



DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
3300 RUSSELL ROAD
QUANTICO, VA 22134-5001

IN REPLY REFER TO

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MAR 25 2016

From: Director, Capabilities Development Directorate

Subj: POLICY FOR IMPLEMENTATION OF INDIVIDUAL MARINE MOBILITY
ATTRIBUTE

Ref: (a) Marine Expeditionary Rifle Squad Initial Capabilities Document (2015)

Encl: (1) MC-LEAP Evaluation Process
(2) Standard Fighting Load Configuration

1. Purpose. To establish policy in the Capabilities Development Directorate for incorporating mobility attributes into capability documents.

2. Background. Reference (a), paragraph 7.3(1) requires the establishment of a mobility attribute. Mobility, as it pertains to requirements for the individual Marine with a standard combat load, is defined here as the relative ability to move efficiently and to effectively accomplish combat related tasks while wearing and carrying assigned weapons and mission essential equipment. Reference (a), paragraph 7.3(1) also identifies an integration requirement for all systems fielded to the infantry to reduce the weight, bulk, and stiffness of issued weapons and equipment, thus improving individual Marine mobility. Reference (a), paragraph 7.3(3) requires the development of thermal strain performance parameters to also be considered when developing items to be worn next to the body.

3. Action. Effective immediately, Capability Integration Officers (CIOs) shall include a mobility attribute in all new Capability Development Documents (CDDs), Capability Production Documents (CPDs), Requirements Memorandums, and updates to existing CDDs and CPDs for weapons and combat equipment that is to be worn or carried by the individual Marine.

a. All CIOs within Capabilities Development Directorate shall:

(1) Incorporate appropriate mobility attributes into capability documents affecting materiel solutions that are worn or carried by the individual Marine. The mobility attribute may be designated a Key Performance Parameter, Key System Attribute, or Additional Performance Attribute as appropriate for the system. There is no requirement to update previous documents unless they are undergoing changes or updates. Attribute examples follow:

(a) "No decrease to mobility and no increase in thermal load (core temperature) for Marines with a standard fighting load as demonstrated by 85% of MC-LEAP test participants (T), 85% of test participants demonstrate a 6% increase in mobility and a 6% decrease in thermal load as measured by the MC-LEAP test (O)."

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(b) "No decrease to mobility and no increase in thermal load (core temperature) for Marines with a standard fighting load as demonstrated by the MC-LEAP test (T=O)."

(2) Capability document originators shall staff all draft documents meeting the criteria in paragraph 3 to Fires and Maneuver Integration Division (FMID) for endorsement. The document originator shall provide rationale for consideration on any request to omit the mobility attribute.

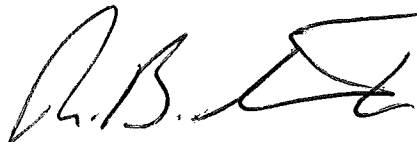
(3) The Marine Corps Load Effects Assessment Program (MC-LEAP) shall be used to evaluate the mobility attribute, per enclosure (1). The results of the MC-LEAP evaluation characterizing the equipment's impact on mobility shall be forwarded to Director, CDD for consideration.

(a) The Marine Expeditionary Rifle Squad (MERS) Program Office at Marine Corps Systems Command will evaluate the mobility attribute for all weapons and combat equipment worn or carried by the individual Marine using MC-LEAP. As such, it is the responsibility of the capability document sponsor to ensure that a MC-LEAP evaluation is included in the system's test and evaluation plan, and to coordinate with FMID and the MERS Program Office to effect the evaluation prior to Milestone C or any fielding decision. MERS has the authority to waive the requirement for a MC-LEAP evaluation in the case that an acceptable, equivalent Service's / Nation's Load Effects Assessment Program (LEAP) evaluation has already been conducted.

(b) The standard fighting load depicted in enclosure (2) consists of authorized equipment and a weapon that are commonly worn/carried, regardless of occupational specialty, while in combat. Therefore, enclosure (2) shall be utilized as the baseline from which mobility evaluations will be made. As new equipment replaces fielded systems, FMID shall update enclosure (2) with additional chronological amendments to configurations. Both the baseline at the date of signing of the requirement and the configuration at the date of the actual evaluation will be included in the evaluation if the two configurations are different.

b. The Requirements Transition Team shall enforce this policy.

4. Point of Contact. The point of contact is Maneuver Branch Head, FMID, at 703-432-8488.



R. B. TURNER JR.

**MARINE CORPS LOAD EFFECTS ASSESSMENT
PROGRAM (MC-LEAP)**

**MC-LEAP OBSTACLE COURSE
AND
MC-LEAP HIKE**

1.0 Purpose

This document describes the Marine Corps Load Effects Assessment Program (MC-LEAP) Obstacle Course and the MC-LEAP Hike procedures established to evaluate mobility attributes. The MC-LEAP course can be used for human subjects research, mobility analysis, pilot trials for studies, physical training and mobility familiarization. The Marine Expeditionary Rifle Squad (MERS) office at Marine Corps Systems Command is responsible for the setup, operation, maintenance, instrumentation of the course, safety, and scheduling of the course.

