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USARIEM TECHNICAL REPORT T18-08

**A COMPENDIUM OF THE PHYSIOLOGICAL DEMANDS OF THE 32
CRITICAL PHYSICALLY DEMANDING TASKS OF COMBAT ARMS SOLDIERS**

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FOREWORD

This technical report is the one in a series documenting the development of a physical employment screening test for seven combat arms military occupational specialties (MOSs) as part of the Soldier 2020 initiative. Portions of the data presented herein were also reported in the technical reports for the individual MOSs. (2-4, 7)

BACKGROUND

Performing physically demanding tasks is an integral part of being a Soldier (8). In general, these tasks include combinations of lifting/lowering, lifting and carrying, pushing/pulling, climbing, digging, and walking/marching/running. Such tasks require a great deal of muscular strength, muscular endurance, and cardiovascular fitness. As part of the U.S. Army Physical Demands Study (which led to the development of the Occupational Physical Assessment Test (OPAT)), 32 physically demanding tasks were identified as being critical to combat arms Soldiers. In order to identify the most physically demanding of those tasks, physiological data were collected on Soldiers performing those tasks. The data collected during this study may be useful for researchers and leadership when understanding the physiological demands placed on Soldiers.

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DISCLAIMERS

The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or as reflecting the views of the Army or the Department of Defense.

The investigators have adhered to the policies for protection of human subjects as prescribed in Army Regulation 70-25, and the research was conducted in adherence with the provisions of 32 CFR Part 219. Protocol # 9300.

This research was supported in part by appointments to the Postgraduate Research Participation Program at the U.S. Army Research Institute of Environmental Medicine administered by the Oak Ridge Institute for Science and Education.

Portions of the data presented in this report have been previously reported.

EXECUTIVE SUMMARY

As part of the U.S. Army Physical Demands Study (which led to the development of the Occupational Physical Assessment Test (OPAT)), 32 physically demanding tasks were identified as being critical to combat arms soldiers. In order to identify the most physically demanding of those tests, data were collected on Soldiers performing those tasks. These data include measures of the weight of objects moved and uniform being worn, as well as the physiological responses of the Soldiers performing the tasks (such as heart rate, rating of perceived exertion, and energy cost). This report provide a comprehensive reference of the physiological demands of the critical physically demanding tasks of combat arms Soldiers. This report will not compare tasks, as this has already been reported for their respective MOSs (2-4, 7)

INTRODUCTION

In January 2013, the Secretary of Defense rescinded the 1994 Direct Ground Combat Definition and Assignment Rule (DGCDAR), which closed all combat occupations to women. The Training and Doctrine Command (TRADOC) tasked the U.S. Army Research Institute of Environmental Medicine (USARIEM) to develop a new physical employment screening test for entry into the combat arms military occupational specialties (MOSs) that were previously closed to women. Both TRADOC and USARIEM followed the recommendations provided by Payne & Harvey (6) to perform a job task analysis on the combat arms MOSs.

The first step was to identify the physically demanding tasks and set task performance standards. To do so, TRADOC began by reviewing field manuals, training videos and physical task descriptions related to each of the MOSs of interest (i.e., 11B Infantryman, 11C Infantryman- Indirect Fire, 12B Combat Engineer, 13B Cannon Crewmember, 13F Fire Support, 19D Cavalry Scout, and 19K Armor Crewman). A group of subject matter experts (SMEs) from each of the proponent schools then developed a task list and associated minimum standards based on this review. The result was a list of 32 physically demanding tasks relevant to these MOSs (Table A). Of these tasks, nine were common to several MOSs and 23 were specific to one or two MOSs. The TRADOC then observed Soldiers from each MOS performing the tasks. If 90% of the Soldiers observed could not perform the tasks to standard, the task statements were revisited by the SME's for accuracy. As part of this TRADOC exercise, USARIEM researchers also observed the Soldiers. The following step was to identify each job's requirements using the task statement, which included specific, quantifiable details of each task. Additionally, it was necessary to verify and observe each task to ensure accuracy of the task standards. The task details and verification included quantity and weights of loads being moved or lifted, distances traveled, Soldier uniform/gear, and equipment required. Next, USARIEM confirmed the task statements through senior leadership, performing face-to-face focus groups with senior- and junior-level Soldiers and sent a job questionnaire to all Soldiers in these seven MOSs.

The final step was to directly measure the physiological responses when performing these tasks. The purpose of this technical report is to describe the physiological demands of the identified tasks. It is important to understand the physiological responses that occur during these tasks in order to determine the physical requirements for successful task completion. Quantifiable metrics of task performance and physiological responses were collected from male Soldiers in each of the MOSs. These measurements included heart rate, rate of perceived exertion and metabolic cost. In addition, female Soldiers from other MOSs also performed the tasks in order to include physiological responses from both sexes.

This report provide a comprehensive reference of the physiological demands of the critical physically demanding tasks of combat arms Soldiers. This report will not compare tasks within an MOS, as this has already been reported for their respective MOSs (2-4, 7).

Table A. List of the 32 Physically Demanding Tasks of Combat Arms Soldiers

TASK	IN 11B	IN 11C	EN 12B	FA 13B	FA 13F	AR 19D	AR 19K
1 Conduct Tactical Movement / Foot March	X	X	X		X	X	X
2 Employ Hand Grenades	X	X	X	X	X	X	X
3 Prepare a Fighting Position (Fill and Emplace Sandbags)	X	X	X	X	X	X	X
4a Drag a Casualty to Immediate Safety	X	X	X	X	X	X	X
4b Remove a Casualty from a Wheeled Vehicle	X		X		X	X	
5 Maintain 25mm Gun on BFV – Install the Barrel	X		X		X	X	
6 Maintain 25mm Gun on BFV – Remove Feeder Assembly	X		X		X	X	
7 Load 25mm H-EIT Tracer Ammunition Can on BFV	X		X		X	X	
8 Load TOW Missile Launcher on BFV	X					X	
9 Move Over, Through, or Around Obstacles	X	X					
10 Move Under Direct Fire	X	X	1		1	1	1
11 Prepare Dismounted TOW Firing Position	X						
12 Engage Targets with a Caliber .50 M2 Machine Gun	X						
13 Lay a 120mm Mortar – Emplace Base Plate		X					
14 Lay a 120mm Mortar – Emplace Cannon		X					
15 Lay a 120mm Mortar for Deflection and Elevation (Traverse)		X					
16 Fire a Mortar (Lift and Hold Round, Place in Tube)		X					
17 Mount M2 .50 Cal Machine Gun Receiver on an Abrams Tank							X
18 Stow Ammunition on an Abrams Tank (Load 120mm MPAT Round to the Ready Rack)							X
19 Load the 120mm Main Gun							X
20 Remove a Casualty from an Abrams Tank							X
21 Transfer Ammunition with an M992 Carrier (CAT)				X			
22 Emplace 155mm Howitzer / Lift Wheel Assembly				X			
23 Displace 155mm Howitzer / Recover Spade Trail Arm and Blade				X			
24 Set Up Gun Laying Positioning System (GLPS)				X			
25 Establish an Observation Point					X		
26 Prepare M1200 Armored Knight Vehicle for Operation					X		
27 Quickly Create a Footpath through Various Obstacles (Carry / Employ Antipersonnel Obstacle Breaching System (APOBS))			X				
28 Prepare Obstacle with the H6 40-lb Cratering Charge			X				
29 Operate a Modular-Pack Mine System (MOPMS)			X				
30 Assist in the Construction of a Bailey Bridge			X				
31 Load / Install a Volcano			X				

IN=Infantry, FA=Field Artillery, AR=Armor, EN=Engineers

X Essential to that specific combat arms military occupational specialty

¹ Following Study 1, move under direct fire was determined to be essential to 12B, 13F, 19D, and 19K as well.

METHODS & RESULTS

Data were collected at three U.S. Army Forces Command installations between September 2013 and March 2014. Cohorts tested included men assigned to each of the MOSs and women who volunteered and were trained to perform the tasks. Prior to testing, all Soldiers were briefed and signed an informed consent form. Descriptives of all 210 Soldiers tested are provided in Table B.

Table B. Descriptive Characteristics of Soldiers Participating in Testing

		N	Mean	SD	Minimum	Maximum
Age (years)	Male	133	22.7	3.4	19	37
	Female	77	24.6	5.1	18	44
	Sex Combined	210	23.4	4.2	18	44
Height (cm)	Male	133	179.6	6.6	162.6	195.6
	Female	77	166.1	6.4	149.9	180.3
	Sex Combined	210	174.6	9.3	149.9	195.6
Mass (kg)	Male	133	84.5	16.1	53.8	129.1
	Female	77	65.9	14.6	43.8	115.0
	Sex Combined	210	77.7	18.0	43.8	129.1
APFT score (points)	Male	133	256	29	162	300
	Female	77	260	29	166	300
	Sex Combined	210	257	29	162	300
Time in Service (years)	Male	133	2.4	2.1	0.4	13.0
	Female	77	3.4	4.0	0.8	25.0
	Sex Combined	210	2.8	3.0	0.4	25.0

PHYSIOLOGICAL MEASUREMENTS

Measurements varied by task. Time to completion was recorded for all tasks. Ratings of perceived exertion (RPE) (1) were also recorded for all tasks. Tasks deemed aerobically-intensive were graded on the 6-20 scale, whereas tasks primarily driven by strength were graded on the CR-10 (i.e., 0-10) scale (1). Tasks with an approximate duration of greater than 5 minutes were deemed aerobic tasks, whereas the remainder were identified as strength tasks. Instructions provided to the trainees for these scales are provided in Appendix C.

Metabolic data were also collected for the aerobic tasks using a Parvo Medics TrueOne 2400 Cart (Sandy, UT) for Tasks 1.1, 1.2, and 27, or an Oxycon Mobile Metabolic Unit (CareFusion, San Diego, CA) for Tasks 3, 7, 18.1, 21, 28, and 31. Data were output using 1-minute averaging, which were then were averaged over the course of the task, eliminating the first minute. Metabolic variables of interest included average heart rate (HR), average oxygen uptake (VO_2) in absolute units ($\text{L} \cdot \text{min}^{-1}$), average VO_2 relative to body mass ($\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$), and percent of estimated maximal VO_2 ($\text{VO}_{2\text{max}}$). $\text{VO}_{2\text{max}}$ was estimated using the following equation (5):

Predicted $VO_2\text{max}$ ($\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) = $110.9 - 2.79$ (2-mile run time [min]) - 0.25 (weight [kg])

Absolute total O_2 consumption (L, product of average VO_2 and time) adjusted for body mass ($\text{L}\cdot\text{kg}^{-1}$) was also calculated. For some tasks, HR at the end of the task was recorded using a Polar heart rate chest-strap monitor and watch (Polar Electro Model T31, Kempele, Finland).

TASK SIMULATIONS

During each task, Soldiers wore the designated uniform (with associated load) as defined by the SMEs from the respective schools. The full breakdown of the each load is illustrated in Appendix A. Briefly, the approximate weight of the basic Army Combat Uniform (ACU) was 12.4 lb. The fighting load includes the ACU plus the weight of personal protective equipment (PPE) and a weapon (70.4 lb) for a total of 83 lb. The loads varied based on the size of the Soldier, particularly the weight of the body armor. The weight of the standard PPE can vary from 63.1 to 77.5 lb. The loads worn for each task are listed in the task descriptions. The 24-hour sustainment load consisted of everything included in the fighting load, plus 19 lb of additional supplies and equipment carried in an assault pack, for a total load of 102 lb. This load also varies from 94 to 110 lb based on the size of the body armor. The task-specific uniform can vary between 42.5 to 57.1 lb, which includes the ACU, Improved Outer Tactical Vest (IOTV) with Enhanced Small Arms Protective Insert (ESAPI) and Enhanced Side Ballistics Insert (ESBI), and an Advanced Combat Helmet (ACH). The loads stated herein refer to size large body armor, so the loads represent the middle of the actual range of weight worn.

Descriptions of the testing condition for each task, as well as the acceptable standard of completion provided by TRADOC (when applicable) are listed. Soldiers were instructed to perform the tasks at the rate they would normally perform the task. All tests were graded “Go” or “No-Go” depending on whether they completed the task to standard. Only physiological data from Soldiers who successfully completed the task to standard are reported.

Further details about each task are provided in Appendix B. For some of the tasks, different variants were performed (e.g. treadmill vs field marching) at separate sites in order to capture different aspects of the task. Not all Soldiers completed all variants of a task.

STATISTICAL ANALYSES

All statistics were calculated using SPSS Version 20 (IBM Corporation, Armonk, New York). For each task and outcome variable, mean and standard deviations were calculated separately by sex, as well as combined.

1. Foot March (11B, 11C, 12B, 13F, 19D, 19K)

The standard tactical movement requires Soldiers to complete a 12-mile foot movement while wearing the 24-hour sustainment load in 24 hours.

Variant 1.1:

Soldiers walked for 20 minutes on a treadmill at 2 to 2.5 mph with no grade. The purpose of this measurement was to determine the energy cost of the task, not to determine if Soldiers could complete a 12-mile foot march. The 20 min of exercise was adequate to achieve a steady metabolic state.

Army Standard: Successful completion of the task

Uniform Load Carried		~102 lb including rucksack				
External Load Moved		N/A				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	20.22	0.41	20.00	21.50
	Female	9	20.03	0.09	20.00	20.27
	Sex Combined	32	20.16	0.36	20.00	21.50
RPE (6-20)	Male	23	9.91	2.41	6.00	13.00
	Female	10	13.30	3.30	7.00	17.00
	Sex Combined	33	10.94	3.09	6.00	17.00
Post HR (bpm)	Male	23	116	14	88	143
	Female	10	135	13	113	155
	Sex Combined	33	122	16	88	155
Mean HR (bpm)	Male	23	112.12	12.15	87.39	133.72
	Female	10	133.16	21.42	100.47	173.06
	Sex Combined	33	118.49	18.08	87.39	173.06
Absolute VO ₂ (L·min ⁻¹)	Male	23	0.99	0.21	0.42	1.24
	Female	10	0.80	0.24	0.35	1.02
	Sex Combined	33	0.93	0.23	0.35	1.24
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	23	12.52	2.73	5.18	17.90
	Female	10	12.23	3.85	5.95	16.87
	Sex Combined	33	12.44	3.05	5.18	17.90
Estimated % VO ₂ max	Male	22	24.56	5.25	10.32	32.49
	Female	9	26.50	8.38	11.55	35.65
	Sex Combined	31	25.12	6.23	10.32	35.65
Total O ₂ Consumption (L)	Male	23	20.07	4.25	8.62	25.87
	Female	9	16.02	5.02	7.00	20.37
	Sex Combined	32	18.93	4.77	7.00	25.87
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	23	253.22	55.52	106.41	357.98
	Female	9	251.18	79.09	119.08	337.42
	Sex Combined	32	252.65	61.67	106.41	357.98
Pass Rate	Male	100% (23/23)				
	Female	100% (10/10)				
	Sex Combined	100% (33/33)				

Soldier performing foot march task on treadmill to measure the energy cost.



Variant 1.2:

Soldiers walked for 20 minutes on a treadmill at 2.0-2.5 mph over various grades on a treadmill to simulate walking up and down hills. The grade changed for each segment and in the following order: 1.0%, 3.0%, 1.0%, 5.0%, 1.0%, 3.0%, and 1.0%.

