-hour urinary phosphorus:		1 gr/24 hr.
24-hour urinary 17-ketosteroids:		
	Female:	4 - 15 mg/24 hr
	Male:	7 - 25 mg/24 hr
24-hour urinary 17-hydroxy-corticosteroids:		5 - 23 mg/24 hr (ketogenic)
24-hour urinary testosterone:		
	Female:	0 - 15 µg/24 hr
	Male:	47 - 156 µg/24 hr
24-hour urinary estriol:		
	Female:	5 - 30 µg/24 hr
	Male:	0 - 10 µg/24 hr
24-hour urinary aldosterone		2 - 10 µg/24 hr
Renin activity (supine)(plasma)		1.1 $\pm$ 0.8 ng per ml per hr
Angiotensin II activity (supine) (plasma)		10 - 30 pg/ml

MEDICAL EVALUATION FORMS

1. GENERAL

This section describes the methodology for reporting the medical evaluations outlined in section III of this document.

Parts 2 and 3 of this section include the detailed procedures for reporting the medical history (Standard Form 93) and the physical examination (Standard Form 88) for all examinees.

Part 4 contains the special NASA forms which pertain to the NASA medical evaluation.

2. STANDARD FORM 93: MEDICAL HISTORY

Every physical examination begins with a complete review of the examinee's medical history. The form used to record the medical history is Standard Form 93 "Report of Medical History." Items 1 through and item 25 may be typewritten, but the remainder of the forms must be handwritten in ink or indelible pencil by the examinee. Although items 1 through 7 are self-explanatory, examinees will be offered assistance in filling out these items.

Caution should be exercised when item 25 is completed. Do not use the term "usual childhood illnesses," but list each illness

separately. Incidents occurring before age 12 may be recorded as occurring during childhood, but all events occurring after age 12 should be recorded with the date (at the very least, the year) of occurrence. Do not use "NS" or nonsymptomatic" in response to items of history; however "No Complications, No Sequelae" (or "NCNS" or "No comp., no seq.") may be used where the comment is appropriate.

After elaborating on all items of history which were affirmatively (except: "Do you have vision in both eyes"), THE EXAMINER WILL ASK THE FOLLOWING SPECIFIC QUESTIONS:

Is there a history of diabetes in your family (parent, sibling, or more than one grandparent)?

Is there a history of psychosis in your family (Parent or sibling)?

Do you now or have you ever worn contact lenses?

Do you now or have you ever used or experimented with any drug, other than prescribed by a physician, (to include LSD, marijuana, hashish, narcotics, or other dangerous drugs as determined by the Attorney General of the United States)?

Have you ever experienced motion sickness or a disturbance of consciousness?

Are there any other items of medical or surgical history that you have not mentioned?

ALL AFFIRMATIVE ANSWERS TO THE ABOVE QUESTIONS will be fully elaborated on in Item 25 of the SF93. A positive family history of diabetes, i.e.,

in parent, sibling, or more than one grandparent, will be initially and periodically evaluated by a fasting blood sugar. The report must record the method used for the blood sugar determination and the normal values for this test by the laboratory performing the test. Negative replies to the above questions will be summarized as follows: "Examinee denies family history of diabetes or psychosis, use of contact lenses or drugs, history of motion sickness or disturbances of consciousness, and all other significant medical or surgical history."

Items 8 through 24 are to be completed by the examinee. Positive answers to items 15 through 24 will be fully explained in the blank space provided on the form. As completed by the examinee, the form may be vague or imprecise. The form should be carefully checked by the examiner and information volunteered by the examinee should be clarified whenever necessary. Complete elaboration of items of personal history that have been answered affirmatively should be entered in chronological order in item 25 before the form is countersigned by the examining physician.

3. STANDARD FORM 88: MEDICAL EXAMINATION

a. Physical Examination. Medical examinations are recorded on Standard Form 88 in a standard format. The paragraphs that follow will describe some of the highlights of a physical examination. There is no substitute for the physician's attention to detail both in the accomplishment of the examination and the clarity of his description of findings.

(1) Identification Data. Items 1 through 17 of Standard Form 88 contain general identification data regarding the examinee. The examiner is not obligated to establish the accuracy or veracity of the information. These items are entered on the Standard Form 88 in a standard format as follows:

Item 1. Last Name, First Name, Middle Name are entered. The entire middle name is recorded. If there is a middle initial only, give the initial without a period. If there is no middle name or initial, put a dash after the first name. The abbreviations IO (Initial Only) and NMI (No Middle Initial) are unnecessary. When "Jr." or similar designations are used, they follow the middle name.

Item 2. Grade and Component or Position. Enter position, e.g., astronaut (pilot or scientist astronaut) or payload specialist.

Item 3. Identification Number. Enter social security number or other appropriate identification number.

Item 4. Home Address. Permanent home address is desired entry, not a temporary mailing address.

Item 5. Purpose of Examination. In a few words, the exact purpose of the examination.

Item 6. Date of Examination. Record the date that examination was initiated; write out or abbreviate the name of the month, do not use number. Additional consultations will be dated when they are conducted.

Item 7. Sex. Enter "male" or "female."

Item 8. Race. Do not abbreviate. Do not confuse with religion.

Item 9. Total years of Government Service. Enter active military duty or full-time civil service only. Enter country and type of service. Experess as years and months. Reserve, and/or part-time, and/or consultant service may be entered in item 16.

Item 10. Agency, Department, or Service, e.g., NASA; ESA; NIH; University of Texas; Southwest Research Institute.

