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A Practical Approach for Assessing Physical Fitness

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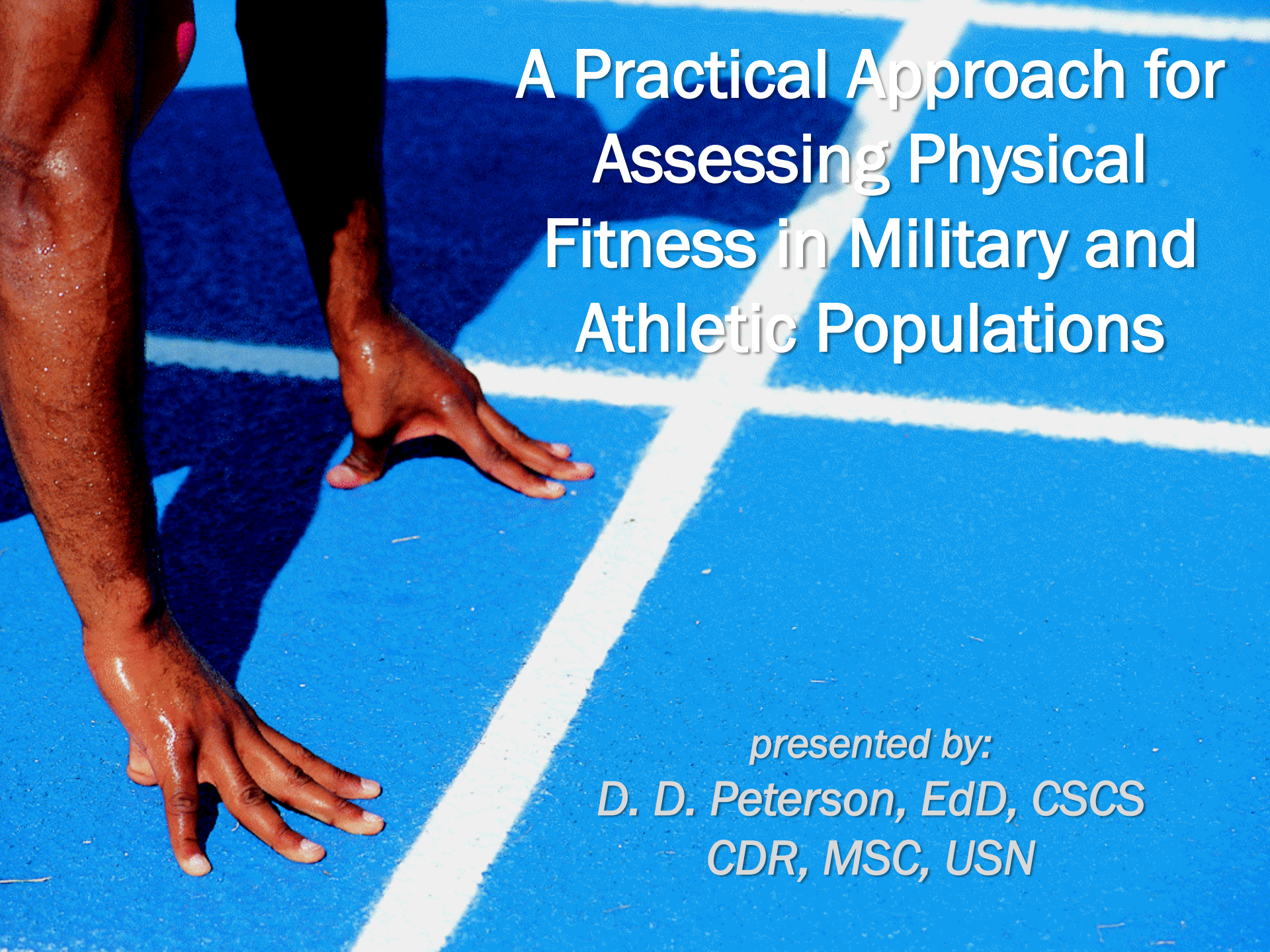

A Practical Approach for Assessing Physical Fitness in Military and Athletic Populations

presented by:
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DISCLAIMER

The opinions and recommendations expressed herein do not necessarily represent those of the US Navy

ACSM Norms for "Average" Fitness based on Age and Gender

	20-29		30-39		40-49		50-59		60+	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
VO2max [1]	45.6	39.5	44.1	37.7	42.4	35.9	39	32.6	35.6	29.7
1.5-mile Run	11:29	13:24	11:54	14:08	12:24	14:53	13:35	16:35	15:04	18:27
Bench Press Weight Ratio [2]	1.14	0.70	0.98	0.60	0.88	0.54	0.79	0.48	0.72	0.47
Push-Ups [3]	22	15	17	13	13	11	10	7	8	5
Sit-Ups	42	38	39	29	34	24	28	20	22	11
% Body Fat	14.8	19.8	18.4	21	20.8	23.7	22.3	26.7	23	27.5
Waist Circumference [4]	35.5 in.	32 in.	35.5 in.	32 in.	35.5 in.	32 in.	35.5 in.	32 in.	35.5 in.	32 in.
Body Mass Index [5]	18.5-24.9	18.5-24.9	18.5-24.9	18.5-24.9	18.5-24.9	18.5-24.9	18.5-24.9	18.5-24.9	18.5-24.9	18.5-24.9