Army Standard: Successful completion of the task

Uniform Load Carried		~102 lb including rucksack				
External Load Moved		N/A				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	20	20.00	0.00	20.00	20.00
	Female	8	20.00	0.00	20.00	20.00
	Sex Combined	28	20.00	0.00	20.00	20.00
RPE (6-20)	Male	20	10.45	1.73	7.00	13.00
	Female	8	14.00	1.85	11.00	17.00
	Sex Combined	28	11.46	2.38	7.00	17.00
Post HR (bpm)	Male	20	128	18	94	172
	Female	7	144	15	125	164
	Sex Combined	27	132	18	94	172
Mean HR (bpm)	Male	11	133.30	14.54	111.26	157.70
	Female	5	137.44	16.47	116.26	156.58
	Sex Combined	16	134.59	14.74	111.26	157.70
Absolute VO ₂ (L·min ⁻¹)	Male	18	1.16	0.43	0.60	1.92
	Female	8	0.90	0.28	0.58	1.23
	Sex Combined	26	1.08	0.41	0.58	1.92
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	18	15.00	4.87	7.77	24.91
	Female	8	15.54	5.75	9.84	23.59
	Sex Combined	26	15.16	5.05	7.77	24.91
Estimated % VO ₂ max	Male	18	30.22	10.91	16.97	47.60
	Female	7	34.15	10.91	19.59	45.32
	Sex Combined	25	31.32	10.83	16.97	47.60
Total O ₂ Consumption (L)	Male	18	23.21	8.66	11.91	38.45
	Female	8	18.01	5.63	11.51	24.53
	Sex Combined	26	21.61	8.11	11.51	38.45
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	18	299.97	97.43	155.35	498.23
	Female	8	310.78	115.10	196.71	471.87
	Sex Combined	26	303.29	100.95	155.35	498.23
Pass Rate	Male	100% (20/20)				
	Female	81.8% (9/11)				
	Sex Combined	93.5% (29/31)				

Variant 1.3:

On a supervised course, Soldiers completed a 12-mile foot movement while wearing the 24-hour sustainment load. Three mandatory rest stations were placed on the course at miles 3, 6 and 9. Soldiers were required to rest for approximately 10 minutes at the first and third station and 30 minutes at the midpoint station. This represented a simulation of a mission execution. Soldiers were allowed to take additional breaks as needed, and were permitted to stay at each official rest stop longer if needed. Soldiers were instrumented with a heart rate monitor and a timing chip (SPORTident Model SIAC1, Arnstadt, Germany). Heart rate and RPE were collected at each rest stop as well as at the finish line.

Army Standard: Successful completion of the task

Uniform Load Carried		~102 lb including rucksack				
External Load Moved		N/A				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	65	222.21	23.41	188.07	292.15
	Female	37	270.59	34.74	218.90	337.13
	Sex Combined	102	239.76	36.39	188.07	337.13
Post RPE (6-20)	Male	84	15.31	2.18	9.00	20.00
	Female	51	16.82	2.23	11.00	20.00
	Sex Combined	135	15.88	2.31	9.00	20.00
Post HR (bpm)	Male	84	151	15	95	187
	Female	55	151	14	120	182
	Sex Combined	139	151	15	95	187
Pass Rate	Male	98.9% (88/89)				
	Female	89.7% (52/58)				
	Sex Combined	95.2% (140/147)				

Soldiers performing the 12-mile foot march



2. Employ Hand Grenades (11B, 11C, 12B, 13B, 13F, 19D, 19K) (NOT TESTED)

While wearing a fighting load minus a weapon, Soldiers threw a hand grenade at least 30 m.

Uniform Load Carried	~71 lb
External Load Moved	1 lb

This task was not tested because it has been demonstrated that skill plays a greater role than physiological demand, and that task performance is not always reliable (10).

3. Fighting Position (11B, 11C, 12B, 13B, 13F, 19D, 19K)

Prepare a Fighting Position

Variant 3.1 (Sandbag Fill)

While wearing a fighting load minus a weapon, Soldiers shoveled sand from a large pile of loose sand into a bucket (to simulate a sandbag) using an entrenchment tool. A bucket was used to standardize the amount of sand moved. Upon auditory signal, Soldiers filled buckets 26 times 55 to 60% full (30-40 lb of sand per bucket).

Army Standard: Fill 26 sandbags in 52 minutes

Uniform Load Carried		~83 lb				
External Load Moved		26 x ~35 lb (~910 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	127	8.80	2.31	4.52	17.95
	Female	86	11.55	2.90	6.58	19.67
	Sex Combined	213	9.91	2.89	4.52	19.67
RPE (6-20)	Male	128	13.46	2.00	7.00	19.00
	Female	86	14.27	1.79	9.00	19.00
	Sex Combined	214	13.78	1.96	7.00	19.00
Post HR (bpm)	Male	127	160	18	115	197
	Female	85	161	14	126	188
	Sex Combined	212	161	17	115	197
Mean HR (bpm)	Male	113	154.55	17.38	116.10	189.87
	Female	81	154.84	14.13	122.80	185.80
	Sex Combined	194	154.67	16.07	116.10	189.87
Absolute VO ₂ (L·min ⁻¹)	Male	127	1.73	0.33	1.14	2.63
	Female	82	1.18	0.20	0.70	1.71
	Sex Combined	209	1.51	0.40	0.70	2.63
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	127	22.30	4.10	12.22	40.51
	Female	82	19.01	3.40	10.40	27.42
	Sex Combined	209	21.01	4.16	10.40	40.51
Estimated % VO ₂ max	Male	122	43.92	7.61	29.12	70.27
	Female	78	39.69	6.40	25.70	55.74
	Sex Combined	200	42.27	7.44	25.70	70.27
Total O ₂ Consumption (L)	Male	126	14.96	4.06	8.55	38.49
	Female	82	13.14	2.90	6.80	22.55
	Sex Combined	208	14.24	3.75	6.80	38.49
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	126	192.85	49.08	103.13	388.15
	Female	82	213.67	55.29	97.60	396.25
	Sex Combined	208	201.06	52.49	97.60	396.25
Pass Rate	Male	100% (134/134)				
	Female	100% (86/86)				
	Sex Combined	100% (220/220)				

Soldier filling sand buckets



Variant 3.2 (Sandbag Carry)

While wearing a fighting load minus a weapon, Soldiers lifted and carried 26 pre-filled sandbags (approximately 40 lb each) a horizontal distance of 10 m where they built a fighting position within 26 minutes. The fighting position consisted of three rows in a rectangular formation. Each row consisted of three sandbags in length and three sandbags in height. One of the three rows only had two sandbags on the third level.

Army Standard: Carry 26 sandbags in 26 minutes

Uniform Load Carried		~83 lb				
External Load Moved		26 x 35 lb (~910 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	143	5.27	2.55	2.85	18.83
	Female	84	7.16	2.02	4.28	12.98
	Sex Combined	227	5.97	2.53	2.85	18.83
RPE (6-20)	Male	143	14.22	2.00	7.00	19.00
	Female	84	15.70	2.06	11.00	20.00
	Sex Combined	227	14.77	2.14	7.00	20.00
Post HR (bpm)	Male	140	178	14	137	209
	Female	82	179	14	135	202
	Sex Combined	222	178	14	135	209
Mean HR (bpm)	Male	115	174.52	14.58	129.38	204.10
	Female	79	175.67	12.04	135.60	200.00
	Sex Combined	194	174.99	13.58	129.38	204.10
Absolute VO ₂ (L·min ⁻¹)	Male	128	2.58	0.46	1.51	3.91
	Female	80	1.73	0.29	1.18	2.46
	Sex Combined	208	2.25	0.58	1.18	3.91
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	128	33.11	5.29	18.61	45.26
	Female	80	27.85	4.48	17.35	42.51
	Sex Combined	208	31.09	5.60	17.35	45.26
Estimated % VO ₂ max	Male	123	65.39	10.00	44.73	90.61
	Female	76	58.20	8.75	41.59	78.75
	Sex Combined	199	62.64	10.14	41.59	90.61
Total O ₂ Consumption (L)	Male	128	13.40	5.03	8.17	39.04
	Female	80	11.94	2.49	8.03	19.37
	Sex Combined	208	12.84	4.29	8.03	39.04
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	128	172.95	66.29	102.44	516.64
	Female	80	194.16	51.25	115.30	376.03
	Sex Combined	208	181.11	61.69	102.44	516.64
Pass Rate	Male	100% (143/143)				
	Female	97.7% (84/86)				
	Sex Combined	99.1% (227/229)				

Soldier carrying sandbags (top) and building a fighting position (bottom).



4a. Casualty Drag (11B, 11C, 12B, 13B, 13F, 19D, 19K)

Drag a Casualty to Immediate Safety (Dismounted)

Upon auditory signal, Soldiers dragged a 270-lb simulated casualty a distance of 15 m as quickly as possible while wearing a fighting load with a weapon. For the simulated casualty, a Survivor dummy (Dummies Unlimited, Pomona, CA) was modified to obtain the necessary weight. The dummy was outfitted with a modified Fighting Load Carrier to serve as a pulling handle.

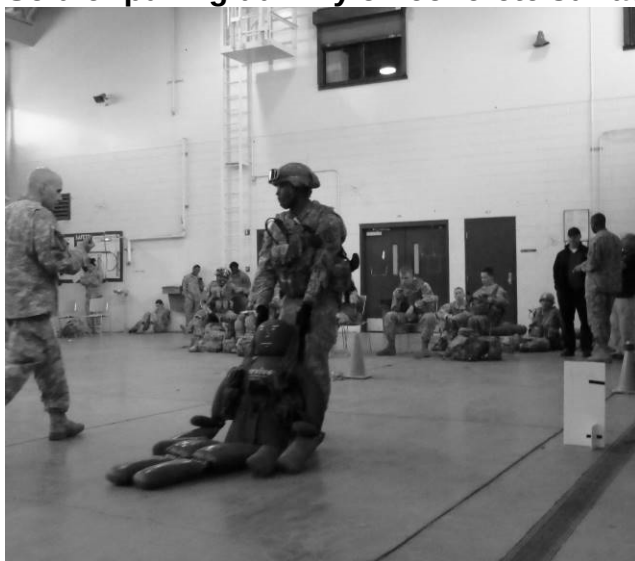
Army Standard: Casualty dragged 15 m in 1 minute

Variant 4a.1:

Soldiers pulled the dummy on a polished concrete motorpool floor.

Uniform Load Carried		~83 lb				
External Load Moved		270 lb				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	0.34	0.23	0.17	1.20
	Female	6	1.05	0.45	0.33	1.53
	Sex Combined	29	0.49	0.41	0.17	1.53
RPE (0-10)	Male	23	5.52	2.00	3.00	10.00
	Female	6	8.67	2.16	5.00	10.00
	Sex Combined	29	6.17	2.38	3.00	10.00
Post HR (bpm)	Male	23	162	14	135	187
	Female	6	175	8	160	185
	Sex Combined	29	165	14	135	187
Pass Rate	Male	100% (23/23)				
	Female	54.5% (6/11)				
	Sex Combined	85.3% (29/34)				

Soldier pulling dummy on concrete surface in motorpool.



Variant 4a.2:

Soldiers pulled the dummy on an asphalt walkway.

Uniform Load Carried		~83 lb				
External Load Moved		26 x ~35 lb (~910 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	129	0.28	0.11	0.15	0.95
	Female	51	1.22	.80	0.27	3.03
	Sex Combined	180	0.55	0.61	0.15	3.03
RPE (0-10)	Male	128	4.62	1.59	1.00	10.00
	Female	50	6.94	2.08	3.00	10.00
	Sex Combined	178	5.27	2.03	1.00	10.00
Post HR (bpm)	Male	129	168	12	134	199
	Female	50	173	16	96	196
	Sex Combined	179	169	13	96	199
Pass Rate	Male	100% (129/129)				
	Female	67.1% (53/79)				
	Sex Combined	87.5% (182/208)				

Soldier dragging dummy on asphalt surface.



4b. BFV Casualty Evacuation (11B, 12B, 13F, 19D)

Remove a Casualty from a Vehicle (Mounted)

As part of a two-Soldier team and while wearing a fighting load without a weapon, Soldiers removed a simulated casualty (approximately 207 lbs, prorated at 103.5 lbs/Soldier) from the commander's seat of a BFV. In order to standardize conditions, which would be impossible using a standard dummy with limbs that may catch in an irregular manner, the simulated casualty for this task was a haul bag (Black Diamond Zion, Salt Lake City, UT) modified to include straps that simulate the shoulder straps of a Combat Vehicle Crewman protective vest. Soldiers performed this task twice. Once it was tested as a member of a two-person team with the bag weighted at 207 lb. Soldiers also performed the task once solo, with the bag weighted at 103.5 lb.

Army Standard: Casualty removed from vehicle in 2 minutes

Variant 4b.1:

Two Soldiers removed the 207-lb bag: 1 inside the BFV and 1 outside the hatch. The physical demands were measured from the outside Soldier's point of view.

Uniform Load Carried		~71 lb				
External Load Moved		207 lb (prorated: 103.5 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	22	0.18	0.10	0.07	0.38
	Female	7	0.32	0.10	0.17	0.43
	Sex Combined	29	0.21	0.11	0.07	0.43
RPE (0-10)	Male	22	3.91	1.95	1.00	8.00
	Female	6	4.50	1.52	3.00	7.00
	Sex Combined	28	4.04	1.86	1.00	8.00
Post HR (bpm)	Male	22	141	20	108	175
	Female	7	147	19	117	169
	Sex Combined	29	143	20	108	175
Pass Rate	Male	95.7% (22/23)				
	Female	77.8% (7/9)				
	Sex Combined	90.6% (29/32)				

Variant 4b.2:

Two Soldiers removed the 207 lb-bag: 1 inside the BFV and 1 outside the hatch. The physical demands were measured from the inside Soldier's point of view.

Uniform Load Carried		~71 lb				
External Load Moved		207 lb (prorated: 103.5 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	22	0.11	0.05	0.03	0.23
	Female	8	0.17	0.14	0.07	0.43
	Sex Combined	30	0.13	0.08	0.03	0.43
RPE (0-10)	Male	21	3.19	1.54	1.00	7.00
	Female	8	3.63	2.00	1.00	7.00
	Sex Combined	29	3.31	1.65	1.00	7.00
Post HR (bpm)	Male	23	143	17	115	174
	Female	8	145	20	107	167
	Sex Combined	31	144	17	107	174
Pass Rate	Male	100% (23/23)				
	Female	88.9% (8/9)				
	Sex Combined	96.9% (31/32)				

Variant 4b.3:

Two Soldiers removed the 207 lb-bag outside the hatch as a team

Uniform Load Carried		Either ~71 lb or ~83 lb				
External Load Moved		207 lb (prorated: 103.5 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	65	0.16	0.13	0.02	0.60
	Female	39	0.23	0.14	0.05	0.60
	Sex Combined	104	0.19	0.14	0.02	0.60
RPE (0-10)	Male	65	3.69	1.26	2.00	9.00
	Female	39	4.67	1.61	1.00	9.00
	Sex Combined	104	4.06	1.47	1.00	9.00
Pass Rate	Male	98.5% (65/66)				
	Female	95.1% (39/41)				
	Sex Combined	97.2% (104/107)				

Two Soldiers pulling haul bag outside of hatch.



Variant 4b.4:

One Soldier removed the 103.5-lb bag from outside the hatch.

Uniform Load Carried		Either ~71 lb or ~83 lb				
External Load Moved		103.5 lb				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	67	0.08	0.09	0.02	0.42
	Female	28	0.44	0.44	0.03	1.70
	Sex Combined	95	0.19	0.30	0.02	1.70
RPE (0-10)	Male	67	2.86	1.04	0.50	5.00
	Female	28	5.00	1.78	1.00	9.00
	Sex Combined	95	3.49	1.63	0.50	9.00
Pass Rate	Male	100% (67/67)				
	Female	68.3% (28/41)				
	Sex Combined	88.0% (95/108)				

Soldier pulling haul bag outside of hatch as a solo task.