2.0 Overview of the MC-LEAP Obstacle Course

The course is composed of eleven obstacles, three human performance stations, range of motion and anthropometry measurements, and a NOPTEL non-live fire shooting station. The course fits into a 160 by 100 foot area. Most personnel can complete the 11 obstacles in under ten minutes so it is a short duration, high intensity physical activity.

2.1 Description of the MC-LEAP Obstacle Course:

The Marine Corps Load Effects Assessment Program (MC-LEAP) obstacle course is depicted in (Figure 1). MC-LEAP comprises a series of combat movements, rifle shooting, and load handling activities derived by Marine Corps subject matter experts as critical movement and task components of dismounted combat mobility. The MC-LEAP Obstacle Course will serve as the methodology to characterize weight, bulk and stiffness of a Marine's equipment suite and provide a metric for the Marine's mobility on the battlefield. MC-LEAP will provide a unique ability to measure the effects of changing equipment in a Marine's load by measuring the effect of the Marine burden through multiple combat related tasks that collect data on the Marine's movement mechanics, time to complete events, physical performance attributes, observed performance, and after action reviews for each iteration of the event. MC-LEAP's purpose is to provide a repeatable evaluation standard for assessing the effects of various combat loads, various integration designs, and various items of equipment in development and procurement.

2.2 Assumptions

- MERS will continue to be resourced in the POM process in part to execute the mobility policy and integration requirements identified in the approved MERS ICD.
- Pre-deployment training for infantry Marines requires completion of individual and collective task requirements. The intended population group are UDP Marines that have completed all pre-deployment training.
- Test procedures and data collection systems will improve over time as the amount of testing conducted increases. It is envisioned the Load Effects Assessment Program procedures and data collection equipment will also be refined over time resulting in improved revisions of this enclosure.
- The access to deployed infantry Marines will be identified in the Operating Force Synchronization matrix enabling trials to be conducted twice annually.

2.3 Limitations

- Forecasting and scheduling equipment to be characterized and utilized in the trials may be adversely affected if equipment delays are encountered resulting in a delay of Mobility testing.
- Some equipment may have limitations or create unique challenges to the Mobility trial protocol. These unique items may require exceptions or changes to the methodology on a case by case basis. An example may be Military Ski System.
- Unforeseen environmental conditions not conducive for testing could create delays in test results.

3.0 Measurements

Time: The MC-LEAP can measure performance time needed to complete the entire circuit while simultaneously measuring the time it takes to traverse singular obstacles within the circuit itself.

Distance: A vertical jump test will record the time duration off the mat jumped by each participant as an indicator of leg power.

Load Handling Speed: The time to transfer horizontal loads and vertical load lifts will be recorded.

Shooting Performance: Using the Noptel target engagement system, the time to engage targets and shot accuracy and consistency (i.e. grouping) will be recorded.

Subjective Ratings: A series of Likert scale questions will be used in which participants will respond at a computer survey kiosk immediately following the course. Questions will require participants to rate the acceptability of each burden condition for flexibility, bulk, and weight, and their performance in terms of agility, speed, mobility, and overall fatigue. Marines will also respond to a computer survey kiosk regarding a 5 kilometer hike survey.

Percentage of Body Weight: Percentage of body weight to load carried in relation to performance decrement will be recorded/calculated in order to define/update published standards.