[1] - Absolute rate of oxygen consumed (L) / weight (kg) / minute

[2] - Weight lifted (lbs) / body weight (lbs)

[3] - Females tested in the modified (aka "knee push-up") position

[4] - Measurement taken at the superior border of the iliac crest

[5] - BMI = weight (kg) / height [2] (m)

Fitness Testing Definition

- A series of exercises designed to assess fitness (e.g., cardiovascular endurance, muscular strength, agility, etc.). [WHAT]
- Typically performed before starting an exercise program as well as periodically to monitor progress. [WHEN]

Fitness Testing Purpose

- Identify physiological strengths & weaknesses
- Rank individuals for selection purposes
- Predict future performances
- Evaluate effectiveness of training program
- Track performance over time
- Assign training parameters
  - load (e.g., based of 1RM)

[WHY]

Field Test Definition

A test used to assess ability that is performed away from the laboratory and does not require extensive training or expensive equipment to administer.

Field Tests Should…

- Be Valid
- Be Reliable
- Be Feasible
- Be Objective
- Be Operationally Relevant
- Incorporate as many components of physical fitness as possible

FUN FACT!

Field tests that measure either distance or time tend to be more **objective** than those that use the number of repetitions performed

Physical Fitness Components

Health Related:

- Cardiovascular Fitness
- Muscular Endurance
- Muscular Strength
- Flexibility
- Body Composition

Skill Related:

- Speed
- Agility
- Power
- Coordination
- Balance
- Reaction Time

Field Test Order

- Non-fatiguing tests
- Agility tests
- Maximum power / strength
- Sprint tests
- Muscular endurance
- Anaerobic capacity
- Aerobic capacity

Criterion vs. Norm Standards

- **Criterion Standards.** Uses established cutoff scores to define minimal (acceptable) levels of performance

US Army Ranger Physical Fitness Test			
Push-Ups	Sit-Ups	Chin-Ups	5-Mile Run
49+	59+	6+	≤40:00

Criterion vs. Norm Standards

- **Normative Standards.** Uses established percentiles based off previous performance from a defined population

Standards are based on a sample of PRT results from over 200,000 members in the Fleet during PRTs from 1997 and 1998. Separate standards were developed for each gender and age group. Standards for each performance category are as follows:

(1) **OUTSTANDING** - Performance above or equal to top 10 percent.

(2) **EXCELLENT** - Performance in top 25 percent, but less than OUTSTANDING.

(3) **GOOD** - Performance better than or equal to lowest 25 percent, but less than EXCELLENT.

(4) **SATISFACTORY/PROBATIONARY** - Performance in bottom 25 percent, but above lowest 10 percent.

(5) **UNSATISFACTORY** - Performance in lowest 10 percent.

Sample Field Tests used by Industry

NFL Combine

- 40-yd Dash
- 225 lb. Bench Press
- Vertical Leap
- Broad Jump
- 20-yd Shuttle
- 3 Cone Drill
- 60-yd Shuttle

NBA Combine

- 185 lb. Bench Press
- Vertical Leap
- ¾ Court Sprint
- Lane Agility Test
- Reactive Shuttle Test

Nike SPARQ

- 40-yd Dash
- Pro-Agility
- Kneeling Powerball Toss
- Vertical Jump

Fitness Tests Used by the Different Services

DoD Instruction 1308.3

- Military Services shall develop and use physical fitness tests (PFTs) that evaluate aerobic capacity, muscular strength, and muscular endurance.