5. 25mm Barrel Install (11B, 12B, 13F, 19D)

Lift, Carry, and Install the Barrel of a 25mm gun on the BFV

As part of a two-Soldier team and wearing a fighting load with a weapon, Soldiers lifted, carried (25 m) and emplaced the 107 lb barrel of the M242 25mm gun for the BFV. This task involved placing the barrel onto the hood of the BFV and climbing up onto the hood/deck. The Soldiers took turns supporting the barrel, while the other Soldier climbed onto the BFV. Once on the hood, the barrel was lifted as a team and rotated into place.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		107 lb (prorated 53.5 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	88	1.79	0.75	0.72	5.50
	Female	52	2.06	0.75	0.93	5.50
	Sex Combined	140	1.89	0.76	0.72	5.50
RPE (0-10)	Male	89	3.21	1.29	0.50	7.00
	Female	52	3.65	1.27	2.00	7.00
	Sex Combined	141	3.38	1.29	0.50	7.00
Pass Rate	Male	100% (89/89)				
	Female	100% (52/52)				
	Sex Combined	100% (141/141)				

Two Soldiers lifting the carried barrel as a team to rotate into place on BFV hood.



6. Feeder Assembly (11B, 12B, 13F, 19D)

Remove the Feeder Assembly of a 25mm gun on the BFV

While wearing a task-specific uniform, a Soldier removed the 59 lb M242 feeder assembly from the gun on the BFV and placed it on the floor in the rear of the vehicle. This task involved lifting, pulling and lowering the assembly out of the slot, holding it while moving across the vehicle seat, and placing it on the floor behind the seat.

Army Standard: Successful completion of the task

Uniform Load Carried		~49 lb				
External Load Moved		59 lb				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	90	0.63	0.76	0.12	5.35
	Female	52	0.83	0.73	0.17	3.93
	Sex Combined	142	0.70	0.75	0.12	5.35
RPE (0-10)	Male	90	2.13	1.02	0.50	5.00
	Female	51	3.22	1.63	1.00	8.00
	Sex Combined	141	2.52	1.37	0.50	8.00
Pass Rate	Male	100% (90/90)				
	Female	98.1% (51/52)				
	Sex Combined	99.3% (141/142)				

Soldier holding the removed M242 feeder assembly in the BFV.



7. Ammo Can Carry (11B, 12B, 13F, 19D)

Load 25mm HEI-T Ammunition Cans onto the BFV

While wearing a fighting load with or without a weapon, Soldiers lifted 30 cans of 25 mm ammunition (~45 lb, each), carried them 15 m, and placed them onto the tailgate of a BFV or a platform of similar height and dimensions. The can dimension were 36 x 33 x 13 cm. Soldiers carried one or two cans at a time.

Note: 23 Men and 10 Females completed the task with a weapon. There was no significant differences in their performance with those who did not have a weapon, so their data are combined.

Uniform Load Carried		Either ~71 lb or ~83 lb				
External Load Moved		30 x 45 lb (1350 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	89	5.36	1.30	3.75	14.30
	Female	50	9.31	2.75	5.44	19.18
	Sex Combined	139	6.78	2.72	3.75	19.18
RPE (6-20)	Male	89	13.29	1.72	8.00	17.00
	Female	50	15.38	1.95	11.00	20.00
	Sex Combined	139	14.04	2.06	8.00	20.00
Post HR (bpm)	Male	89	169	14	116	195
	Female	50	171	14	118	192
	Sex Combined	139	170	14	116	195
Mean HR (bpm)	Male	74	163.86	12.44	138.90	191.00
	Female	44	167.23	12.41	132.67	192.00
	Sex Combined	118	165.11	12.49	132.67	192.00
Absolute VO ₂ (L·min ⁻¹)	Male	80	2.61	0.33	1.81	3.34
	Female	47	1.70	0.25	1.26	2.19
	Sex Combined	127	2.27	0.54	1.26	3.34
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	80	33.54	4.94	22.26	52.13
	Female	46	27.60	4.11	19.87	37.71
	Sex Combined	126	31.37	5.46	19.87	52.13
Estimated % VO ₂ max	Male	79	66.32	7.56	51.25	85.29
	Female	43	57.99	8.42	40.31	78.95
	Sex Combined	122	63.38	8.80	40.31	85.29
Total O ₂ Consumption (L)	Male	80	13.69	1.68	9.78	17.54
	Female	46	15.33	3.09	9.59	24.12
	Sex Combined	126	14.29	2.42	9.59	24.12
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	80	176.19	26.22	123.47	230.08
	Female	46	252.68	68.12	156.02	550.46
	Sex Combined	126	204.11	58.92	123.47	550.46
Pass Rate	Male	100% (90/90)				
	Female	100% (50/50)				
	Sex Combined	100% (140/140)				

Soldier holding ammunition cans to place on platform.



8. Load TOW Missile (11B, 19D)

Load Tube-Launched, Optically-Tracked, Wire-Guided (TOW) Missile Launcher on the BFV

While wearing a fighting load minus the weapon, Soldiers loaded and unloaded two TOW-2B Aero Missiles (65 lb each) into the BFV Mounted TOW Weapon System.

Army Standard: Successful completion of the task

Uniform Load Carried		~71 lb				
External Load Moved		2 x 65 lb (130 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	47	0.70	0.30	0.40	2.12
	Female	29	2.28	1.65	0.82	7.15
	Sex Combined	76	1.30	1.29	0.40	7.15
RPE (0-10)	Male	47	2.63	.99	0.50	5.00
	Female	29	5.14	1.81	2.00	10.00
	Sex Combined	76	3.59	1.82	0.50	10.00
Pass Rate	Male	100% (47/47)				
	Female	96.7% (29/30)				
	Sex Combined	98.7% (76/77)				

Soldier loading a TOW-2B Aero missile into TOW Weapon System.



9. Obstacles (11B, 11C)

Move Over, Through, or Around Obstacles

While wearing or carrying a fighting load with a weapon, Soldiers scaled/climbed a 2-m vertical obstacle with assistance. During the task, Soldiers were allowed to remove their equipment and throw it over the obstacle before attempting to climb over.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		Own body mass plus uniform				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	43	0.36	0.16	0.18	1.00
	Female	28	0.80	0.64	0.27	3.22
	Sex Combined	71	0.53	0.47	0.18	3.22
RPE (0-10)	Male	43	2.78	1.15	0.50	5.00
	Female	28	3.79	1.83	2.00	10.00
	Sex Combined	71	3.18	1.53	0.50	10.00
Pass Rate	Male	100% (43/43)				
	Female	100% (28/28)				
	Sex Combined	100% (71/71)				

Soldier climbing over a 2-m wooden wall.



10. Move Under Fire (11B, 11C)

Move Under Direct Fire

During this task, Soldiers wore a fighting load and carried a weapon at the ready. Soldiers started the task in the prone position. Upon command, the Soldiers rose from a prone position, sprinted to the first marker (10-15 meters away) and assumed the predetermined kneeling position. Soldiers remained in the position for 5 seconds, rose and sprinted to the next marker and assumed the next predetermined position (i.e., kneel). The cycle continued as kneel-kneel-prone until the Soldiers completed a total distance of 100 m.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		N/A				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	42	1.28	0.06	1.13	1.38
	Female	28	1.49	0.12	1.22	1.85
	Sex Combined	70	1.36	0.13	1.13	1.85
RPE (6-20)	Male	43	13.00	1.84	9.00	17.00
	Female	28	13.46	1.79	9.00	17.00
	Sex Combined	71	13.18	1.82	9.00	17.00
Post HR (bpm)	Male	42	166	18	67	188
	Female	27	168	13	140	188
	Sex Combined	69	167	16	67	188
Pass Rate	Male	100% (43/43)				
	Female	100% (28/28)				
	Sex Combined	100% (71/71)				

Soldier in predetermined prone position waiting for signal to sprint to next marker.



11. Prepare Dismounted TOW (11B)

Prepare Dismounted TOW Firing Position

While wearing a fighting load minus the weapon, Soldiers lifted, carried a distance of 15 m, and loaded a TOW-2B Aero Missile (65 lb) onto a Ground Mounted TOW Weapon System.

Army Standard: Successful completion of the task

Uniform Load Carried		~71 lb				
External Load Moved		65 lb				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	24	0.25	0.06	0.17	0.38
	Female	15	0.46	0.17	0.23	0.93
	Sex Combined	39	0.33	0.16	0.17	0.93
RPE (0-10)	Male	24	1.60	2.54	0.00	13.00
	Female	15	2.13	0.99	0.00	4.00
	Sex Combined	39	1.81	2.08	0.00	13.00
Pass Rate	Male	100% (24/24)				
	Female	100% (15/15)				
	Sex Combined	100% (39/39)				

Soldier placing a TOW-2B Aero Missile onto a Ground Mounted TOW Weapon System.



12. Engage Targets (11B)

Engage Targets with a .50 Caliber M2 Machine Gun

While wearing a fighting load with a weapon and working as a member of a two-person team, Soldiers lifted and carried the 153 lb M2 HB Machine Gun with tripod a distance of 10 m.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		153 lb (prorated 76.5 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	24	0.12	0.05	0.08	0.30
	Female	15	0.14	0.06	0.08	0.30
	Sex Combined	39	0.13	0.06	0.08	0.30
RPE (0-10)	Male	24	1.13	0.66	0.50	2.00
	Female	15	1.77	1.18	0.50	5.00
	Sex Combined	39	1.37	0.94	0.50	5.00
Pass Rate	Male	100% (24/24)				
	Female	100% (15/15)				
	Sex Combined	100% (39/39)				

Two Soldiers carrying the M2 HB Machine Gun with tripod.



13. Emplace Base Plate (11C)

Lay a 120mm Mortar- Emplace Base Plate

While wearing a fighting load with a weapon and working as a member of a two-person team. Soldiers lifted and carried the 120mm mortar base plate (136 lb) a distance of 25 m.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		136 lb (prorated 68 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	19	0.18	0.03	0.13	0.25
	Female	13	0.19	0.03	0.15	0.25
	Sex Combined	32	0.18	0.03	0.13	0.25
RPE (0-10)	Male	19	1.39	0.83	0.50	3.00
	Female	13	1.92	1.29	0.50	4.00
	Sex Combined	32	1.61	1.05	0.50	4.00
Pass Rate	Male	100% (19/19)				
	Female	100% (13/13)				
	Sex Combined	100% (32/32)				

Two Soldiers carrying the mortar base plate.



14. Emplace Cannon (11C)

Lay a 120mm Mortar- Emplace Cannon

While wearing a fighting load with a weapon and as part of a two-person team, Soldiers lifted, carried the 120mm mortar cannon tube (110 lb) a distance of 25 m.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		110 lb (prorated 55 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	19	0.32	0.09	0.20	0.50
	Female	12	0.36	0.10	0.22	0.50
	Sex Combined	31	0.34	0.09	0.20	0.50
RPE (0-10)	Male	19	2.03	0.95	0.50	4.00
	Female	13	2.15	0.97	0.50	3.00
	Sex Combined	32	2.08	0.94	0.50	4.00
Pass Rate	Male	100% (19/19)				
	Female	100% (13/13)				
	Sex Combined	100% (32/32)				

Two Soldiers carrying the mortar cannon tube.



15. Traverse a Mortar (11C)

Lay a 120mm Mortar for Deflection and Elevation (Traverse)

As part of a two-Soldier team and wearing a task-specific uniform, Soldiers adjusted the 120mm mortar cannon with the site and bipod in order to change deflection.

Army Standard: Successful completion of the task

Uniform Load Carried	~49 lb
External Load Moved	183 lb (prorated 91.5 lb)

Two Soldiers pre-lift of the mortar cannon to change deflection.

Because the task required more skill than physical requirements, this task was not observed but not tested.



16. Fire a Mortar (11C)

Fire a Mortar (Lift and Hold Round, Place in Tube)

While wearing a task-specific uniform, Soldiers lifted 120mm HE rounds (29 lb, each) to approximately 2 m in height for a total of five times. Soldiers lifted the first round up (2 m) and held it at the end of the cannon tube for 10 seconds before releasing it. Rounds 2-5 did not have to be suspended prior to release and were loaded with no rest between rounds.

Army Standard: Successful completion of the task

Uniform Load Carried		~49 lb				
External Load Moved		5 x 29 lb				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	19	0.46	0.07	0.37	0.68
	Female	13	0.49	0.07	0.43	0.70
	Sex Combined	32	0.47	0.07	0.37	0.70
RPE (0-10)	Male	19	1.05	0.88	0.00	3.00
	Female	13	1.12	0.98	0.00	3.00
	Sex Combined	32	1.08	0.91	0.00	3.00
Pass Rate	Male	100% (19/19)				
	Female	100% (13/13)				
	Sex Combined	100% (32/32)				

Two Soldiers holding a round at the end of cannon tube.



17. Mount .50 Caliber Machine Gun (19K)

Mount M2 .50 Caliber Machine Gun on the Abrams Tank

While wearing a task-specific uniform, Soldiers lifted the M2 .50 caliber machine gun (56 lb) from the ground to the gun mount on an Abrams Tank.

Army Standard: Successful completion of the task

Uniform Load Carried		~49 lb				
External Load Moved		56 lb				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	0.56	0.19	0.22	0.95
	Female	15	0.89	0.29	0.62	1.70
	Sex Combined	38	0.69	0.28	0.22	1.70
RPE (0-10)	Male	23	2.00	0.93	0.50	3.00
	Female	15	3.33	1.11	2.00	6.00
	Sex Combined	38	2.53	1.19	0.50	6.00
Pass Rate	Male	100%				
	Female	100%				
	Sex Combined	100%				

Soldier mounting an M2 .50 caliber machine gun on Abrams Tank.



18. Stow Ammo (19K)

Stow Ammunition on Abrams Tank

While wearing a fighting load minus the weapon, Soldiers completed two subtasks in order to test the individual demands of stowing ammunition on the Abrams tank. These subtasks are outlined below. Soldiers had a rest period of at least 5 min between completion of the subtasks.

Army Standard: Moved 36 rounds in 20 min for each phase

Variant 18.1 (Hull)

Soldiers moved 36 rounds (~55 lb, each) from an ammunition point to the tables simulating the deck of a tank (~1.5 m vertical height). The ammunition point was placed 5 m from the simulated deck of the tank.