Item 11. Organization Unit. Enter NASA, ESA, or other organizational unit mail code, e.g., JSC/DD.

Item 12. Date of Birth. Write or abbreviate month. Record age in parentheses following date.

Item 13. Place of Birth. If not born in a city or town, enter county and state. If born in a foreign country, make entry as complete as possible.

Item 14. Name, Relationship in Parentheses and Address of Next of Kin. This is the person to be notified in the event of death or an emergency.

Item 15. Examining Facility, Examiner, and Address. Enter complete name and address of medical facility where examination was done and the full name of the examiner.

Item 16. Other Information.

Item 17. Rating or Specialty. Enter flying rating or designation if appropriate.

(2) Clinical Evaluation. Items 18 through 43 require a check in the appropriate column - "Normal" or "abnormal." Clinical findings that require annotation will be entered in the space provided to the right, preceded by the item number. The abbreviation "NE" (Not Examined) will be entered in the "normal" column for items that were not clinically evaluated.

Item 18. Head, Face, Neck, and Scalp.

Examination. These areas will be carefully inspected and palpated for evidence of residuals of injury or other deformity. Cervical lymph nodes and the thyroid gland will be palpated. Lymphadenopathy will be described in detail and a clinical opinion of the etiology will be recorded. Skin rashes, cysts, or scarring of this area requires a statement of whether these defects will interfere with wearing an oxygen mask or protective helmet.

Sample Entry. "3 discrete, freely movable, firm, one-half inch nodes in the right anterior cervical chain, probably benign."

Item 19. Nose.

Examination. Inspect the anterior and posterior nares. Note residuals of surgery. Record estimated percent of obstruction to airflow if septal deviation, enlarged turbinates, or spurs are present.

Item 20. Sinuses.

Examination. Transillumination, X-ray evaluation, and cytological study of the nasal secretions should be done when indicated.

Sample Entry. "Marked tenderness over left maxillary sinus. Transillumination poor. X-ray shows fluid level. Nasal smear negative for eosinophiles."

Item 21. Mouth and Throat.

Examination. Carefully examine the nasopharynx, the pharynx, and when indicated, the larynx. If tonsils are enucleated, this is considered "abnormal" (post-operative) and this item is marked accordingly. Do not record "WHNS" (Well healed, not symptomatic) after "Tonsils enucleated."

Sample Entry. "Tonsils enucleated."

Item 22. Ears-General (Including External Canals).

Examination. The external ear will be inspected and the mastoid region inspected and palpated for signs of scars or disease. The external auditory canal will be inspected. Cerumen, if present, must be removed prior to an attempt to visualize the tympanic membrane and prior to determination of auditory acuity. X-ray studies, caloric tests of vestibular sensitivity, or tuning fork tests will be done when indicated by history or findings.

Sample Entry. "Bilateral severe swelling, injection, and tenderness of both ear canals."

Item 23. Drums (Perforation).

Examination. Both drums will be visualized. In the event that scarring of the tympanic membrane is observed, the percent of involvement of the membrane will be recorded, as well as the mobility of the membrane. On all examinations a definite statement will be made as to whether the ear drums move on valsalva maneuver.

Sample Entry. "Valsalva normal bilaterally. Slight injection of pars flaccida, right ear. No bulging. No fluid level visible."

Item 24. Eyes-General.

Examination. Inspect and palpate the anterior portions of the eyeballs and their adnexa. When there is ptosis of the lids, a statement will be made as to the cause and the amount of interference with vision. If a pterygium is noted, it will be desribed as to enroachment on the cornea (in millimeters), progression and vascularity.

Sample Entry. "Pterygium, left eye. Does not encroach on cornea; is not progressive; avascular."

Item 25. Opthalmoscopic.

Examination. The media will be examined first with a +6.00 diopter ophthalmoscopic lens at a distance of approximately 45 centimeters. Any opacity appearing in the red reflex on direct examination or on movement of the eye will be localized and described. The fundus will be examined with the strongest plus or weakest minus lens necessary to bring the optic nerve into sharp focus. Particular attention will be paid to the color, surface, and margin of the optic

nerve; presence of any hemorrhages, exudates, or scars throughout the retina; any abnormal pigmentation or retinal atrophy; any elevation of the retina; and the condition of the retinal vascular bed. The macula will be specifically examined for any change. All observed abnormalities will be recorded. When the examination is part of the Astronaut or Payload Specialist selection, the pupils must be dilated with a mydriatic. On all other examinations, dilation is at the discretion of the examiner.

Sample Entry. "Increased pigmentation, right macula, possibly due to solar burn. No impairment of visual function. No evidence of active or progressive disease. NS."

Item 26. Pupils (Equality and Reaction).

Examination. The size, shape, and equality of the pupils, and pupillary reactions (direct, consensual, and accommodative) will be observed. Any abnormalities will be recorded and investigated.

Sample Entry. "Slight irregularity of pupils, right larger than left. Size and shape of pupils, and light, and accommodative reflexes are all normal. Inequality considered physiologic."

Item 27. Ocular Mobility (Associated Parallel Movements, Nystagmus).

Examination. Observation of gross ocular mobility to determine concomitant movement of the eyes in the six cardinal directions, and to detect nystagmus or nystagmoid movements. Examinations for some purposes also require entries in items 62 through 68.

Sample Entry. "Very fine nystagmoid movements of both pupils, at rest, and in all directions of gaze. Fast component to the right. Examinee not aware of this. Probably congenital."

Item 28. Chest and Lungs.

Examination. The examination of the chest and lungs should be carried out in a systematic fashion, as described in a standard textbook of physical diagnosis. Special attention will be directed toward detection and evaluation of:

1. Conditions which appreciably limit respiratory functional ability.

2. Conditions which can reasonably be expected to progress to a stage of chronic disability, or to cause frequent periods of recurrent acute disability.

3. All infectious diseases in the active stage.

4. Benign or malignant tumors. There are three conditions which are most often inadequately evaluated and which can result in unnecessary expense and time loss. These disorders are asthma (including asthmatic bronchitis), bronchiectasis, and tuberculosis. When these conditions are discovered or suspected, on the basis of history or examination, the examinee should be referred to a qualified consultant in chest diseases for a detailed evaluation and recommendations.

An examination of the breast will be performed on all female examinees with the patient properly draped and a female attendant present.

Sample Entry. "Musical rales heard over both posterior lower lung fields. Disappear after coughing. No wheezes. Findings consistent with history of asthmatic bronchitis."

Item 29. Heart (Thrust, Size, Rhythm, Sounds).

Examination. A very careful examination is necessary to assure that candiates for the position of astronaut or payload specialist do not have diseases or disorders of the heart or blood vessels which may restrict activity, be subject to aggravation, or be expected to cause circulatory failure or embarrassment under stress. Heart murmurs are a particular problem, and there are no absolute rules that allow the physicial to easily distinguish significant and innocent heart murmurs. Innocent murmurs are frequently heard in perfectly normal individuals. On the other hand, the diastolic murmurs of aortic or mitral valvular disease are very significant and easily missed. Whenever a murmur is heard, the time in the cardiac cycle, the intensity by grade (along with the basis - IV or VI - of the grade), the location, transmission, the effects of respiration or change in position, and an opinion of whether the murmur is organic or functional will be included.

Sample Entry. "Grade II/VI soft systolic murmur heard only in pulmonic area and on recumbency, not transmitted. Disappears on exercise and deep inspirations. Probably functional."

Item 30. Vascular System.

Examination. Examination consists primarily of inspection and palpation intended to detect evidence of arterial or venous insufficiency. Additional tests should be done when detected. When varicose veins are present, record location, severity, and evidence of venous insufficiency. Carotid, radial, femoral, popliteal and pedal pulses should be palpated. Absent or unequal pulses, or the presence of a bruit over any artery will be recorded.

Sample Entry. "Varicose veins, mild, posterior superficial veins of both legs. No evidence of venous insufficiency. NS."

Item 31. Abdomen and Viscera.

Examination. Carefully describe any organomegaly or masses detected. If a dilated inguinal ring is found, a statement will be included as to whether there is a hernia. Scars from abdominal surgery are recorded in this item, and described by length in centimeters, direction, and location.

Sample Entry. "5 centimeter linear diagonal scar, RLQ. well healed not symptomatic."

Item 32. Anus and Rectum.

Examination. Make note of surgical scars and hemorrhoids in regards to size, number, severity, and location. Describe fissures, fistulas, cysts, etc. Sigmoidoscopy is required on all examinees of age 35 and above. A definite statement will be made indicating that the examination was performed.

Sample Entry. "Small external hemorrhoids at 3 and 9 o'clock, NS. Prostate normal."

Item 33. Endocrine System.

Examination. Observe for any stigmata of endocrine disorder, such as unusual fat or hair distribution, skin changes, etc.Palpate the thyroid gland carefully for asymmetry, enlargement or nodules.

Sample Entry. "Slight soft, nontender enlargement of both lobes of the thyroid gland. No other stigmata of thyroid disease. Considered to be within normal limits."

Item 34. Genitourinary System.

Examination. A search will be made for evidence of venereal disease and for malformations. If a varicocele or hydrocele is found, it will be described in terms of size and painfulness. The location of an undescended testicle, in relationship to the inguinal canal, will be recorded.

Sample Entry. "Varicocele, left, small, NS."

Item 35. Upper Extremities.

Item 36. Feet

Item 37. Lower Extremities.

Examination. Record any deformities or other abnormal appearances, limitations of strength or range of motion, and any evidence of previous surgery. Attachment 9 will serve as a useful guide in determining the usual range of motion of normal joints. Although the "normal" column may be checked, a definite statement of the condition of the extremity or joint will be made when there is a history of previous fractures or dislocations. When flat feet are

detected, enter a description of the stability of the foot, symptoms, if any, and presence of eversion, bulging of the medial border, and rotation of the astragalus. "Mild," "moderate," or "severe" may be used in describing the loss of normal architecture.

Sample Entry. "Flat feet, moderate. Feet stable, asymptomatic, with no eversion or bulging, no rotation." With a history of an uncomplicated Colles' fracture, right, 1965: "No weakness, deformity, or limitation of motion, right lower arm."

Item 38. Spine. Other Musculoskeletal.

Examination. Evaluate the general felxibility of the entire spine. Include the sacroiliac and lumbosacral joints and the pelvis. If scoliosis is detected, the amount and location of the deviation, in centimeters from the midline, will be stated.

Sample Entry. "Scoliosis, primary deviation 1 centimeter to right of midline at level of T-8."

Item 39. Identifying Body Marks, Scars, Tattoos.

Examination. Only marks or scars of purely identifying significance are recorded in this item. Scars of surgical procedures are recorded in the item which includes their location.

Sample Entry. "2.5 centimeters, vertical linear scar, dorsum left forearm. WHNS." "Tattoo 'MOTHER' in blue with red heart surrounding, dorsum right forearm."

Item 40. Skin, Lymphatics.

Examination. The entire skin of the examinee will be inspected in a well-lighted room. Particular attention should

be directed to any cutaneous manifestations of systemic disease. Describe pilonidal cysts or sinuses in this item. If any skin disease is present, record the chronicity and prior response to treatment in item 73. Skin rashes, cysts, or scarring of the torso or extremities requires a statement of whether these defects will interfere with wearing of personal protective equipment, parachute harnesses, space suite, or spacecraft restraints.

Sample Entry. "Very mild pitting caused by old acne over back. No evidence of activity. Will not interfere with wearing of personal protective equipment or parachute harness."

Item 41. Neurologic.

Examination. A general neurological examination, including the cranial nerves. Any abnormalities in the sensory or motor modalities will be recorded, as well as any inequalities in the reflexes.

Sample Entry. "Decreased sensation (light touch and pin prick) over the distribution of the fifth lumbar and first sacral nerve roots on the right. No apparent atrophy of the right leg. Extensors of right great toe weaker than the left. DTR's are equal and active, except that ankle jerk on right is diminished."

Item 42. Psychiatric.

Examination. This examination is done by the examining physician and depends greatly on the examiner's experience and judgment. However, even a brief examination, properly conducted, will succeed in identifying those individuals with psychiatric problems or symptoms of a degree which might impair their effective performance

of duty. With the examinee at ease and with the remainder of the examination already accomplished, sufficient personal history should be obtained to enable the examiner to make an estimate of how effectively the examinee has functioned in the past. School and occupational history, and the examinee's ability to live in harmony with others, are particularly pertinent subjects. During the interview, observe the examinee's behavior and also make an estimate of his general intelligence. In questionable cases, a more thorough psychiatric evaluation should be requested. When appropriate, a diagnosis of psychiatric or character and behavior disorder will be recorded. Otherwise, brief descriptive remarks are acceptable. Give consideration to the fact that nonmedical personnel may have occasion to read medical records, and be careful to protect sensitive information from unauthorized disclosure.

Sample Entry. "Antisocial trends," "poor achievement record," or "emotionally immature and very dependent."

Item 43. Pelvic.

Examination. A pelvic examination will be performed on all female examinees, with patient properly draped and a female attendant present. This will include a detailed pelvic and adnexa examination including a Papanicolaou smear.

Item 44. Dental

Examination. The mouth, teeth, and supporting structures will be examined by a dental officer and the results summarized in this item. The "type" of dental examination, the dental calssification, and a statement whether the examinee is qualified, will be

entered under "Remarks." Examinations which are part of the astronaut or payload specialist selection require a complete oral radiographic survey. An accepted periodontal evaluation with a resulting numerical "score" will be performed on all initial examinations on astronaut candidates and on subsequent annual physicals.

Examination. Three basic types as follows

Type 1 - Artificial illumination using mouth mirror, explorer, periodontal probe, and a complete oral radiographic survey.

Type 2 - Artificial illumination using mouth mirror, explorer, periodontal probe, and bite wing radiographs.

Type 3 - Artificial illumination using mouth mirror, explorer, and periodontal probe.

When an examinee has artificial dentures, removable or fixed, the dental officer will include a statement of the denture's "serviceability." A serviceable denture must satisfactorily restore masticatory function, appearance, and clear speech. Complete denture prosthesis must demonstrate adequate phonetics, retention, stability, interocclusal space and occlusion. Oral tissues supporting the prosthesis must be in good health.

When a removable dental prosthesis is required, the examinee must provide himself with a duplicate prosthesis prior to actual participation in a space flight. This requirement exists if in the judgment of the dental officer, loss or breakage of the existing dental prosthesis would handicap the examinee to the extent he could not enunciate

clearly or adequately masticate a normal diet.

Sample Entry. "Type 1, Qualified for selection" b. Laboratory Examination. Specific laboratory and special NASA tests required of astronauts described in Section III . Deviations from normal values should be noted and compared to the corresponding NASA standards.

Item 45. Urinalysis.

A routine analysis (specific gravity, protein, sugar, and microscopic study) will be performed and recorded for all examinees.

Item 46. Chest X-ray.

A 14 x 17 P-A chest film is standard, and serves as a permanent record. The use of photoroentgenograms is discouraged. Record in this item the film size, the place and date the film was made, the film identification number, and the results.

Item 47. Serology.

A standard serological test for syphilis will be performed on all examinations, initial and periodic, and whenever required by other directives. All positive results will be repeated, and additional tests or examinations will be done as may be indicated.

Item 48. EKG.

12 lead-electrocardiograms are required for all examinations. However, electrocardiograms should also be done whenever medical history or clinical findings are suggestive of cardiac abnormality.

Item 49. Blood Type and RH Factor.

All examinees will have blood type and RH factor recorded. After the initial determination, the results may be copied onto subsequent

examinations and annotated "on record."

Item 50. Other Tests.

Other tests should, as a minimum, include the full protocol described in Sections III and IV of this document.

(1) Measurements and Other Findings. Items 51 through 72 provide space to record specific measurements and tests. Metric units of measurement will be used and when practical, English units will follow in parenthesis. The units of measure used will be recorded.

Item 51. Height.

Record the height to the nearest centimeter and/or quarter of an inch, with the examinee in stocking feet. The sitting height will be measured and recorded in parenthesis following the standing height on all selection examinations. To measure sitting height, the examinee will be seated on a hard table or stool, hips flexed at 90°, lower legs dangling free, torso erect, and the head facing directly forward.

Item 52. Weight.

Examinee will be weighed, without clothes, on a standard set of scales and weight will be recorded to the nearest tenth of a kilogram.

Item 53. Color Hair.

Item 54. Color Eyes.

Item 55. Build.

This item, in a general way, relates body mass to stature. Regardless of height, an excessive accumulation of body fat over and above that compatible with average skeletal and physical requirements should be

recorded as "obese." Mark one item that best describes the individual.

Item 56. Temperature.

Abnormal temperatures will be rechecked and explained.

Item 57. Blood Pressure.

Blood pressure determinations will be made according to the recommendations of the American Heart Association. For periodic medical examinations record the blood pressure while sitting and after standing for 3 minutes.

Item 58. Pulse.

Complete the entire item by recording the pulse rate in the positions and conditions indicated for all selection examinations. For periodic medical examinations, record the pulse while sitting and after standing for 3 minutes.

Item 59. Distant Vision.

The best uncorrected vision of each eye is recorded first, using a standard 20 foot eye examination or a Vision Test Apparatus, Near and Distant, FSN 6615-299-8048 (VTA-ND). Complete instructions for the use of the latter alternative are included with each instrument. Test charts for visual acuity vary, but in general the examinee must correctly name approximately 75 percent of the letters on a given line in order to be credited with that degree of visual acuity. Visual acuity is recorded in the form of a fraction, with a numerator indicating the distance in feet at which the letters were read (usually "20") and a denominator indicating the distance in feet at which the person with

average vision could read the letters. It is unnecessary to qualify the simple fraction further - for example "20/30 +2!" If the distant visual acuity is less than 20/20 in either eye, the best correctable visual acuity will also be recorded. This item is required on all physical examinations.

Item 60. Refraction.

Cycloplegic refraction is required as a part of all physical examinations. If the distant visual acuity is less than 20/20, the prescription that gives the best corrected vision will be entered, and the derivation of that prescription will be recorded after the word "Refraction." That entry may be "cycloplegic," "manifest," or "by lens" if the prescription is read from spectacles with a lensometer.

Item 61. Near Vision.

Uncorrected near visual acuity will be determined for each eye separately, using Chart Set, Vision Acuity Testing, Near Vision, FSN 6515-598-8077 at a distance of approximately 14 inches, or the VTA-ND. If uncorrected vision is less than 20/20, the refractive prescription that gives best corrected near vision will be determined. If refraction is performed, the corrective prescription shall be entered. Near visual acuity will be recorded as a fraction with the numeral 20 as the numerator. Visual equivalents for the interpretation of common notations are shown in table 1. If the prescription which corrects near visual acuity is the same as that which corrects distant visual acuity, the entry following "by" should be "same." If there is a presbyopic correction, "same" is assumed and the amount of the presbyopic correction is entered, for example, "+1.50."

NOTE: Contact lenses will not be worn during any part of the examination, and it is essential that such lenses not be worn for 3 weeks preceding the selection examination.

Table 1. Equivalents in Near Visual Acuity Notations

Snellen English	Standard Test Chart	Snellen Metric	Jaeger
20/20	14/14	0.50M	J-1
20/25	14/17.5	.62	J-2
20/30	14/21	.75	J-4
20/40	14/28	1.00	J-6
20/50	14/35	1.25	J-8
20/70	14/49	1.75	J-12
20/100	14/70	2.25	J-14
20/200	14/140	-	

Item 62. Heterophoria.

Vertical and lateral phorias are measured on examinations for initial commission and flying training or periodic examinations for flying. Phorias are routinely measured only at distance. If phorias are measured by using the "far" drum of the VTA-ND, enter VTA-ND (Far) in the left-hand margin of item 62. If testing is done in an eye examining room enter "20" in the left-hand margin. Enter the numerical results under the appropriate abbreviations. Prism divergence, prism convergence, and pupillary distance are not recorded. Near point of convergence (PC) is recorded in millimeters. If the eyes are orthophoric on the cover test examination, enter "Ortho" after "CT." If deviations are noted, record the fact and enter the amount and character of the deviation in item 24.

Item 64. Color Vision.

The standard screening test for color vision is the Vision Test Set, Color Vision (VTS-CV) also called Plate Set, Pseudoisochromatic, 15 plates FSN 6515-299-8186. This set consists of 1 demonstration plate and 14 test plates in a ring binder. This test must be administered under the lamp listed as Light, Color Perception Testing, FSN 6515-345-6625. Any other light source alters the colors perceived by the examinee and renders the test results invalid. If the examinee cannot pass the screening test, he will be tested with the Vision Test Apparatus, Color Threshold Tester (VTA-CTT), FSN 6515-388-3700. The purpose of the VTA-CTT is to quantitate the degree of color vision deficiency. A score of 50 or better on the VTA-CTT indicates a mild or Grade 1 deficiency, considered safe for aviation. A score from 35 to 49 indicates a moderate or Grade 2 deficiency, and a score of 34 or less indicates a severe or Grade 3 deficiency. If the examinee passes the screening test, the proper entry in this item is VTS-CV Passes." If the examinee does not pass the screening test, enter "VTS-DV Fails" and the number of plates missed, and record the score on the VTA-CTT in item 73. Congenital color vision deficiency does not change throughout life. Once the degree of color vision deficiency has been established by careful testing, repetition of the testing is unnecessary. The entry "On Record" and the results of previous testing is sufficient, but caution is urged so that invalid test results are not perpetuated.

Item 65. Depth Perception.

The VTA-ND is the standard screening test for depth perception, but is the most difficult for some examinees to pass even though their fusion

and depth perception is normal. Visual acuity less than 20/20 in either eye also makes the test very difficult or impossible to pass. If the Vision Test Apparatus is not available, or if the examinee fails the standard test, the Verhoeff depth perception apparatus (DPA-V), or the Howard-Dolman apparatus (H-D) is acceptable. Record the name of the test used in item 65 and the test results, corrected or uncorrected, in the spaces provided. On the VTA-ND, results should be recorded as passes through D, E, or F. The results on the DPA-V will be recorded simply as passes or fails, and the results on the Howard-Dolman will be recorded as the average error in millimeters on not less than five trials.

Item 66. Field of Vision.

A confrontation test is the routine test used to confirm a full field of vision. Facing the examiner squarely, the examinee closes his left eye and holds it closed with gentle pressure of a finger or two, and fixes his gaze on the left eye of the examiner who has closed his right eye. The examiner holds a plain white 3 mm sphere on a wire handle overhead and in a plane midway between the two. Keeping his hand out of the way, he lowers the sphere until the examinee sees it. The examinee and the examiner should see the sphere simultaneously. The extent of the visual field should be measured at 45° intervals. When the testing of the right eye is complete, the same technique is used to test the left eye. If, on the confrontation test, the field of vision appears to be constricted, or if the examiner suspects a visual field defect, use the perimeter and the tangent screen for a more exact study. The results will be recorded on DD Form 742, Clinical Record-Visual Field Examination. Normal results

are recorded as "Confrontation Normal."

Item 67. Night Vision.

Night vision testing is not done unless there is reason to suspect a night-vision deficiency because of familial or personal history, fundus changes, behavior in dim light, etc. The standard test for night vision is the Landolt Ring, also called the Adaptometer, Radioactive Plaque, Night Vision, FSN 6515-382-1000. In a dark room, after dark adaptation, the examinee must correctly describe 4 out of 4, or 8 out of 10 random presentations. Beginning at a distance of 5 feet, the presentations are moved farther away until the examinee fails to name 8 out of 10 presentations correctly. Scoring is based on the maximum distance at which the examinee correctly names 8 out of 10 presentations, as follows:

10 feet or more.....Superior

5 to 9 feet .....Satisfactory

Less than 5 feet.....Unsatisfactory

If night-vision deficiency is not suspected, the entry "Not Indicated By History" or "NIBH" will suffice.

Item 68. Red Lens Test.

Required only for the selection examination. This test is intended to demonstrate diplopia which occurs not with central fixation, but with gaze shifted away from the central point. The examinee is seated 30 inches away from a tangent screen or other suitable fixation point approximately 48 inches above the floor. A filter, Diplopia Test, Ted, FSN 6515-346-2800, is placed before either eye. (The red lens in the standard trial lens set is not satisfactory.) A dim point source of

light is moved outward at least 20 inches from the center in the six cardinal directions of gaze and the examinee follows the light with his eyes while his head remains stationary. The light should appear pink to the examinee, and he should be instructed to report changes in the color (suppression), or a doubling of the light (diplopia). If suppression or diplopia develops, the point on the screen at which this occurs is noted and recorded. Diplopia at extreme gaze is not unusual and not necessarily pathological.

Item 69. Intraocular Tension.

Intraocular tension will be determined on all selection examinations and on all periodic examinations of examinees who are 35 years of age or older. The standard test utilizes a calibrated Schiotz tonometer, FSN 6515-382-6100, which measures the identability of the cornea or by the American Optical noncontact tonometer. This examination will be performed by a physician or optometrist. The examinee should be lying comfortably on his back, should be reassured, and should have a clear and definite fixation point on the ceiling. A short-acting topical ophthalmic anesthetic is used and the examination is performed promptly after instillation of the anesthetic. The tonometer must zero properly on the test block, the plunger and indicator needle must move freely, and scale deflection must be at least 4 units to give a valid reading. Scale deflection is converted to the calculated intraocular tension by the use of a calibration scale, table 2, and recorded in millimeters of mercury.

Item 70. Hearing.

Whispered and spoken voice hearing tests should not be routinely performed. "NE" (Not Examined) or dashes in each space are sufficient entries.

Item 71. Audiometer.

Pure-tone audiometry is required on all medical examinations and thresholds will be determined at frequencies of 500, 1000, 2000, 3000, 4000, and 6000 cycles per second. The type of instrument used and the calibration of the machine (ISO 1964) will be recorded beside the title of the item. When air audiometry shows significant hearing loss, bone conduction audiometry and additional specialized testing will be done to clarify etiology and amount of impairment to speech reception.

Item 72. Psychological and Psychomotor.

Required for all selection examinations. The interview is unstructured, but the interviewer should explore the following areas:

Is the examinee's motivation for the duty for which he is being examined based on realistic knowledge? Is it in keeping with his long-range goals (and perhaps those of his family)? Does his scholastic history, occupational history, and military history indicate lack of motivation, failures, or disciplinary difficulties? How does he react to stress? Does he express emotions which are out of context with the interview? Are his long-range goals realistic and in keeping with his potentialities?

Item 73. Notes and Significant or Interval History.

The entries in this item will be essentially the same as the entries in item 25, SF 93. When a previous waiver for some disqualifying defect

Table 2. 1955 Calibration Scale for Schiotz Tonometers

Approved by the Committee on Standardization of Tonometers of the American Academy of Ophthalmology and Otolaryngology.

R Tonometer Reading	Load, gm 5.5 gm	7.5 gm	10 gm	15 gm
	Pressure, mm Hg			
0.0	41.5	59.1	81.7	127.5
0.5	37.8	54.2	75.1	117.9
1.0	34.5	49.8	69.3	109.3
1.5	31.6	45.8	64.0	101.4
2.0	29.0	42.1	59.1	94.3
2.5	26.6	38.8	54.7	88.0
3.0	24.4	35.8	50.6	81.8
3.5	22.4	33.0	46.9	76.2
4.0	20.6	30.4	43.4	71.0
4.5	18.9	28.0	40.2	66.2
5.0	17.3	25.8	37.2	61.8
5.5	15.9	23.8	34.4	57.6
6.0	14.6	21.9	31.8	53.6
6.5	13.4	20.1	29.4	49.9
7.0	12.2	18.5	27.2	46.5
7.5	11.2	17.0	25.1	43.2
8.0	10.2	15.6	23.1	40.2
8.5	9.4	14.3	21.3	38.1
9.0	8.5	13.1	19.6	34.6
9.5	7.8	12.0	18.0	32.0
10.0	7.1	10.9	16.5	29.6
10.5	6.5	10.0	15.1	27.4
11.0	5.9	9.0	13.8	25.3
11.5	5.3	8.3	12.6	23.3
12.0	4.9	7.5	11.5	21.4
12.5	4.4	6.8	10.5	19.7
13.0	4.0	6.2	9.5	19.7
13.5		5.6	8.6	16.5
14.0		5.0	7.8	15.1
14.5		4.5	7.1	13.7
15.0		4.0	6.4	12.6
15.5			5.8	11.4
16.0			5.2	10.4
16.5			4.7	9.4
17.0			4.2	8.5
17.5				7.7
18.0				6.9
18.5				6.2
19.0				5.6
19.5				4.9
20.0				4.5

has been granted, the reviewing authority, date, and reason for the waiver will be recorded. This space also will be used when necessary to explain or amplify other items on the SF 88. If still more space is required, use SF 507, "Clinical Record Rept. on or Cont of SF."

c. Summary and Signature Items. Items 74 through 82 provide space to summarize the findings of this entire examination and history, and authenticate the examination with signatures of the examiner(s).

Item 74. Summary of Defects and Diagnoses.

Summarize the defects that are considered to be significant or which require future consideration or evaluation (such as non-static defects which may become worse). Enter only the item number, followed by a short, concise diagnosis. Do not record unimportant and insignificant findings.

Item 75. Recommendations - Further Specialist Examinations Indicated.

Specialist examinations and consultation reports which support this examination should not be reiterated in this item - they will have been done before the examination is considered complete. However, an entry such as "Recommend opthalmology evaluation every three months because of elevated intraocular pressure" is most appropriate. Waiver of defects may be requested or recommended in this item when there would be no compromise of safety, individual well-being, or effective duty performance.

Item 77. Examinee Is or Is Not Qualified For.

The examinee either is qualified or is not for the purpose for which he has been examined. Check the appropriate phrase and enter the purpose of the examination. When a waiver has been granted previously by a higher headquarters or if a waiver for the defect is granted by the NASA Medical Board, the entry "Is acceptable with waiver for..." is made if there are no other disqualifying defects.

Item 78. If not Qualified, List Disqualifying Defects by Item Number.

Use item numbers only, not diagnoses. If qualified, enter a dash.

Items 79 and 80. Typed or Printed Name of Physician.

Carbon signature on duplicate copies is acceptable, if legible. Signature stamps are NOT acceptable. It is unwise practice to sign "for" the examining physician. Item 80 may be used to enter the name of an additional examiner, if desired. NOTE: The name of the optometrist or physician performing the cycloplegic examination will be entered in item 80. The optometrist or physician will sign the original SF 88 to verify that item 60 is correct.

Item 81. Typed or Printed Name of Dentist or Physician.

The original copy of reports of medical examination will be signed by the examining dental officer to authenticate the accuracy of the dental information recorded.

Deception. Physicians traditionally perform physical examinations when approached by a patient who is, or believes himself to be, ill and seeking medical aid or treatment. An accurate history and careful examination is the essence of successful medicine. However, the NASA physician will sometimes be confronted by an examinee who would have the physician believe that he is physical perfection when he is far from it, or that he is ill or infirm when there is little if anything wrong with his health. The general term for this subterfuge is malingering. The motivation for it is usually some secondary gain to the examinee. The examinee has a conscious awareness of what he is doing and the motivation and goals responsible for his actions. Simulation (sometimes called

"positive malingering") is the feigning of some condition that does not exist. Dissimulation (or "negative Malingering") is the attempt to conceal some medically disqualifying condition. The purpose of the latter may be to gain certification of medical qualification despite a disqualifying condition, or to be qualified for some special duty, such as astronaut or flying, for which the condition is disqualifying. Individuals may attempt to dissimulate because of poor judgment or a failure to understand the hazards of their condition in relation to their duties.

(a) Simulation. It is not possible to list all of the disorders that have been simulated. The following brief discussion will serve to show the variety.

(1) Feigned Medical Disorders. The evaluation of complaints of pain is always difficult. There is a special need for the physical examination to be thorough in this group, and the detection of malingering depends upon the absence of positive findings in an individual who presents the general characteristics of the malinger. Tachycardia and thyrotoxicosis may be temporarily induced by taking drugs such as thyroid extract. Egg albumin or sugar may be added to urine. Canned milk may be used to simulate urethral discharge. Cantharides may be taken to cause albuminuria. Digitalis or quinidine may be taken to cause abnormal heart findings. Mechanical and chemical irritants may be used to cause irritation about any body orifice, or of the skin. Cathartics may be taken to bring about purging or simulate a chronic diarrhea. An appearance of hemoptysis may be produced by adding blood,

either human or animal, to the sputum. Sometimes merely coloring matter is added. Those who can vomit voluntarily what they swallow use the same means to create the appearance of hematemesis. Similarly, coloring matter may be added to the stool. Jaundice may be simulated by taking picric acid which can be demonstrated in the urine.