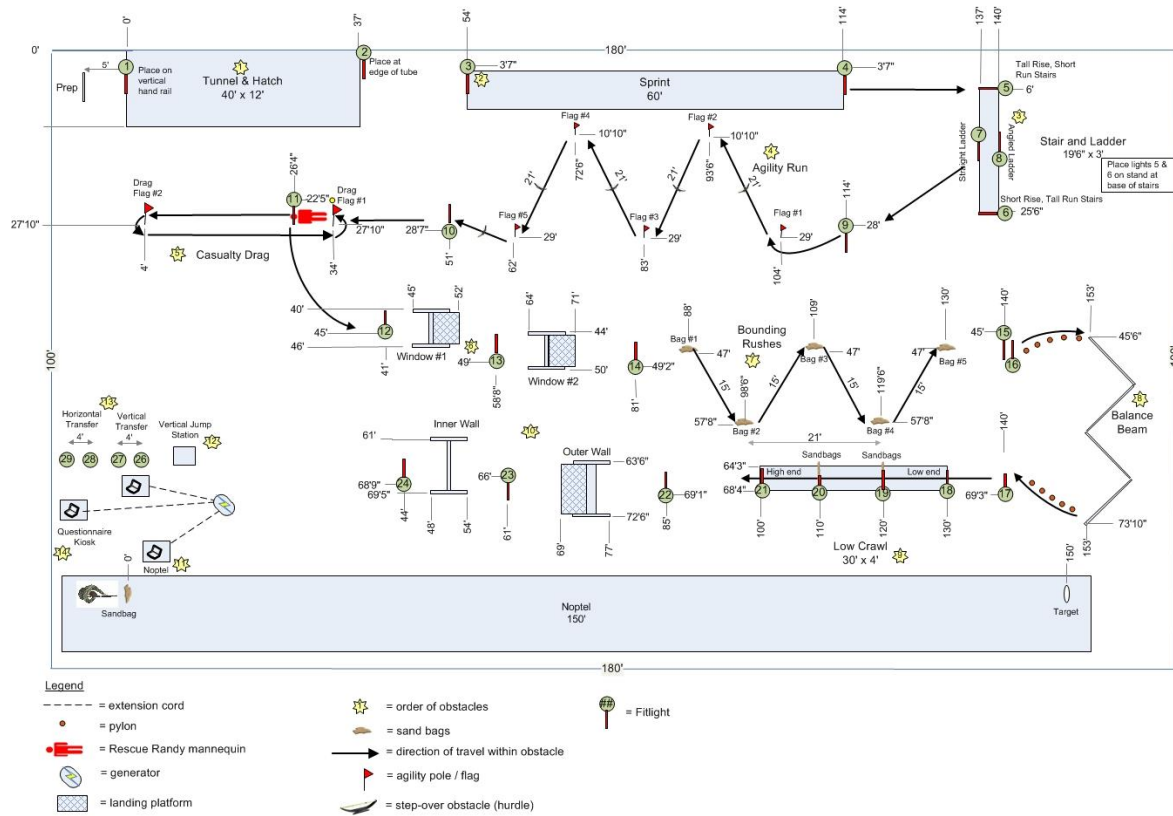


Figure 1. MC-LEAP Course layout with timing stations (180 x 100 feet).

Movement times will be automatically measured and recorded for each combat activity and for the entire course through a FitLight timing system utilizing IR sensing beam or touch with a FitScan bracelet. The FitLight sensors send the timing event to a central computer using short range WiFi throughout the instrumented course. Each light changes color following the breaking of the IR beam to ensure a time event was taken. An optical rifle target scoring system (Noptel ST-2000 Expert Shooter System) will be used to assess Marine shooting performance following the effects of the movement activities in the MC-LEAP Course. Three sensor pad stations will measure vertical leap, vertical load lifting, and horizontal load transfer handling performance. Finally, a web-based survey kiosk will be used to record Marine self-assessment scores for mobility, speed, agility, maneuverability in confined space, exertion, and physical comfort.

During MC-LEAP events, the following background information, anthropometry measurements, and range of motion will be collected for participants.

- Age
- Gender
- Rank
- Pre-existing Injury (-ies)
- Years of Service
- MOS
- Billet
- # of Deployments
- Self reported equipment size data

The following anthropometric measurements will be taken:

- Height
- Weight
- Chest Circumference
- Torso Length
- Waist Circumference
- Iliocristale Height
- Cervical Height
- 2nd Thoracic Height

To evaluate increased loads against flexibility, range of motion measurements will be taken during each test condition including the unencumbered baseline (boots, t-shirt & FROG uniform). Measurements will be taken using a combination of a goniometer, a Wells and Dillon Sit and Reach apparatus, inclinometer, and a digital level. The following ranges of motion will be measured:

- Trunk Forward Flexion
- Trunk Lateral Flexion (Standing)
- Trunk Rotation

3.1 Initial Briefing:

Prior to data collection, participants will be provided an in-brief and background information on the MC-LEAP, a safety brief, and a MC-LEAP orientation of the obstacle course and its accessory test stands.

3.2 Practice Runs:

Following the initial briefings, the Marines will walk through the MC-LEAP Course with a staff demonstrator and will be given movement instructions and safety instructions for each station. Marines will then be given time to practice obstacles on the course. Training runs are not required when executing the course for purposes of physical training where data collection is not the objective. Marines will be checked and measured after being equipped to ensure their diameter does not exceed the safe dimensions for traverse of the tunnel. If an equipped Marine exceeds the safe clearance for executing the tunnel obstacle, the tunnel will be bypassed from the course run for that specific equipment configuration.

3.3 Evaluation Runs:

Marines will traverse the MC-LEAP Course while wearing operational gear and equipment currently issued by the USMC. Any prototype equipment worn in runs of the course will have a safety release from Marine Corps Systems Command Safety Office.

Between each course run-through, the Marine will be given at a minimum 45 minutes of sedentary rest time in order for the cardiovascular system to adequately recover from the previous run and return to resting heart rate. A commercial Polar heart rate monitor may be used to record heart rate through the course in order to determine exertion levels and ensure return to resting heart rate based on a Marine's desire to capture this information for use for themselves or as part of the MERS staff training.

For every Marine on the course there will be one MERS Staff member running along beside him or her to provide reminders of the correct course path, proper procedure, ensure timing gates activate, observe the Marine and his equipment, observe the Marine for any signs of unsafe levels of fatigue or exhaustion, and to watch for any safety concerns. No more than 2 Marines will be permitted to run on the course at any one time. This will prevent the Marines from passing/colliding into one another as well as prevent the attention of researchers and safety monitors from becoming divided.