Uniform Load Carried		~71 lb				
External Load Moved		36 x 55 lb (1980 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	6.01	0.59	4.60	7.35
	Female	15	7.82	1.06	6.03	9.32
	Sex Combined	38	6.72	1.20	4.60	9.32
RPE (6-20)	Male	23	13.57	1.93	9.00	17.00
	Female	15	14.73	2.12	12.00	19.00
	Sex Combined	38	14.03	2.06	9.00	19.00
Post HR (bpm)	Male	23	162	18	106	190
	Female	15	174	13	160	198
	Sex Combined	38	167	17	106	198
Mean HR (bpm)	Male	18	164.78	12.02	146.00	182.00
	Female	14	168.71	12.34	153.00	190.00
	Sex Combined	32	166.50	12.12	146.00	190.00
Absolute VO ₂ (L·min ⁻¹)	Male	22	2.44	0.36	1.78	3.25
	Female	13	1.84	0.26	1.55	2.31
	Sex Combined	35	2.21	0.44	1.55	3.25
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	22	31.93	3.83	25.06	38.41
	Female	13	30.34	3.87	25.59	40.48
	Sex Combined	35	31.34	3.87	25.06	40.48
Estimated % VO ₂ max	Male	20	63.21	7.90	49.91	80.22
	Female	13	62.13	4.82	54.74	72.02
	Sex Combined	33	62.78	6.79	49.91	80.22
Total O ₂ Consumption (L)	Male	22	14.53	1.78	10.80	19.33
	Female	13	14.11	1.20	10.96	15.63
	Sex Combined	35	14.37	1.58	10.80	19.33
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	22	191.33	25.40	142.45	234.95
	Female	13	235.55	36.86	186.48	289.36
	Sex Combined	35	207.76	36.71	142.45	289.36
Pass Rate	Male	100% (23/23)				
	Female	100% (15/15)				
	Sex Combined	100% (38/38)				

Variant 18.2 (Ready Rack)

Soldiers moved 36 rounds (~55 lb, each) from the turret of the tank into the ammunition (“ready”) rack inside the tank. Soldiers were handed a round from the turret and were required to lower it into the tank to place it into the rack.

Uniform Load Carried		~71 lb				
External Load Moved		36 x 55 lb (1980 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	7.10	2.04	3.02	10.00
	Female	12	11.80	5.05	5.55	19.93
	Sex Combined	35	8.71	4.01	3.02	19.93
RPE (6-20)	Male	23	13.52	1.97	9.00	17.00
	Female	12	14.83	2.08	12.00	17.00
	Sex Combined	35	13.97	2.08	9.00	17.00
Post HR (bpm)	Male	23	159	23	126	195
	Female	12	171	14	151	195
	Sex Combined	35	163	21	126	195
Pass Rate	Male	100% (23/23)				
	Female	92.9% (13/14)				
	Sex Combined	97.3% (36/37)				

One Soldier handing another Soldier a round to place into the ready rack.



19. Load the Main Gun (19K)

Load the 120mm Main Gun on an Abrams Tank

While wearing a task-specific uniform, Soldiers loaded five 120mm MPAT rounds (~55 lb, each) into the breach of the Abrams tank main gun as quickly as possible. Soldiers also performed this task on a simulator outside the tank to determine how quickly the rounds can be loaded when there was no requirement to remove the round from the breech between loadings.

Variant 19.1

Task completed in an actual tank. Each round was removed from the breech after loading, so the task was not performed continuously. The removal time was not recorded. Because of the time lapse required between each round to remove a loaded round, pass rates were not calculated.

Uniform Load Carried		~49 lb				
External Load Moved		5 x 55 lb (275 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	0.42	0.06	0.30	0.55
	Female	6	0.48	0.10	0.32	0.58
	Sex Combined	29	0.43	0.07	0.30	0.58
RPE (0-10)	Male	23	3.04	1.30	1.00	5.00
	Female	6	4.50	1.05	3.00	6.00
	Sex Combined	29	3.34	1.37	1.00	6.00

Variant 19.2

Task completed in a wooden simulator.

Army Standard: Load 5 rounds in 35 seconds.

Uniform Load Carried		~49 lb				
External Load Moved		5 x 55 lb (275 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	0.35	0.04	0.28	0.45
	Female	11	0.45	0.08	0.33	0.57
	Sex Combined	34	0.38	0.07	0.28	0.57
RPE (0-10)	Male	23	2.57	1.15	0.50	5.00
	Female	11	3.27	1.19	1.00	5.00
	Sex Combined	34	2.79	1.19	0.50	5.00
Pass Rate	Male	100% (23/23)				
	Female	73.3% (11/15)				
	Sex Combined	89.5% (34/38)				

Soldier grabbing round from simulated storage area (left) and placing in a simulated breech (right)



20. Abrams Casualty Evacuation (19K)

Remove a Casualty from an Abrams Tank

As part of a three-Soldier team and while wearing a fighting load minus a weapon, Soldiers removed a 225-lb (prorated 75 lb) simulated casualty from the commander's seat of an Abrams tank. The same haul bag used in Task 4b was used in this task. When the task was performed as a team of three Soldiers, two Soldiers were outside of the hatch and one was inside of the tank. Soldiers performed this task three times: once as part of a team on the outside of the hatch, once as a member of a team from the inside of the hatch, and once solo from the outside with the bag weighted at 75 lb.

Army Standard: Successful completion of the task

Variant 20.1:

Three Soldiers removed the 225-lb haul bag: 1 inside the tank, 2 outside the hatch. The physical demands were measured from the outside Soldier's point of view.

Uniform Load Carried		~71 lb				
External Load Moved		225 lb (prorated 75 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	22	0.05	0.03	0.02	0.13
	Female	14	0.06	0.03	0.02	0.13
	Sex Combined	36	0.06	0.03	0.02	0.13
RPE (0-10)	Male	20	2.25	1.20	0.50	5.00
	Female	14	3.07	1.21	1.00	5.00
	Sex Combined	34	2.59	1.25	0.50	5.00
Pass Rate	Male	100% (23/23)				
	Female	100% (15/15)				
	Sex Combined	100% (38/38)				

Variant 20.2:

Three Soldiers removed the 225-lb haul bag: 1 inside the tank, 2 outside the hatch.
The physical demands were measured from the inside Soldier's point of view.

Uniform Load Carried		~71 lb				
External Load Moved		225 lb (prorated 75 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	0.05	0.03	0.02	0.13
	Female	15	0.05	0.02	0.02	0.10
	Sex Combined	38	0.05	0.02	0.02	0.13
RPE (0-10)	Male	21	2.17	1.02	0.50	4.00
	Female	11	2.77	1.66	0.50	6.00
	Sex Combined	32	2.38	1.28	0.50	6.00
Pass Rate	Male	100% (23/23)				
	Female	100% (15/15)				
	Sex Combined	100% (38/38)				

Variant 20.3:

One Soldier removed the 75-lb haul bag from outside the hatch.

Uniform Load Carried		~71 lb				
External Load Moved		75 lb				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	0.03	0.04	0.02	0.22
	Female	14	0.08	0.12	0.02	0.48
	Sex Combined	37	0.05	0.08	0.02	0.48
RPE (0-10)	Male	23	1.24	.67	0.50	3.00
	Female	15	2.30	1.16	0.50	5.00
	Sex Combined	38	1.66	1.03	0.50	5.00
Pass Rate	Male	100% (23/23)				
	Female	100% (15/15)				
	Sex Combined	100% (38/38)				

21. Transfer Ammo with a FAASV (13B)

Transfer Ammunition (M795 HE Rounds) with an M992 Field Artillery Ammunition Supply Vehicle (FAASV)

While wearing approximately task-- specific uniform, the Soldiers completed two subtasks in order to test individual demands of transferring ammunition with an M992 FAASV (also known as a Carrier Ammunition Tracked or CAT). Soldiers had a 15-minute break between completion of the subtasks. The subtasks are outlined below.

Army Standard: Carried 30 rounds in 15 min for each phase

Variant 21.1 (Outside)

Soldiers moved 30 M795 HE rounds (105 lb, each) from a pallet onto a platform simulating the tailgate of a M992 FAASV (~1 m from the ground).

Uniform Load Carried		~49 lb				
External Load Moved		30 x 105 lb (3150 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	20	3.58	0.75	2.48	5.18
	Female	8	6.41	1.89	4.48	10.15
	Sex Combined	28	4.39	1.74	2.48	10.15
RPE (6-20)	Male	20	15.15	1.69	11.00	17.00
	Female	8	17.63	2.39	13.00	20.00
	Sex Combined	28	15.86	2.19	11.00	20.00
Post HR (bpm)	Male	20	183	14	156	210
	Female	8	189	12	170	204
	Sex Combined	28	185	14	156	210
Mean HR (bpm)	Male	18	179.53	14.06	154.50	208.50
	Female	8	183.94	13.86	160.80	200.17
	Sex Combined	26	180.89	13.88	154.50	208.50
Absolute VO ₂ (L·min ⁻¹)	Male	19	2.88	0.49	1.78	4.01
	Female	8	1.78	0.30	1.21	2.24
	Sex Combined	27	2.56	0.67	1.21	4.01
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	19	34.78	4.74	25.00	42.32
	Female	8	27.39	1.92	23.68	29.91
	Sex Combined	27	32.59	5.33	23.68	42.32
Estimated % VO ₂ max	Male	17	71.27	6.77	63.55	86.52
	Female	7	57.38	6.35	46.16	66.19
	Sex Combined	24	67.22	9.17	46.16	86.52
Total O ₂ Consumption (L)	Male	19	9.91	1.33	8.11	12.53
	Female	8	11.00	1.79	8.19	13.59
	Sex Combined	27	10.23	1.53	8.11	13.59
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	19	120.07	14.95	99.40	144.90
	Female	8	172.61	38.22	130.10	240.37
	Sex Combined	27	135.64	33.85	99.40	240.37
Pass Rate	Male	100% (20/20)				
	Female	80.0% (8/10)				
	Sex Combined	93.3% (28/30)				

Soldier picking up round on a pallet to walk over to FAASV.



Variant 21.2 (Inside)

Soldiers moved 30 M795 HE rounds (105 lb, each) from the tailgate of the FAASV into the designated locations on the ammunition rack inside the FAASV. Lift heights ranged from just above the ground to ~1.6 m.

Uniform Load Carried		~49 lb				
External Load Moved		30 x 105 lb (3150 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	17	9.16	3.18	3.58	14.58
	Female	0				
	Sex Combined	17	9.16	3.18	3.58	14.58
RPE (6-20)	Male	17	17.06	1.52	14.00	20.00
	Female	0				
	Sex Combined	17	17.06	1.52	14.00	20.00
Post HR (bpm)	Male	17	190	9	175	205
	Female	0				
	Sex Combined	17	190	9	175	205
Mean HR (bpm)	Male	16	185.24	8.51	171.43	200.17
	Female	0				
	Sex Combined	16	185.24	8.51	171.43	200.17
Absolute VO ₂ (L·min ⁻¹)	Male	16	2.67	0.47	1.76	3.62
	Female	0				
	Sex Combined	16	2.67	0.47	1.76	3.62
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	16	31.93	3.77	25.00	38.26
	Female	0				
	Sex Combined	16	31.93	3.77	25.00	38.26
Estimated % VO ₂ max	Male	15	63.48	8.06	50.57	78.21
	Female	0				
	Sex Combined	15	63.48	8.06	50.57	78.21
Total O ₂ Consumption (L)	Male	16	23.52	7.84	12.98	40.06
	Female	0				
	Sex Combined	16	23.52	7.84	12.98	40.06
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	16	284.49	95.17	129.76	463.33
	Female	0				
	Sex Combined	16	284.49	95.17	129.76	463.33
Pass Rate	Male	85.0% (17/20)				
	Female	0.0% (0/10)				
	Sex Combined	57.7% (17/30)				

Soldier placing the HE round into ammunition rack.



22) Lift Wheel Assembly (13B)

Emplace 155mm Howitzer (Lift Wheel Assembly)

As part of a two-Soldier team and wearing a fighting load with a weapon, the wheel assembly of a 155mm Howitzer (135 lb) was lifted from the ground to the emplacement position (height = 2 m, distance = 0.5 m). Time started on a verbal command and stopped when the wheel assembly was emplaced.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		135 lb (prorated 67.5 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	20	0.05	0.03	0.03	0.18
	Female	10	0.06	0.05	0.03	0.18
	Sex Combined	30	0.05	0.04	0.03	0.18
RPE (6-20)	Male	20	1.65	0.67	1.00	3.00
	Female	10	1.50	0.71	1.00	3.00
	Sex Combined	30	1.60	0.67	1.00	3.00
Pass Rate	Male	100% (20/20)				
	Female	100% (10/10)				
	Sex Combined	100% (30/30)				

Two Soldiers preparing to lift the wheel assembly of a Howitzer.



23. Life Spade Trail Arm and Blade (13B)

Displace 155mm Howitzer (Lift Spade Trail Arm and Blade)

As part of a two-Soldier team and wearing a fighting load with a weapon, the spade trail arm and blade (204 lb) of a 155mm Howitzer was lifted to the displacement position (height = 2 m, distance = 0.5 m). Time started on a verbal command and stopped when the spade trail arm and blade were emplaced.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		204 lb (prorated 102 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	20	0.05	0.02	0.03	0.08
	Female	10	0.05	0.02	0.03	0.08
	Sex Combined	30	0.05	0.02	0.03	0.08
RPE (6-20)	Male	20	1.50	0.69	1.00	3.00
	Female	10	1.40	0.52	1.00	2.00
	Sex Combined	30	1.47	0.63	1.00	3.00
Pass Rate	Male	100% (20/20)				
	Female	100% (10/10)				
	Sex Combined	100% (30/30)				

Two Soldiers lifting the spade trail arm and blade of Howitzer .



24. Set Up GLPS (13B) (NOT TESTED)

Set Up Gun Laying Positioning System (GLPS)

Wearing a fighting load with a weapon and given the four containerized components of a GLPS (up to 44 lbs max) located 3 m from the assembly site, Soldiers assembled, mounted, and sighted GLPS within 8 min.

Uniform Load Carried	~83 lb
External Load Moved	Heaviest container is 44 lb

This task was not tested because following observation of the task, it was determined that the technical demands were a greater limiting factor on task performance than the physical demands.

25. Establish an Observation Point (13F) (NOT TESTED)

Establish an Observation Point

Conduct a 24-kilometer dismounted tactical movement with supported maneuver unit, carry Forward Observer (FO) specific equipment to perform fire support tasks.

Uniform Load Carried	~102 lb including pack
External Load Moved	N/A

This task was not tested as a distinct task due to its redundancy to the foot march (Task 1). Because of the long distance, time requirement and the risk of injury from this task, it was decided not perform this task, and that the data from Task 1 would be roughly equivalent.

26. Install/Remove FS3 (13F)

Install/Remove Fire Support Sensor System (FS3) on M1200

As part of a two-Soldier team and wearing a fighting load with a weapon, Soldiers lifted the FS3 (102 lb) onto the deck an M1200 Armored Knight Vehicle (AKV). They carried (3 m), and installed the FS3. After completing the installation, the Soldiers then uninstalled the FS3. A third Soldier was present to provide stability to the FS3 once it was lifted onto the AKV.

Army Standard: Successful completion of the task

Variant 26.1:

Physical demands of installing the FS3.

Uniform Load Carried		~83 lb				
External Load Moved		120 lb (prorated 60 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	20	1.41	0.75	0.80	3.35
	Female	11	1.86	0.74	0.92	3.35
	Sex Combined	31	1.57	0.76	0.80	3.35
RPE (6-20)	Male	20	3.45	1.00	2.00	6.00
	Female	11	4.82	1.66	2.00	8.00
	Sex Combined	31	3.94	1.41	2.00	8.00
Post HR (bpm)	Male	20	157	16	127	182
	Female	11	166	13	142	191
	Sex Combined	31	161	15	127	191
Pass Rate	Male	100% (20/20)				
	Female	100% (11/11)				
	Sex Combined	100% (31/31)				

Two Soldiers installing the FS3 on the AKV.



Variant 26.2:

Physical demands of uninstalling the FS3.