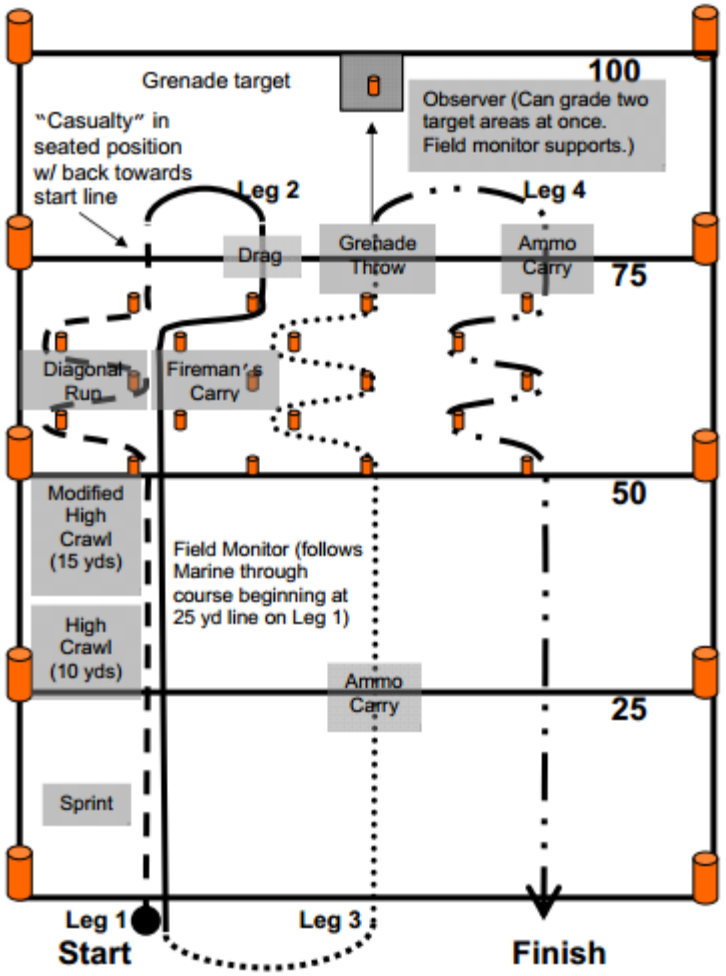
- PFTs shall assess baseline **generalized fitness** and not represent mission specific fitness demands.

USMC Physical Fitness Test

- Pull-ups (Males) / Flexed Arm Hang (Females)
- Crunches
- 3.0-Mile Run

USMC Combat Fitness Test

- 880-yd run
- 2-min overhead press
- Obstacle Course



Army Physical Fitness Test

- **Primary Components:**
  - Push-Up
  - Sit-Up
  - 2.0-Mile Run
- **Alternate Cardio Options:**
  - 800-yd Swim
  - 6.2-Mile Stationary Bike
  - 2.5-Mile Walk Test

Air Force Physical Fitness Test

- **Primary Components:**
  - Curl-Ups (1-min)
  - Push-Ups (1-min)
  - 1.5-Mile Run
- **Alternate Cardio Options:**
  - 1.0-Mile Rockport Walk Test

Navy Physical Readiness Test

- **Primary Components:**
  - Curl-Ups
  - Push-Ups
  - 1.5-Mile Run
- **Alternate Cardio Options:**
  - 450-m / 500-yd Swim
  - 12-min Elliptical
  - 12-min Stationary Bike

ACSM's Guidelines for Exercise Testing & Prescription (9th Ed.)

- **Chapter 4, page 77:** "Some electronic fitness equipment [bike] cannot be calibrated and **should not** be used for testing."

5K Bike vs. 500-yd Swim

Correlation between VO_2max, 1.5 Mile Run, and 500-yd Swim			
	VO_2max	1.5 Mile Run	500-yd Swim
VO_2max	-	-0.84 *	-0.32
1.5 Mile Run	-	-	0.44 *
500-yd Swim	-	-	-

Correlation between VO_2max, % BF, Swim Skill, and Swim Time				
	Swim Time	VO_2max	Swim Skill	% BF
Swim Time	-	-0.32	-0.83 *	0.20
VO_2max	-	-	0.28	-0.74 *
Swim Skill	-	-	-	0.24
% BF	-	-	-	-

* $p < 0.01$, N = 60

Possible New Physical Fitness Tests

Army Physical Readiness Test

- 60-yd Shuttle
- 1-Minute Rower
- Standing Long Jump
- 1-Minute Push-Up
- 1.5-Mile Run

Army Combat Readiness Test

- 400-m Run w/Weapon
- Individual Movement Techniques
- Ammo Can Shuttle Sprint
- Casualty Drag
- Agility Sprint

TRADOC Soldier 2020

- **Transition to a standards-based Army**
  - Match Soldiers to jobs that best correspond to their physical ability
- **Apply standards uniformly to every Soldier**
  - No age or gender-based exceptions to these standards

Soldier 2020 Predictor Tests

Muscular Strength:

- Handgrip
- Upright pull
- Biceps curl
- Squat lift

Power:

- Standing long Jump
- Medicine-ball put
- Overhead powerball throw
- Resistance pull

Muscular Endurance:

- Sit-ups
- Push-ups
- Arm ergometer

Cardiovascular Endurance:

- Beep test
- Step test

Speed & Agility:

- Illinois agility test
- 300-m run

Army Operational Physical Assessment Test (OPAT)

- Standing Long Jump
- 3-kg Medicine Ball Put
- Deadlift
- Aerobic Interval Run

Air Force Combat Fitness Test?