3.4 Firing Accuracy:

Firing Accuracy may be recorded using the Noptel ST-2000 Expert Marksmanship System. This system is an integrated rifle marksmanship training device that attaches onto either the barrel of a rifle (Figure 2) or rail system. The Noptel System consists of two optical units, two targets, and proprietary software.



Figure 3. Noptel ST-2000 Expert Marksmanship System (left); attached to a rifle (right).

The Noptel System can stand alone or can be attached to a laptop computer (containing the Noptel Software) via a USB cable. The system works by emitting an infra-red LED light towards the target upon the rifle being fired. The light is reflected back to the optical receiver by prisms mounted on the target and the software converts this to a target score. The targets are mounted 150 feet away from the firing line (Figure 2).



Figure 3. Noptel Targets.

The Noptel ST-2000 Expert Marksmanship System will be BZO'd by a MERS staff member at the beginning of each day. Once BZO is completed, Marines will prepare for the MC-LEAP Course by donning the load configuration set up by the MERS staff and can ask any final questions and/or receive any final instructions.

3.5 Procedures for traversing the MC-LEAP stations:

While wearing the designated load condition, the Marines will traverse the MC-LEAP stations in the following order and manner:

Station 1: Tunnel and Hatch

The Marine approaches the stair portion of the tunnel and hatch obstacle (Figure 4) and climbs up the stairs one step at a time.



Figure 4. Tunnel and Hatch

The Marine then lowers himself (feet first) into the AAV sized hatch opening (Figure 5, left).

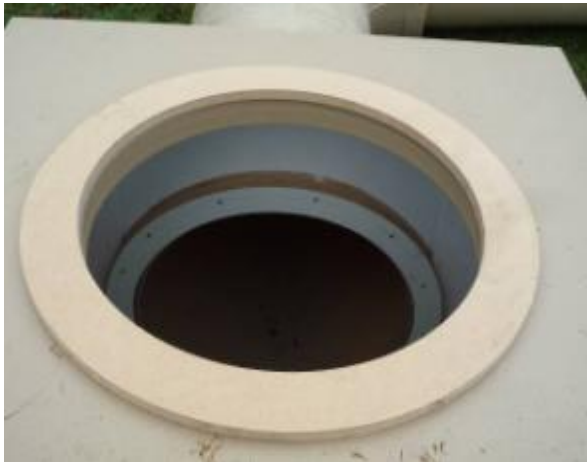


Figure 5. Hatch Opening.



Figure 5. Tunnel Opening.

Next, the Marine crouches and enters the opening of the tunnel (Figure 5, right). The Marine will continue traversing through the tunnel until the Marine emerges out the other end. If the Marine has any difficulty in the tunnel, the sections can be separated with buckle release mechanisms. Upon completing the length of the tunnel, the Marine quickly returns to a standing position and runs past the FitLight timing gate.

Station 2: Sprint



Figure 6. Sprint Lane.

The Sprint station starts once the Marine passes the FitLight timing gate (Figure 6). The Marine sprints as fast as possible for 20 yards. The sprint ends when the next FitLight timing gate is crossed.

Station 3: Stairs and Ladders



Figure 7. Stairs and Ladders

The Marine will run to the stair and ladder obstacle (Figure 7) and progress through this obstacle in the following order:

- a. run to the base of the high rise stairs.
- b. climb up the high rise stairs; down the low rise stairs.
- c. climb up low rise stairs; down high rise stairs.

- d. climb up the angled ladder; then down the straight ladder.
- e. climb up straight ladder; then down angled ladder.

The Marine finishes this obstacle by passing the FitLight timing gate at the bottom of the angled ladder.

Station 4: Agility Run

The Marine runs towards the first flag (Figure 8). The Marine makes a tight cut around the outside of the flag and heads back in the opposite direction towards the second flag, jumping over hurdle obstacles along the way and continues this sequence for

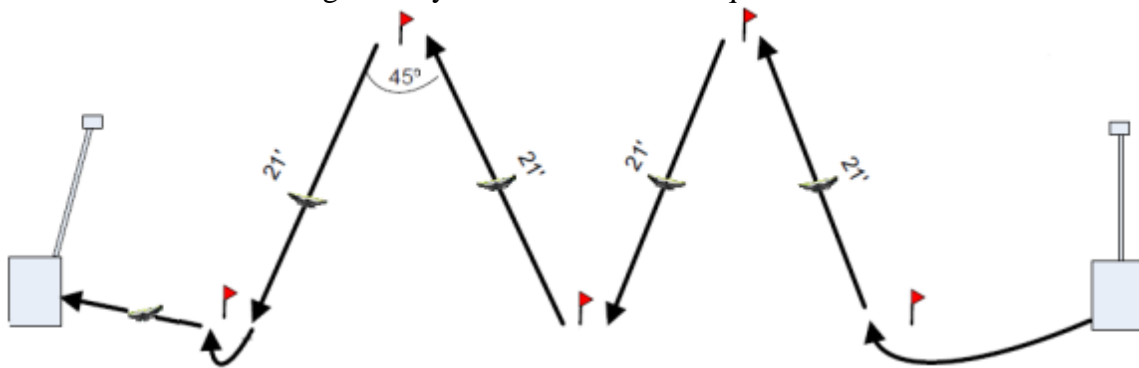


Figure 8: Agility Run

the set of five (5) flags and five (5) hurdles (Figure 8). This segment is completed when the Marine crosses past the FitLight timing gate after the fifth hurdle.

Station 5: Casualty Drag



Figure 9. Casualty Drag Path.

Using the casualty strap on the Plate Carrier, the Marine will drag “Rescue Randy” mannequin (Figure 9) out to the turn-around point and back to the original position at which the mannequin was located.

Station 6: Window Obstacle

To complete the window obstacles, the Marine must first go through the window opening of Window 1 (Figure 10, left). The Marine is free to choose whether or not he/she wants to use toe holds to assist him in climbing up the wall. After landing on the platform, the Marine runs to Window 2 (Figure 10, right) and climbs through the window opening.

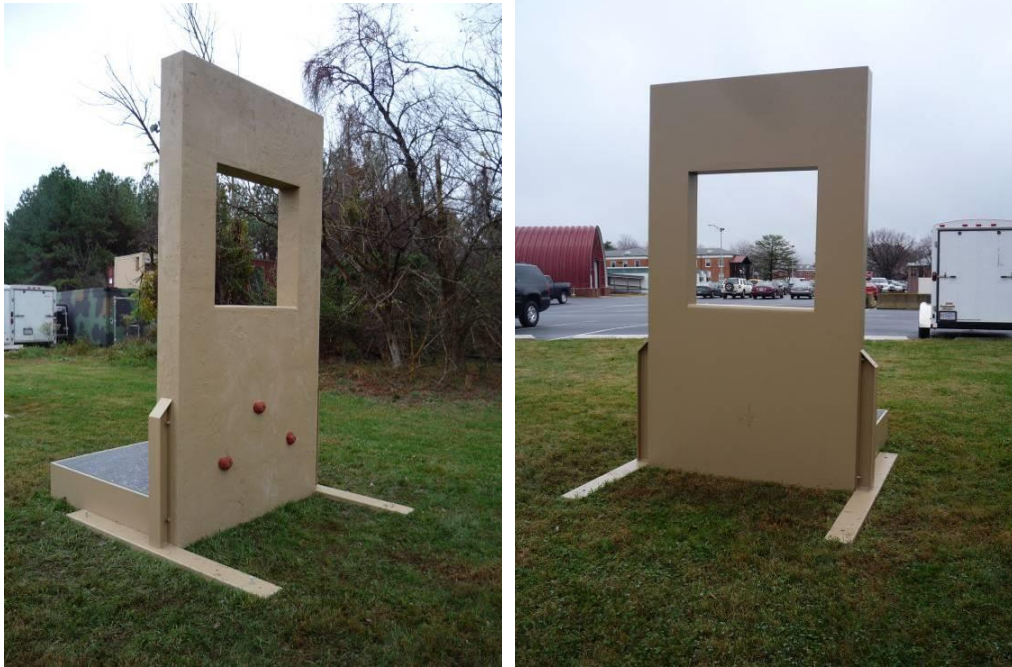


Figure 10. Window Stations.

Station 7: Bounding Rushes

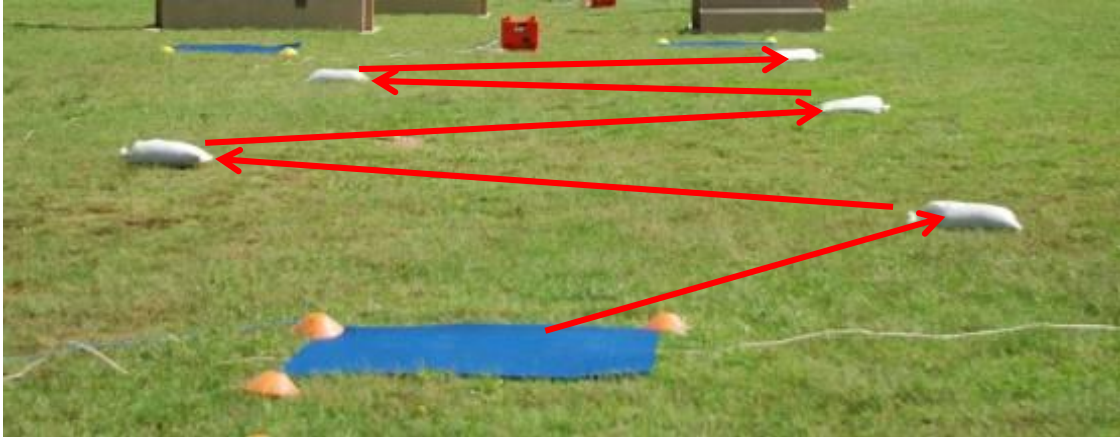


Figure 11. Bounding Rushes Path.

The Marine runs to the first pile of sandbags (Figure 11). Upon arriving at the first set of sandbags, the Marine assumes a prone position, acquires a sight picture, then leaps up to a running position. The Marine then sprints to the next (staggered) pile of sandbags and assumes another prone position. This cycle repeats until all piles of sandbags have been reached. This segment ends when the Marine runs past the final FitLight timing gate.

Station 8: Balance Beam



Figure 12. Balance Beam.

For the balance beam obstacle, the Marine keeps to the outside of the line of cones (Figure 12) and steps up onto the beam from the left end. Jumping up onto the beam from the side is not permitted. The Marine carefully walks across the balance beam while stepping over padded box-shaped obstacles. Stepping on top of the box obstacles is not permitted. The Marine must exit the balance beam by stepping off the end (not the side) and then keeping to the outside of the line of cones, run towards the next timing gate. If a Marine falls off the balance beam, the Marine gets on where he or she fell off.

Station 9: Low Crawl



Figure 13. Low Crawl.

The Marine begins by passing the FitLight timing gate and then low crawls underneath the canvas as fast as he/she can (Figure 13). At the 10 foot mark there will be a row of sandbags where the Marine will flip over and crawl on his or her back or side until reaching the next row of bags (20 foot mark). The Marine will flip over and perform a high crawl for the remainder. The Marine then runs past the timing gate thus completing this section.

Station 10: Inner and Outer Courtyard Walls.

The wall obstacle is comprised of an inner and outer courtyard wall set in a staggered formation. The Marine begins by traversing over the outer courtyard wall (foreground, Figure 14)



Figure 14. Outer (foreground) and Inner Courtyard Walls

as quickly as possible. Any manner of traversing is permitted, and the Marine may use the foot holds to assist him if he/she wishes. After traversing the outer courtyard wall, the Marine sprints to the inner courtyard wall and crosses over it as fast as possible, passing the final FitLight timing gate.

Station 11: Firing Accuracy

Firing Accuracy will be recorded using the Noptel ST-2000 Expert Marksmanship System. The system works by emitting an infra-red LED light towards the target upon the rifle being fired. The light is reflected back to the optical receiver by prisms mounted on the target and the software converts this to a target score. The targets are mounted 150 feet away from the firing line (Figure 15).



Figure 15. Noptel Targets.

To execute, the Marine will be instructed to pick up the rifle and approach the firing line and take a tactical kneeling position. Upon the command “Fire” (given by the MERS Staff Member), the Marine is given 15 seconds in which to complete 5 shots. He/she must aim for the center of the target. After 15 seconds has elapsed, if the 5 shots have not been taken the researcher will command “Cease Fire” and no further shots will be permitted.

Station 12: Vertical Jump

The jump station (Figure 16, left) consists of a rubber mat with an embedded sensor (Figure 16, right) attached to a laptop computer. A set of 6 differently colored tennis balls suspended from a rope serve as targets to facilitate goal setting for each jump. When the Marine jumps, the sensor measures the time off the mat, and computer software converts that time to a jump height and lower limb power. In order for this calculation to occur, the participant’s body mass (body weight + clothing + gear) will be taken and entered prior to the jump testing.



Figure 16. Embedded Sensor.



Figure 16. Jump Station.

The Marine will perform a series of three maximal-effort jumps. After the MERS staff member clicks “Start” on the laptop, the Marine will be instructed to make one maximal vertical jump. The MERS staff member records the jump and then instructs the Marine to make a second maximal vertical jump when ready. The same protocol is followed for a third and final jump. The database software will identify the maximum jump and calculate the average jump height.

Station 13: Weight Transfer

The weight transfer station is used to measure the Marine's ability to quickly transfer a weight from one platform to another within each of the test conditions. There are two components to the weight transfer station: horizontal transfer (Figure 17, left) and vertical transfer (Figure 17, right).

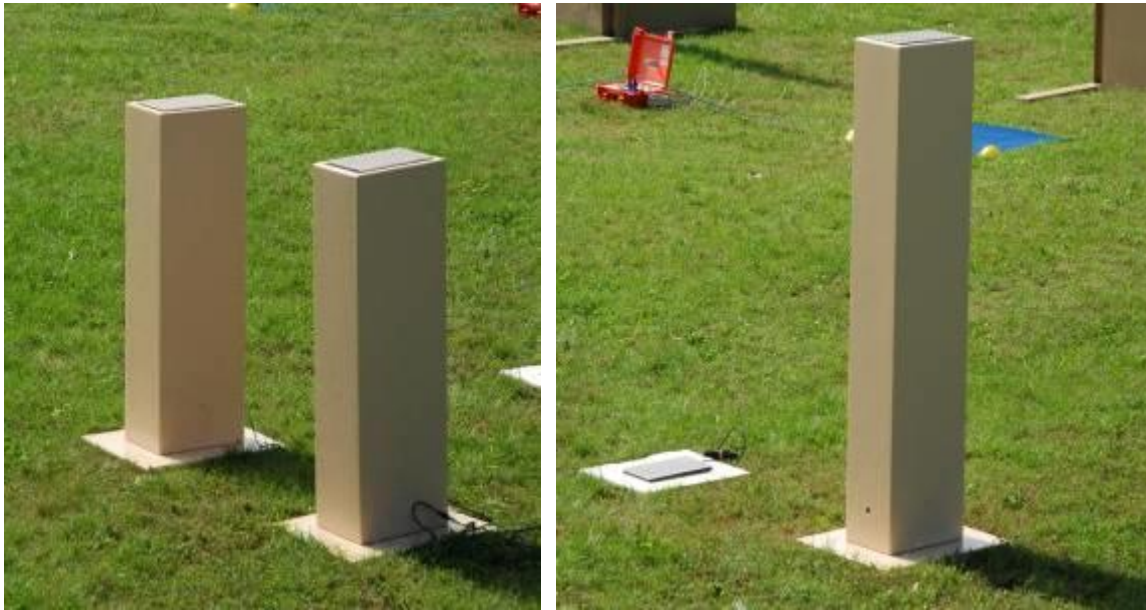


Figure 17. Horizontal (left) and Vertical Transfer (right) Stations.

The horizontal lift platforms are 48” from the ground, and a 30 lb ammunition can is used as the lifting load. The vertical platform is 68” from the ground and a 30 lb ammunition can will be used as the lifting load for the vertical transfer. For both the horizontal and vertical transfers, six lifts (with back and forth being considered one lift) are to be performed, and the time it takes to complete this set of six lifts is recorded.

Station 14: Subjective Rating Questionnaire Kiosk (MERS Staff Training Only)

The questionnaire kiosk consists of a stand-alone computer terminal that runs a program containing a one-page questionnaire. The questionnaire collects subjective data regarding the Marine's acceptability rating of various parameters of their test condition. The Marine will be presented with the screen (Figure 18). He/she must fill in his participant number and condition, as well as an answer for each of the seven questions before the “Submit” button becomes active.

MERS Combine - Questionnaire

Instructions
On a scale of 1 to 7, with 1 being Completely Unacceptable, 4 being Borderline and 7 being Completely Acceptable, please rate your acceptability of the following..

Identification
Enter Participant# [] Select Condition [v]

Question 1
The flexibility of the test condition
 1 2 3 4 5 6 7

Question 2
The bulk of the test condition
 1 2 3 4 5 6 7

Question 3
The weight of the test condition
 1 2 3 4 5 6 7

Question 4
Your agility while wearing the test condition
 1 2 3 4 5 6 7

Question 5
Your speed while wearing the test condition
 1 2 3 4 5 6 7

Question 6
Your mobility while wearing the test condition
 1 2 3 4 5 6 7

Question 7
Your overall fatigue while wearing the test condition
 1 2 3 4 5 6 7

Comments (Used 0 of 500 allowed characters)

Figure 18. Subjective Questionnaire (sample).

4.0 Risk and discomfort to Participants

a) Risk to Participants: Limited to what is expected when traversing any Marine Corps obstacle or endurance course when/while wearing combat loads (e.g. slips, trips, falls, dehydration, and musculoskeletal injury).

b) How will Risks be Minimized: Risks will be minimized by the safety provisions built into the design of the obstacles.

(1) Climbing and crossing obstacles have railings on all stairs and foam covers on any exposed edges. Obstacles requiring Marines to traverse over a high wall (6') or climb through windows include a padded platform to cushion the Marine in the event they were to slip and fall.

(2) Each obstacle shall be examined for signs of wear, tear, cracks, splinters, rust, broken or protruding pieces, and stability on a daily basis. Railings shall be examined to ensure they are not loose or unstable. All bolts and nuts will be checked.

(3) Prior to any testing or practice runs, Marines will be given a safety briefing and walk-through of the MC-LEAP Course, in which proper and safe techniques of

traversing obstacles will be discussed. During this (or any other) time, Marines are free to ask any questions they may have concerning the obstacles or the method of traversing them.

(4) When using the Noptel system, safe rifle handling procedures will be practiced as if the rifle were a live weapon.

(5) Bottled water or ice water will be available at the completion of each run to avoid dehydration.

(6) Safety Precautions and Emergency Procedures/ Plans to Deal with Adverse Events or Injuries: In the event of a medical emergency for a participant, a hospital corpsman, or likewise trained personnel, will administer aid and call for transportation to the nearest medical treatment facility.

4.1 Use of the MC-LEAP Course

Requests for use of the MC-LEAP Course will be submitted to the Gruntworks Director via email for approval and coordination with the MERS Director. The Gruntworks Director is Mr. Eric Baker, eric.t.baker@usmc.mil or Comm: (703)784-6858. Priority for use of the MC-LEAP Course will be managed by the MERS Director. The MERS Director is Mr. Mark Richter, mark.richter@usmc.mil or Comm: (703)432-3680.

4.2 Responsibilities

The MC-LEAP Course is under the operational responsibility of Marine Corps Systems Command (MCSC) who is a tenant unit aboard Marine Corps Base, Quantico (MCBQ). The MERS Division operates, manages and utilizes the MC-LEAP course in order to meet their mission to manage the Squad as a System and perform Squad Integration duties in support of the program management offices (PMOs) within Program Executive Office Land Systems (PEO LS) and MCSC. The MERS Division reports to the Chief Engineer (CHENG) of the Marine Corps, Deputy Commander, Systems Engineering, Interoperability, Architectures and Technology (DC SIAT). The MC-LEAP course will be operated and maintained in accordance with the applicable regulations and procedures established for the course.

4.3 MC-LEAP Obstacle Course Summary

Almost 2000 runs of the MC-LEAP course have been executed so far without any significant injuries. The course is safe when executed properly under supervision. The MC-LEAP Standard Operating Procedure manual ensures continued safe operation of the course for all events.

5.0 Marine Corps Load Assessment Program Hike

The Hike Assessment provides a long duration equipment wear event with various exertion levels and reflects similar hike tasks and characteristics from 2016 revision of the Infantry Training and Readiness Manual. The purpose of the hike is to determine the load condition

effects on the Marine, and collect data, observations and perceived effects in order to quantify the mobility implications for an equipment item as part of the complete system.

5.1 Key Trial Parameters

- a) Distance – 15 kilometers at a pace of 4 kilometers per hour
- b) Terrain – improved and unimproved roads with minimal to mild terrain relief
- c) Participants – Infantry Marines that have completed pre-deployment training
- d) Controlled Rate of March with constant speed in order to achieve a constant level of effort from the Marines
- e) Hydration is at individual's desired rate but will record fluid intake. Water is the only fluid intake.

5.2 Instrumentation

- a) Timing Devices/Stop Watch- Time recording in distance increments.
- b) Hidalgo Physiological Status Monitor - Core temperature, heart rate, respiration rate, and skin temperature.
- c) Inertial Measurement/Unit Trunk Angle Measurement - Identifies center of gravity shift and indicator of mechanical issues.
- d) Contact Pressure Point Measurement - Identifies actual pressures primarily for shoulder area.
- e) VO2 Max / Respiratory Quotient (Instrumentation in Development) - Non intrusive method to capture data in development by MIT Lincoln Labs. Periodic measurements at pre-defined increments during the hike. Handed to the Marine by the data collector walking with the Marine. Prototypes available June 2016.
- f) Load Sensor Suite (Instrumentation in Development) - Instrumented Inserts. Boot insert to capture load data in development by MIT Lincoln Labs. MERS will have 5 to 10 inserts available in April 2016. Validation test using USARIEM Treadmill Force Plate.

5.3 Measured Metrics

- Time variations to the prescribed rate of march
- Metabolic work rates differences within subjects' configurations from Hidalgo PSM and VO2 Max
- Gait and pace changes
- Trunk Angle changes

- Load Cell Data from Inserts
- Survey
- Comfort and Perceived Exertion surveys
- Body Mapping Survey- pressure points and hot spots
- General equipment questions

5.4 Hike Baseline Test Configuration

- Assault Load Configuration from MC-LEAP Obstacle Course configurations
- Assault Load and contents
- Approach March load and contents
- Hike speed and distance - Longer than 12 kms and less than 20 kms
- Has to be repeated with rest recovery periods in between hike equipment configurations

5.5 Sample Hike Trial Designs

a) Mobility Metric Generation utilizing Three Comparisons

(1) Baseline - Marine in Rifleman Assault Load with Assault Pack. (Sub Maximal Test)

(2) THOR System (25.6 lbs) – Current in service system on a Marine in Rifleman Assault Load with select items from his Assault Pack.

(3) MEU-SOC CREW System (40 lbs)- In development system placed on a Marine in Rifleman Assault Load with select items from his Assault Pack (same items as above).

b) Utilize MC-LEAP Obstacle Course and MC-LEAP Hike for mobility evaluation.

MC-LEAP Gear Configuration



MC-LEAP Gear Configuration



Clothing Worn & Packed Weight	Total Weight (Lbs)
Marine Corps Combat Utility, Blouse and Trouser (Seasonal)	2.97
Uniform, Utility, Belt	.3
Ballistic Eye Pro(Day/Night)	.31
M50 Mask (include twin filters) w/ Carrier	3.0
Gloves	0.3
T-Shirt, Green	0.18
Undershorts	0.25
Marine Corps Combat Boots w/ Laces	3.12
Socks	0.16
Watch, Wrist	0.1
Card, ID	0.03
Tags, ID	0.1
Light Weight Helmet w/ Cover, Band, and NVG Base Plate	3.5
Plate Carrier w/ Soft Armor	9.0
SAPI Plates (Front, Back, and 2x side)	19.0
Pouches (1-dump, 3- Double Magazine, 2 grenade)	2.0
IFAK – Individual First Aid Kit	2.1
AN/PVS-14 w/ Elbow/Rhino Mount (in pouch)	1.0
Hydration System, CamelBak (Full)	6.91
M-4 with RCO	7.31
Total Rifleman Fighting Load Weight (Not including SL-3)	61.64 Lbs