Uniform Load Carried		~83 lb				
External Load Moved		120 lb (prorated 60 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	20	1.11	0.80	0.52	3.43
	Female	11	1.51	0.90	0.65	3.43
	Sex Combined	31	1.25	0.85	0.52	3.43
RPE (6-20)	Male	20	3.10	1.25	2.00	7.00
	Female	11	3.45	1.44	2.00	7.00
	Sex Combined	31	3.23	1.31	2.00	7.00
Post HR (bpm)	Male	20	154	15	117	180
	Female	11	163	14	145	185
	Sex Combined	31	157	15	117	185
Pass Rate	Male	100% (20/20)				
	Female	100% (11/11)				
	Sex Combined	100% (31/31)				

Two Soldiers holding the removed FS3 .



27. Anti-Personnel Obstacle Breaching System (APOBS) (12B)

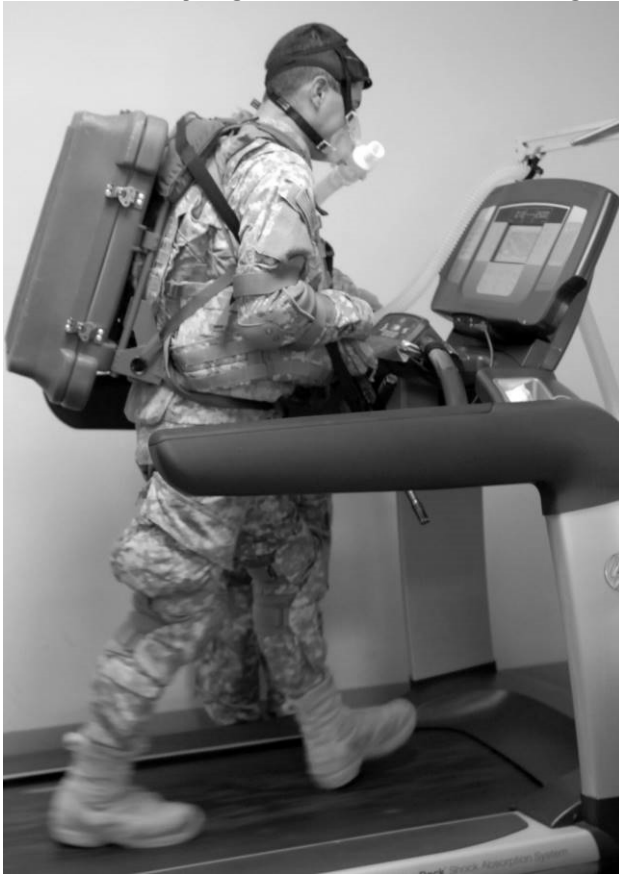
Carry and Emplace the APOBS

While wearing a fighting load with a weapon, Soldiers walked on a treadmill, carrying the APOBS on their back (68 lb) at a self selected pace of ~2-mph (3.5-km/hr) pace for 2 km.

Army Standard: Move APOBS 2 km in 60 min

Uniform Load Carried		~83 lb				
External Load Moved		68 lb				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	20	22.42	3.84	17.00	34.58
	Female	5	31.34	7.57	23.60	43.90
	Sex Combined	25	24.21	5.87	17.00	43.90
RPE (6-20)	Male	21	16.29	2.05	11.00	19.00
	Female	5	17.40	3.21	13.00	20.00
	Sex Combined	26	16.50	2.28	11.00	20.00
Post HR (bpm)	Male	21	179	16	137	199
	Female	5	177	12	163	196
	Sex Combined	26	179	15	137	199
Mean HR (bpm)	Male	16	159.99	16.93	128.62	181.59
	Female	3	163.39	14.86	154.04	180.52
	Sex Combined	19	160.53	16.28	128.62	181.59
Absolute VO ₂ (L·min ⁻¹)	Male	21	1.86	0.53	0.88	2.82
	Female	4	1.14	0.31	0.78	1.51
	Sex Combined	25	1.74	0.57	0.78	2.82
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	21	22.81	6.00	10.93	31.93
	Female	4	18.19	6.80	9.22	25.71
	Sex Combined	25	22.07	6.23	9.22	31.93
Estimated % VO ₂ max	Male	20	46.03	10.41	21.05	60.79
	Female	4	37.33	11.83	21.74	49.86
	Sex Combined	24	44.58	10.90	21.05	60.79
Total O ₂ Consumption (L)	Male	20	40.73	8.22	19.61	54.35
	Female	4	31.84	7.16	21.90	38.20
	Sex Combined	24	39.25	8.60	19.61	54.35
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	20	502.01	85.23	243.40	631.31
	Female	4	505.09	164.14	260.10	606.74
	Sex Combined	24	502.52	97.55	243.40	631.31
Pass Rate	Male	91.3% (21/23)				
	Female	50.0% (5/10)				
	Sex Combined	78.8% (26/33)				

Soldier carrying APOBS while walking on a treadmill .



28. Cratering Charge (12B)

Carry and Emplace the H6 Cratering Charge

While wearing a fighting load with a weapon, Soldiers lifted and carried H6 Cratering Charges (40 lb each) from a stockpile location to an emplacement area 100 m away. This was performed until three charges were moved. Soldiers carried one or two Cratering Charges at a time.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		3 x 40 lb (120 lb total)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	5.01	0.57	3.92	6.58
	Female	10	6.36	0.82	5.05	7.42
	Sex Combined	33	5.42	0.90	3.92	7.42
RPE (6-20)	Male	23	13.70	2.49	8.00	19.00
	Female	10	14.80	2.44	11.00	19.00
	Sex Combined	33	14.03	2.49	8.00	19.00
Post HR (bpm)	Male	23	166	14	133	192
	Female	10	170	12	141	179
	Sex Combined	33	167	13	133	192
Mean HR (bpm)	Male	21	159.39	14.07	127.36	184.40
	Female	10	165.43	9.80	140.82	175.47
	Sex Combined	31	161.33	13.00	127.36	184.40
Absolute VO ₂ (L·min ⁻¹)	Male	21	2.41	0.27	1.80	2.93
	Female	10	1.68	0.13	1.43	1.83
	Sex Combined	31	2.17	0.42	1.43	2.93
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	21	30.56	3.93	21.37	35.94
	Female	10	25.78	3.69	21.62	32.85
	Sex Combined	31	29.02	4.42	21.37	35.94
Estimated % VO ₂ max	Male	20	59.96	6.03	40.94	70.08
	Female	9	56.39	5.91	44.92	61.82
	Sex Combined	29	58.86	6.12	40.94	70.08
Total O ₂ Consumption (L)	Male	21	12.01	0.78	10.76	14.04
	Female	10	10.60	1.10	8.79	12.61
	Sex Combined	31	11.55	1.11	8.79	14.04
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	21	152.71	18.92	111.82	189.75
	Female	10	162.07	17.77	129.37	187.12
	Sex Combined	31	155.73	18.79	111.82	189.75
Pass Rate	Male	100% (23/23)				
	Female	100% (10/10)				
	Sex Combined	100% (33/33)				

Soldier carrying Cratering Charge to emplacement area.



29. Modular-Pack Mine System (MOPMS) (12B)

Carry and Emplace the Modular-Pack Mine System

As part of a two-Soldier team, each wearing a fighting load with a weapon, Soldiers lowered and carried the MOPMS (160 lb) from a transport vehicle to the emplacement area (100 m). The vehicle bed height was 2 m. Soldiers grasped the side handles of the MOPMS and lowered it to the ground, then carried it 100 m and placed it on the ground. The MOPMS has side handles and pop-out stretcher-like handles. Soldiers were permitted to carry with either set of handles.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		160 lb (prorated 80 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	1.76	0.46	1.22	2.98
	Female	9	2.03	0.57	1.33	2.98
	Sex Combined	32	1.84	0.50	1.22	2.98
RPE (0-10)	Male	23	3.57	1.27	1.00	7.00
	Female	9	5.33	1.73	3.00	8.00
	Sex Combined	32	4.06	1.61	1.00	8.00
Post HR (bpm)	Male	22	161	16	127	190
	Female	9	175	11	160	190
	Sex Combined	31	165	16	127	190
Pass Rate	Male	100% (23/23)				
	Female	100% (9/9)				
	Sex Combined	100% (32/32)				

Two Soldiers carrying MOPMS to emplacement area.



30. Bailey Bridge (12B)

Lift and Carry Rocking Roller during Construction of a Bailey Bridge

As part of a two-Soldier team, each wearing a fighting load with a weapon, Soldiers lifted and carried the rocking roller (206 lb) a distance of 50 m.

Army Standard: Successful completion of the task

Uniform Load Carried		~83 lb				
External Load Moved		206 lb (prorated 103 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	23	2.92	1.45	1.28	7.62
	Female	9	3.86	1.75	1.97	7.62
	Sex Combined	32	3.19	1.57	1.28	7.62
RPE (0-10)	Male	23	5.48	1.59	4.00	10.00
	Female	9	7.11	2.32	3.00	10.00
	Sex Combined	32	5.94	1.93	3.00	10.00
Post HR (bpm)	Male	23	168	12	143	199
	Female	9	175	7	165	185
	Sex Combined	32	170	11	143	199
Pass Rate	Male	100% (23/23)				
	Female	90.0% (9/10)				
	Sex Combined	97.0% (32/33)				

Two Soldiers carrying a rocking roller.



31. Volcano (12B)

Load and Install a Volcano Mine System

As part of a four-Soldier team, each wearing an ACU with an ACH (no other PPE), Soldiers lifted into and installed a Volcano Mine System (i.e., beam frame, two tripod assemblies, and two launcher racks) in the cargo bed of a Family of Medium Tactical Vehicle (FMTV). All lifts were performed by two Soldiers to approximately 2 m in height. The weight of the components ranged from 151 to 370 lb (prorated 75.5 to 185 lb/Soldier). Soldiers completed this task in teams both from the ground and vehicle position.

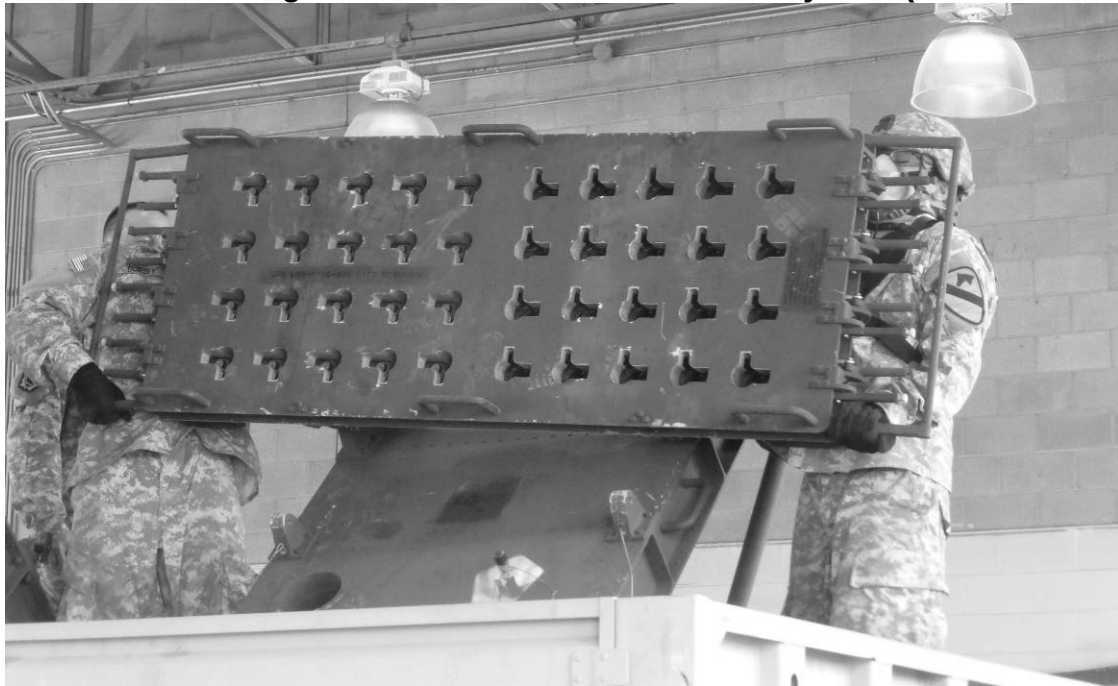
Army Standard: Successful completion of the task

Variant 31.1

Physical demands of a team member in the vehicle were recorded.

Uniform Load Carried		~16 lb				
External Load Moved		1 x 370 lb (prorated 185 lb), 2 x 151 lb (prorated 75.5 lb), 4 x 226 lb (prorated 113 lb) Total 1576 lb (prorated 788 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	16	21.40	6.49	15.15	40.83
	Female	7	27.13	7.10	17.90	40.83
	Sex Combined	23	23.14	7.05	15.15	40.83
RPE (6-20)	Male	18	14.56	2.71	9.00	19.00
	Female	7	18.29	1.89	17.00	22.00
	Sex Combined	25	15.60	3.00	9.00	22.00
Post HR (bpm)	Male	15	160	15	137	192
	Female	7	165	18	127	180
	Sex Combined	22	162	16	127	192
Mean HR (bpm)	Male	8	154.84	16.15	132.10	185.39
	Female	5	168.72	5.52	161.79	174.51
	Sex Combined	13	160.18	14.55	132.10	185.39
Absolute VO₂ (L·min⁻¹)	Male	8	1.89	0.23	1.50	2.15
	Female	5	1.45	0.11	1.32	1.56
	Sex Combined	13	1.72	0.29	1.32	2.15
Body Mass Relative VO₂ (ml·kg⁻¹·min⁻¹)	Male	8	23.60	2.30	20.53	27.21
	Female	5	24.10	3.54	19.62	29.10
	Sex Combined	13	23.79	2.71	19.62	29.10
Estimated % VO₂max	Male	8	48.34	3.85	40.52	52.33
	Female	5	50.24	6.12	44.67	59.11
	Sex Combined	13	49.07	4.70	40.52	59.11
Total O₂ Consumption (L)	Male	8	43.24	11.39	29.89	61.39
	Female	5	34.61	4.79	27.51	40.98
	Sex Combined	13	39.92	10.12	27.51	61.39
Body Mass Relative O₂ Consumption (L·kg⁻¹)	Male	8	552.62	193.85	310.99	875.43
	Female	5	578.44	136.01	460.81	809.54
	Sex Combined	13	562.55	168.10	310.99	875.43
Pass Rate	Male	100% (18/18)				
	Female	100% (7/7)				
	Sex Combined	100% (25/25)				

Two Soldiers lifting launcher rack of Volcano Mine System (vehicle Soldier).



Variant 31.2

Physical demands of a team member on the ground were recorded.