- **Worden and White III (2012):**
  - ½ mile run
  - 2-min repetitive dumbbell lift
  - 1-min push-ups
- **Mitchell et al. (2014):**
  - 1.5-mile run
  - 2-min repetitive dumbbell lift

2011 PRT Beta Test

- Single-Leg Plank
- Single-Leg Wall Squat
- Cadence Push-Ups
- Standing Long Jump
- Leg/Hip Dynamometer
- Pro Agility Test
- 300-yd Shuttle
- 2-Km Rower
- 5-Km Bike Test

Navy Physical Fitness Test

- **Primary Components:**
  - Standing Long Jump
  - Plank
  - 300-yd Shuttle
- **Alternate Cardio Options:**
  - 2-Km Rower

Navy General Fitness Test

- **Primary Components:**
  - Abdominal Circumference
    - Umbilicus
  - Plank
  - 1.5-mile Run
- **Alternate Cardio Options:**
  - 2-Km Rower

HSIAC Recommendations

According to Human Systems Information Analysis Center (HSIAC), the two most important components of fitness for assessing general health are:

- Aerobic Capacity
- Body Composition

Constable, S., & Palmer, B. (2000). *The Process of Physical Fitness Standards Development*. Wright-Patterson AFB, OH: Human Systems IAC Program Office.

FUN FACT!

According to HSIAC, the most important component of fitness in terms of injury prevention and work capacity is **muscular strength**

Modified PRT

- **Primary Components:**
  - Abdominal Circumference
    - Umbilicus
  - 1.5-mile Run
- **Alternate Cardio Options:**
  - 2-Km Rower

Modified PRT

Male			Points	Female		
A/C (in.)	1.5-mile Run	2K Rower		A/C (in.)	1.5-mile Run	2K Rower
≤ 35	09:30	07:00	**100**	≤ 30	11:00	08:00
-	09:35	07:06	**99**	-	11:15	08:06
35.25	09:40	07:12	**98**	30.25	11:25	08:12
-	09:50	07:18	**97**	-	11:35	08:18
35.5	10:00	07:24	**96**	30.5	11:45	08:24
-	10:10	07:30	**95**	-	11:55	08:30
35.75	10:15	07:36	**94**	30.75	12:05	08:36
-	10:20	07:42	**93**	-	12:20	08:42
36	10:30	07:48	**92**	31	12:30	08:48
-	10:40	07:54	**91**	-	12:40	08:54
36.25	10:50	08:00	**90**	31.25	12:50	09:00
-	10:55	08:06	**89**	-	12:55	09:06
36.5	11:00	08:12	**88**	31.5	13:00	09:12
-	11:10	08:18	**87**	-	13:10	09:18
36.75	11:20	08:24	**86**	31.75	13:20	09:24
-	11:25	08:30	**85**	-	13:30	09:30
37	11:30	08:33	**84**	32	13:45	09:33
-	11:35	08:36	**83**	-	14:00	09:36
37.25	11:40	08:39	**82**	32.25	14:30	09:39
-	11:50	08:42	**81**	-	14:45	09:42
37.5	12:00	08:45	**80**	32.5	15:15	09:45
-	12:10	08:48	**79**	-	15:30	09:48
37.75	12:15	08:51	**78**	32.75	15:40	09:51
-	12:20	08:54	**77**	-	15:50	09:54
38	12:25	08:57	**76**	33	16:00	09:57
-	12:30	09:00	**75**	-	16:10	10:00
38.25	12:35	09:15	**74**	33.25	16:20	10:15
-	12:40	09:30	**73**	-	16:30	10:30
38.5	12:45	09:30	**72**	33.5	16:40	10:30
-	12:50	09:45	**71**	-	16:50	10:45
38.75	13:00	10:00	**70**	33.75	17:00	11:00
-	13:15	10:02	**69**	-	17:10	11:02
39	13:30	10:05	**68**	34	17:15	11:05
-	13:45	10:07	**67**	34.25	17:20	11:07
39.25	14:00	10:10	**66**	34.5	17:25	11:10
-	14:15	10:12	**65**	34.75	17:30	11:12
39.5	14:30	10:15	**64**	35	17:40	11:15
-	14:45	10:17	**63**	35.25	17:45	11:17
39.75	15:00	10:20	**62**	35.5	17:50	11:20
-	15:15	10:25	**61**	35.75	17:55	11:25
40	15:30	10:30	**60**	36	18:00	11:30

	≤ 34 years	35-44 years	45-54 years	55+ years
Maximum	200	190	175	160
Outstanding	185	175	155	145
Excellent	165	155	145	135
Good	150	145	130	125
Satisfactory	120	120	120	120