(2) Feigned Surgical Conditions. Old scars, injuries, and orthopedic disorders may be the basis for feigned pain or disability. Substances may be injected under the skin to cause abscesses. The motivation of self-inflicted wounds is a complex psychological phenomenon. Most self-destructive attempts, both mutilation and suicide, are symptoms of grossly abnormal mental states, and many of these mental conditions are not classisfied as psychoses.

(3) Feigned Nervous or Mental Illness. Psychoses are rarely feigned by examinees, and when attempted are usually silly, foolish types of imitations. Mental deficiency is frequently feigned, especially by illiterates. Pain and hyperesthesia are the most frequent of all complaints. However, the history is frequently inconsistent and the ordinary indications of suffering are absent. There is usually an absence of the other symptoms that accompany the type of pain complained of, and an absence of objective evidence of localized pains. The examinee's behavior should be noted when he believes himself unobserved. Low back pain is a particularly frequent complaint and organic disease can be excluded by X-ray and orthopedic consultation. A complaint of anesthesia itself creates a suspicion of malingering as most people with anesthesia are unaware of it.

(4) Feigned Disorders of the Special Senses. Simulation of defective sight or hearing are very common. There are no hard-and-fast rules for clarifying such pretenses, but the alertness and ingenuity of the examiner will successfully expose most of these deceptions.

(5) Loss of Vision. To verify complete loss of vision in one eye, a 6° prism, base out, is placed before the "blind" eye. If diplopia is reported, or if the "blind" eye moves inward to fuse the two images, both eyes have sight. A high plus lens (+16) is placed before the good eye, and a weak plus or minus lens before the "blind" eye. If a distant chart is read, vision in the "blind" eye is good. With a projector, polarized light or colors may be used with appropriate filters before the examinee's eyes demonstrate that both eyes are seeing. There is usuallly no light reflex of the pupil of the blind eye.

(6) Diminution of Vision. Prism tests are not applicable. Opthalmoscopic and retinoscopic examinations will estimate refractive errors and rule out opacities. There is gross correlation between refractive error and visual acuity under cycloplegia. The use of weak lenses in front of the "weak" eye while a high plus lens is before the good eye, or testing at different distances, will assist in elucidating true visual acuity. The examinee's occupation may have been such that it could not have been followed without more vision than he claims.

(7) Hearing Loss. Deafness of all degrees, from partial unilateral loss through complete bilateral loss, may be feigned. There is frequently the history that hearing varies from day to day for some undeterminable reason. The examiner should show sympathy and a sincere

desire to determine what type of loss is present and what can be done to correct it. In all but the most extreme cases, it is well to "reassure" the examinee that he need not worry about failing the test inasmuch as he can often be fitted with a hearing aid which will restore acceptable hearing. Pure tone auditometry and speech reception test should be repeated. Pure tone tests may be done by starting with high test intensities (70 or 80 d b) and gradually descending, while speech threshold tests are started at low levels and increased to the point of response. Hearing that is much better for speech than for pure tones at 500, 1000,and 2000 cycles is substantial evidence of functional hearing loss. Further, the use of masking adds to the difficulty of remembering at exactly what degree of loudness hearing was admitted. When gross inconsistencies in these results produce a suspicion of malingering, it is preferable to elicit the services of a trained audiologist who can administer tests such as Psychogalvanic Skin Response Audiometry, Delayed Speech Feed-Back Tests, Doerfler-Stewart Test, Lombard Test, Stenger Test, etc.

b. Dissimulation. Dissimulation usually takes the form of concealed or distorted medical history, or memorized or learned test responses. Sometimes the deception will be more blatant, as the taking of oral medication to camouflage hypertension, gout, or diabetes, or the use of contact corneal lenses (prior to the examination) in an attempt to minimiae refractive error. The examiner must remain alert and astute in uncovering these masquerades.

(1) Concealed History. Since the examiner depends on the veracity of the history, total concealment of significant items of history will usually go undetected. Sometimes an examinee may attempt to distort the significance of an illness, an injury, or a hospitalization. However, corroborative information can usually be obtained from private physicians, clinics, or hospitals.

(2) Vision. Normal visual acuity and normal color vision are easy to fake if the examinee has memorized the correct responses. The test materials should be protected from study and the examining techniques should insure that examinees are not afforded an opportunity to benefit from the responses of those who precede them. Visual acuity charts and tests should be varied from time to time. Pseudoisochromatic plates should have their order of presentation changed periodically. The test plates in the VTS-CV can be memorized. There are other nonstandard tests that cannot be memorized and these should be employed whenever there is a suspicion that the examinee is not seeing what he reports. The examiner must remember that many of the visual tests are entirely subjective, and that erroneous responses are extremely difficult to detect. The responses to the phoria tests on the VTA-ND can be learned; failure to make an abnormal response on the red lens test could be considered a normal test. When there is a reason, be suspicious, be cynical, and verify findings using alternative tests.

(3) Hearing. It is difficult or impossible for an examinee to dissimulate a hearing loss on a manual audiogram. With the advent of

automatic audiometers, some examinees have attempted to "beat the machine." However, careful interpretation of the record will usually indicate whether the examinee could hear the tones as indicated, or was mechanically pressing the response button.