Uniform Load Carried		~16 lb				
External Load Moved		1 x 370 lb (prorated 185 lb), 2 x 151 lb (prorated 75.5 lb), 4 x 226 lb (prorated 113 lb) Total 1576 lb (prorated 788 lb)				
Physiological Demands		N	Mean	SD	Minimum	Maximum
Time to Complete (min)	Male	15	23.90	6.51	15.15	40.83
	Female	8	23.32	8.39	15.15	40.83
	Sex Combined	23	23.70	7.03	15.15	40.83
RPE (6-20)	Male	18	11.61	3.09	6.00	17.00
	Female	7	14.43	1.90	11.00	17.00
	Sex Combined	25	12.40	3.06	6.00	17.00
Post HR (bpm)	Male	16	140	22	86	167
	Female	7	155	23	111	178
	Sex Combined	23	145	23	86	178
Mean HR (bpm)	Male	5	134.43	14.60	119.45	158.55
	Female	7	142.59	15.92	123.35	168.38
	Sex Combined	12	139.19	15.28	119.45	168.38
Absolute VO ₂ (L·min ⁻¹)	Male	5	1.35	0.27	1.02	1.64
	Female	7	1.08	0.31	.63	1.55
	Sex Combined	12	1.19	0.31	.63	1.64
Body Mass Relative VO ₂ (ml·kg ⁻¹ ·min ⁻¹)	Male	5	15.82	1.53	14.05	17.98
	Female	7	17.56	5.74	9.64	26.04
	Sex Combined	12	16.84	4.43	9.64	26.04
Estimated % VO ₂ max	Male	5	34.00	4.41	28.20	39.25
	Female	7	36.12	9.42	24.10	49.77
	Sex Combined	12	35.24	7.53	24.10	49.77
Total O ₂ Consumption (L)	Male	5	31.72	4.49	25.73	36.87
	Female	7	23.65	5.58	18.22	35.23
	Sex Combined	12	27.02	6.45	18.22	36.87
Body Mass Relative O ₂ Consumption (L·kg ⁻¹)	Male	5	377.94	57.20	289.79	433.00
	Female	7	383.48	106.18	279.69	556.34
	Sex Combined	12	381.17	85.72	279.69	556.34
Pass Rate	Male	100% (19/19)				
	Female	100% (8/8)				
	Sex Combined	100% (27/27)				

Two Soldiers lifting beam frame of Volcano Mine System to the cargo bed of a FMTV (ground Soldier).



DISCUSSION

This study quantified the physiological demands of completing 32 critically physically demanding tasks of combat arms Soldiers. These data provide a valuable resource for understanding the physiological requirements of these tasks. Sharp et al. (9) had previously presented data on physically demanding tasks of Soldiers; however, the database was largely limited to descriptions of the tasks. This is the first study to examine the physiological responses (i.e., RPE, HR, VO₂) while actually performing these tasks.

As no individual MOS requires a Soldier to successfully perform all 32 tasks, it would not be appropriate to compare the demands of the 32 tasks. Comparisons of the demands within an MOS are previously reported (2-4, 7). Briefly, based on a number of factors including mass moved, physiological demands, requirement for all members of an MOS to be able to complete the tasks, and frequency of task performance, eight tasks were as representing the most physically demanding requirements of these seven MOSs. They were the foot march (Task 1), sandbag carry (Task 3.2), drag a casualty to safety (Task 4a), casualty evacuation from a vehicle (Tasks 4b and 20), move under direct fire (Task 10), stow ammunition on Abrams tank hull (Task 18.1), loading the main gun of an Abrams (Task 19), and the inside phase of transfer ammo with a FAASV (Task 21.2; see Table A). The full process of down-selecting to determine these eight tasks is described in the technical reports for the respective MOSs (2-4, 7).

LIMITATIONS

While this study was designed to simulate real world conditions, we were not able to account for all variables. Some tasks had to be modified to allow for testing (e.g., haul bag used for casualty extraction). Tasks were completed on successive days, so any cumulative fatigue or discomfort may have affected performance on later days. While this may affect performance on individual tasks, it is not uncommon for Soldiers in the field to have to perform these physical tasks on consecutive days. In addition, several tasks were completed as teams of two or more people. This makes it difficult to fully understand the demands of the task on an individual, as the two Soldiers may not be evenly distributing the burden of the task.

Most notably, all tasks were tested in a controlled garrison environment. Soldiers were instructed exactly how to perform the task, based on recommendations provided by subject matter experts. It is possible that in a real situation, there may be variations on the task that may increase or decrease the individual demands, such as material on which the casualty is dragged, distance of carry (e.g., ammunition cans, sandbags, MPAT rounds), or weight of the casualty. In addition, at no time were the Soldiers in immediate danger. In a deployed, high-stress situation, the physiological demands are likely increased, and tasks may be performed repeatedly, or in an entirely different manner.

CONCLUSIONS

Soldiers perform a number of aerobically and strength demanding tasks. Researchers can use this knowledge of the physiological demands to aid in study design and development, while leadership may be able to use this information to aid in decision making and policy development.

RECOMMENDATIONS

- This reference provides a general overview of the physiological requirements of tasks. It should be consulted by individuals who need to understand the physical requirements of both individual Soldiering tasks and Soldiering as a career.
- These study data represent the physiological responses to the tasks as they were identified in 2013. Periodic re-evaluation of the tasks and the physiological demands should occur to account for changes in mission requirements and equipment.

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APPENDIX A. UNIFORM LOAD VARIANTS



Soldier Load



Uniform 12.4 lbs

Boots	5.00
ACU	3.20
Multi tool	0.50
Rigger Belt	0.50
Patches	0.49
Patrol Cap	0.48
ID Tags	0.38
Undershirt	0.35
Gloves	0.25



12.4 lbs

Eye Pro	0.25
Notebook	0.25
Drawers	0.20
Socks	0.20
Wrist Watch	0.19
Ear Plugs	0.13
Chapstick	0.01
ID Card	0.01

Personal Protective Equipment and Weapon (PPE) 63.03 to 77.60 lbs*

100 oz Hydration system (With Water)	7.10
Fighting Load Carrier	1.25
30 round magazine pouch (3 x 0.25)	0.75
Hand grenade pouch (2) with (2) M67	
Fragmentation Grenades	1.86
Lensatic Compass w/case	0.27
Individual First Aid Kit (IFAK)	1.08
Mag light flashlight w/2 ea AA battery	0.24
Infrared signal beacon, PHOENIX	
w/Battery	0.70
Ballistic Knee/Elbow Pads	0.79
Visual/Language Translator Card	0.01
Casualty Feeder Report/	
Witness Statement	0.01
Advanced Combat Helmet (ACH)	3.25
Helmet Cover w/camouflage cover band	0.28
Night Vision goggle mounting plate	0.20
Ballistic Protection Goggles (ESS)	0.15
M4 Carbine w/fully loaded magazine	7.50

M68- CCO w/ battery	0.71
3 point sling	0.30
Back-Up Iron Sight	0.32
M-4 RAS & Fwd Pistol Grip	1.55
5.56mm Magazine with 30 rounds each (6 ea)	6.42
Sure Fire light w/ battery	0.50
PAQ-4C w/batteries	0.90
Total	36.14



IOTV w/ neck/groin protector	11.69-19.63*
Enhanced Small Arms Protective	
Inserts	7.60-14.20*
Enhanced Side Ballistic Insert set	
with Side Plate Carrier	7.60
Total	63.03 to 77.57 lbs

Uniform 12.4 lbs + PPE 63.03 to 77.57 lbs*
= Fighting Load 75.43 to 89.97 lbs*

* see slide 4, Weights for IOTV Gen II

V1.5 Sep 2013

* see slide 4, Weights for IOTV Gen II



Soldier Load - <24 hour Sustainment Load



Sustainment Load Carried in Assault Pack

Assault Pack w/ waist pack	4.2
2QT Canteen w/Cover and Sling w/water	4.15
Liner Poncho	1.14
Poncho	1.05
Improved Rain suit Top	1.7
Improved Rain suit Bottom	1.7
Neck Gaiter	1
Meal Ready To Eat 1 ea (1.50/0.68 kg)	1.5
Undershirt moisture wicking x 1 ea	0.35
Socks x 1 pr	0.2
Improved Cleaning Kit	1.6
Flexi Cuffs (4 large per soldier)	0.04
Chemlight (2per)	0.04
Water purification tablets	0.02
Camo Face Paint	0.02
VS17 Panel (small)	0.3

19.0 lbs



Uniform	12.4
PPE	63.03 to 77.57*
+ <24 Hr Sustainment Load	19.0
Approach March Load	94.43 to 108.97 lbs*



* see slide 4, Weights for IOTV Gen II

V1.5 Sep 2013

* see slide 4, Weights for IOTV Gen II

APPENDIX B. TASK DESCRIPTION SLIDES PROVIDED BY TRADOC



Task 1: Conduct Tactical Movement
11B, 11C, 19D, 19K, 13F, 12B





Task: Conduct a 24 Kilometer Tactical Movement

Condition: Wearing / Carrying 94 – 109 lbs Evenly Distributed Across the Entire Body

Standard: Complete in not less than 22 or more than 24 hours; the entire distance should not be completed in one segment.



Conduct Tactical Movement

Carry minimum of 102 lbs evenly distributed over entire body and remain able to fight at conclusion of march of 24 kilometers per day.

Weight: 94-109 lbs Horizontal Distance: 24 km Vertical Distance: Terrain Dependant Time: 24 hours	Weight: 94-109 lbs is combined weight of Basic Soldier Uniform (12 lbs), PPE (63.03 to 77.57 lbs), and <24 hour sustainment load (19 lbs) Horizontal Distance: Army Standard for Tactical Movement is 3-4 km per hour. 24 km per day is representative of 2 Combat Patrols (6-8 km out and 6-8 km back twice a day) from Combat Outposts and Joint Security Sites Time: 22 to 24 hours
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- This is not an individual event; however, all platoons and squads do not have to complete the event at the same time.
- Platoon/Squad Leaders may adjust the rate of movement as necessary while still maintaining the ability to complete the task in 22 to 24 hours.
- Soldiers who do not finish with their platoon/squad should be counted as No-GOs.

V1, 5 Sep 2013



Task 2: Employ Hand Grenades
11B, 11C, 19D, 19K, 13B, 13F, 12B





Task: Employ Hand Grenades

Condition: Wearing / Carrying 63.65 to 78.19** lbs Fighting Load(no weapon) and given two M69 Practice Hand Grenades

Standard: Throw at least one Hand Grenade 30 meters



Employ Hand Grenades

Throw hand grenade to engage enemy forces

Weight: 1 lb Horizontal Distance: 30 m Vertical Distance: N/A Time: N/A	Weight: M67 Fragmentation Grenade or M69 Practice Hand Grenade Horizontal Distance: Doctrinally, the Army considers 30 m to be hand grenade range, 30 m engages a 35 m target
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*Weight range based on difference for sizes XS-4XL of uniform items & body armor

** 63.65 to 78.19 lbs is fighting load minus 11.78 lbs for M4 & items attached to the M4

V1, 5 Sep 2013



Task 3: Prepare a Fighting Position (Fill and Emplace Sandbags) 11B, 11C, 19D, 19K, 13B, 13F, 12B



Task: Fill Sandbags

Condition: Wearing / Carrying 63.65 to 78.19** lbs Fighting Load(-) (no weapon) and given entrenching tool, 26 empty sandbags, sufficient fill

Standard: 26 sandbags filled 55-60% full in 52 minutes

Fill Sandbags

Dig, lift, and shovel 11 lbs scoops of dirt in bent, stooped or kneeling position into sandbags.

Weight: 11 lbs
Horizontal Distance: N/A
Vertical Distance: 0.75 m
Time: 52 minutes

Weight: 11 lbs is combined weight of e-tool and average weight of various soil compositions
Vertical Distance: 0.75 meters is height of a sandbag, 3-5 scoops of dirt fill one sandbag
One hasty fighting position (without overhead cover) uses 26 sand bags
Time: 2 minute average to fill a sandbag

Task: Carry / Emplace Sandbags

Condition: Wearing / Carrying 64–80* lb Fighting Load(-) (no weapon) and given 26 sandbags (55-60% full)

Standard: Hasty fighting position (without overhead cover) built in 26 minutes 10 meters from the original position of the sandbags

Carry/Emplace Sandbags

Lift 30-40 lb sandbags waist to shoulder high, carry them 10 m and emplace

Weight: 30-40 lbs
Horizontal Distance: 10 m
Vertical Distance: 1 m to 1.5 m
Time: 26 minutes

Weight: Based on soil composition and bags filled 55-60%, a sandbag weighs 30-40 lbs
Horizontal Distance: 10 meters is farthest distance carried from fill point without a vehicle
Vertical Distance: Waist to shoulder height
Time: 1 minute to carry/emplace a sandbag

*Weight range based on difference for sizes XS-4XL of uniform items & body armor

** 63.65 to 78.19 lbs is fighting load minus 11.78 lbs for M4 & items attached to the M4

V1, 5 Sep 2013



Task 4a: Drag a Casualty to Immediate Safety (Dismounted) 11B, 11C, 19D, 19K, 13B, 13F, 12B



Task: Individually Drag a Casualty to Immediate Safety

Condition: Wearing / Carrying 75.43 to 89.97 lbs* Fighting Load and given a casualty (~188 lbs) with an 83 lbs Fighting Load for a total weight of ~271 lbs

Standard: Casualty dragged 15 meters.

Evaluator's Note: See Next Slide

Soldier on the Ground

Individually lift, drag, and carry a casualty to a safe location; casualty is in harm's way

Weight: ~271 lbs
Horizontal Distance: 15 m
Vertical Distance: 0.5-2 m
Time: As quickly as possible

Weight: ~188 lbs incapacitated Soldier with an 83 lb Fighting Load
Horizontal Distance: 15m is approximately half the distance a Soldier could move during a 3-5 second rush
Vertical Distance: 0.5 - 2 m is height Soldier would carry or drag casualty.

V1, 5 Sep 2013



Task 4b: Remove a Casualty from a Vehicle* (Mounted) **11B, 19D, 13F, 12B**



Task: Remove a Casualty from a Vehicle*;
Three Soldier Task

Condition: See Next Slide

Standard: Casualty removed from Vehicle*

* 11B, 19D, 13F: BFV, Stryker

* 12B: BFV or Buffalo (Type of Unit
Dependant)

Lift from the Inside of a Vehicle **Three Soldiers perform this task from a BFV, Stryker, or Buffalo**

Weight: ~207 lbs (prorated ~103.5 ls)
Horizontal Distance: 1-2 m
Vertical Distance: 1.5 m
Time: 2 Minutes

Weight: ~188 lbs incapacitated Soldier with 19 lbs of Vehicle Crewman Uniform and equipment

Horizontal Distance: 1.5 m is the height from the commander's seat to the top of the turret
Vertical Distance: To clear vehicle

Three Soldiers perform this task; two on the vehicle and one inside. The two Soldiers on the vehicle lift the vast majority of the casualty's weight. The Soldier in the vehicle primarily guides the casualty.