Navy Operational Fitness Test

- **Components:**
  - Kneeling Powerball Toss
    - 2-kg powerball - Females
    - 3-kg powerball - Males
  - Standing Long Jump
  - 40-yd Dash
  - 50-yd Loaded Carry
    - (2) 24-kg kettlebells - Females
    - (2) 32-kg kettlebells - Males
  - 300-yd Shuttle

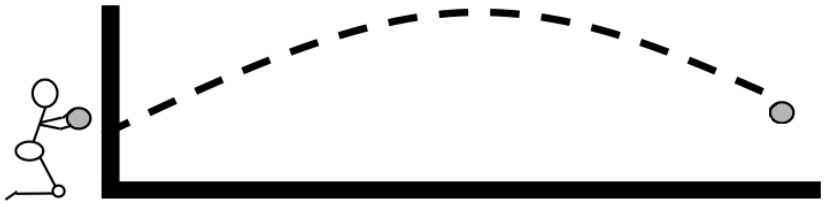
Navy Operational Fitness Test

Male					Points	Female				
KPB Toss (ft)	SLJ (cm)	40-yd Sprint (sec)	Loaded Carry (sec)	300-yd Shuttle		KPB Toss (ft)	SLJ (cm)	40-yd Sprint (sec)	Loaded Carry (sec)	300-yd Shuttle
38	275	4.9	12	00:55	100	28	225	5.3	15	01:00
37.5	272	-	-	-	99	-	222	-	-	01:01
37	270	-	-	00:56	98	27.5	220	5.4	-	01:02
36.5	267	5.0	-	-	97	-	217	-	16	01:02
36	265	-	13	00:57	96	27	215	5.5	-	01:03
35.5	262	-	-	-	95	-	212	-	-	01:04
35	260	5.1	-	00:58	94	26.5	210	5.6	17	01:05
34.5	257	-	-	-	93	-	207	-	-	01:06
34	255	-	14	00:59	92	26	205	5.7	-	01:07
33.5	252	5.2	-	01:00	91	-	202	-	18	01:08
33	250	-	-	01:01	90	25.5	200	5.8	-	01:09
32.5	247	-	-	01:02	89	-	197	-	-	01:10
32	245	5.3	15	01:02	88	25	195	5.9	19	01:11
31.5	240	-	-	01:03	87	-	190	-	-	01:12
31	235	-	-	01:04	86	24.5	185	6.0	-	01:13
30.5	230	5.4	-	01:05	85	-	180	-	20	01:14
30	229	-	16	01:06	84	24	179	6.1	-	01:15
29.5	228	-	-	01:07	83	-	178	-	-	01:16
29	227	5.5	-	01:08	82	23.5	177	6.2	21	01:17
28.5	226	-	-	01:09	81	-	176	-	-	01:18
28	225	-	17	01:10	80	23	175	6.3	-	01:19
27.5	224	5.6	-	01:11	79	-	174	-	22	01:20
27	223	-	-	01:12	78	22.5	173	6.4	-	01:21
26.5	222	-	-	01:13	77	22	172	-	-	01:22
26	221	5.7	18	01:14	76	21.5	171	-	23	01:23
25.5	220	-	-	01:15	75	21	170	6.5	-	01:24
25	219	-	-	01:16	74	20.5	169	-	-	01:25
24.5	218	5.8	-	01:17	73	20	168	-	24	01:26
24	217	-	19	01:18	72	19.5	167	6.6	-	01:27
23.5	216	-	-	01:19	71	19	166	-	-	01:28
23	215	5.9	-	01:20	70	18.5	165	-	25	01:29
22.5	210	-	-	01:21	69	18	164	6.7	-	01:30
22	205	-	20	01:22	68	17.5	163	-	-	01:30
21.5	200	6.0	-	01:23	67	17	162	-	26	01:31
21	195	-	-	01:24	66	16.5	161	6.8	-	01:32
20.5	190	-	-	01:25	65	16	160	-	-	01:33
20	185	6.1	21	01:26	64	15.5	158	-	28	01:34
19.5	180	-	-	01:27	63	15	156	6.9	-	01:35
19	175	6.2	-	01:28	62	14.5	154	-	29	01:36
18.5	170	-	-	01:29	61	14	152	-	-	01:37
18	165	6.3	22	01:30	60	13.5	150	7.0	30	01:38

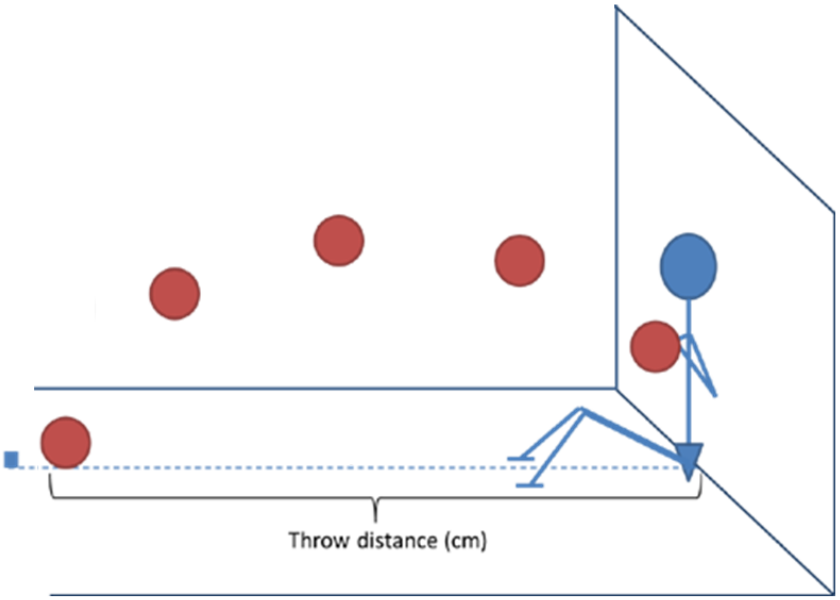
	≤ 34 years	35-44 years	45-54 years	55+ years
Maximum	500	475	430	400
Outstanding	455	430	390	365
Excellent	415	395	355	330
Good	375	355	320	310
Satisfactory	300	300	300	300

Upper Body Power Tests

Kneeling Powerball Toss



Seated Medicine Ball Put



NOFT 2.0

- **Components:**
  - Seated Medicine Ball Put
    - 2-kg Medicine Ball
  - Standing Long Jump
  - 50-yd Loaded Carry
    - (2) 24-kg kettlebells - Females
    - (2) 32-kg kettlebells - Males
  - 300-yd Shuttle

NOFT 2.0

Male				Points	Female			
SMB Put (ft)	SLJ (cm)	Loaded Carry (sec)	300-yd Shuttle		SMB Put (ft)	SLJ (cm)	Loaded Carry (sec)	300-yd Shuttle
30.4	275	12	00:55	**100**	18.9	225	15	01:00
29.5	272	-	-	**99**	18.5	222	-	01:01
28.6	270	-	00:56	**98**	18.2	220	-	01:02
27.7	267	-	-	**97**	17.9	217	16	01:02
26.8	265	13	00:57	**96**	17.6	215	-	01:03
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24	245	15	01:02	**88**	16.2	195	19	01:11
23.8	240	-	01:03	**87**	16.1	190	-	01:12
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23.4	229	16	01:06	**84**	15.8	179	-	01:15
23.3	228	-	01:07	**83**	15.7	178	-	01:16
23.2	227	-	01:08	**82**	15.6	177	21	01:17
23.1	226	-	01:09	**81**	15.5	176	-	01:18
23	225	17	01:10	**80**	15.4	175	-	01:19
22.9	224	-	01:11	**79**	15.3	174	22	01:20
22.8	223	-	01:12	**78**	15.2	173	-	01:21
22.7	222	-	01:13	**77**	15.1	172	-	01:22
22.6	221	18	01:14	**76**	15	171	23	01:23
22.5	220	-	01:15	**75**	14.9	170	-	01:24
22.4	219	-	01:16	**74**	-	169	-	01:25
22.3	218	-	01:17	**73**	14.8	168	24	01:26
22.2	217	19	01:18	**72**	-	167	-	01:27
22.1	216	-	01:19	**71**	14.7	166	-	01:28
21.9	215	-	01:20	**70**	-	165	25	01:29
21.8	210	-	01:21	**69**	14.6	164	-	01:30
21.7	205	20	01:22	**68**	-	163	-	01:30
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21.5	195	-	01:24	**66**	14.4	161	-	01:32
21.4	190	-	01:25	**65**	14.3	160	-	01:33
21.2	185	21	01:26	**64**	14.2	158	28	01:34
21.1	180	-	01:27	**63**	14.1	156	-	01:35
21	175	-	01:28	**62**	14	154	29	01:36
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20.7	165	22	01:30	**60**	13.8	150	30	01:38

	≤ 34 years	35-44 years	45-54 years	55+ years
Maximum	400	380	345	320
Outstanding	365	345	315	295
Excellent	335	315	285	265
Good	300	285	255	250
Satisfactory	240	240	240	240

Body Composition Recommendations

DoD Instruction 1308.1

- Initial guidance provided 3 considerations for services to consider:
  - Body composition is an integral part of physical fitness 
  - Body composition plays an important role in professional military appearance 
  - Body composition is a good indicator of general health 

DoD Instruction 1308.1

- Additional considerations for method selection:
  - Measurements need to be easily obtained from the field
  - Minimal amount of skill required to take the measurements
- As a result, all four services opted to use circumference measurements (at least initially) as the basis for their BCA programs

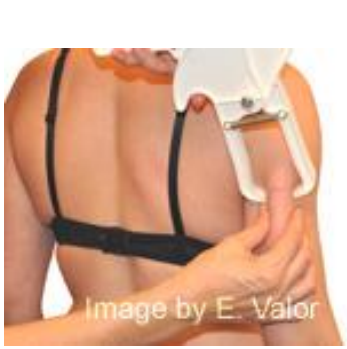
DoD Instruction 1308.3

- Establish percent body fat standards using the circumference-based method

- Circumference-based methods are inextricably linked to military body fat standards and have been carefully evaluated against other methods

FUN FACT!

Although not considered the most accurate method in terms of predicting actual % body fat; skinfolds and circumference measurements are extremely useful in terms of tracking/monitoring actual fat loss/gain over time



BCA Programs of the Other Services

Service BCA Standards

Maximal Allowable Body Fat Percentages (%BF) / Abdominal Circumference (AC) by Service

Service	Age	%BF Men	%BF Women	AC Men	AC Women
Air Force	-	-	-	>39	>35.5
	-	-	-	35	31.5
Army	17-20	20%	30%	-	-
	21-27	22%	32%	-	-
	28-39	24%	34%	-	-
	40+	26%	36%	-	-
Marine Corps	17-26	18%	26%	-	-
	27-39	19%	27%	-	-
	40-45	20%	28%	-	-
	46+	22%	29%	-	-
Navy	17-39	22%	33%	-	-
	40+	23%	34%	-	-
					High Risk
					Moderate Risk

U.S. Marine Corps

- First service to use circumference measurements to assess body composition

U.S. Army

- Initially, used 4-site skinfolds to assess body composition
  - Bicep
  - Tricep
  - Subscapular
  - Suprailiac
- In 1986, transitioned to circumference-based equations similar to those used by the Navy and Marine Corps

U.S. Air Force

- Initially, used circumference measurements similar to the other services
- In 2009, received DoD approval to transition to a single abdominal circumference measurement
  - Superior border of the iliac crest

- Research* has shown a strong correlation between excess abdominal fat and certain metabolic diseases
  - Insulin resistance
  - Impaired glucose tolerance
  - Type 2 diabetes
  - Dyslipidemia
  - Cancer
- Research† has also shown that abdominal circumference is a good predictor of these risks

** Cerhan et al. (2014). A pooled analysis of waist circumference and mortality in 650,000 adults.*

† Hodgdon, J.A. (2012). A revised equation for prediction of body fat content in Navy women.

U.S. Navy

- In 1982, used the current circumference sites for males but different sites for females
  - Neck
  - Waist (umbilicus)
  - Bicep
  - Forearm
  - Thigh
- Prior to 1994, all Sailors were required to participate in the BCA

NAVADMIN 178/15 & 061/16

- Sailors now have 3 ways in which to pass the BCA:
  - Comply w/ Ht/Wt tables
  - Pass single-site abdominal circumference
    - Males: ≤ 39 in.
    - Females: ≤ 35.5 in.
  - Comply w/ DoD max. allowable %BF limits
    - Males: ≤ 26%
    - Females: ≤ 36%

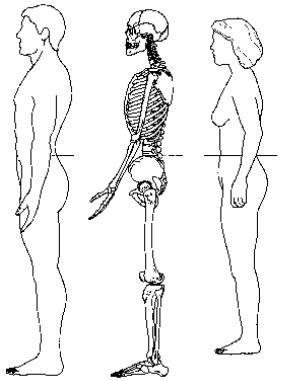
NAVADMIN 178/15 & 061/16

- Additionally, stricter BCA standards will be used to help identify Sailors at risk:
  - Males
    - 18-21: 22%
    - 22-29: 23%
    - 30-39: 24%
    - 40+: 26%
  - Females
    - 18-21: 33%
    - 22-29: 34%
    - 30-39: 35%
    - 40+: 36%

Abdominal Circumference

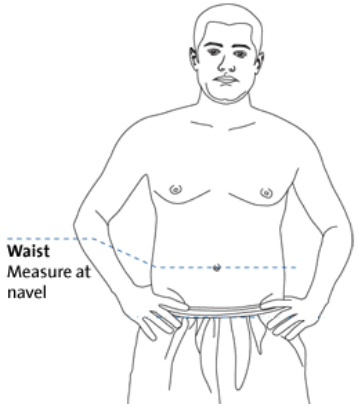
National Institutes of Health (NIH):

- Superior Border of Iliac Crest
  - Males: 40 in.
  - Females: 35 in.

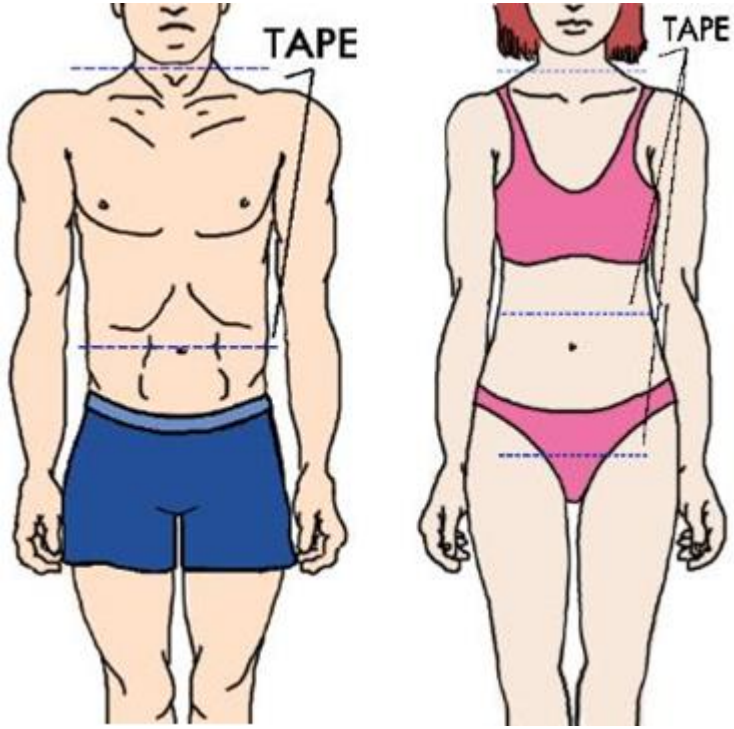


Naval Health Research Center (NHRC):

- Umbilicus
  - Males: 40.2 in.
  - Females: 36 in.

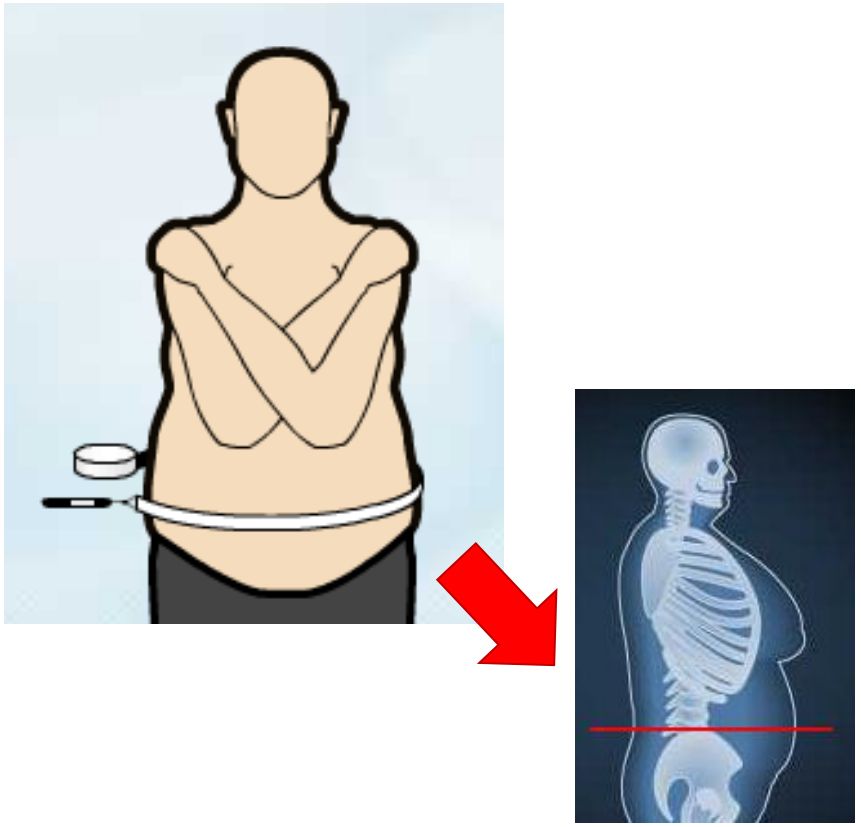


Circumference Measurements



DoD Circumference Sites

NIH Circumference Site



Proposed Revisions to the Navy's BCA Program

Proposed Revisions

- Mandatory single-site abdominal circumference for all service members
  - Umbilicus

- Proposed BCA Standards:

Health Risk Category	Pass/Fail BCA	Male (in.)	Female (in.)
Low Risk	Pass	≤ 35	≤ 30
Moderate Risk	Pass	> 35 - 40	> 30 - < 36
High Risk	Fail	≥ 40	≥ 36

* Requires medical evaluation/consultation

Practical Application

- Provide a brief explanation of and rationale for periodic fitness testing

- Provide a brief history and description of the various fitness tests and body composition assessments used by the different branches of service

- Provide several fitness testing options for healthy/active populations of various ages and genders

Questions?

body-by-meat.blogspot.com