V1, 5 Sep 2013



Task 5: Maintain 25mm Gun on a BFV – Install the Barrel **11B, 19D, 13F, 12B**



Task: Install an M242 25mm Barrel on the
M242 Gun on a BFV; Two Soldier Task

Condition: Wearing / Carrying 75.43 to 89.97
lbs* Fighting Load and given a BFV with an
M242 Gun and an M242 25mm Barrel

Standard: Barrel is carried 25 meters and lifted
onto BFV hull

Armor Standard: Barrel is carried 3 meters
and lifted onto BFV hull

Lift an M242 25mm Barrel onto the Deck of a BFV

- Removal of M242, 25mm barrel
- Required during maintenance and during remedial action misfire procedures

Lift 107 Pounds 1 Meter and Carry 3 Meters or 25 Meters as Part of a 2 Soldier Team

Weight: 107 lbs (prorated
53.5 lbs)
Horizontal Distance: 3 m
or 25 m
Vertical Distance: 1 m
Time: n/a

Weight: Barrel weighs
107 lbs
Horizontal Distance:
Barrel to BFV
Vertical Distance: BFV
hull

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 6: Maintain 25mm Gun on BFV – Remove Feeder Assembly 11B, 19D, 13F, 12B



Task: Remove the M242 Feeder Assembly from the M242 Gun on a BFV

Condition: Wearing / Carrying 30-44* lbs (IOTVC with ESAPI and ESBI, CVC/ACH Helmet) and given a BFV with an M242 Gun and an M242 Feeder Assembly

Standard: Feeder assembly properly removed

Remove the M242 Feeder Assembly

- Required during maintenance and during remedial action misfire procedure



Lift 59 Pounds 6 Inches and Carry 1 Meter While Seated

Weight: 59 lbs
Horizontal Distance: 1 m
Vertical distance: 6 in
Time: N/A

Weight: M242 Feeder Assembly weighs 59 lbs

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 7: Load 25mm HEI-T Ammunition Can on BFV 11B, 19D, 13F, 12B



Task: Load 30 25mm High-Explosive Incendiary Tracer (H-EIT) Ammo Cans onto a BFV

Condition: Wearing / Carrying 63.65 to 78.19** lbs Fighting Load(-) (no weapon) and given a BFV and 30 Ammo Cans with 45 Rounds of H-EIT per can

Standard: 30 Ammunition Cans carried 15 meters and loaded onto BFV 75.43 to 89.97 lbs*

Lift 45 Pounds Waist High and Carry 5 or 15 Meters

Weight: 45 lbs
Horizontal Distance: 15 m
Vertical distance: 1 m
Time: N/A

Weight: One 25mm ammunition can weighs 45 lbs (contains 45 rounds)
Basic Load (25mm) for a BFV is 900 rounds (30 ammunition cans)
Horizontal Distance: 15 m is an estimated safe distance between the back of the BFV and the ammunition supply point or ammunition carrier
Vertical Distance: 1 m is waist high

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor

** 63.65 to 78.19 lbs is fighting load minus 11.78 lbs for M4 & items attached to the M4



Task 8: Load the TOW Missile Launcher on BFV 11B, 19D



Task: Load TOW-2B Aero (BGM-71F6) Missile into a BFV Mounted TOW Weapon System

Condition: Wearing / Carrying 64–80* lb Fighting Load(+) (no weapon) and given a BFV with a TOW Missile Launcher and 2 TOW-2B Aero (BGM-71F6) Missiles

Standard: 2 Missiles properly loaded



Lift 65 Pounds 1 Meter and Carry 2 Meters

Weight: 65 lbs
Horizontal Distance: 2 m
Vertical Distance: 1 m
Time: N/A

Weight: TOW-2B Missile weighs 65 lbs
Vertical Distance: Rear of launcher lowers to ~1 m from floor of crew compartment

*Weight range based on difference for sizes XS-4XL of uniform items & body armor

** 63.65 to 78.19 lbs is fighting load minus 11.78 lbs for M4 items attached to the M4

V1, 5 Sep 2013



Task 9: Move Over, Through, or Around Obstacles 11B, 11C



Task: Move Over, Through, or Around Obstacles; Scale / Climb 2 Meter Vertical Obstacle with Assistance

Condition: Wearing / Carrying 75.43 to 89.97 lbs* fighting load. If necessary, equipment may be removed, but must be worn / carried after obstacle is cleared

Standard: Obstacle successfully negotiated, with assistance from other squad members (if needed). Last Soldier must be pulled up, not pushed over (if needed) for realism.



Scale and Climb a 2 Meter Vertical Obstacle With Assistance

Weight: 75.43 to 89.97* lbs
Horizontal Distance: Varies
Vertical Distance: 2 m
Time: n/a

Weight: Fighting Load weighs 75.43-89.97* lbs
Vertical Distance: Typical natural or manmade obstacle

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 10: Move Under Direct Fire 11B, 11C



Task: Move Under Direct Fire (Rise from a Prone, Kneeling, or Crouched Position; Sprint 3 to 5 Seconds; Return to a Prone, Kneeling, or Crouched Position)

Condition: Wearing / Carrying 75.43 to 89.97 lbs* Fighting Load

75.43 to 89.97

Standard: Sprint 100 meters (in 3 to 5 second increments)



**Rise from a Prone, Kneeling, or Crouched Position;
Sprint for 3 to 5 Seconds
with 75.43 to 89.97 lbs* Fighting Load;
Then Return to a Prone, Kneeling, or Crouched Position**

Weight: 75.43 to 89.97* lbs
Horizontal Distance: 100 m
Vertical Distance: n/a
Time: n/a

Weight: Fighting Load weighs 75.43 to 89.97* lbs
Horizontal Distance: Move out of targeting range

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 11: Prepare a Dismounted TOW Firing Position 11B



Task: Load a TOW-2B Aero (BGM-71F6) Missile into a Ground Mounted TOW Weapon System

Condition: Wearing / Carrying 64–80* lbs (no weapon) and given TOW Missile Launcher and 1 TOW 2B Missiles in the stowage rack of a HMMWV located 15 meters from dismounted TOW launcher.

Standard: 1 TOW-2B (BGM-71F6) Missiles properly loaded into TOW Tube



**Lift 65 Pound Round 1 Meter,
Carry 15 Meters, and Place in Tube**

Weight: 65 lbs
Horizontal Distance: 15 m
Vertical Distance: 1 m
Time: N/A

Weight: TOW 2B Missile weighs 65 lbs
Replicate loading one Missile in dismounted launcher.
Horizontal Distance: 15 m is safe distance between the firing position and the ammunition supply point or ammunition carrier
Vertical Distance: Tube height

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 12: Engage Targets with a Caliber .50 M2 Machine Gun 11B



Task: Lift and Carry M2 HB Machine Gun; 2 Soldier Task

Condition: Wearing / Carrying 75.43 to 89.97 * lbs uniform, weapon, and PPE and given M2 HB Machine Gun with Tripod

Standard: M2 HB Machine Gun with Tripod is successfully lifted and moved from a primary position to an alternate position 10 meters away



Lift 153 Pound .50 Cal M2 Machine Gun 1 Meter and Carry 10 Meters as Part of a 2 Soldier Team

Weight: 153 lbs
(76.5 lbs pro-rated)
Horizontal Distance: 10 m
Vertical Distance: 1.5 m
Time: n/a

Weight: M2 HB Machine Gun and tripod weigh 153 pounds (prorated 76.5lbs)
Horizontal Distance: 10 m is distance to reposition gun between primary and alternate sector of fire in defense
Vertical Distance: Shoulder height

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 13: Lay a 120mm Mortar – Emplace Base Plate 11C



Task: Lay a 120mm Mortar – Emplace Base Plate; 2 Soldier Task

Condition: Wearing / Carrying 75.43 to 89.97 * lb Fighting Load and given a 120mm Mortar Base Plate located 25 meters from emplacement site

Standard: Base Plate properly emplaced

Emplace Base Plate

- Base Plate is transported mounted to the side of the M1064A3 or on a specially designed trailer
- Base plate is dismounted and moved from the vehicle/trailer to the firing position
- Base plate is returned to storage positions when squad is ordered to displace from current firing position

Carry 136 Pounds, 25 Meters as Part of a 2 Soldier Team

Weight: 136 lbs (prorated 68 lbs)
Horizontal Distance: 25 m
Vertical Distance: 1 m
Time: Rapidly

Weight: 120mm mortar base plate weighs 136 lbs (prorated 68 lbs)
Horizontal Distance: 25 meters is the minimum safe distance that the mortar would be emplaced from its carrier
Vertical Distance: 1 m is waist height

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 14: Lay a 120mm Mortar – Emplace Cannon 11C



Task: Lay a 120mm Mortar – Emplace Cannon; 2 Soldier Task

Condition: Wearing / Carrying 75.43 to 89.97 * lb Fighting Load and given a 120mm Mortar Cannon located 25 meters from an emplaced 120mm Mortar Base Plate

Standard: Cannon properly emplaced

Emplace Cannon

- Cannon is lifted from vehicle or the ground and inserted into base plate by squad member
- Cannon is raised and rotated to attached bi-pod assembly
- Required every time mortar is placed into action at new firing position

Lift 110 Pounds 1.5 Meters and Carry 25 Meters as Part of a 2 Soldier Team

Weight: 110 lbs (prorated 55 lbs)
Horizontal Distance: 25 m
Vertical Distance: 1.5 m
Time: Rapidly

Weight: Cannon tube weighs 110 lbs
Horizontal Distance: 25 meters is the minimum safe distance that the mortar would be emplaced from its carrier
Vertical Distance: 1.5 meters raises cannon from surface to allow for attachment of bipod assembly

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 15: Lay a 120mm Mortar for Deflection and Elevation (Traverse) 11C



Task: Lay a 120mm Mortar for Deflection and Elevation; 2 Soldier Task

Condition: Wearing / Carrying 46* lbs (Uniform Below) and given a 120mm Mortar Cannon with site and bipod

Standard: Deflection (greater than 200 Mils) properly changed

Uniform

Body Armor w/ Neck/Groin Protector (Size Large)
Enhanced Small Arms Protective Inserts (Size Large)
Enhanced Side Ballistic Insert Set w/ Side Plate Carrier
100 oz Hydration System (w/ Water)
Advanced Combat Helmet (ACH) w/ Night Vision Goggle Mounting Plate, and Helmet Cover w/ Band
Ballistic Protection Goggles (ESS)
Ballistic Knee and Elbow Pads
Visual/Language Translator Card
Casualty Feeder Report/Witness Statement

Lift 183 Pounds 6 Inches, Carry 1 Meter, and Lower as Part of a 2 Soldier Team

Weight: 183 lbs (prorated 91.5 lbs)
Horizontal Distance: 1 m
Vertical Distance: 6 in
Time: N/A

Weight: Combined weight of 120mm mortar cannon, bipod, and sight is 183 lbs
- The assistant gunner lifts the bipod by squatting slightly, with legs shoulder width apart. He supports his elbows on his knees while he grabs the bipod legs and lifts them until their feet slightly clear the ground.
Horizontal Distance: To change deflection
Vertical Distance: Clearance

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 16: Fire a 120mm Mortar 11C



Task: Fire a Mortar (Lift Round, Hold for up to 10 Seconds, Place in Tube)

Condition: Wearing / Carrying 46* lbs (Uniform Below) and given a 120mm Mortar and 5 120mm HE rounds

Standard: All rounds fired in 1 minute 15 seconds

Uniform

Body Armor w/ Neck/Groin Protector (Size Large)
Enhanced Small Arms Protective Inserts (Size Large)
Enhanced Side Ballistic Insert Set w/ Side Place Carrier
100 oz Hydration System (w/ Water)
Advanced Combat Helmet (ACH) w/ Night Vision Goggle
Mounting Plate, and Helmet Cover w/ Band
Ballistic Protection Goggles (ESS)
Ballistic Knee and Elbow Pads
Visual/Language Translator Card
Casualty Feeder Report/Witness Statement

**Lift 29 Pound Round 2 Meters, Hold for up to 10 Seconds,
Place it in the End of the Gun Tube**

Weight: 29 lbs
Horizontal Distance: n/a
Vertical Distance: 2 m
Time: 15 Seconds per round; 75 seconds total

Weight: Heaviest round (120mm HE) is 29 lbs
Vertical Distance: 2 m is the height at maximum elevation
- Ability to hold round for up to 10 seconds is required to conduct "time on target" and "coordinated illumination" missions. Only applies to the first round.

V1.5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 17: Mount M2 .50 Cal Machine Gun Receiver on an Abrams Tank 19K



Task: Mount M2 .50 Caliber Machine Gun Receiver on an M1 Abrams Tank

Condition: Wearing / Carrying 30-44* lbs (IOTVC with ESAPI and ESBI, CVC/ACH Helmet) and given an Abrams Tank and an M2 .50 Caliber Machine Gun Receiver located next to the tank

Standard: M2 .50 Caliber Machine Gun Receiver properly mounted

Lift 56 Pounds 1.2 Meters, Carry 2.4 Meters, and Put on a Mount

Weight: 56 lbs
Horizontal Distance: 1.2 m
Vertical Distance: 2.4 m (2 x 1.2 m)
Time: n/a

Weight: M2 .50 Caliber Machine Gun Receiver weighs 56 lbs
Vertical Distance: Ground to turret (ground to hull, hull to turret)
Horizontal Distance: Distance to mount

V1.5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 18: Stow Ammunition on an Abrams Tank (Variation 1 (Preferred))

19K



Task: Move 120mm MPAT Rounds from Ammo Pad or HEMTT to Tank; 2 Soldier Task (1 on Ammo Pad or HEMTT, 1 in Tank)

Condition: Wearing / Carrying 63.65 to 78.19** lbs Fighting Load(no weapon) and given an Abrams Tank and 36 120mm MPAT Rounds on an Ammo Pad or HEMTT directly adjacent to the Tank

Standard: Load 36 MPAT Rounds from Ammo Pad or HEMTT to Ready Rack in 20 minutes (Parts 1 and 2)



Lift 55 Pounds 1 Meter and Carry .5 Meters (Part 1)

Weight: 55 lbs
Horizontal Distance: 0.5 m
Vertical Distance: 1 m
Time: 20 min (Part 1 and Part 2)

Weight: 120mm MPAT round weighs 55 lbs
Horizontal Distance: Ammo Pad or HEMTT to tank
Vertical Distance: Approximate height at which round is carried
Time: Loading 36 rounds takes 20 minutes

Lift 55 Pounds 1.2 Meters and Carry .5 Meter (Part 2)

Weight: 55 lbs
Horizontal Distance: 0.5 m
Vertical Distance: 1.2 m
Time: 20 min (Part 1 and Part 2)

Weight: 120mm MPAT round weighs 55 lbs
Horizontal Distance: Ammo pad or HEMTT to hull, hull to turret, turret to internal ready rack
Vertical Distance: Turret to internal ready rack
Time: Loading 36 rounds takes 20 minutes

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor
** 63.65 to 78.19 lbs is fighting load minus 11.78 lbs for M4 & items attached to the M4



Task 18: Stow Ammunition on an Abrams Tank (Variation 2)

19K



Task: Move 120mm MPAT Rounds from Ammo Point to Tank; 3 Soldier Task (1 on Ground, 1 on Hull, 1 in Turret)

Condition: Wearing / Carrying 63.65 to 78.19** lbs Fighting Load(no weapon) and given an Abrams Tank and 36 120mm MPAT Rounds 5 meters from Abrams Tank

Standard: Load 36 MPAT Rounds from Ammo Point to Ready Rack in 20 minutes (Parts 1 and 2)



Lift 55 Pounds 1 Meter and Carry 5 Meters (Part 1)

Weight: 55 lbs
Horizontal Distance: 5 m
Vertical Distance: 1 m
Time: 20 min (Inclusive of both Part 1 and Part 2)

Weight: 120mm MPAT tank round weighs 55 lbs
Horizontal Distance: Ammo point to tank - Hands 120mm round to Soldier on hull
Vertical Distance: Approximate height at which the round is carried
Time: Loading 36 rounds takes 20 minutes

Lift 55 Pounds 1.2 Meters and Carry .5 Meter (Part 2)

Weight: 55 lbs
Horizontal Distance: 0.5 m
Vertical Distance: 1.2 m
Time: 20 min (Inclusive of both Part 1 and Part 2)

Weight: 120mm MPAT round weighs 55 lbs
Horizontal Distance: Hull to turret, turret to internal ready rack
Vertical Distance: Hull to turret, turret to internal ready rack
Time: Loading 36 rounds takes 20 minutes.

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor
** 63.65 to 78.19 lbs is fighting load minus 11.78 lbs for M4 & items attached to the M4



Task 19: Load the 120mm Main Gun 19K



Task: Load a 120mm MPAT Round from the Ready Rack into the Breach

Condition: Wearing / 30-44* lbs (IOTVC with ESAPI and ESBI, CVC/ACH Helmet) and given 5 120mm MPAT rounds, M1 Abrams Tank

Standard: Successfully load 5 120mm MPAT Rounds in 35 seconds; one round every 7 seconds

Lift 55 Pounds 1 Meter and Rotate 1 Meter

Weight: 55 lbs
Horizontal Distance: 1 m
Vertical Distance: 1 m
Time: 7 seconds per round; 35 seconds total

Weight: 120mm MPAT round weighs 55 lbs
Horizontal Distance: Ready rack to breach
- Motion is a rotational, twisting movement to load round into the breach
Vertical Distance: Ready rack to breach
Time: 1 round is loaded every 7 seconds during gunnery
Firing Mission: 5 Rounds

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 20: Remove a Casualty from an Abrams Tank (Mounted) 19K



Task: Remove a Casualty from an Abrams Tank (through Gunner's or Commander's Hatch); 3 Soldier Task

Condition: Wearing / Carrying 30-44* lb Fighting Load(-) (no weapon, no helmet, no fighting load carrier) and given a casualty (~188 lbs) with a 30-44* lb Fighting Load(-) (no weapon, no helmet, no fighting load carrier) for a total weight of ~218-232* and an Abrams Tank

Standard: Casualty removed from Abrams Tank

Lift from the Inside of a Tank Turret Three Soldiers perform this task from an Abrams Tank

Weight: ~218-232* lbs (prorated ~73-77 lbs)
Horizontal Distance: 1-2 m
Vertical Distance: 1.5 m
Time: As quickly as possible

Weight: ~188 lb incapacitated Soldier with 30-44* lb Fighting Load(-)
Horizontal Distance: 1.5 m is the height from the commander's seat to the top of the turret
Vertical Distance: To clear vehicle

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 21: Transfer Ammo with an M992 Carrier Ammunition Tracked (CAT) 13B



Task: Transfer Ammunition with an M992 Carrier Ammunition Tracked (CAT). 2 Soldier Task (Performed by 2 Soldiers (1 on Ground, 1 in CAT). The 3 Soldier crew is authorized to rotate duties; 1 Soldier will perform security at all times).

Evaluated Physical Demand: Load M795 / M107 HE Rounds into the M992.

Conditions: Wearing mission specific personal protective equipment: ACH, IOTV with front and back plates, eye protection, and gloves, and given a M992 CAT and 90 x M795 / M107 HE Rounds 3 meters from CAT

Standard: 90 Rounds loaded onto CAT in 45 minutes

Load / Unload M795 / M107 HE Rounds Transfer Ammunition On / Off the M992 Carrier Track Vehicle

Weight: 105 / 100 lbs
Horizontal Distance: 3 m
Vertical Distance: 1.6 m
Time: 45 minutes
- Performed 3-6 times per day

Weight: M795 (standard HE round) weighs 105 lbs; M107 HE weighs 100 lbs
Horizontal Distance: Ammunition flat rack to M992
Vertical Distance: Upper bustle rack (from floor of CAT).
- To provide the 223 rounds expected to be fired, the M992 crew would upload and download the CAT 3 complete times each day.
- In a decisive action environment, a Soldier may handle between 45-90 rounds, 6 times a day. The Soldier will also handle the associated number of powder canisters (weight up to 51 lbs) during upload and download procedures.
- M992 Crew is 3 Soldiers; one M992 supports one M109A6 Paladin Howitzer. Ammo Team Chief, Ammo Handler, and Driver rotate duties during operations. One Soldier will maintain security over watch at all times.

V1, 5 Sep 2013



Task 22: Emplace a 155mm Howitzer / Lift Wheel Arm Assembly 13B



Task: Emplace a 155mm Howitzer (Lift Wheel Arm Assembly); 2 Soldier Task

Condition: Wearing / Carrying 75.43 to 89.97 fighting load and given a 155mm Howitzer

Standard: Wheel Arm Assembly properly lifted to enable howitzer to meet the 6 minute emplacement standard



Lift the Wheel Arm Assembly Lift 135 Pounds as a Two Soldier Team

Weight: 135 lbs (prorated 67.5 lbs)
Horizontal Distance: 0.5 m
Vertical Distance: 2 m
Time: 6 minutes to ready to fire

Weight: Wheel arm assembly weighs 135 lbs
Horizontal Distance: Max lift of Wheel Arm Assembly
Vertical Distance: The range of motion for the wheel arm assembly is 2 m
Time: 6 minutes is the howitzer emplacement standard
- Performed simultaneously by 2 x 2 Soldier teams.

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 23: Displace a 155mm Howitzer / Recover Spade Trail Arm and Blade 13B



Task: Displace a 155mm Howitzer (Recover Spade Trail Arm and Blade); 2 Soldier Task

Condition: Wearing / Carrying 75.43 to 89.97 Fighting Load and given a 155mm Howitzer

Standard: Spade Trail Arm properly recovered to enable howitzer to meet the 5 minute displacement standard which includes taking the howitzer out of firing configuration and putting it into travel configuration, connecting to prime mover, recovering mission essential equipment, and depart firing point.



Recover the Spade Trail Arm and Blade Lift 204 Pounds as a Two Soldier Team and Traverse to a New Azimuth of Fire or Displacing within 5 Minutes

Weight: 204 lbs (prorated 102 lbs)
Horizontal Distance: 0.5 m
Vertical Distance: 2 m
Time: 5 minutes per displacement

Weight: Spade trail arm and blade weighs 204 lbs
Horizontal Distance: Max lift of trail arm and blade
Vertical Distance: The range of motion for the trail arm and blade is 2 m
Time: Displacement standard is 5 minutes to take howitzer out of firing configuration and into travel configuration, connect to prime mover, recover mission essential equipment, and depart firing point.

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*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 24: Set Up Gun Laying Positioning System (GLPS) 13B



Task: Set up Gun Laying Positioning System (GLPS)

Condition: Wearing / Carrying 75.43 to 89.97 Fighting Load and given the four containerized components of a GLPS located 3 meters from the assembly site

Standard: Assemble, mount, and sight GLPS within 8 minutes

Transport the SVP262-1 Gyroscope Container of the Gun Laying Positioning System (GLPS) Lift 44 Pounds 1 Meter and Carry 3 Meters Within 8 Minutes

Weight: 44 lbs
Horizontal Distance: 3 m
Vertical Distance: 1 m
Time: 8 minutes

Weight: Gyroscope and container (heaviest of four containers) weigh 44 lbs combined
Horizontal Distance: To set up site is 3 m
Vertical Distance: Top of tripod is 1 m
Time: 8 minutes is standard to prepare GLPS for operation
- Leader Task

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 25: Establish An Observation Point 13F



Task: Establish an Observation Point

Evaluated Physical Demand: Conduct a 24 Kilometer Dismounted Tactical Movement with supported maneuver unit, carry Forward Observer (FO) specific equipment to perform fire support tasks

Conditions: Wearing / Carrying 94.43 to 108.97* lbs (see below)

Standard: Complete in 24 hours; Soldiers do not have to complete the entire 24 kilometers at once.

Establish An OP Carry FO Specific Fighting Load, Evenly Distributed Over Entire Body During Dismounted Tactical Movement

Weight: 94.43 to 108.97* lbs
Horizontal Distance: up to 24 km (~15 miles)
Vertical Distance: Terrain dependant
Time: 22-24 Hours

Weight:

- Basic Soldier Uniform (12 lbs) (as provided by Infantry Proponent)
- PPE (63.03 to 77.57 lbs*) (as provided by Infantry Proponent)
- Patrols remaining in the field overnight or for multiple days increase weight significantly (additional ammunition, food, water, mission essential equipment, etc.)
- Horizontal Distance: - This is not an individual event; however, all platoons and squads do not have to complete the event at the same time.
- Platoon/Squad Leaders may adjust the rate of movement as necessary while still maintaining the ability to complete the task in 22 to 24 hours.
- Soldiers who do not finish with their platoon/squad should be counted as No-GOs.

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 26: Prepare an M1200 Armored Knight Vehicle For Operation 13F



Task: Prepare an M1200 Armored Knight Vehicle For Operation; Install and Uninstall the Fire Support Sensor System (FS3); 3 Soldier Task

Condition: Wearing / Carrying 75.43 to 89.97 lbs* Fighting Load and given an M1200 Armored Knight Vehicle and an FS3 located 3 meters from the Vehicle

Standard: FS3 properly installed and subsequently properly uninstalled

Install and Uninstall the Fire Support Sensor System (FS3) Lift 120 Pounds 2 Meters and Carry 3 Meters as a 2 Soldier Team

Weight: 120 lbs (prorated 60 lbs)
Horizontal Distance: 3 m
Vertical Distance: 2 m
Time: n/a

Weight: FS3 weighs 120 lbs
Vertical Distance: 2 m to top of the M1200.
- Lift is performed by 2 Soldiers; 3rd Soldier stabilizes



V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 27: Quickly Create a Footpath Through Various Obstacles 12B



Task: Move to Obstacle with Antipersonnel Obstacle Breaching System (APOBS); 2 Soldier Task

Conditions: Wearing / Carrying 75.43 to 89.97 lbs* Fighting Load plus APOBS (60 lbs per Soldier), Total Weight: 135.43-149.97 lbs*

Standard: Move APOBS 2 kilometers in 60 minutes



Perform Foot March

Walk, Run, and Climb Over Varying Terrain for a Distance of 2 Kilometers with 120 Pound APOBS; 2 Soldier Task

Weight: 120 lbs (prorated 60 lbs)
Horizontal Distance: 2 km
Vertical Distance: Terrain
Dependant
Time: 60 minutes

Weight: APOBS weighs 120 lbs
Horizontal Distance: Vehicle to breach site is up to 2 km

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 28: Prepare Obstacle with the H6 40 Pound Cratering Charge 12B



Task: Prepare Obstacle with the H6 40 Pound Cratering Charge

Condition: Wearing / Carrying 75.43 to 89.97 lbs* Fighting Load and given 5 H6 40 Pound Cratering Charges 100 Meters from Obstacle Site

Standard: Five H6 Catering Charges are placed in a row 100 meters from stockpile



Carry / Emplace the H6 40 lb Cratering Charge Three Cratering Charges are Placed in a Row

Weight: 40 lbs
Horizontal Distance: 100 m
Vertical Distance: 1 m to 1.5 m
Time: n/a

Weight: H6 weighs 40 lbs
Horizontal Distance: Stockpile to emplacement area
Vertical Distance: Waist to chest height

V1, 5 Sep 2013

*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 29: Operate a Modular-Pack Mine System (MOPMS) 12B



Task: Carry / Emplace the MOPMS; 2 Soldier Task

Conditions: Wearing / Carrying 75.43 to 89.97 lbs* Fighting Load and given a vehicle with a MOPMS

Standard: MOPMS carried and emplaced 100 meters from the vehicle

Carry / Emplace the MOPMS As a 2 Soldier Team

Weight: 160 lbs (prorated 80 lbs)
Horizontal Distance: 100 m
Vertical Distance: 2 m
Time: As quickly as possible

Weight: MOPMS weighs 160 lbs
Horizontal Distance: Vehicle to emplacement site
Vertical Distance: Vehicle

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*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 30: Assist in the Construction of a Bailey Bridge 12B



Task: Assist in the Construction of a Bailey Bridge; Lift, Carry, and Emplace the Rocking Roller Template, Bridge Bearing and Rocking Roller; Heaviest Lift is the 206 Pound Rocking Roller (2 Soldier Lift, Prorated 103 lbs); 2 Soldier Task

Condition: Wearing / Carrying 75.43 to 89.97 lbs* Fighting Load with the Base Plate in place and given a Rocking Roller Template, Bridge Bearing, and Rocking Roller

Standard: Soldiers lift, carry, and place Rocking Roller Template, Bridge Bearing, then Rocking Roller

Lift and Carry Rocking Roller and Additional Bridge Components 3 components with weights range from 68 to 206 pounds, carried by 2 Soldier team

Weight: 206 lbs (prorated 103 lbs)
Horizontal Distance: 50 m
Vertical Distance: 1 m
Time: n/a

Weight: Rocking roller (heaviest prorated weight of all components) weighs 206 lbs
Horizontal Distance: up to 50 meters
Vertical Distance: Waist

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*Weight range based on difference for sizes XS-4XL of uniform items & body armor



Task 31: Install a Volcano Mine System 12B



Task: Install a Volcano; 2 Soldier Task

Conditions: Wearing / Carrying 16+ lb Uniform with ACH & cover (no body armor, no weapon, no camelback, no ammunition, no fighting load carrier, no individual protective equipment, no first aid kit), and given a Volcano (on the ground) and a cargo vehicle

Standard: Volcano is properly assembled in the bed of the vehicle



Set up Volcano

Lift Beam Frame, two Tripod Assemblies and two Launcher Racks (2 Soldier lift ranging from 151-370 pounds) from ground, carry to the bed of the cargo vehicle and lift 2 meters in the air to give to the receiving team on the cargo vehicle.

Task	Max Payload Ind / Team (lb)	Max Distance (m)	Max Height (m)	Reps
Lift, receive, install Beams	185 / 370	5	2	1
Lift, receive, install Tripod Assembly	75.5 / 151	5	2	2
Lift, receive, install Launcher racks	113 / 226	5	2	4

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APPENDIX C. SCALES USED DURING TESTING

Borg CR10 Scale

Brief Instruction: “During the job task, pay close attention to the exertion required for the physical work, which, should reflect your total amount of effort and fatigue. Don’t be concerned with any one factor (e.g., duration, leg pain, shortness of breath); concentrate on your total body feeling of exertion. It’s your own feeling that is important, not how it compares to other people or what other people think. Be as accurate as you can.”

Continue for Initial Instruction:

“The scale goes from, “0, nothing at all,” to “10, Extremely Hard,” which is the main anchor, and is the hardest effort most people have ever experienced.

0 “Nothing at all” You are lifting no weight.

3 “Moderate” Task is not especially hard or difficult. It feels fine.

7 “Very Hard” You have to push yourself very much.

10 “Extremely Hard” You are doing as much as you possibly can do.

(Adapted from: Adapted from 1998 Borg HK, ACSM’s Guidelines for Exercise Testing and Prescription 7th Edition, and Borg 1990 SJWEH - Psychophysical scaling with applications in physical work and the perception of Exertion)

0	Nothing at all
0.5	Extremely Light
1	Very Light
2	Light
3	Moderate
4	
5	Hard
6	
7	Very Hard
8	
9	
10	Extremely Hard

Borg 6-20 Scale

Brief Instruction: “During the job task, we want you to pay close attention to how hard you feel the physical work rate is. This feeling should reflect your total amount of exertion and fatigue, combining all sensations and feelings of physical stress, effort, and fatigue. Don’t concern yourself with any one factor such as leg pain, shortness of breath, or exercise intensity. It’s your own feeling of effort and exertion that is important, not how it compares to other people or what other people think. Be as accurate as you can.”

Continue for Initial Instruction:

“Look at this rating scale; we want you to use this scale from 6 to 20 where 6 means “no exertion at all,” and 20 means “maximal exertion.”

- 9 corresponds to “very light” exercise. For most healthy people it represents walking slowly at their own pace for several minutes.
- 13 corresponds to “somewhat hard” exertion, but it still feels OK to continue.
- 17 corresponds to “very hard” or difficult exercise. A healthy person can still go on but they really have to push themselves. It feels very strenuous and the person is very tired.
- 19 corresponds to very strenuous exercise. To most people it is the most strenuous exercise they have ever experienced.

Try to appraise your feeling of exertion as honestly as possible, without thinking about the actual job task or purpose of the task.”

(Adapted from: Adapted from 1998 Borg HK, ACSM’s Guidelines for Exercise Testing and Prescription 7th Edition, and Borg 1990 SJWEH - Psychophysical scaling with applications in physical work and the perception of Exertion)

6	No exertion at all
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion