USAARL Report No. 2017-19

Return-to-Duty Toolkit: Assessments and Tasks for Determining Military Functional Performance Following Neurosensory Injury

By Amanda Kelley[1], Art Estrada[1], John Crowley[1], Donald Marion[2], Stephanie Karch[1], James Truong[1], Angela Fulbright[1], Jonathan Taylor[1], Amanda Hayes[1,3], Katie Feltman[1], Kyle Bernhardt[1,3], Jared Basso[1,3], Susan Fondy[1], Mark Showers[4]

[1]U.S. Army Aeromedical Research Laboratory
[2]Defense and Veterans Brain Injury Center/GDIT
[3]Oak Ridge Institute for Science and Education
[4]National Intrepid Center of Excellence

United States Army Aeromedical Research Laboratory

Aircrew Health and Performance Division
Auditory Protection and Performance Division
Vision Protection and Performance Division

September 2017

Notice

Qualified Requesters

Qualified requesters may obtain copies from the Defense Technical Information Center (DTIC), Fort Belvoir, Virginia 22060. Orders will be expedited if placed through the librarian or other person designated to request documents from DTIC.

Change of Address

Organizations receiving reports from the U.S. Army Aeromedical Research Laboratory on automatic mailing lists should confirm correct address when corresponding about laboratory reports.

Disposition

Destroy this document when it is no longer needed. Do not return it to the originator.

Disclaimer

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other official documentation. Citation of trade names in this report does not constitute an official Department of the Army endorsement or approval of the use of such commercial items.

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
29-09-2017	Final	

4. TITLE AND SUBTITLE

Return-to-Duty Toolkit: Assessments and Tasks for Determining Military Functional Performance Following Neurosensory Injury

5a. CONTRACT NUMBER	5b. GRANT NUMBER	5c. PROGRAM ELEMENT NUMBER
N/A	N/A	N/A

6. AUTHOR(S)

Kelley, Amanda M.; Estrada, Art; Crowley, John; Marion, Donald; Karch, Stephanie; Truong, James; Fulbright, Angela; Taylor, Jonthan C.; Hayes, Amanda; Feltman, Katie; Bernhardt, Kyle; Basso, Jared; Fondy, Susan R.E.; Showers, Mark

5d. PROJECT NUMBER	5e. TASK NUMBER	5f. WORK UNIT NUMBER
N/A	N/A	N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Aeromedical Research Laboratory
P.O. Box 620577
Fort Rucker, AL 36362

8. PERFORMING ORGANIZATION REPORT NUMBER

USAARL 2017-19

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Medical Research and Materiel Command
504 Scott Street
Fort Detrick, MD 21702-5012

10. SPONSOR/MONITOR'S ACRONYM(S)

USAMRMC

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

N/A

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

Defense and Veterans Brain Injury Center/GDIT; Oak Ridge Institute for Science and Education; National Intrepid Center of Excellence

14. ABSTRACT

One of the most challenging decisions facing military health care providers is if and when a previously wounded warfighter is fit for return to duty (RTD). A variety of assessments are available to decision makers to assist in making informed and accurate determinations of RTD status. The purpose of this Toolkit is to be a reference guide and resource containing currently available assessments for use by healthcare providers who make RTD and fitness-for-[military] duty (FFD) decisions. Depending on the nature of the original injury, the Toolkit is intended to provide a tailorable selection of assessments from which to measure progress toward FFD and from which to make final RTD determinations. While many of the assessments are well known and well validated, others contained in this reference document possess various states of trial and validation. Some of the assessments included here are considered "good clinical practice," while others should more appropriately be viewed as clinical options. The Toolkit includes several assessments that were recently developed and are based on military functional tasks.

15. SUBJECT TERMS

Return-to-duty, operational performance, measurement reliability, toolkit, assessment, validity, neurosensory injury

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Loraine St. Onge, PhD
UNCLAS	UNCLAS	UNCLAS	SAR	264	19b. TELEPHONE NUMBER *(Include area code)* 334-255-6906

This page is intentionally blank.

Acknowledgements

The authors wish to thank the members of USAARL Aircrew Health and Performance Division for their contributions and assistance in preparing this document. They are also very grateful for the extraordinary editorial assistance provided by Ms. Jessica Cumbee. A special thanks is extended to Ms. Katherine Helmick, Deputy Director, Defense Veterans Brain Injury Center, for her steadfast support and contributions to this effort. The authors also want to thank all of the professionals who contributed to the workshops and drafts of this document.

This page is intentionally blank.

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

List of Figures

This page is intentionally blank.

Introduction

This Return-to-Duty Toolkit serves as the final product of an effort sponsored by the U.S. Army Medical Research and Materiel Command's (USAMRMC's) Military Operational Medicine Research Program (MOMRP) Task Area P1, "Return-to-Duty Standards and Strategies After Neurosensory Injury." Task Area P1 addressed the need for research aimed at providing evidence-based criteria for standards to determine the level of operational competence and performance of a warfighter after injury to the brain and sensory systems–mainly traumatic-brain-injury-related (TBI-related). The Toolkit contains the efforts of many dedicated experts including medical researchers, occupational and physical therapists, and healthcare providers who shared the goal of providing evidence-based tools for military return-to-duty (RTD) assessments. Its publication is due largely to the contributions of experts who participated in three workshops, the proceedings of which are available for review (Estrada, Crowley, & Stokes, 2013; Thornson, Basso, McCulley, & King, 2016; Kelley et al., 2017).

The purpose of this Toolkit is to be a reference guide and resource containing currently available assessments for use by healthcare providers who must make RTD decisions. Depending on the nature of the original injury, the Toolkit intends to provide a tailorable selection of assessments from which to measure progress toward RTD and from which to make final RTD determinations. While many of the assessments are well known and well validated, others contained in this reference document possess various states of trial and validation. While some assessments included here are considered good clinical practice, others should more appropriately be viewed as clinical options. For example, the Toolkit includes several assessments that were recently developed and are based on military functional tasks. These military-task-based assessments clearly show ecological validity (or relevance to real-life military duties), but due to the limited time since their development, generally lack rigorous study to determine reliability and predictive validities.

Assessing a warfighter's readiness and ability to return-to-duty (RTD) is not an exact science. It requires a mix of evidence-based validated clinical tools, that establish or confirm diagnoses that may implicitly determine future duty status (e.g., post-traumatic epilepsy confirmed with an electroencephalogram [EEG]), and occupationally specific performance assessments that possess a high degree of ecological validity (e.g., dynamic marksmanship ability potentially degraded by disequilibrium due to chronic traumatic encephalopathy). Clinicians and decision makers may be able to rely entirely on a definitive diagnosis (as in epilepsy) or may need a functional assessment (as in dizziness) to defend an RTD recommendation, especially when a warfighter's specific ability can vary widely with a specific diagnosis. Clinical decision algorithms can provide consistency and hopefully represent medical consensus, but these are not always available. A toolkit, such as the one presented herein, can be used to customize performance assessments to specific military occupational requirements and/or to the warfighter's specific potential impairment–within the clinician's scope of practice.

How to Use This Toolkit

One of the hardest challenges in medicine is to piece together the available data into a holistic picture. Sometimes the challenge is knowing what data to ask for, and sometimes the task is interpreting the data already gathered. When making RTD decisions, clinicians have three basic requirements:

1) Understanding the history, symptomatology, and clinical course of the diagnosis.

2) Knowledge of the available clinical tests and how to interpret them.

3) Framework to make an informed and holistic decision about return to duty.

This toolkit is designed to help clinicians with the last two requirements. It seeks to do this in a number of ways:

Interpret the Results of Previous Testing: By the time RTD decisions are considered, a broad array of extensive testing by numerous primary care providers and specialists has often occurred. The toolkit will help clinicians interpret the most commonly performed clinical evaluations, and understand their significance in terms of predicting successful RTD. The toolkit is organized by systems or domains and provides a description of each test, the required equipment, time, resources, outcome measures, and basics of test interpretation.

Identify the Need for Additional Testing: The toolkit is also designed to help clinicians decide whether additional tests or assessments are needed to inform a RTD decision. For example, if no tests in a particular domain have been shown to predict occupational performance, and the clinical diagnosis is certain, there may be no point in subjecting the patient to further expensive testing with the RTD decision resting on expert opinion and subjective judgment. If there is a need for additional testing, the toolkit provides the pros and cons of tests (some of which are free and easily administered in the clinician's office) recommended and/or developed by experts in the fields of rehabilitation and fitness for duty assessment.

In the end, the decision to allow warfighters to return to duty remains a challenge. The toolkit is designed to help the clinician assess the significance of neurosensory injury, correctly interpret available testing, apply clinical judgment and experience, and make the best possible determination regarding return to duty.

Neurobehavioral Assessments

General Comments

When assessing the neurobehavioral aspects of RTD after neurosensory injury, standard clinical assessment tools can provide useful information regarding severity and prognosis. Only one measurement of neurobehavioral performance has been validated for RTD use – the Exertional Test. The table below provides a listing of clinical neurobehavioral assessments that may be relevant to RTD decision-making (including the Exertional Test), as well as other standardized measures likely to be performed as part of a comprehensive neurobehavioral workup, as well as less common assessments that may be useful. On the pages that follow, additional detailed information is provided for selected assessments to assist the care provider in understanding how the technique can assist in RTD decision-making.

Note that these neurobehavioral assessment methods can be performed in the primary care provider's office if the necessary equipment and instructions are available. However, specialist referral may be necessary to properly quantify and document the result, as well as to ensure proper follow-up on abnormal screening tests.

Assessment Category	Assessment	Specialty Referral Required for Administration*	Additional Details Provided In This Chapter
RTD Assessment Tool (validated for RTD evaluation)	Exertional Test	No	Page 4
Standard Clinical Assessments (not specifically proven as an RTD assessment)	Neurobehavioral Symptom Inventory (NSI)	No	Page 5
	Epworth Sleepiness Scale (ESS)	No	Page 6
Other Assessments (less common tests that may be used)	Headache Impact Test (HIT-6)	No	Page 7
	Insomnia Severity Index (ISI)	No	Page 8
	Pittsburgh Sleep Quality Index (PSQI)	No	Page 9
	Migraine Disability Assessment Scale (MIDAS)	No	Page 11

Return to Duty Assessment Tool

Assessment: Exertional Test

Summary and description: A physical exertion test is typically administered when a concussed warfighter reports no symptoms. The objective of the test is to reveal any hidden symptoms through an increase in intracranial pressure and is also used in return-to-play decision making. The exertional test should not be administered prior to 24 hours following injury. If brief physical exertion results in physical or cognitive symptoms, then a period of continued rest and observation may be appropriate. Description: The Exertional Test requires the warfighter to engage in aerobic activity such as running in place or push-ups until 65–85% of the target heart rate is reached (the target heart rate is 220 minus age). The administrator then asks the warfighter about any symptoms present.

Equipment needed: N/A

Time to administer: 20 minutes

Administration and scoring instructions: Warfighter performs aerobic activity for approximately 20 minutes (Guskiewicz et al., 2004) or until 65–85% of the target heart rate is reached (the target heart rate is 220 minus age). Options for activity include but are not limited to running in place, push-ups, or sit-ups.

Immediately following the physical exertion exercise, the administrator asks whether any of the following symptoms are present:

- Headache
- Vertigo
- Photophobia
- Imbalance
- Dizziness
- Nausea
- Tinnitus
- Visual changes or blurred vision

The presence of any symptoms reported indicates further rest or evaluation is required. The reader is referred to the Progressive Return to Activity Clinical Practice Guideline for further reading at https://dvbic.dcoe.mil/material/progressive-return-activity-following-acute-concussionmild-tbi-guidance-rehabilitation-1.

Reference citations:

Guskiewicz, K. M., Bruce, S. L., Cantu, R. C., Ferrara, M. S., Kelly, J. P., McCrea, M., ... & McLeod, T. C. V. (2004). National Athletic Trainers' Association position statement: management of sport-related concussion. Journal of Athletic Training, 39(3), 280.

Moore, J. (2010). Military neuropsychology. Springer Publishing Company.

Standard Clinical Assessments

Assessment: Neurobehavioral Symptom Inventory

Summary: The Neurobehavioral Symptom Inventory (NSI) is used to determine the presence and severity of symptoms commonly reported following concussion/traumatic brain injury including headaches, light and noise sensitivity, clumsiness, nausea, numbness or tingling, changes in taste and/or smell, and sleep disturbances. Research has been conducted with a military population and shows that scores are stable across repeated administration. Scores correlate with known diagnoses and those from clinically valid assessment tools (e.g., Beck's Depression Inventory, Posttraumatic Stress Disorder Checklist - Military version, and Beck's Anxiety Inventory).

Description: The NSI is a self-report instrument consisting of 22 items designed to assess post-concussion syndrome symptoms. It is frequently used by the Departments of Defense and Veterans Affairs. The instrument is included in Appendix B.

Equipment needed: N/A

Time to administer: 5–10 minutes

Administration and scoring instructions: Self-report of 22-items; a total score is calculated by summing raw scores. Scores range from 0–4 in normal, healthy military population, suggesting that scores exceeding 4 may indicate abnormal frequency and/or severity of symptoms.

Additional Resources:

http://dvbic.dcoe.mil/information-papers-concussionmild-traumatic-brain-injury-health-care-outcomes

http://dvbic.dcoe.mil/research/interpreting-change-neurobehavioral-symptom-inventory-and-ptsd-checklist-military-personnel.

Reference citation:

Vanderploeg, R. D., Silva, M. A., Soble, J. R., Curtiss, G., Belanger, H. G., Donnell, A. J., & Scott, S. G. (2015). The structure of postconcussion symptoms on the neurobehavioral symptom inventory: a comparison of alternative models. *The Journal of Head Trauma Rehabilitation*, *30*(1), 1-11.

Assessment: Epworth Sleepiness Scale

Summary: The Epworth Sleepiness Scale (ESS) is used to determine the presence and severity of daytime sleepiness potentially indicative of insomnia or sleep disturbances. It may be used with other sleep disorder/disturbance assessment tools (e.g., Insomnia Severity Index [page 8]). Research has been conducted with a military population and shows that scores are stable across repeated administration. Research suggests good sensitivity and specificity to sleep disorders as well as good internal consistency such that items that measure the same construct produce similar scores or outcomes. While this assessment has not been evaluated for RTD, it is often included to evaluate symptoms associated with sleep disturbances, a common symptom following mTBI (Mathias & Alvaro, 2012).

Description: The ESS is an 8-item self-report instrument. It was designed to measure daytime sleepiness. The instrument is included in Appendix C.

Equipment needed: N/A

Time to administer: 5–10 minutes

Administration and scoring instructions: Self-administered. Maximum score of 24 and minimum score of 0. The higher the score, the greater the likelihood the individual experiences daytime sleepiness. Item scores are summed and are interpreted as:

- Lower normal daytime sleepiness: 0-5
- Higher normal daytime sleepiness: 6-10
- Mild excessive daytime sleepiness: 11-12
- Moderate excessive daytime sleepiness: 13-15
- Severe excessive daytime sleepiness: 16-24

Additional Resource:

The ESS is copyrighted. A license is required to use the ESS, whether or not a license fee is required. Some users of the ESS have to pay a license fee, others do not. The contact info is **https://eprovide.mapi-trust.org/instruments/epworth-sleepiness-scale**.

Reference citations:

Johns, M. W. (1992). Reliability and factor analysis of the Epworth Sleepiness Scale. *Sleep, 15*(4), 376-381.

Johns, M. W. (2000). Sensitivity and specificity of the multiple sleep latency test (MSLT), the maintenance of wakefulness test and the Epworth sleepiness scale: Failure of the MSLT as a gold standard. *Journal of Sleep Research, 9*(1), 5-11.

Mathias, J. L., & Alvaro, P. K. (2012). Prevalence of sleep disturbances, disorders, and problems following traumatic brain injury: a meta-analysis. Sleep medicine, 13(7), 898-905.

Other Assessments

Assessment: Headache Impact Test-6

Summary: The Headache Impact Test-6 (HIT-6) is used to determine the presence and severity of headaches that impact daily function and tasks. Research has been conducted with a military population and shows that scores are stable across repeated administration. Research suggests good internal consistency such that items that measure the same construct produce similar scores or outcomes. Scores correlate with known diagnoses and those from a clinically valid general health assessment tool (e.g., Short Form Health Survey-8) and have been shown to accurately discriminate between headache pain severity groups.

Description: The HIT-6 is a 6-item self-report instrument. It was designed to measure the extent to which headaches impair or influence one's abilities in various daily tasks.

Equipment needed: N/A

Time to administer: 5–10 minutes

Administration and scoring instructions: Self-administered. The higher the score, the greater the perceived handicap due to headaches, with a score of 50 or higher indicative of significant headache pain. Item scores are summed (min = 36 and max = 78) providing the following possible results:

- Little or no impact: 36–49
- Some impact: 50–55
- Substantial impact: 56–59
- Severe impact: 60–78

Additional Resource:

The HIT-6 is free for download at **http://neurohealth.info/wp-content/uploads/2010/10/hit6.pdf**.

Reference citations:

Cooper, D. B., Phuong, M. C., Armistead-Jehle, P., Vanderploeg, R. D., & Bowles, A. O. (2012). Relationship between mechanism of injury and neurocognitive functioning in OEF/OIF service members with mild traumatic brain injuries. *Military Medicine, 177*(10), 1157-1160.

Kosinski, M., Bayliss, M. S., Bjorner, J. B., Ware Jr., J. E., Garber, W. H., Batenhorst, A., Cady, R., Dahlöf, C.G.H., Dowson, A., & Tepper, S. (2003). A six-item short-form survey for measuring headache impact: The HIT-6. *Quality of Life Research, 12*, 963-974.

Yang, M., Rendas-Baum, R., Varon, S. F., & Kosinski, M. (2011). Validation of the Headache Impact Test (HIT-6) across episodic and chronic migraine. *Cephalalgia, 31*(3), 357-367.

Assessment: Insomnia Severity Index

Summary: The Insomnia Severity Index (ISI) is used to determine the presence and severity of insomnia relative to fatigue. It may be used with other sleep disorder/disturbance assessment tools (e.g., Epworth Sleepiness Scale [page 6]). Research has been conducted with a military population and shows that scores are stable across repeated administration and correlate with sleep diaries. Research suggests good sensitivity and specificity to sleep disorders as well as good internal consistency such that items that measure the same construct produce similar scores or outcomes.

Description: The ISI is a 7-item self-report instrument. It was designed to measure the nature, severity, and impact of one's insomnia. The instrument is included in Appendix D.

Equipment needed: N/A

Time to administer: 5–10 minutes

Administration and scoring instructions: Self-administered. Maximum score of 28 and minimum score of 0. The higher the score, the greater the severity of insomnia. Item scores are summed providing the following possible results:

- Absence of insomnia: 0–7
- Sub-threshold insomnia: 8–14
- Moderate insomnia: 15–21
- Severe insomnia: 22–28

Reference citations:

Craig, B. J., Clemans, T. A., Hernandez, A. M., & Rudd, M. D. (2013). Loss of consciousness, depression, posttraumatic stress disorder, and suicide risk among deployed military personnel with mild traumatic brain injury. *Journal of Head Trauma Rehabilitation, 28*(1), 13-20).

Morin, C. M., Belleville, G., Bélanger, L., & Ivers, H. (2011). The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep, 34*(5), 601-608.

Assessment: Pittsburgh Sleep Quality Index

Summary: The Pittsburgh Sleep Quality Index (PSQI) is used to determine sleep quality with respect to daytime sleepiness, insomnia, and sleep disturbances. Research has been conducted with a military population and shows that scores are stable across repeated administration. The PSQI has been shown to correlate with other measures related to sleep disturbances (Epworth Sleepiness Scale) and to discriminate between healthy controls and those with known sleep disorders (Carpenter & Andrykowski,1998). Research suggests good sensitivity and specificity to sleep disorders.

Description: The PSQI is a 19-item self-report instrument, with five additional questions to be rated by a bed-partner or roommate. It was designed to measure an individual's sleep quality over the previous 30 days.

Equipment needed: N/A

Time to administer: 5–10 minutes

Administration and scoring instructions: Self-administered. Maximum score of 21 and minimum score of 0. The bed-partner/roommate questions are not included in scoring, but are for clinician information. There are seven subcomponent scores that are summed for a total score. Outcome measures include a total score and the following subcomponent scores:

- Subjective sleep quality
- Sleep latency
- Sleep duration
- Habitual sleep efficiency
- Sleep disturbances
- Use of sleeping medications
- Daytime dysfunction

Scores greater than 5 are indicative of impaired sleep quality. The higher the score, the worse the sleep quality.

Additional Resource:

Available online at
http://www.psychiatry.pitt.edu/sites/default/files/page-images/PSQI_Instrument.pdf.

Reference citations:

Buysse, D., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index - A new instrument for psychiatric practice and research. *Psychiatry Research, 28,* 193-213.

Insana, S. P., Hall, M., Buysse, D. J., & Germain, A. (2013). Validation of the Pittsburgh Sleep

Quality Index Addedendum for posttraumatic stress disorder (PSQI-A) in male military veterans. *Journal of Traumatic Stress, 26*(2), 192-200.

Carpenter, J. S., & Andrykowski, M. A. (1998). Psychometric evaluation of the Pittsburgh sleep quality index. *Journal of psychosomatic research*, *45*(1), 5-13.

Assessment: Migraine Disability Assessment Scale

Summary: The Migraine Disability Assessment Scale (MIDAS) can be used for all headache symptoms and is used to determine the presence and severity of headaches as well as the extent to which daily function and tasks are impacted. Research has been conducted with a military population and shows that scores are stable across repeated administration and correlate with patient headache diaries.

Description: The MIDAS is a 5-item self-report instrument. It was designed to measure the impact of headache disability.

Equipment needed: N/A

Time to administer: 5–10 minutes

Administration and scoring instructions: Self-administered. Individuals record the number of missed days or days with limitations to activity due to headache in occupational, social, and leisure domains. The self-recorded number of days is then summed. Individuals also report on the frequency of headaches and intensity of pain. This is not scored, but provided to the clinician as additional information. The higher the number of days lost, the greater the perceived handicap due to headaches.

Additional resource:

Available at **https://migraine.com/pro/midas/**.

Reference citations:

Stewart, W. F., Lipton, R. B., Dowson, A. J., & Sawyer, J. (2001). Development and testing of the Migraine Disability Assessment (MIDAS) questionnaire to assess headache-related disability. *Neurology, 56*(1), S21-S28.

Theeler, B. J., Mercer, R., & Erickson, J. C. (2008). Prevalence and impact of migraine among U.S. Army soldiers deployed in support of Operation Iraqi Freedom. *Headache: The Journal of Head and Face Pain, 48*(6), 876-882.

Neurocognitive Assessments

General Comments

Computerized Neurocognitive Tests (CNT) are a standard component of evaluating concussed patients and have been studied extensively. Additionally, military researchers have contributed significantly to the literature on the utility of CNTs in concussion diagnosis and evaluation (e.g., Nelson et al., 2016). While this topic is still passionately debated, these tests are commonly used in the sports medicine and military health communities. One major criticism is that much of the validity and reliability studies have been conducted by the test developers and, at present, there is no consensus in the community regarding which CNT is best for concussion patients. All neurocognitive assessments require the associated assessment manual and/or software which includes measure interpretation.

When assessing the neurocognitive aspects of RTD after neurosensory injury, standard clinical assessment tools can provide useful information regarding severity and prognosis. Only three measurements of neurocognitive performance have been validated for RTD use – the Automated Neuropsychological Assessment Metrics (ANAM), the Immediate Post-Concussion Assessment and Cognitive Test (ImPACT), and the Defense Automated Neurobehavioral Assessment (DANA). The table below provides a listing of clinical neurocognitive assessments that may be relevant to RTD decision-making (including the three listed above), as well as other standardized measures likely to be performed as part of a comprehensive auditory workup, as well as less common assessments that may be useful. On the pages that follow, additional detailed information is provided for selected assessments to assist the care provider in understanding how the technique can assist in RTD decision-making.

Note that the assessment methods can be performed in the primary care provider's office if the necessary equipment and instructions are available. Specialist referral may be necessary to properly quantify and document the result, as well as to ensure proper follow-up on abnormal screening tests.

Assessment Category	Assessment	Specialty Referral Required for Administration*	Additional Details Provided In This Chapter
RTD Assessment Tool (validated for RTD evaluation)	Automated Neuropsychological Assessment Metrics (ANAM)	No	Page 14
	Immediate Post-Concussion Assessment and Cognitive Test (ImPACT)	No	Page 16
	Defense Automated Neurobehavioral Assessment (DANA)	No	Page 18
Standard Clinical Assessments (not specifically proven as an RTD assessment)	Neuropsychological Assessment Battery (NAB)	No	Page 20
	Repeatable Battery for the Assessment of Neuropsychological Status (RBANS)	No	Page 22
	Victoria Symptom Validity Test (VSVT)	No	Page 23
	MicroCog Assessment of Cognitive Functioning	No	Page 24
Other Assessments (less common tests that may be used)	Connor's Adult ADHD [Attention Deficit Hyperactivity Disorder] Rating Scale	No	Page 26
	Speed and Capacity of Language Processing Test (SCOLP)	No	Page 28
	Visuospatial Construction Index	No	Page 29

* Note that screening or qualitative versions of these tests may be suitable for office use by the primary care provider, but specialty referral is often necessary to quantify the test results, or to ensure proper clinical follow-up after an abnormal screening test.

Return to Duty Assessment Tools

Assessment: Automated Neuropsychological Assessment Metrics

Summary: The Automated Neuropsychological Assessment Metrics (ANAM) is a library of computer-based assessments developed by the U. S. Army for evaluation of cognitive function. A 2013 Department of Defense Instruction (DoDI) states "Neurocognitive assessment tools will be used in a screening capacity to detect cognitive changes as part of a clinical evaluation and will not be used as a standalone diagnostic tool." At the time of this writing, warfighters must complete the ANAM within 12 months pre-deployment. The ANAM is then administered within 24–72 hours post-injury and subsequently compared to one's baseline score as a reference point. Research on the stability of scores across repeated administration of the ANAM has produced inconsistent results such that stability either is poor or meets the minimum clinical standards for reliability. With respect to detectability of impairments, the ANAM has been shown to detect deficits within 10 days of injury in a small sample of athletes. Sensitivity and specificity have not been adequately established.

Description: The ANAM consists of the following tests (note that any subset of the tests can be administered):

- 2-Choice Reaction Time
- Code Substitution – Learning, Immediate or Delayed
- Demographics/History Module
- Effort Measure
- Go/No-Go
- Grammatical Reasoning
- Logical Relations – Symbolic
- Procedural Reaction Time
- Pursuit Tracking
- Running Memory CPT
- Simple Reaction Time
- Sleep Scale
- Spatial Processing – Sequential and Simultaneous
- Manikin
- Matching Grids
- Matching to Sample
- Math Processing
- Memory Search
- Mood Scale
- Post-Traumatic Stress Assessment
- Tower Puzzle
- Stroop
- Symptoms Scale
- Switching
- Tapping
- Standard Continuous Performance Task

Equipment needed:

- ANAM software

Time to administer: 25 minutes

Administration and scoring instructions: Administered by clinician/medical personnel electronically. Scoring is provided and outputted by the ANAM program which is then interpreted by a medical professional. Outcome measures include subtest scores for each test listed above and a composite score.

Additional Resource:

More information available at **http://vistalifesciences.com/anam-faqs**.

Reference citations:

Department of Defense. Department of Defense Instruction 6490.13. In: Department of Defense, ed2013.

C-Shop. ANAM4 TBI: User manual. Norman, OK.: Center for the Study of Human

Operator Performance, University of Oklahoma; 2007.

Nelson, L. D., LaRoche, A. A., Pfaller, A. Y., Lerner, E. B., Hammeke, T. A., Randolph, C., ... & McCrea, M. A. (2016). Prospective, head-to-head study of three computerized neurocognitive assessment tools (CNTs): reliability and validity for the assessment of sport-related concussion. Journal of the International Neuropsychological Society, 22(1), 24-37.

Assessment: Immediate Post-Concussion Assessment and Cognitive Test

Summary: The Immediate Post-Concussion Assessment and Cognitive Test (ImPACT) is an assessment tool that the U.S. Army Special Operations Command (USASOC) recommends for decision making following concussion. According to USASOC Neurocognitive Testing and Post – Injury Evaluation and Treatment Clinical Practice Guideline (2010), "This evaluation should take place no earlier than the day after the injury, and after that can be conducted at any time post-injury. Testing can be done by any trained medical officer or medic. Ideally, the warfighter will have a baseline test against which to compare against. If no baseline is available, comparison will be made against normative population data. Test interpretation is only to be done by a trained licensed provider." Research on the stability of scores has produced inconsistent results suggesting strong stability in testing with athletes, but only moderate stability in testing with college students. Research also has shown positive results with respect to detectability of impairments within 1–3 days post-injury in concussed athletes. Note that the ImPACT is the most widely used neurocognitive assessment tool used in athletic communities. Study in military populations, using a military version of the ImPACT, found that personnel with a history of diagnosed blunt mTBI reported more mTBI and PTSD symptoms than those with no history of diagnosed mTBI and were a significantly greater risk of developing PTSD symptoms following the mTBI (Kontos et al., 2013).

Description: The ImPACT consists of six tasks measuring attentional processes, verbal recognition memory, visual working memory, visual processing speed, reaction time, numerical sequencing ability, and learning: Word Memory, Design Memory, X's and O's, Symbol Match, Color Match, and Three Letters.

Equipment needed:

- ImPACT assessments

Time to administer: 30 minutes

Administration and scoring instructions: Administered by clinician/medical personnel electronically. Outcome measures include three neurocognitive composite scores, motor speed, reaction time, and impulse control. Scoring is provided by the program which contains normative data to which individuals' scores are compared.

Additional Resource:

The ImPACT can be purchased at **https://www.impacttest.com/purchase/form/new/clinic**.

Reference citations:

Kontos, A. P., Kotwal, R. S., Elbin, R. J., Lutz, R. H., Forsten, R. D., Benson, P. J., & Guskiewicz, K. M. (2013). Residual effects of combat-related mild traumatic brain injury. Journal of Neurotrauma, 30(8), 680-686.

Lutz, R. H, Kane, S., & Lay J. (2010). USASOC neurocognitive testing and post-injury evaluation and treatment clinical practice guideline (CPG). Journal of Special Operations Medicine; 10(1): 31-38.

Nelson, L. D., LaRoche, A. A., Pfaller, A. Y., Lerner, E. B., Hammeke, T. A., Randolph, C., ... & McCrea, M. A. (2016). Prospective, head-to-head study of three computerized neurocognitive assessment tools (CNTs): Reliability and validity for the assessment of sport-related concussion. Journal of the International Neuropsychological Society, 22(1), 24-37.

Assessment: Defense Automated Neurobehavioral Assessment

Summary: The Defense Automated Neurobehavioral Assessment (DANA) is an assessment tool that includes a library of standardized cognitive and psychological assessments developed by the U.S. Navy Bureau of Medicine and Surgery. The DANA has been evaluated for validity with military populations and research has found that scores correlate with comparable NCAT (neurocognitive assessment tool) subtests (e.g., ANAM). DANA scores are shown to be stable across repeated administration. As of publication, the DANA had not yet been tested in the RTD setting.

Description: The DANA has three versions that range from a brief 5-minute screen to a 45-minute complete assessment. The DANA is a Java-based mobile application that runs on an Android operating system and consists of three versions:

DANA Rapid (5 Minutes)	DANA Brief (15 Minutes)	DANA Standard (45 Minutes)
• Simple Reaction Time (SRT) • Procedural Reaction Time (PRO) • Go/No-Go (GNG)	• SRT • Code Substitution Simultaneous (CDS) • PRO • Spatial Discrimination (SPD) • GNG • Code Substitution Delayed (CDD) • Patient Health Questionnaire (PHQ) • Primary Care PTSD Screen (PC-PTSD) • Insomnia Screening Index (ISI)	• SRT • CDS • PRO • SPD • GNG • CDD • Matching to Sample • Sternberg Memory Search (STN) • Combat Exposure Scale (CES) • PHQ • Pittsburgh Sleep Quality Index (PSQI) • PTSD Checklist–Military Version (PCL–M) • Deployment Stress Inventory (DSI)

Equipment needed:

- DANA application and mobile device.

Time to administer: Three versions available ranging from 5–45 minutes.

Administration and scoring instructions: Administered electronically by clinician/medical

personnel. Outcomes measures include reaction times and subtest scores. Scoring is provided and outputted by the DANA software program that is then interpreted by a medical professional.

Reference citation:

Lathan, C., Spira, J. L., Bleiberg, J., Vice, J., & Tsao, J. W. (2013). Defense Automated Neurobehavioral Assessment (DANA)—Psychometric Properties of a New Field-Deployable Neurocognitive Assessment Tool. Military Medicine, 178(4), 365-371.

Standard Clinical Assessments

Assessment: Neuropsychological Assessment Battery

Summary: The Neuropsychological Assessment Battery (NAB) is an assessment tool that is commonly used in the acute post-TBI setting but has not been adopted by the DoD. The NAB contains both a screening tool and a more detailed long version. It is indicated for use at least 24 hours post-injury and in a rehabilitation setting. Scores are stable across repeated administration. Scores correlate with those from clinically valid assessment tools (e.g., Boston Naming Test). If available, NAB results can provide useful information, but it has not been studied in the military RTD setting. Note that the NAB profile of scores and the terminology used in the DSM-5 neurocognitive domains are nearly equivalent.

Description: The NAB is an assessment battery, which includes 33 neuropsychological tests categorized into six modules: attention, language, spatial ability, memory, executive functions, and screening (designed to provide clinician or medical provider with recommended modules for an individual patient). The modules can be administered individually.

Equipment needed:

- Record forms (examiner)
- Response booklets (patient)
- Test manuals
- Five colored markers (figure drawing test)
- Stopwatch
- Clipboard

Time to administer:

- Screening Module – 45 minutes
- Attention Module – 45 minutes
- Language Module – 35 minutes
- Memory Module – 45 minutes
- Spatial Module – 25 minutes
- Executive Functions Module – 30 minutes
- Total time for all modules – 3 hours and 40 minutes

Administration and scoring instructions: Administered by clinician/medical personnel via paper and pencil. The outcome measures include indices of attention, spatial ability, language, memory, and executive function, along with a total index. Scores are presented as *t* scores. The screening module has been shown to correlate with functional ability while recovering from moderate to severe TBI. Scores below the 10^{th} percentile of population norms have been taken as abnormal. Scoring procedures and interpretation guidelines are provided in the user's manual and will be provided in narrative form by the examining psychologist. Further investigation should be considered if any significant impairment or deficit is described.

Reference citations:

Stern, R. A., & White, T. (2003). *NAB, Neuropsychological Assessment Battery: Administration, scoring, and interpretation manual*. Psychological Assessment Resources.

Zgaljardic, D. J., & Temple, R. O. (2010). Neuropsychological Assessment Battery (NAB): Performance in a Sample of Patients with Moderate-to-Severe Traumatic Brain Injury. *Applied Neuropsychology* 17(4) 283-8. PMID 21154042.

Assessment: Repeatable Battery for the Assessment of Neuropsychological Status

Summary: The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is an assessment tool that is commonly used in the acute post-TBI setting but has not been adopted by the DoD. It is indicated for use at least 24 hours post-injury and in a rehabilitation setting. Research has been conducted with a military population and shows that scores are stable across repeated administration. Scores correlate with those from clinically valid assessment tools (e.g., Weschler Adult Intelligence Scale). Research supports excellent internal consistency such that items that measure the same construct produce similar scores or outcomes. If available, RBANS results can provide useful information, but it has not been studied in the military RTD setting.

Description: The RBANS is an assessment battery, composed of 12 subtests, that measures immediate and delayed memory, language, attention, and visuospatial ability.

Equipment needed:

- RBANS kit including user's manual, record and scoring forms, and stimulus book

Time to administer: 30 minutes

Administration and scoring instructions: Administered by primary care providers via paper and pencil or electronically. The outcome measures include indices of attention, language, immediate memory, visuospatial ability, and delayed memory, along with a total score. Scoring instructions are provided in the RBANS manual. A complete breakdown of subgroup means and standard deviations can be found in RBANS Supplement 1 at http://images.pearsonclinical.com/images/PDF/technical_reports/RBANS.pdf. Additionally, PCMs should be aware that some of the subtest scores have very narrow normal ranges especially in young normal patients, so a small change in these can cause a rapid drop in the associated index score.

Reference citations:

Krusz, J. C., Mears, F. G., & Katz, H. N. (2015). Traumatic brain injury evaluation, treatment, and rehabilitation. *Practical Pain Management, 15*(1). https://www.practicalpainmanagement.com/pain/other/brain-injury/traumatic-brain-injury-evaluation-treatment-rehabilitation

McKay, C., Casey, J. E., Wertheimer, J., & Fichtenberg, N. L. (2007). Reliability and validity of the RBANS in a traumatic brain injured sample. *Archives of Clinical Neuropsychology, 22*(1), 91-98.

Randolph, C. (1998). *RBANS manual: Repeatable battery for the assessment of neuropsychological status*. San Antonio, TX: The Psychological Corporation.

Wilk, C. M., Gold, J. M., Bartko, J. J., Dickerson, F., Fenton, W. S., Knable, M., ... & Buchanan, R. W. (2002). Test-retest stability of the Repeatable Battery for the Assessment of Neuropsychological Status in schizophrenia. *American Journal of Psychiatry, 159*(5), 838-844.

Assessment: Victoria Symptom Validity Test

Summary: The Victoria Symptom Validity Test (VSVT) is an assessment tool that is commonly used in the acute post-TBI setting but has not been adopted by the DoD. It is used as a way to assess the validity of a patient's asserted cognitive impairments, and some experts interpret its results as indicative of the level of effort expended by the patient. Research has been conducted with a military population, and stability of scores across repeated administration has not been established. Scores have been shown to accurately discriminate between patients independently classified as valid or invalid performance. Research supports adequate sensitivity and specificity for mTBI; however, findings are inconsistent given varied cut-off scores and severities of TBI. If available, VSVT results can provide useful information, but it has not been studied in the military RTD setting.

Description: The VSVT is a 48-item "effort" test that assesses the likelihood of false representation or mimicking cognitive deficits.

Equipment needed:

- VSVT software and manual
- Computer compatible with software

Time to administer: 18–25 minutes

Administration and scoring instructions: Administered and scored electronically. Outcome measures include total items correct, type and number of items correct, response latency, and right-left preference. Scoring instructions are provided in VSVT manual. A score of 30–48 items correct is considered "valid," 18–29 items correct suggests "questionable validity", and scores 17 and below are considered "likely invalid." A valid test indicates that significant effort was put forth by the tester, making falsification of testing results unlikely while an invalid test indicates that the tester may be mimicking cognitive deficits.

Reference citations:

Macciocchi, S. N., Seel, R. T., Alderson, A., & Godsall, R. (2006). Victoria Symptom Validity Test performance in acute severe traumatic brain injury: Implications for test interpretation. *Archives of Clinical Neuropsychology, 21*(5), 395-404.

Silk-Eglit, G. M., Lynch, J. K., & McCaffrey, R. J. (2016). Validation of Victoria Symptom Validity Test cutoff scores among mild traumatic brain injury litigants using a known-groups design. *Archives of Clinical Neuropsychology, 31*(3), 231-245.

Slick, D. J., Hopp, G., Strauss, E., & Spellacy, F. J. (1996). Victoria Symptom Validity Test: Efficiency for detecting feigned memory impairment and relationship to neuropsychological tests and MMPI-2 validity scales. *Journal of Clinical and Experimental Neuropsychology, 18*(6), 911-922.

Assessment: MicroCog Assessment of Cognitive Functioning

Summary: The MicroCog Assessment of Cognitive Functioning is an assessment tool that is commonly used by military aerospace neuropsychologists for selection purposes. It has also been used to assess long term effects of concussion with athletes (e.g., Australian football players). The MicroCog Assessment has not been adopted by the DoD, but has been used in RTD settings. The MicroCog is used by the U.S. Air Force in return-to-flying duties decisions and the waiver process but no research on its use in US Army RTD has been published nor have criteria for determining RTD decisions (Chappelle et al., 2010). Research shows that scores are stable across repeated administrations. Note that the MicroCog is also used for detecting mild cognitive impairment in elderly populations.

Description: The MicroCog is a computerized assessment battery designed to detect cognitive impairment. The battery includes 18 subtests categorized into five domains: attention, memory, spatial ability, reasoning, and reaction time.

Equipment needed:

- MicroCog kit
- Computer compatible with software

Time to administer: 60–90 minutes

Administration and scoring instructions: Administered and scored electronically. Outcome measures include:

- Attention index score
- Memory index score
- Reasoning index score
- Spatial ability index score
- Reaction time index score
- Processing accuracy score
- Processing speed score
- General cognitive functioning index score
- General cognitive proficiency index score

See user manual for scoring interpretation recommendations.

Additional Resources:

https://www.pearsonclinical.com/psychology/products/100000134/microcog-assessment-of-cognitive-functioning-windows-edition-2004-microcog-for-windows.html.

Reference citations:

Elwood, R. W. (2001). MicroCog: assessment of cognitive functioning. *Neuropsychology review*, *11*(2), 89-100.

Raymond, P. D., Hinton-Bayre, A. D., Radel, M., Ray, M. J., & Marsh, N. A. (2006). Test–retest

norms and reliable change indices for the MicroCog Battery in a healthy community population over 50 years of age. *The Clinical Neuropsychologist, 20*(2), 261-270.

Chappelle, W. L., Ree, M. J., Barto, E. L., Teachout, M. S., & Thompson, W. T. (2010). Joint use of the MAB-II and MicroCog for improvements in the clinical and neuropsychological screening and aeromedical waiver process of rated USAF pilots (No. AFRL-SA-BR-TR-2010-0002). AIR FORCE RESEARCH LAB BROOKS CITY-BASE TX HUMAN PERFORMANCE WING (711TH).

Other Assessments

Assessment: Connor's Adult Attention Deficit Hyperactivity Disorder Rating Scale

Summary: The Adult Attention Deficit Hyperactivity Disorder (ADHD) Rating Scale is used to determine the presence and severity of ADHD symptoms. Research has not been conducted with a military population. However, research with a civilian population shows that agreement between raters is excellent, and supports adequate sensitivity and specificity for adults with ADHD. Research findings are inconsistent with respect to whether this scale produces outcomes similar to other valid measures of ADHD. While this assessment has not been evaluated for RTD, it can be included to evaluate symptoms associated with attention and memory problems, common symptoms following mTBI (Helmick, 2010). The scale measures the presence and severity of ADHD symptoms.

Description: There are three versions available: long, short, and screening. The long version is composed of 60 items (rated by both patient and administrator), the short version is condensed to 26 items, and the screening version contains 30 items.

Equipment needed:

- Computer if scoring/administering electronically
- Forms if scoring administering paper and pencil

Time to administer: 30 minutes (long version); 10 minutes (short and screening versions)

Administration and scoring instructions: Administered/scored paper and pencil or electronically. Instructions are provided in complete kit. Outcome measures include:

- Inattention/memory problems subscale (long and short versions)
- Hyperactivity/restlessness subscale (long and short versions)
- Impulsivity/emotional lability subscale (long and short versions)
- Problems with self-concept subscale (long and short versions)
- DSM-IV inattentive symptoms (long and screening versions)
- DSM-IV hyperactive-impulsive symptoms (long and screening versions)
- DSM-IV ADHD symptoms total (long and screening versions)
- ADHD index (all versions)
- Inconsistency index (long and short versions)

Normative data are available by purchasing kit and manual at **https://www.mhs.com/MHS-Assessment?prodname=caars**.

Reference citations:

Conners, C. K., Erhardt, D., & Sparrow, E. P. (1999). *Conners' adult ADHD rating scales (CAARS): Technical manual*. North Tonawanda: MHS.

Helmick, K. (2010). Cognitive rehabilitation for military personnel with mild traumatic brain injury and chronic post-concussional disorder: results of April 2009 consensus conference. *NeuroRehabilitation, 26*(3), 239-255.

Assessment: Speed and Capacity of Language Processing Test

Summary: The Speed and Capacity of Language Processing Test (SCOLP) is a computerized test of language processing. Research supports the use of this test post-TBI. However, research has not been conducted with a military population. Scores correlate with those from clinically valid assessment tools (e.g., National Adult Reading Test). Research supports good internal consistency such that items that measure the same construct produce similar scores or outcomes and that scores are stable across repeated administration. Research supports good sensitivity and specificity for detecting language and information processing deficits following a closed head injury.

Description: The SCOLP consists of two subtests: the speed of comprehension test (a measure of information processing speed) and the spot-the-word test, which was designed to measure whether the speed results from the first test are due to reduced function or indicative of a baseline low level of function.

Equipment needed:

- Forms
- Manual

Time to administer: 10–15 minutes

Administration and scoring instructions: Administered/scored paper and pencil. Instructions are provided in complete kit. Outcome measures include:

- Total number completed in 2-minute period (maximum score of 100) – speed of comprehension test
- Number correct (maximum score of 60) – spot-the-word test

Scoring criteria for this test are copyrighted and will be provided to the PCM by the examining psychologist. Normative data have only been established for age groups from 75 - 94 years of age (Saxton et al., 2001). Cut-off scores to indicate normal vs. abnormal have not been published in the open medical literature. The SCOLP can be purchased at **https://www.pearsonclinical.com/education/products/100000591/speed-and-capacity-of-language-processing-test-scolp.html**.

Reference citation:

Saxton, J. A., Ratcliff, G., Dodge, H., Pandav, R., Baddeley, A., & Ganguli, M. (2001). Speed and capacity of language processing test: normative data from an older American community-dwelling sample. *Applied Neuropsychology, 8*(4), 193-203.

Assessment: Visuospatial Construction Index

Summary: The Visuospatial Construction Index (VCI) is not really a vision test but relates to visuospatial performance and would likely be administered by a psychologist, not an optometrist. The VCI consists of line orientation and figure copy subtest and is a general measure of visuospatial ability (the ability to imagine images/objects and understand differences and similarities between objects). Research shows that scores on this test correlated with scores on the Benton Visual Retention Test – Fourth Edition, an assessment of visual perception, memory, and visuo-constructive abilities. Research shows adequate internal consistency such that items that measure the same construct produce similar scores or outcomes. Preliminary evidence suggests the test may be useful for the purposes of diagnosis and RTD, but consensus by the health care community has not yet been reached.

Description: The VCI is a subsection of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) (Randalph, 1998). The VCI is a generalized measure of visuospatial ability and consists of line orientation and figure copy subtests.

Equipment needed:

- RBANS stimulus book
- Pencil

Time to administer: 5–7 minutes

Administration and scoring instructions: Examiner administered. The outcome measure is a composite visuospatial score. Higher scaled scores indicate better visuospatial ability.

Administration:

1. Figure copy: patient copies a 10-part geometric figure as accurately as possible.
2. Line orientation: 10- items. Each item involves a radiating array of 13 lines spanning 180 degrees. Below the array are two target lines that are identical in orientation to two of the lines from the array. The patient is to identify the matching lines.

Scoring:

1. Figure copy: Each part of the figure receives a 2-point score (accuracy and placement) for a total of 20 points. Scoring is in accordance with the RBANS manual.
2. Line orientation: One point is given for each correctly matched line for a total of 20 points.
3. Note: Scores from both subtests are scaled and combined to form the Index. The scaling norms are in the RBANS scoring guide.

The scaled norm for all components of the RBANS can be converted to a percentile and is also correlated to a descriptive score of very superior, superior, high average, average, low average, borderline, and extremely low. Caution must be taken in score interpretation as everyone has a different level of innate skill at drawing and spatial construction.

Reference citation:

Randolph, C. (1998). Repeatable battery for the assessment of neuropsychological status (RBANS). San Antonio, TX: Psychological Corporation.

Auditory Assessments

General Comments

When assessing the auditory aspects of RTD after neurosensory injury, standard clinical assessment tools can provide useful information regarding severity and prognosis. Only one measurement of hearing performance has been validated for RTD use – Speech Recognition in Noise Test (SPRINT). The table below provides a listing of clinical auditory assessments that may be relevant to RTD decision-making (including the SPRINT), as well as other standardized measures likely to be performed as part of a comprehensive auditory workup, as well as less common assessments that may be useful. On the pages that follow, additional detailed information is provided for selected assessments to assist the care provider in understanding how the technique can assist in RTD decision-making.

Note that some of the assessment methods can be performed in the primary care provider's office if the necessary equipment and instructions are available--other techniques must be performed only by the relevant specialist due to complexity, cost, risk, etc. In some cases (e.g., audiometry), the primary care provider routinely performs qualitative versions of the specified assessments, but specialist referral is necessary to properly quantify and document the result, as well as to ensure proper follow-up on abnormal screening tests.

Assessment Category	Assessment	Specialty Referral Required for Administration*	Additional Details Provided In This Chapter
RTD Assessment Tool (validated for RTD evaluation)	Speech Recognition in Noise Test (SPRINT)	Yes	Page 32
Standard Clinical Assessments (not specifically proven as an RTD assessment)	Pure Tone Audiometry	No	-
	Immittance testing (reflexes, tympanometry, reflex decay)	No	-
	Speech Audiometry	Yes	-
	Otoacoustic Emissions	No	-
Other Assessments (less common tests that may be used)	Modified Rhyme Test (MRT)	Yes	Page 34
	Callsign Acquisition Test (CAT)	Yes	Page 36
	Speech, Spatial, and Qualities Hearing Scale (SSQ)	No	Page 37
	Hearing Handicap Inventory for Adults (HHIA)	No	Page 38

* Note that screening or qualitative versions of these tests may be suitable for office use by the primary care provider, but specialty referral is often necessary to quantify the test results, or to ensure proper clinical follow-up after an abnormal screening test.

Return to Duty Assessment Tool

Assessment: Speech Recognition in Noise Test

Summary: Specialty referral is required for administration of this test. The Speech Recognition in Noise Test (SPRINT) is a clinical test of speech recognition in noise that was developed in 1992 by researchers from the Army Audiology and Speech Center at the Walter Reed Army Medical Center. The test was developed to provide medical evaluation boards standardized information regarding a hearing-impaired warfighter's potential communication handicap in an occupational setting when the audiometric thresholds reach the level of an H3 profile in the Military Physical Profile Serial System (PULHES). The test was implemented because there is great inter-subject variability in communication difficulty among warfighters with H3 profiles depending on whether the communication setting is quiet or noisy. The SPRINT is currently a required test for determining auditory fitness for duty during a medical board.

Description: The original test consists of 200 monosyllabic words (Form C of the NU-6 lists) presented in a pre-recorded background of six-talker multi-talker babble noise. The speech to babble ratio is +9dB. The test is divided into four 50-word lists, recorded on separate tracks on a CD audio. A separate calibration track is available on the SPRINT CD.

There is also a 100-word list, however, the usage of the 100-word list is subject to clinical audiologist discretion. The abbreviated 100-word list version is validated to estimate scores on the 200-word list for the purposes of comparison to published normative data.

Equipment needed:

- Audiometer
- Earphones,
- Soundbooth
- SPRINT CD
- CD Player
- SPRINT worksheet for identifying incorrect items

Time to administer: The 200-word list version takes about 20 minutes to administer (the 100-word- list takes about 10 minutes).

Administration and scoring instructions: Prior to administration, the audiologist sets the audiometer attenuator to 50 decibels Hearing Level, routes the signal to both right and left earphones, and adjusts the volume unit (VU) meter to 0, using a calibration tone. The audiologist instructs the warfighter using the instructions enclosed in the SPRINT compact disc and starts the test. The lists play consecutively with a short break between each list. The audiologist must listen to the words that the warfighter says in response to the recording and mark whether the correct word was identified.

Outcome measures include the number of correctly identified words (the raw score of correctly identified words is converted to a percentile ranking, using the graph on the SPRINT worksheet). The percentile ranking will fall within one of the five recommendation categories based on the number of correctly identified words and the number of years in service. The five categories are:

Category A – Retention in current assignment
Category B – Retention in current assignment with restrictions
Category C – Reassignment to (or retention in) a non-noise hazardous AOC (area of concentration) / MOS (military occupational skill)
Category D – Discretionary (based on audiologist recommendation)
Category E – Separation from service

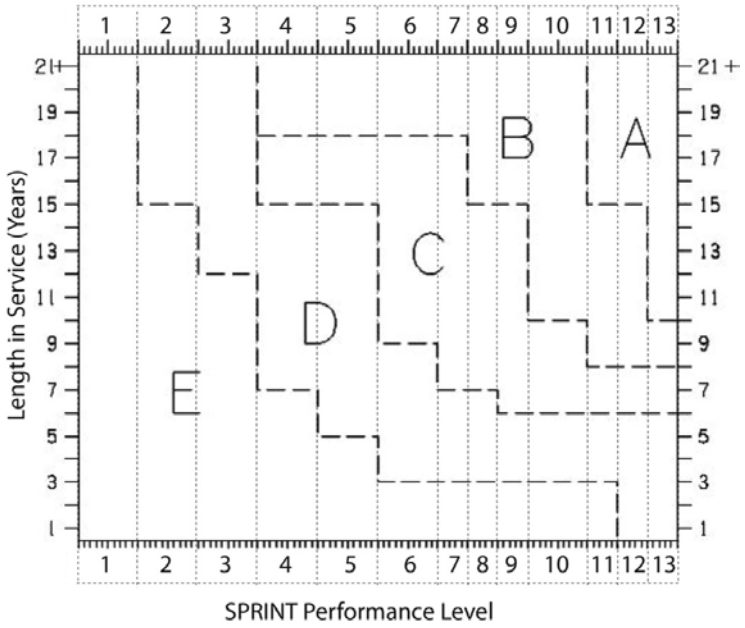


Figure 1. Normogram for determining recommended disposition (Brungart et al., 2017)

The protocol for administration, materials, and scoring sheets are available at **http://militaryaudiology.org/**.

Reference citations:

Brungart, D. S., Walden, B., Cord, M., Phatak, S., Theodoroff, S. M., Griest, S., & Grant, K. W. (2017). Development and validation of the Speech Reception in Noise (SPRINT) Test. Hearing Research, 349, 90-97.

Cord, M. T., Walden, B. E., & Atack, R. M. (1992). Speech Recognition In Noise Test (SPRINT for H-3 Profile). Walter Reed Army Medical Center.

Other Assessments

Assessment: Modified Rhyme Test

Summary: Specialty referral is required for administration of this test. The Modified Rhyme Test (MRT) is an assessment used to determine whether the sound pressure levels in a given environment at the listener's position degrade the speech communication performance or intelligibility to an unacceptable level. This test has not been used to determine whether one can RTD but may be used to determine a warfighter's ability to function with active hearing protection in an operational, occupational listening environment (Brungart et al., 2014). The test may be used to supplement the SPRINT recommendation, particularly in cases where the recommendation on the SPRINT is "Category D – Discretionary (based on audiologist recommendation)." The MRT may be used to demonstrate that augmenting the warfighter's hearing ability with active hearing protection allows the warfighter to perform above the 80% cutoff with an H3 profile hearing loss. This test is required by MIL-STD-1474E to determine whether equipment and noises in the environment exceed the level for safe communication and is thus used as a test for determining risk of injury due to inability to communicate effectively. At the time of publication, evidence supporting reliability and validity are unavailable for the updated MRT.

Description: The MRT is a test that consists of 50 monosyllabic words in 6 lists (300 words total). Each list is presented as 50 ensembles of 6 related words. The listener (patient) must identify which of the 6 alternatives in a set is the word being transmitted.

Equipment needed:

- Audio files
- Response sheet
- Anechoic chamber, sound booth, or environment with equalized transmission of sound pressure levels between various locations that is less than 2 dB in every octave band from 125 to 4000 Hz
- Hardware for transmitting recording
- Earphones

Time to administer: 10 minutes

Administration and scoring instructions: The patient is presented each audio trial with a varied level of signal to noise and are instructed to select the word within a group of six choices that is being transmitted. The outcome measure is the percentage correct with 80% considered acceptable.

Audio files available at **https://www.nist.gov/ctl/pscr/modified-rhyme-test-audio-library**.

Reference citations:

Brungart, D., Makashay, M. J., Summers, V., Sheffield, B. M., & Heil, T. A. (2014). Assessing functional auditory performance in hearing-impaired listeners with an updated version of the Modified Rhyme Test. *The Journal of the Acoustical Society of America*, *135*(4), 2391-2391.

House, A. S., Williams, C., Hecker, M. H., & Kryter, K. D. (1963). Psychoacoustic speech tests: A modified rhyme test. *The Journal of the Acoustical Society of America, 35*(11), 1899-1899.

Voran, S. (2013, October). Using articulation index band correlations to objectively estimate speech intelligibility consistent with the modified rhyme test. In *Applications of Signal Processing to Audio and Acoustics (WASPAA), 2013 IEEE Workshop on* (pp. 1-4). IEEE.

Assessment: Callsign Acquisition Test

Summary: Specialty referral is required for administration of this test. The Callsign Acquisition Test (CAT) is used for predicting and assessing effectiveness of speech communication in various environments encountered by a warfighter on the battlefield. The CAT was developed by Army Research Laboratory, Human Research and Engineering Directorate. The CAT can be done in addition to accepted performance tests (i.e., SPRINT or MRT) for supplemental performance information, but would not replace those tests. Initial evaluation of the validity of the CAT supports the use of the test for speech intelligibility in both quiet and noisy conditions as well as the construct validity such that results correlated with word recognition tests. Reliability information is not available. Shortened versions have also been tested with good results (Blue, Ntuen, & Letowski, 2010).

Description: The CAT is a 126-item speech intelligibility test.

Equipment needed:

- Desktop computer
- CD with speech test material
- CAT software
- Earphones

Time to administer: 10 minutes

Administration and scoring instructions: The patient hears a series of CAT phrases (128 total) with background noise played at a set signal-to-noise ratio. For each phrase, the patient identifies the callsign presented. The outcome measure is the percentage of correct responses. Normative data were not available at the time of publication. Refer to audiologist for interpretation.

Reference citations:

Rao, M. D., & Letowski, T. (2006). Callsign acquisition test (CAT): Speech intelligibility in noise. *Ear and hearing*, *27*(2), 120-128.

Blue, M.A., Ntuen, C., & Letowski, T. (2010). Speech intelligibility measured with shortened versions of Callsign Acquisition Test (CAT). *Applied Ergonomics*. *41(2),*291-294.

Assessment: Speech, Spatial, and Qualities of Hearing Scales

Summary: The Speech, Spatial and Qualities of Hearing Scales (SSQ) is used to determine how well a patient believes he/she would do in a variety of complex listening situations illustrative of real life. Research suggests that scores are stable across repeated administration using the interview method but not using the self-administered form. Evaluation of the SSQ also supports construct validity such that outcomes were similar to those produced by an independent auditory disability measure (modified from the Hearing Disabilities and Handicaps Scale). The SSQ has not been tested in a military population or an RTD setting.

Description: The SSQ is a 49-item self-report test of auditory disability.

Equipment needed: N/A

Time to administer: 10 minutes

Administration and scoring instructions: Self-administered or interview. Respondents rate themselves on each item using a ruler ranging from 0 to 10. The left-hand end of the ruler represents complete inability, or absence, of a quality. The right-hand end of the ruler represents complete ability, or complete presence, of a quality. Outcome measures include:

- Speech Hearing ratings
- Spatial Hearing ratings
- Other functions ratings

Higher scores reflect greater ability. Normative data were not available at the time of publication.

Reference citation:

Gatehouse, S., & Noble, W. (2004). The speech, spatial and qualities of hearing scale (SSQ). *International Journal of Audiology, 43*(2), 85-99.

Assessment: Hearing Handicap Inventory for Adults

Summary: The Hearing Handicap Inventory for Adults (HHIA) was designed to assess the effects of hearing impairment on the emotional and social adjustment of adults. Research has shown that scores are stable across repeated administration and correlate with audiometric measures (pure-tone sensitivity and suprathreshold word recognition ability). Research has not been conducted with a military population or an RTD setting.

Description: The HHIA is a 25-item self-assessment scale composed of two subscales (13 emotional and 12 social/situational).

Equipment needed: N/A

Time to administer: 10 minutes

Administration and scoring instructions: Self-administered. Responses are awarded as follows: “yes” is assigned 4 points, “sometimes” is assigned 2 points, and “no” is assigned 0 points. Maximum score of 100 indicating significant perceived handicap, and minimum score of 0 indicating no perceived handicap.

- No Handicap: 0–16
- Mild-Moderate Handicap: 18–42
- Significant Handicap: 44+

Reference citation:

Newman, C. W., Weinstein, B. E., Jacobson, G. P., & Hug, G. A. (1990). The Hearing Handicap Inventory for Adults: psychometric adequacy and audiometric correlates. *Ear and Hearing*, *11*(6), 430-433.

Vestibular Assessments

General Comments

When assessing the vestibular aspects of RTD after neurosensory injury, standard clinical assessment tools can provide useful information regarding severity and prognosis, but no assessment of vestibular health has been specifically validated as a RTD tool (i.e., a measurement that has been shown to predict military occupational outcome). The table below provides a listing of clinical balance assessments that may be relevant to RTD decision-making, including standardized measures likely to be performed as part of a comprehensive vestibular workup, as well as less common assessments that may be useful. On the pages that follow, additional detailed information is provided for selected assessments to assist the care provider in understanding how the technique can assist in RTD decision-making.

Note that some of the assessment methods can be performed in the primary care provider's office, if the necessary equipment and instructions are provided–other techniques must be performed only by the relevant specialist due to complexity, cost, risk, etc. In some cases (e.g., Romberg), the primary care provider routinely performs qualitative versions of the specified assessments, but specialist referral is necessary to properly quantify and document the result, as well as to ensure proper follow-up on abnormal screening tests.

Assessment Category	Assessment	Specialty Referral Required for Administration*	Additional Details Provided In This Chapter
RTD Assessment Tool (validated for RTD evaluation)	None	-	-
Standard Clinical Assessments (not specifically proven as an RTD assessment)	Vestibulonystagmography/Electronystagmography (VNG/ENG)	Yes	-
	Positioning Testing – Roll Test	No	-
	Vestibular Evoked Myogenic Potential (VEMP)	Yes	-
	Rotational Chair Testing	Yes	-
	Romberg Test	No	-
	Bedside Head Impulse Test (HIT)	No	-
	video Head Impulse Test (vHIT)	Yes	-
	Clinical Test of Sensory Interaction on Balance (CTSIB)	Yes	-
	Modified Clinical Test of Sensory Interaction on Balance (mCTSIB)	Yes	-
	Sensory Organization Test (SOT)	Yes	Page 41
	Balance Error Scoring System (BESS)	No	Page 44
	Dynamic Visual Acuity (DVA)	Yes	Page 47
Other Assessments (less common tests that may be used)	Head Shake Sensory Organization Test (HS-SOT)	Yes	Page 51
	Dynamic Gait Index (DGI)	No	Page 53
	Motion Sensitivity Quotient (MSQ)	No	Page 55
	Dizziness Handicap Inventory (DHI)	No	Page 57

* Note that screening or qualitative versions of these tests may be suitable for office use by the primary care provider, but specialty referral is often necessary to quantify the test results, or to ensure proper clinical follow-up after an abnormal screening test.

Standard Clinical Assessments

Assessment: Sensory Organization Test

Summary: Specialty referral is required for administration of this test. Sensory organization is the ability to effectively process and coordinate individual sensory inputs to maintain balance control. Therefore, Sensory Organization Testing (SOT) when completed during Computerized Dynamic Posturography (CDP) assesses a patient's ability to maintain postural stability using or suppressing visual, vestibular, and somatosensory information. Specifically, the SOT assists in determining vestibular dysfunction relative to somatosensory, visual, and vestibular sensory systems presenting as imbalance and impaired postural control (Natus Medical Incorporated, 2013). Although the SOT has not been specifically evaluated as predicting successful RTD, it can provide useful information regarding warfighter performance. In the deployed setting, the SOT was shown to be sensitive to postural instability within the first week post-mild TBI (post-mTBI) (Haran et al., 2016). Research supports adequate stability of the resulting composite scores across repeated administration as well as adequate construct validity given that scores correlate with other clinical assessments (e.g., Dizziness Handicap Inventory). Normative values have been established for Special Operation Forces across U.S. military branches (Pletcher et al., 2017). Research suggests low to moderate levels of sensitivity and specificity for detecting otolith disorders.

Description: The SOT utilizes six conditions in increasing difficulty to assess the patient's ability to integrate orientational information to maintain postural control. This is accomplished by having patients stand on a platform with dual-force plates within a 3-sided surround. Each condition is increasingly difficult, with conditions adding sway-referenced movements to either the force-plates, surround, or to both simultaneously. Throughout, the patient's anterior-posterior sway is recorded. Sway-referenced motion or the equipment's ability to tilt the support surface and/or visual surround directly in relation to the patient's anterior-posterior body sway, eliminates visual and/or somatosensory information, respectively. The test conditions systematically eliminate useful visual and/or support surface information, creating sensory conflict situations. These conditions isolate vestibular balance control, as well as stress the adaptive responses of the central nervous system. Each condition is repeated three times, and scoring is based on an average of these three trials (Shepard & Janky, 2008).

Equipment needed:

- Computerized Dynamic Posturography (i.e., Natus NeuroCom Balance Master®, Natus Equitest®, Natus SMART EquiTest®, or Natus SMART EquiTest® Clinical Research System).
- Associated data acquisition software

Time to administer: 10–15 minutes

Administration and scoring instructions: For all tests of the CDP, the patient must be fitted with and don a safety harness. The patient is then instructed to step up and onto the platform, is attached to the safety bar/straps (via D rings and carabiners), and their feet must be correctly positioned. The patient is then asked to face forward with their arms by their side in a quiet and relaxed stance for each task, with further specific instructions given prior to each test/trial

(Natus, 2013).

The six conditions of the SOT are increasingly difficult from 1 to 6. Each trial is 20 seconds in duration, and each condition is comprised of three trials. In brief, the instructions for each condition are:

- Condition 1 – eyes open
- Condition 2 – eyes closed
- Condition 3 – eyes open, surround sway-referenced
- Condition 4 – eyes open, force-plate sway-referenced
- Condition 5 – eyes closed, force-plate sway-referenced
- Condition 6 – eyes open, surround and force-plate sway-referenced

The outcome measures are:

- Equilibrium score – patients' sway compared to an allowable sway of 12.5 degrees; scores can range 0 to 100 (higher scores indicate better stability with minimal sway).
- Composite score – weighted average of the six conditions; scores can range 0 to 100 (higher scores indicate better stability with minimal sway).
- Sensory analysis ratios – provides ratio of the patient's ability to process and use input from the somatosensory (SOM), visual (VIS), and vestibular (VEST) systems; provides the degree to which the patient relies on visual information despite its correctness (PREF).
- Center of gravity (COG) alignment – in degrees, it is the patient's COG relative to the center of foot.
- Strategy analysis – amount of movement at the ankles and hips used to maintain balance.

The associated computer system will process the signals from the force-plate and quantify these measures to understandable stability values.

Additional resource:

NeuroCom Test Protocols – **http://balanceandmobility.com/products/neurocom-test-protocols/#sot**.

Reference citations:

Gianoli, G., McWilliams, S., Soileau, J., & Belafsky, P. (2000). Posturographic performance in patients with the potential for secondary gain. Otolaryngology—*Head and Neck Surgery*, 122(1), 11-18.

Haran, F. J., Slaboda, J. C., King, L. A., Wright, W. G., Houlihan, D., & Norris, J. N. (2016). Sensitivity of the balance error scoring system and the sensory organization test in the combat environment. *Journal of Neurotrauma*, *33*(7), 705-711.

Natus Medical Incorporated. (2013). *Balance manager systems: Computerized dynamic posturography clinical interpretations guide*. Clackamas, OR.

Pletcher, E. R., Williams, V., Abt, J. P., Morgan, P. M., Parr, J. J., , M. F., ... & Sell, T. C. (2017). Normative data for the NeuroCom Sensory Organization Test in US Military Special Operations Forces. *Journal of Athletic Training*, *52*(2), 129-136.

Shepard, N., Janky, K., & Jacobson, G. (2008). Background and technique of computerized dynamic posturography. *Balance function assessment and management*, 339-357.

Shepard, N., & Telian, S. (1996). *Practical management of the balance disorder patient*. San Diego, CA: Singular Publishing Group, Inc.

Assessment: Balance Error Scoring System

Summary: The Balance Error Scoring System (BESS) and modified BESS are balance assessment tools that are frequently used in sports medicine in the acute post-TBI setting. The BESS allows for testing with equipment worn. Normative values are available for adults between the ages of 20 to 69 (Iverson, Kaarto, & Koehle, 2008). Caution may be warranted using the Iverson, et al (2008) data set for injured warfighters, as the 20-29 year old cohort is small. However, it reported 20 to 29 year old non-athletes performed similarly to collegiate athletes aged 18 to 22 years old, and therefore the authors report the smaller cohort may be representative of their age group. A normative data set does not exist for military personnel.

A modified BESS and instrumented BESS are also available (King, et al, 2014). The modified BESS differs from the BESS in that balance is assessed using only the firm surface stances. The Defense Veteran Brain Injury Center (DVBIC) has included the modified BESS as a balance assessment for recurrent concussion evaluations as part of the Concussion Management in Deployed Settings for Combat Medic/Corpsman Algorithm (2017). Additionally, the U.S. Army Office of The Surgeon General has included the modified BESS in the Medic Algorithm for Concussion Management in the Garrison Setting (v1.2, 2016). It should be noted that trials within the firm surface are not as difficult for the vestibular system compared to those using a foam surface. Additionally, young student athletes with and without a history of concussion were found to have few errors in the firm surface trials (Valovich McLeod, Bay, Lam, & Chhabra, 2012).

Description: The BESS utilizes a patient's postural stability utilizing the number of errors committed during a battery of assessments. The patient is asked to close his/her eyes while completing three static stances (double-leg, single-leg, and tandem) on a firm and foam surface. This results in a total administration of six trials.

Scores increase with age, head injury, functional ankle instability/bracing, fatigue and exertion (Bell, et al, 2011; Wilkins, et al, 2004). Additionally, a relationship was not found to exist between BESS scores and patient height, while a medium correlation ($r= 0.16$, $p< 0.001$) was found between BESS scores and patient weight (Iverson, Kaarto, & Koehle, 2008). Research has been conducted with a military population (Haran, et al, 2016).

Equipment needed:

- Medium-density foam pad
- Stopwatch
- Score Card

Time to administer: Approximately 10 minutes

Administration and scoring instructions: The patient is asked to maintain one of three stances (double-leg, single-leg and tandem) on one of two surfaces (bare feet on a firm floor or on medium-density foam). This results in a total administration of six trials. Each trial is 20 seconds in length. Testing should be completed with shoes off (socks can remain on) and any ankle tape removed. The patient should have his or her hands on his or her hips and eyes closed before each trial.

The BESS is a subjective interpretation of total number of errors committed during a 20-second trial. The maximum score (worst) for any single trial is 10 errors, with a maximum total score of 60. If the patient is unable to complete a trial, the score for that trial is 10. An error occurs if: eyes are opened; hands come off of the hips; steps, stumbles, or falls out of position; lifts either foot or heel; bend at the hip greater than 30˚; or remains out of test position for more than 5 seconds (Bell et al., 2011; Iverson, Kaarto, & Koehle, 2008). When a patient makes a series of concurrent errors, the multiple concurrent errors should be counted as one (Bell et al., 2011). To improve accuracy and reliability of test scores, it is recommended that the BESS be administered at least three times on the same day (Haran et al., 2016).

The National Football League uses the modified BESS as part of their Sideline Concussion Assessment Test or SCAT. Results are compared to pre-injury baseline values obtained for that individual athlete.
(**https://static.nfl.com/static/content/public/photo/2014/02/20/0ap2000000327062.pdf**)
Normative data for adults can be found at
https://www.hindawi.com/journals/rerp/2013/846418/cta/.

Additional resource:

BESS protocol available at:
https://theconcussionblog.files.wordpress.com/2011/02/bessprotocolnata09.pdf.

Reference citations:

Bell, D. R., Guskiewicz, K. M., Clark, M. A., & Padua, D. A. (2011). Systematic review of the balance error scoring system. *Sports Health, 3*(3), 287-295.Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury Defense and Veterans Brain Injury Center. (2017). *Concussion management in deployed settings*.

Haran, F. J., Slaboda, J. C., King, L. A., Wright, W. G., Houlihan, D., & Norris, J. N. (2016). Sensitivity of the balance error scoring system and the sensory organization test in the combat environment. *Journal of Neurotrauma, 33*(7), 705-711.

Iverson, G. L., Kaarto, M. L., & Koehle, M. S. (2008). Normative data for the balance error scoring system: implications for brain injury evaluations. *Brain Injury, 22*(2), 147-152.

King, L. A., Horak, F. B., Mancini, M., Pierce, D., Priest, K. C., Chesnutt, J., … & Chapman, J. C. (2014). Instrumenting the balance error scoring system for use with patients reporting persistent balance problems after mild traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*, *95*(2), 353-359.

Riemann, B. L., Guskiewicz, K. M., & Shields, E. W. (1999). Relationship between clinical and forceplate measures of postural stability. Journal of *Sport Rehabilitation*, 8(2), 71-82.

U.S. Army Office of The Surgeon General. (2016) *Army concussion management in the garrison setting algorithm pocket card* (v1.2).

Valovich McLeod, T. C., Bay, R. C., Lam, K. C., & Chhabra, A. (2012). Representative baseline

values on the Sport Concussion Assessment Tool 2 (SCAT2) in adolescent athletes vary by gender, grade, and concussion history. *The American Journal of Sports Medicine, 40*(4), 927-933.

Assessment: Dynamic Visual Acuity

Summary and description: Specialty referral is required for administration of this test. Dynamic Visual Acuity (DVA), a component of a comprehensive vestibular assessment, is a measure of visual acuity while the head is in movement. The measure of interest in this test is visual acuity loss (i.e., visual acuity while the head is in motion compared to visual acuity while the head is static) and is in part due to the vestibulo-ocular reflex (VOR) (Natus, 2013). This task can be completed while the head is being rotated in the pitch (up/down), yaw (right/left) or roll (side/side) plane. Dysfunction of the VOR (e.g., vestibular hypofunction, unilateral vestibular loss, bilateral vestibular loss) would result in a patient being unable to or have a reduced capacity to visualize objects during head movement.

Older studies correlate DVA with task performance for pilots, drivers, and warfighters. In healthy U.S. warfighters, sleep deprivation was found to not affect DVA test performance (Behar et al., 1976; Scherer, Claro & Heaton, 2013). Gotshall and Hoffer (2010) encourage the use of DVA as a valuable tool in tracking recovery from vestibular deficits after blast-induced mTBI (Gotshall & Hoffer, 2010). However, the RTD implications of the DVA have yet to be described. Performance on the DVA is not affected by sleep deprivation.

A qualitative version of the DVA test can also be performed in the office or the bedside with the use of a Snellen chart instead of a computer and patient-worn head tracker.

Research shows excellent stability of outcome measures (e.g., active pitch head movements, active yaw impulses) across repeated administration and strong evidence of construct validity given that scores correlate with those of measures of similar constructs (e.g., Scleral Search Coil). Evidence suggests excellent sensitivity and specificity of active yaw impulses for detecting vestibular hypofunction whereas research suggests poor to adequate sensitivity and excellent specificity of active pitch for detecting vestibular hypofunction. Research has been conducted with a military population.

Natus' inVision DVA test requires participants to maintain a constant head velocity of 85 to 120 degrees/second while an optotype ("E") varies in size. This test provides information regarding visual acuity loss and visual acuity symmetry.

Equipment needed:

- Clinical Bedside
  - Optometric exam chart (i.e., Snellen Chart)
- Computerized
  - NeuroCom® inVision
  - Micro*medical*™ Technologies VORTEQ™

Time to administer: 5–15 minutes

Administration and scoring instructions:

When completed bedside, or non-instrumented, the patient is seated at a standard distance from the optometric exam chart (i.e., 20 feet for the Snellen chart). If the patient wears corrective

lenses, testing can be completed while the patient dons and uses their eyewear, however type of lenses (i.e., single, bifocal, or progressive) should be noted.

Visual acuity without head movement (i.e., static visual acuity, SVA) is measured first. The measured SVA is used as a baseline and referenced when calculating the individual's visual acuity lost due to head movement. This measure should be completed on the same day of dynamic visual acuity testing. The patient is required to read the lowest line in which all letters are recognizable and correctly identified. The examiner should record this line and the total number of optotype correctly identified (Scherer & Stoskus, 2014).

To complete the dynamic portion of the DVA test, the examiner stands behind the patient and rotates the patient's head in the plane of excitation (i.e., pitch, yaw, and roll) at 2 Hz (Baloh, 1998). The patient's head should be turned 20 to 30 degrees from midline. Again, the patient is asked to read the lowest line in which all letters are recognizable and correctly identified. The examiner should record this line and total number of optotype incorrectly identified (Scherer & Stoskus, 2014). An abnormal response that would suggest vestibular pathology is a loss of three or more lines from the measured static threshold during the dynamic condition (Kheradmand, Bronstein & Zee, 2013; Scherer & Stoskus, 2014).

Computerized DVA testing requires the patient seated at eye level and approximately 5 to 12 feet from the computer monitor (Natus, 2013). The patient then dons a head tracker device which monitors velocity and direction of head movement. If the patient wears corrective lenses, testing can be completed while the patient wears their eyewear, however type of lenses (i.e., single, bifocal, or progressive) should be noted for possible contraindication. Unit of measure is reported in LogMAR, or logarithm of the minimum angle of resolution.

Similar to the bedside DVA test, the computerized DVA test requires the SVA to be measured first. In this task, the patient is asked to identify the direction of the optotype (i.e., "E") as it varies in size (based on the patient's previous answer) and orientation (i.e., up, down, right, left). Once the optotype appears, the patient is to identify its orientation. The patient's response is then entered into the computer and the computer marks the response as either correct or incorrect. The size of the optotype will vary based on the patient's response and accuracy. This pattern continues until the smallest size optotype is recognize accurately 50% of the time during head movement (i.e., visual acuity threshold). If the patient is unfamiliar with this task, it is important that he/she is provided an opportunity to practice.

The dynamic condition of the DVA test requires the patient to move their head in the plane of excitation (i.e., pitch, yaw, roll) at a predetermined velocity (85 to 120 degrees/second) while keeping their eyes on the computer screen. The task required of the patient is similar to that completed during the SVA portion of the test while continuously moving their head in the predetermined direction and velocity while watching the computer monitor for an optotype.

The amount of visual acuity lost due to head movement is measured by subtracting the DVA threshold from the SVA threshold. The computer software completes this automatically. Normal function of the DVA is indicated with similar static and dynamic visual acuity. Some variance can be noted between the two, with loss ranging 0.012 to 0.08 logMAR in normal functioning VOR systems (Natus, 2013). Negative visual acuity loss scores suggest VOR function better during head movement and a positive score indicates visual acuity is better when the head is not

moving (McCaslin, Dundas, & Jacobson, 2008). Further, when the VOR is abnormal, the DVA will be worse (i.e., higher) than the SVA either towards the affected side (i.e., unilateral loss) or both sides if the loss is bilateral (Baloh, 1998; Honaker & Janky, 2011).

Outcome measures:

- Bedside DVA Test:
  - Total number of lines loss due to head movement
- Computerized DVA Test:
  - DVA Loss – logMAR loss between static and left or right direction head movement
  - DVA Loss Symmetry – percent logMAR difference between right and left direction movement
  - Left Direction Logarithm of the Minimum Angle Resolution (logMAR) – actual measure provided when head movement is to the left
  - Right Direction logMAR – actual measure provided when head movement is to the right

Reference citations:

Bahar, I., Kimball, K.A., and Anderson, D.A. (1976). Dynamic Visual Acuity in Fatigued Pilots. USAARL Report 76-24.

Baloh, R.W. (1998). Vestibular Symptoms and Signs in Dizziness, Hearing Loss, and Tinnitus. F.A. Davis Company, Philadelphia, PA.

Gottshall, K., Drake, A., Gray, N., McDonald, E., & Hoffer, M. E. (2003). Objective vestibular tests as outcome measures in head injury patients. The Laryngoscope, 113(10), 1746-1750.

Gottshall, K. R., & Hoffer, M. E. (2010). Tracking recovery of vestibular function in individuals with blast-induced head trauma using vestibular-visual-cognitive interaction tests. *Journal of neurologic physical therapy, 34*(2), 94-97.

Herdman, S.J., Tusa, R.J., Blatt, P., Suzuki, A., Venuto, P.J., & Roberts, D. (1998). Computerized Dynamic Visual Acuity Test in the Assessment of Vestibular Deficits. The American Journal of Otology, 19: 790-796.

Honaker, J., & Janky, K. (2011). A New Spin on the Vestibular Test Battery: Dynamic Visual Acuity and Subjective Visual Vertical. The ASHA Leader, 16, retrieved from: http://leader.pubs.asha.org/article.aspx?articleid=2279102 on 25 October 2017.

Kheradmand, A., Bronstein, A., & Zee, D.S. (2013). Clinical Bedside Examination. In Bronstein, A.M. & Kennard, C. (Eds.), Oxford Textbook of Vertigo and Imbalance. Oxford University Press, United Kingdom.

Lee, M.H., Durnford, S., Crowley, J.S., & Rupert, A.H. (1996). Visual Vestibular Interaction in the Dynamic Visual Acuity Test During Voluntary Head Rotation. USAARL Report No. 96-33.

McCaslin, D. L., Dundas, J. A., & Jacobson, G. P. (2008). The bedside assessment of the vestibular system. In Jacobson, G. P. & Shepard, N. T. (Eds.), Balance function assessment and management (pp. 63–97). San Diego, CA: Plural.

National Research Council. (1985). *Emergent techniques for assessment of visual performance*. National Academies.

Natus Medical Incorporated. (2013). *Balance manager systems: Computerized dynamic posturography clinical operations guide*. Clackamas, OR.

Petersen, J.A., Straumann, D., & Weber, K.P. (2013). Clinical diagnosis of bilateral vestibular loss: three simple bedside tests. Therapeutic Advances in Neurological Disorders, 6(1): 41-45.

Riska, K. M., & Hall, C. D. (2016). Reliability and normative data for the dynamic visual acuity test for vestibular screening. *Otology & Neurotology*, *37*(5), 545-552.

Scherer, M.R., Claro, P.J., & Heaton, K.J. (2013). Sleep Deprivation Has No Effect on Dynamic Visual Acuity in Military Service Members Who Are Healthy. Physical Therapy, 93(9): 1185-1196.

Scherer, M.R., & Stoskus, J.L. (2014). Dynamic Visual Acuity Test – Non-Instrumented. Retrieved from: http://www.rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=1194 on 25 October 2017.

Other Assessments

Assessment: Head Shake Sensory Organization Test

Summary and description: Specialty referral is required for administration of this test. The Head Shake Sensory Organization Test (HS-SOT) is a supplemental test that is not typically completed for all patients. Patients who score within normal limits on the SOT and who are symptomatic should complete the HS-SOT. Additionally, it is appropriate for use in a patient population that requires maintenance of vestibular function during high demand tasks (i.e., warfighter, aviators). As a supplemental test, the HS-SOT measures postural stability utilizing conditions 2 and 5 of the SOT (eyes closed with stable or unstable surface, respectively) while asking patients to move their head in one of three planes of motion. Research shows that scores are stable across repeated administration and correlate with those from a self-report dizziness scale (Dizziness Handicap Inventory). Research suggests low sensitivity and specificity for detecting unilateral vestibular neuritis.

The HS-SOT is to be completed on the same day as the SOT. The patient is required to stand on the dual-force plate facing the 3-sided surround. The test conditions require the patient to rotate his/her head at a constant velocity in a specified plane of excitation (pitch, yaw, or roll).

Equipment needed:

- Computerized Dynamic Posturography (i.e., Natus NeuroCom Balance Master®, Natus Equitest®, Natus SMART EquiTest®, or Natus SMART EquiTest® Clinical Research System)
- Associated data acquisition software

Time to administer: 5–15 minutes

Administration and scoring instructions: For all tests of the CDP, the patient must be fitted with and don a safety harness. The patient is then instructed to step up and onto the platform, is attached to the safety bar/straps (via D rings and carabiners), and feet correctly positioned. The patient is then asked to face forward for each task with arms by side in a quiet and relaxed stance, with further specific instructions given prior to each test/trial (Natus Medical Incorporated, 2013).

The HS-SOT is an extension of conditions 2 and 5 of the SOT; therefore, the administration is relatively the same, except the addition of prompting the patient to move his or her head at a constant velocity. Each condition has six trials, and each trial is 20 seconds.

- Condition 2 – eyes closed
- Condition 5 – eyes closed, force-plate sway-referenced

The outcome measure is the Equilibrium Score Ratio, a comparison of postural stability during head movement to similar condition in which the head is still (SOT conditions 2 and 5). Normal functional balance/vestibular involvement are indicative of similar function despite head movement (i.e., ratios with a score closer to 1). The associated computer system will process the signals from the force plate and quantify these measures to understandable stability values.

Reference citations:

Lim, H. W., Kim, K. M., Jun, H. J., Chang, J., Jung, H. H., & Chae, S. W. (2012). Correlating the Head Shake–Sensory Organizing Test with Dizziness Handicap Inventory in compensation after vestibular neuritis. *Otology & Neurotology*, *33*(2), 211-214.

Mishra, A., Davis, S., Speers, R., & Shepard, N. T. (2009). Head shake computerized dynamic posturography in peripheral vestibular lesions. *American Journal of Audiology*, *18*(1), 53-59.

Natus Medical Incorporated. (2013). *Balance manager systems: Computerized dynamic posturography clinical interpretations guide*. Clackamas, OR.

Pang, M. Y., Lam, F. M., Wong, G. H., Au, I. H., & Chow, D. L. (2011). Balance performance in head-shake computerized dynamic posturography: aging effects and test-retest reliability. *Physical Therapy*, *91*(2), 246-253.

Park, M. K., Lim, H. W., Cho, J. G., Choi, C. J., Hwang, S. J., & Chae, S. W. (2012). A head shake sensory organization test to improve the sensitivity of the sensory organization test in the elderly. *Otology & Neurotology*, *33*(1), 67-71.

Assessment: Dynamic Gait Index

Summary: The Dynamic Gait Index (DGI) is an 8-item walking tests that allows for the evaluation of balance in both steady-state walking and multiple dynamic conditions (e.g., walking while moving the head or changing speed). Specifically, the DGI assesses a patient's ability to modify his/her own gait within a dynamic environment to maintain balance. The DGI is indicated for determining imbalance and risk of falling. In conjunction with other vestibular assessments, the DGI may be useful for RTD purposes (Gottshall & Hoffer, 2010). Research suggests that scores are stable across repeated administration but the level of agreement between raters is adequate. Scores are shown to correlate with similar measures (e.g., Berg Balance Scale) and self-reported fall history; however, sensitivity and specificity to detect vestibular disorders has not been demonstrated. Research has been conducted with a military population.

Description: The DGI is a set of eight walking tests designed to evaluate fall risk, gait, and balance. Patients complete each test and the medical provider provides a score from 0 (severe impairment) to 3 (normal).

Equipment needed:

- Shoebox
- 2 cones
- Stairs
- Walkway large enough to accommodate 20' long and 15" wide

Time to administer: 10 minutes

Administration and scoring instructions: The DGI provides a score from 0 (severe impairment) to 3 (normal) for each walking test using standardized criteria (total of eight walking tests). The total possible score is 24. A score less than 19 suggests fall risk. In a TBI population, Medley, Thompson, and French (2006) found that "a person who scores 19 out of 24 points on the DGI has a 28% probability of falling. A person who scores 24 out of 24 points would have a 6% chance of falling and a person who scores 0 out of 24 points would have a 100% chance of falling."

Additional Resource:

Dynamic Gait Index protocol available at:
http://www.exercisepd.com/uploads/3/5/3/1/3531021/dgi.functionalgaitassessment.pdf.

Reference citations:

Gottshall, K. R., & Hoffer, M. E. (2010). Tracking recovery of vestibular function in individuals with blast-induced head trauma using vestibular-visual-cognitive interaction tests. *Journal of Neurologic Physical Therapy, 34*(2), 94-97.

Herdman, S. J. (2000). *Vestibular Rehabilitation*, Second Edition. F.A. Davis Company, Philadelphia, PA.

Medley, A., Thompson, M., & French, J. (2006). Predicting the probability of falls in community

dwelling persons with brain injury: a pilot study. *Brain Injury, 20*(13-14), 1403-1408.

Pletcher, E. R., Williams, V. J., Abt, J. P., Morgan, P. M., Parr, J. J., Wohleber, M. F., ... & Sell, T. C. (2017). Normative Data for the NeuroCom Sensory Organization Test in US Military Special Operations Forces. *Journal of Athletic Training*, *52*(2), 129-136.

Whitney, S. L., Hudak, M. T., & Marchetti, G. F. (2000). The dynamic gait index relates to self-reported fall history in individuals with vestibular dysfunction. *Journal of Vestibular Research, 10*(2), 99-105.

Assessment: Motion Sensitivity Quotient Test

Summary: The Motion Sensitivity Quotient (MSQ) Test is advocated for use to quantify susceptibility to motion-induced and motion-provoked dizziness symptoms, and may be useful as a habituation therapy. The MSQ is designed to induce dizziness and measure the duration and subjective intensity of the dizziness. A limitation would be vulnerability to positive or negative malingering. Limited information is available utilizing this assessment in a military population. Additionally, it has not been studied for RTD purposes. Research does show, however, that scores are stable across repeated administration and with different raters and that the MSQ is sensitive and specific to motion-induced dizziness.

Description: Patients complete 16 movements and indicate the onset/offset of any dizziness experienced for each movement as well as rating the intensity (Smith-Wheelock, Shepard, & Talian, 1991). A stopwatch measures duration.

Equipment needed:

- Stopwatch
- Mat table
- Chair

Time to administer: 10–15 minutes

Administration and scoring instructions: Duration of symptoms is coded on a scale of 0 to 3 (1 point for 5 s to 10 s of dizziness, 2 points for 11 s to 30 s, and 3 points for >30 s) while intensity is rated on a scale of 0 to 5. Each of the 16 rapid body movements is scored by adding the duration points to the intensity rating. The MSQ is then calculated by multiplying the total number of movements multiplied by the total score divided by 20.48. The range of possible scores is 0 (no dizziness) to 100 (severe dizziness for all movements).

- Normal: 0%
- Mild sensitivity: 0–10%
- Moderate sensitivity: 11–30%
- Severe sensitivity: 31–100%

Additional Resource:

Clinical protocol for administration is provided in Smith-Wheelock, Shepard, & Talian (1991)

Reference citations:

Akin, F. W., & Davenport, M. J. (2003). Validity and reliability of the Motion Sensitivity Test. *Journal of Rehabilitation Research and Development*, *40*(5), 415.

Maskell, F., Chiarelli, P., & Isles, R. (2006). Dizziness after traumatic brain injury: overview and measurement in the clinical setting. *Brain Injury*, *20*(3), 293-305.

Shepard, N. T., Smith-Wheelock, M., Telian, S. A., & Raj, A. (1993). Vestibular and balance rehabilitation therapy. *Annals of Otology, Rhinology & Laryngology*, *102*(3), 198-205.

Smith-Wheelock, M., Shepard, N.T., & Telian, S. A. (1991). Physical therapy program for vestibular rehabilitation. *The American Journal of Otology*, *12*(3), 218-25.

Weightman, M. M., Radomski, M. V., Msshima, P. A., & Roth, C. R. (2015). *Mild traumatic brain injury rehabilitation toolkit*. Government Printing Office.

Assessment: Dizziness Handicap Inventory

Summary: The Dizziness Handicap Inventory (DHI) is a subjective inventory that correlates well in TBI patients with more expensive and objective assessments of vestibular function, such as the SOT. The DHI is indicated for determining the severity of dizziness, vertigo, and imbalance. The DHI has not been studied for RTD purposes, and would be susceptible to reporting biases. However, research shows that scores are stable across repeated administration and that outcomes correlate with observed data including the number of dizzy spells experienced per year. Research has used the DHI with a military population but that work has not been specific to RTD settings.

Description: The DHI is a 25-item self-report instrument. It was designed to measure the extent to which dizziness impairs or influences one's abilities.

Equipment needed: N/A

Time to administer: 10 minutes

Administration and scoring instructions: Self-administered. Maximum score of 100 and minimum score of 0. The higher the score, the greater the perceived handicap due to dizziness. Item scores are summed. The following cut-off criteria with respect to functional impairment is provided (Whitney, Wrisley, Brown, & Furman, 2004):

- Mild impairment: 0–30
- Moderate impairment: 31–60
- Severe impairment: 61–100

Additional Resource:

Available at multiple sites including **www.rehab.msu.edu/_files/_docs/Dizziness_Handicap_Inventory.pdf**. Copyrighted 1990, American Medical Association.

Reference citations:

Gottshall, K., Drake, A., Gray, N., McDonald, E., & Hoffer, M. E. (2003). Objective vestibular tests as outcome measures in head injury patients. *The Laryngoscope*, *113*(10), 1746-1750.

Jacobson, G. P., & Newman, C. W. (1990). The development of the dizziness handicap inventory. *Archives of Otolaryngology–Head & Neck Surgery*, *116*(4), 424-427.

Kaufman, K. R., Brey, R. H., Chou, L. S., Rabatin, A., Brown, A. W., & Basford, J. R. (2006). Comparison of subjective and objective measurements of balance disorders following traumatic brain injury. *Medical Engineering & Physics*, *28*(3), 234-239.

Whitney, S. L., Wrisley, D. M., Brown, K. E., & Furman, J. M. (2004). Is perception of handicap related to functional performance in persons with vestibular dysfunction?. *Otology & Neurotology*, *25*(2), 139-143.

Vision Assessments

General Comments

When assessing the vision aspects of RTD after neurosensory injury, standard clinical assessment tools can provide useful information regarding severity and prognosis, but no assessment of ocular health has been specifically validated as a RTD tool (i.e., a measurement that has been shown to predict military occupational outcome). The table below provides a listing of clinical vision assessments that may be relevant to RTD decision-making, including standardized measures likely to be performed as part of a comprehensive vision workup, as well as less common assessments that may be useful. On the pages that follow, additional detailed information is provided for selected assessments to assist the care provider in understanding how the technique can assist in RTD decision-making.

Note that some of the assessment methods can be performed in the primary care provider's office, if the necessary equipment and instructions are provided--other techniques must be performed only by the relevant specialist due to complexity, cost, risk, etc. In some cases (e.g., pupillary light reflex, visual fields), the primary care provider routinely performs qualitative versions of the specified assessments, but specialist referral is necessary to properly quantify and document the result, as well as to ensure proper follow-up on abnormal screening tests.

Assessment Category	Assessment	Specialty Referral Required for Administration*	Additional Details Provided In This Chapter
RTD Assessment Tool (validated for RTD evaluation)	None	-	-
Standard Clinical Assessments (not specifically proven as an RTD assessment)	Visual acuity	No	-
	Visual fields	No	-
	Ocular fixation	No	-
	Ocular mobility (pursuits/saccades, convergence/divergence)	No	-
	Ocular alignment (phorias/tropias)	No	-
	Accommodation (amplitude/facility)	Yes	-
	Tonometry	No	-
	Color vision	No	-
	Pupillary Light Reflex	No	Page 61
	King-Devick Test	No	Page 63
Other Assessments (less common tests that may be used)	Vestibular Oculomotor Test (Vestibular Ocular Motor Screening)	Yes	Page 64
	Northeastern State University College of Optometry Oculomotor Test	Yes	Page 66

* Note that screening or qualitative versions of these tests may be suitable for office use by the primary care provider, but specialty referral is often necessary to quantify the test results, or to ensure proper clinical follow-up after an abnormal screening test.

Standard Clinical Assessments

When assessing the RTD implications of visual impairment, standard clinical assessment of vision symptoms and performance forms the basis for RTD assessment and predictions for occupational performance, but no absolute criteria exist. Some of these assessments can be completed by the primary care provider (see table above) but referral to an optometrist/ophthalmologist is indicated for any abnormal screenings. Thorough details are not provided for all of these assessments, as they are not appropriate for administration by those not trained in this specialty area. The optometrist/ophthalmologist would administer a comprehensive optometric/ophthalmic examination prior to conducting any additional assessments. This comprehensive examination would include the following at a minimum:

- Visual acuity
- Visual fields
- Ocular fixation
- Ocular mobility (pursuits/saccades, convergence/divergence)
- Ocular alignment (phorias/tropias)
- Accommodation (amplitude/facility)
- Tonometry
- Color vision

Assessment: Pupillary Light Reflex

Summary and description: While the Pupillary Light Reflex (PLR) is routinely checked in any physical exam, specialty referral is required for quantitative administration of the test. The PLR test is a potential objective bio-measure/marker of mTBI using an *automated* pupilometer. The test can detect abnormal pupillary dynamics. Research shows that outcomes are stable across repeated administration, with very little disagreement between examiners (less than 1%). Some measures can distinguish between TBI patients and healthy controls, and outcomes correlate with other ocular measures. Preliminary research with a military population suggests diagnostic utility, and that while basic measures can be done manually, automated pupilometers are more reliable and accurate. Further research is warranted.

The PLR test relies on the oculomotor response of iris muscles that expand/contract in response to increased/decreased levels of light present in the environment. This response allows the individual to adapt to various levels of ambient light.

Equipment needed:

- Automated pupilometer (e.g., NeurOptics PLR-200, newer NeurOptics PLR-3000)

Time to administer: 3–5 minutes

Administration and scoring instructions: Examiner administered. Instructions provided by the -automated pupilometer manual. For scoring, outcome measures are displayed digitally and can be downloaded from the device to a computer. Research suggests that mTBI patients will have smaller pupil diameters, smaller constriction amplitude, and slower velocities. The outcome measures include:

- Maximum pupil diameter
- Average constriction velocity*
- Constriction latency
- Average dilation velocity*
- Minimum pupil diameter
- Average constriction latency
- 75% recover of dilation*
- Percentage of constriction
- Maximum constriction velocity

*indicates measures found by Capo-Aponte (2015) to be abnormal in patients with previous TBI

At the time of publication, no cutoff criteria had been agreed upon for determining abnormal function.

Reference citations:

Capo-Aponte, J. E. (2015). *Pupillometry and saccades as objective mTBI biomark.* Geneva Foundation, Tacoma, WA.

Herbst, K., Sander, B., Milea, D., Lund-Andersen, H., Kawasaki, A. (2011). Test-retest repeatability of the pupil light response to blue and red light stimuli in normal human eyes using a novel pupillometer. *Frontiers in Neurology*, *2*, 1-5. doi:10.3389/fneur.2011.00010

Truong, J. Q., & Ciuffreda, K. J. (2016). Comparison of pupillary dynamics to light in the mild traumatic brain injury (mTBI) and normal populations. *Brain injury*, *30*(11), 1378-1389.

Assessment: King-Devick Test

Summary and description: The King-Devick Test (K-D test) is a visual performance measure that requires eye saccades, oculomotor convergence/accommodation, attention, and language ability. The test is used for return-to-play decisions in sports. Research has evaluated this test with military populations (including in hypoxic conditions) and suggests the test is very stable across repeated administration, correlates with intersaccadic intervals measured with eye tracking, and can distinguish between healthy controls and military mTBI patients.

Patients are required to read numbers aloud as quickly and accurately as possible. The more time taken to complete the stimulus cards, the worse oculomotor performance is assumed. Typically, the test is administered at multiple time points and difference scores are used for evaluation.

Equipment needed:

- Stopwatch
- Tablet/computer if electronic version is being used

Time to administer: 2 minutes

Administration and scoring instructions: Examiner administered. Appropriate for primary care provider to administer and consensus of return-to-play utility by health care community. Outcome measures are cumulative time to complete the three cards and total errors. Specific instructions are included in Appendix E. The test results are compared to the individual's personal normal. As such, there is no baseline standard for the K-D. Post-concussion values can be used to track improvement, but cannot demonstrate a return to baseline. To score, the administrator totals the times for each of the cards and the number of errors made for each card. Diagnostic criteria are available at **https://kingdevicktest.com/**.

Reference citation:

Walsh, D. V., Capo-Aponte, J. E., Beltran, T., Cole, W. R., Ballard, A., & Dumayas, J. Y. (2016). Assessment of the King-Devick (KD) test for screening acute mTBI/concussion in warfighters. *Journal of the Neurological Sciences, 370*, 305-309. doi: 10.1016/j.jns.2016.09.014

Other Assessments

Assessment: Vestibular Oculomotor Test (Vestibular Ocular Motor Screening)

Summary: Specialty referral is required for administration of this test. The Vestibular Oculomotor Test (Vestibular Ocular Motor Screening) (VOMS) is a measure to assess vestibular and oculomotor impairments via patient self-report. Recommended to be administered by an optometrist, an ophthalmologist, or a neurologist. Patients report baseline symptoms, perform seven assessments, and verbally rate their symptoms compared to baseline on a scale from 0 (none) to 10 (severe). Higher scores indicate more symptom provocation. Research shows excellent internal consistency such that items that measure the same construct produce similar scores or outcomes. Some research suggests that the test correlates with scores on the post-concussion symptoms scale; however, findings are inconsistent. Preliminary evidence suggests that the test may be useful in distinguishing between healthy controls and TBI patients. The test has been incorporated in the National Collegiate Athletic Association – Department of Defense (NCAA–DoD) Concussion Assessment, Research and Education (CARE) Consortium study of military academy cadets (2017).

Description: Patients report baseline symptoms on a scale from 0 (none) to 10 (severe) regarding headache, dizziness, nausea, and fogginess. Then, patients perform seven assessments (smooth pursuits, saccades–horizontal, saccades–vertical, near point convergence, visual oculomotor reflex [VOR] -horizontal, VOR-vertical, visual motion sensitivity). After each assessment, patients verbally rate their symptoms compared to baseline on a scale from 0 (none) to 10 (severe). Higher scores indicate more symptom provocation.

Equipment needed:

- Tape measure
- Metronome
- Target with 14-point font

Time to administer: 5–10 minutes

Administration and scoring instructions: Examiner administered with patient report of verbal symptom ratings. Instructions provided in Appendix F. Sum across symptom categories for each assessment to obtain total symptom score for assessment. Total symptom scores ≥ 2 and Near-Point-Convergence values $\geq$ 5cm suggest abnormal results and referral for targeted vestibular and oculomotor testing is indicated (Mucha et al., 2014).

Reference citations:

Broglio, S. P., McCrea, M., McAllister, T., Harezlak, J., Katz, B., Hack, D., ... & CARE Consortium Investigators. (2017). A National Study on the Effects of Concussion in Collegiate Athletes and US Military Service Academy Members: The NCAA–DoD Concussion Assessment, Research and Education (CARE) Consortium Structure and Methods. *Sports Medicine*, *47*(7), 1437-1451.

Mucha, A., Collins, M. W., Elbin, R. J., Furman, J. M., Troutman-Enseki, C., DeWolf, R. M., … & Kontos, A. (2014). P. A brief vestibular/ocular motor screening (VOMS) assessment to evaluate concussions: Preliminary findings. *The American Journal of Sports Medicine,42*(10), 2479-2486. doi: 10.1177/036354651454375

Assessment: Northeastern State University College of Optometry Oculomotor Test

Summary: Specialty referral is required for administration of this test. The Northeastern State University College of Optometry (NSUCO) Oculomotor Test is a standardized method of scoring eye movements while patients perform pursuits and saccades. Scoring is used to determine if a patient demonstrates impairments with these visual skills. Recommended to be administered by an optometrist, an ophthalmologist, or a neurologist. Preliminary evidence supports use in RTD and return-to-play settings, but consensus in the field has not been reached. Research suggests that scores are stable across repeated administration, that the level of agreement between raters is acceptable, and that the test can distinguish between groups of differing skill levels. Research does not include use with a military population at the time of publication.

Description: Patients are graded by the examiner on (1) ability, (2) accuracy, (3) degree of head movement the patient uses to perform the task, and (4) the degree of body movement used. Higher scores indicate better functioning.

Equipment needed:

- Targets: Small (approximately ½ cm in diameter) colored reflective spheres mounted on dowel sticks. One target is used for pursuits and two targets are used for saccades.

Time to administer: 2–5 minutes

Administration and scoring instructions: See Appendix G. The outcome measures are four examiner ratings of ability, accuracy, head movement, and body movement for saccades and pursuits. Norms for age and sex are reported by Maples, Atchley, and Ficklin (1992) and are available in Appendix G.

Reference citations:

Maples, W. C., Atchley, J., & Ficklin, T. (1992). Northeastern State University College of Optometry's Oculomotor norms. *Journal of Behavioral Optometry*, *3*(6), 143-150.

Maples, W. C., & Ficklin, T. W. (1988). Inter-rater and test-retest reliability of pursuits and saccades. *Journal of the American Optometric Association, 59*(7), 549-552.

Maples, W. C., & Ficklin, T. W. (1991). Test retest reliability of the King-Devick saccade and the NSUCO oculomotor tests. *Journal of Behavioral Optometry, 3*, 209-214.

Maples, W. C., & Ficklin, T. W. (1990). Comparison of eye movement skills between above average and below average readers. *Journal of Behavioral Optometry*, *1*, 87-91.

Mental Health Assessments

General Comments

According to the National Center for PTSD, concussion and TBI patients are at an increased risk of psychiatric disorders including depression, anxiety, and PTSD. In particular, PTSD symptoms are strongly associated and overlap with many physical and neurocognitive symptoms of mTBI and persistent post-concussion syndrome (see the VA/DoD Clinical Practice Guideline for the Management of Post-Traumatic Stress, 2010, for further information). All mental health assessments in this section are categorized as standard clinical assessments.

When assessing the mental health aspects of RTD after neurosensory injury, standard clinical assessment tools can provide useful information regarding severity and prognosis, but no assessment of mental health has been specifically validated as a RTD tool (i.e., a measurement that has been shown to predict military occupational outcome). The table below provides a listing of clinical mental health assessments that may be relevant to RTD decision-making, including standardized measures likely to be performed as part of a comprehensive mental health workup. On the pages that follow, additional detailed information is provided for the assessments to assist the care provider in understanding how the technique can assist in RTD decision-making.

Note that the assessment methods can be performed in the primary care provider's office if the necessary equipment and instructions are provided. In some cases, the primary care provider routinely performs qualitative versions of the specified assessments, but specialist referral is necessary to properly quantify and document the result, as well as to ensure proper follow-up on abnormal screening tests.

Assessment Category	Assessment	Specialty Referral Required for Administration*	Additional Details Provided In This Chapter
RTD Assessment Tool (validated for RTD evaluation)	None	-	-
Standard Clinical Assessments (not specifically proven as an RTD assessment)	PTSD Checklist – Civilian Version (PCL-C) and – Military Version (PCL-M)	No	Page 69
	PTSD Checklist for DSM-5 (PCL-5)	No	Page 70
	Detailed Assessment of Posttraumatic Stress (DAPS)	No	Page 72
	Patient Health Questionnaire – 9 (PHQ-9)	No	Page 73
	Alcohol Use Disorder Identification Test (AUDIT)	No	Page 74
	Quality of Life Scale (QOLS)	No	Page 75
	Beck Depression Inventory (BDI)	No	Page 76
	Beck Anxiety Inventory (BAI)	No	Page 77
	Overall Anxiety Severity and Impairment Scale (OASIS)	No	Page 78
Other Assessments (less common tests that may be used)	None	-	-

* Note that screening or qualitative versions of these tests may be suitable for office use by the primary care provider, but specialty referral is often necessary to quantify the test results, or to ensure proper clinical follow-up after an abnormal screening test.

Standard Clinical Assessments

Assessment: PTSD Checklist–Civilian Version and –Military Version

Summary: The PTSD Checklist – Civilian Version (PCL–C) has not been directly linked to occupational prognosis in TBI patients, but may provide supplemental information for patients suffering TBI in the civilian environment. The PTSD Checklist –Military Version (PCL-M) is the most commonly used PTSD assessment tool in the DoD and may be encountered frequently in the evaluation of TBI patients. While the PCL-M may provide supplemental information related to RTD, it has not been directly linked to occupational prognosis for TBI patients. Research has been conducted with a military population and shows that scores are stable across repeated administration. Scores correlate with those from clinically valid assessment tools (e.g., Clinician administered PTSD scale [CAPS-5]). Research supports good internal consistency such that items that measure the same construct produce similar scores or outcomes.

Description: The PCL-C and -M are both 17-item paper and pencil, self-report instruments. The PCL-M was designed to measure symptoms of post-traumatic stress disorder in individuals within the military population.

Equipment Needed: N/A

Time to administer: 5–10 minutes

Administration and scoring instructions: Self-administered. Outcome measures include total symptom severity score, intrusions subscale, avoidance subscale, and hyperarousal subscale. All response options range from 1 “Not at all” to 5 “Extremely.” Maximum score of 85 and minimum score of 17. Item scores are summed.

- Low estimated possibility of posttraumatic stress: 17–33
- Moderate estimated possibility of posttraumatic stress: 34–43
- High estimated possibility of posttraumatic stress: 44–85

Additional resource:

Instrument available from **http://www.ptsd.va.gov/**.

Reference citations:

Wilkins, K. C., Lang, A. J., & Norman, S. B. (2011). Synthesis of the psychometric properties of the PTSD Checklist (PCL) Military, Civilian, and Specific Versions. *Depression & Anxiety, 28*(7), 596-606.

Ruggiero, K. J., Ben, K. D., Scotti, J. R., & Rabalais, A. E. (2003). Psychometric properties of the PTSD Checklist-Civilian version. *Journal of Traumatic Stress, 16*(5), 495-502.

Assessment: Posttraumatic Stress Disorder Checklist for DSM-5

Summary: The PTSD Checklist for DSM-5 (PCL-5) is used for monitoring symptoms over time and throughout treatment, screening individuals for PTSD, and for making provisional PTSD diagnoses. The PCL-5 has not been directly linked to occupational prognosis in TBI patients, but may provide supplemental information. Research has been conducted with a military population and shows that scores are stable across repeated administration. Scores correlate with those from clinically valid assessment tools (e.g., PTSD Symptom Scale – Interview version). Research supports good internal consistency such that items that measure the same construct produce similar scores or outcomes.

Description: The PCL-5 is a 20-item self-report instrument. It was intended to assess symptoms of PTSD listed in the Diagnostic and Statistical Manual of Mental Health Disorders-Fifth Edition (American Psychiatric Association, 2013).

Equipment needed: N/A

Time to administer: 5–10 minutes.

Administration and scoring instructions: Self-administered. Outcome measures include:

- Total symptom severity score
- Intrusion subscale
- Avoidance subscale
- Alterations in arousal subscale
- Reactivity subscale

All response options range from 0 “not at all” to 4 “extremely.” There are three versions of the PCL-5 that vary in respect to the inclusion of PTSD Criterion A and the Life Events Checklist. Maximum score of 80 and minimum score of 0. Item scores are summed to find total symptom severity score. A cutoff score of greater than 33 indicates increased likelihood of PTSD. Elevated subscale scores are indicative of areas of focus used to plan treatment options.

Additional resource:

Instrument available from **http://www.ptsd.va.gov/**.

Reference citations:

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

Bovin, M. J., Marx, B. P., Weathers, F. W., Gallagher, M. W., Rodriguez, P., Schnurr, P. P., & Keane, T. M. (2016). Psychometric properties of the PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders–Fifth Edition (PCL-5) in veterans. *Psychological Assessment*, *28*(11), 1379.

Wortmann, J. H., Jordan, A. H., Weathers, F. W., Resick, P. A., Dondanville, K. A., Hall-Clark,

B., Foa, E. B., ..., & Litz, B. T. (2016). Psychometric analysis of the PTSD Checklist-5 (PCL-5) among treatment-seeking military service members. *Psychological Assessment, 28,* 1392-1403. doi: 10.1037/pas0000260

Assessment: Detailed Assessment of Posttraumatic Stress

Summary: The Detailed Assessment of Posttraumatic Stress (DAPS) is frequently used in clinical assessment of a specific traumatic event. It is more in-depth than the more commonly used PCL-M and PCL-C screening tools. DAPS results can provide useful information, but it has not been studied in the RTD setting. Research has been conducted with a military population and shows good internal consistency such that items that measure the same construct produce similar scores or outcomes. Scores correlate with those from clinically valid assessment tools (e.g., Personality Assessment Inventory – Suicide subscale). Research supports good sensitivity and specificity for PTSD.

Description: The DAPS is a 104-item self-report instrument used to diagnose PTSD or acute stress disorder.

Equipment needed: N/A

Time to administer: 20–30 minutes

Administration and scoring instructions: Self-administered (hard copy or digitally). The DAPS can be hand scored or scored using software. The outcome measures include:

- Total Score
- Negative bias subscale
- Positive bias subscale
- Relative trauma exposure subscale
- Peritraumatic distress subscale
- Peritraumatic dissociation subscale
- Re-experiencing subscale
    - Avoidance subscale
    - Effortful avoidance
- Numbing
- Hyperarousal subscale
- Posttraumatic stress-total subscale
- Posttraumatic impairment subscale
- Trauma-specific dissociation subscale
- Substance abuse subscale
- Suicidality subscale

All subsection values have a mean of 50. Scores above 65 are considered abnormal. The negative and positive bias scores are useful in detecting malingering or symptom concealment.

Reference citation:

Briere, J. (2001). *Detailed Assessment of Posttraumatic Stress: DAPS: Professional Manual*. Lutz, FL: Psychological Assessment Resources.

Assessment: Patient Health Questionnaire – 9

Summary: The Patient Health Questionnaire – 9 (PHQ–9) is frequently encountered in clinical assessment as a screening tool for psychology referral, but not directly related to TBI RTD. Research has been conducted with a military population and shows that scores are stable across repeated administration. Scores correlate with those from clinically valid assessment tools (e.g., 20-item Short-Form General Health Survey). Research supports good sensitivity and specificity for major depression.

Description: The PHQ–9 is a 9-item self-report measure intended to measure the presence and symptoms of depression. Instrument is available in Appendix H.

Equipment Needed: N/A

Time to administer: 5–10 minutes

Administration and scoring instructions: Self-administered. All response options range from 0 "not at all" to 3 "nearly every day." Item scores are summed to find depression severity. Maximum score of 27 and minimum score of 0. The response to the final and non-scored question indicates potential impairment due to depression symptoms. A positive response to question 9 indicates suicidality and indicates necessary intervention.

- No indication of depression: score of 0–4
- Minimal level of depression: score of 5–9
- Minor level of depression: score of 10–14
- Moderate level depression: score of 15–19
- Severe level of depression: score of 20–27

Reference citations:

Gilbody, S., Richards, D., Brealey, S., Hewitt, C. (2007). Screening for depression in medical settings with the Patient Health Questionnaire (PHQ): A diagnostic meta-analysis. *Journal of General Internal Medicine, 22*(11), 1596-1602.

Martin, A., Rief, W., Klaiberg, A., & Braehler, E. (2006). Validity of the brief Patient Health Questionnaire Mood Scale (PHQ-9) in the general population. *General Hospital Psychiatry, 28*, 71-77.

Pietrzak, R. H., Johnson, D. C., Goldstein, M. B., Malley, J. C., & Southwick, S. M. (2015). Perceived stigma and barriers to mental health care utilization among OEF-OIF Veterans. *Psychiatric Services, 60*(8), 1118-1122.

Assessment: Alcohol Use Disorder Identification Test

Summary: The Alcohol Use Disorder Identification Test (AUDIT) is frequently encountered in clinical assessment as a screening tool for substance abuse/psychology referral, but not directly related to TBI RTD. Research has been conducted with a military population and shows that scores are stable across repeated administration. Research supports good sensitivity and specificity for alcohol use disorders. Research supports adequate internal consistency such that items that measure the same construct produce similar scores or outcomes.

Description: The AUDIT is a 10-item questionnaire that was developed by the World Health Organization and is used to identify alcohol use disorders or harmful alcohol use in individuals. Instrument provided in Appendix I.

Equipment Needed: N/A

Time to administer: 2 minutes

Administration and scoring instructions: The AUDIT is intended to be administered and scored by a clinician. All response options range from 0 to 4, although the Likert-type response options differ between questions. Item scores are summed to find Total score. Maximum score of 40 and minimum score of 0.

- Advice to reduce alcohol consumption is suggested: score of 8–15
- Counseling and alcohol consumption monitoring is suggested: score of 16–19
- Evaluation for alcohol dependence is suggested: score of 20 or above

Additional Resource:

Available at **http://auditscreen.org**. Contact for reprint permission Programme on Substance Abuse, World Health Organization, 1211 Geneva, Switzerland.

Reference citations:

Saunders, J. B., Aasland, O. G., Babor, T. F., De La Fuente, J. R., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction, 88*, 791-804.

Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B., & Montiero, M. G. (2001). *The Alcohol Use Identification Test* (2nd ed.). Switzerland: World Health Organization.

Assessment: Quality of Life Scale

Summary: The Quality of Life Scale (QOLS) is encountered in clinical assessment as a screening tool for general psychological well-being, but not directly related to TBI RTD. The scale may have relevance to occupational satisfaction. Research shows that scores are stable across repeated administration and correlate with those from clinically valid assessment tools (e.g., Life Satisfaction Index).

Description: The Quality of Life Scale is a 15-item self-report instrument intended to measure six aspects of quality of life including material and physical, social, recreation community and civic activities, personal development and fulfillment, relationships with others, and independence. Instrument is available in Burckhardt & Anderson (2003).

Equipment needed: N/A

Time to administer: 5 minutes

Administration and scoring instructions: Self-administered. Response options range from 1 "terrible" to 7 "delighted." Maximum score of 112 and minimum score of 16. Item scores are summed to find the total score. According to Burckhardt & Anderson (2003), the average score for a healthy population is a total score of 90. Average scores are available for some clinical populations (e.g., 63 for PTSD patients) but one is not available for mTBI patients or those with post-concussive symptoms.

Reference citation:

Burckhardt, C. S., & Anderson, K. L. (2003). The Quality of Life Scale (QOLS): Reliability, validity, and utilization. *Health and Quality of Life Outcomes, 1*(60), 1-7.

Assessment: Beck Depression Inventory

Summary: The Beck Depression Inventory (BDI) is frequently encountered in clinical assessment as a screening tool for psychology referral (specifically major mood disorders), but not directly related to TBI RTD. Research has been conducted with a military population and shows that scores are stable across repeated administration. Scores correlate with those from clinically valid assessment tools (e.g., Beck's Hopelessness Scale) and clinician-provided evaluations. Research supports adequate internal consistency such that items that measure the same construct produce similar scores or outcomes.

Description: The BDI is a 21-item self-report assessment intended to indicate the presence and severity of depression symptoms.

Equipment needed: N/A

Time to administer: 5 minutes

Administration and scoring instructions: Self-administered. Outcome measures include a total score, affective subscale, and somatic subscale. Minimum of 0 and a maximum of 63. Response options range from 0 to 3. Item scores are summed to find total score.

- Minimal symptoms of depression: 0–13
- Mild symptoms of depression: 14–19
- Moderate symptoms of depression: 20–28
- Severe symptoms of depression: 29–63

Reference citation:

Richter, P., Werner, J., Heerlein, A., Kraus, A., & Sauer, H. (1998). On the validity of the Beck Depression Inventory. *Psychopathology, 31*, 160-168.

Assessment: Beck Anxiety Inventory

Summary: The Beck Anxiety Inventory (BAI) is frequently encountered in clinical assessment as a screening tool for psychology referral (specifically major mood disorders), but not directly related to TBI RTD. Research has been conducted with a military population and shows that scores are stable across repeated administration. Scores correlate with those from clinically valid assessment tools (e.g., Hamilton Anxiety Rating Scale). Research supports good internal consistency such that items that measure the same construct produce similar scores or outcomes.

Description: The BAI is a 21-item self-report instrument intended to indicate the presence and severity of anxiety symptoms.

Equipment needed: N/A

Time to administer: 5 minutes

Administration and scoring instructions: Self-administered. Maximum of 63 and a minimum of 0. Response options range from 0 to 3. Item scores are summed to find total score.

- Minimal symptoms of anxiety: 0–7
- Mild symptoms of anxiety: 8–15
- Moderate symptoms of anxiety: 16–25
- Severe symptoms of anxiety: 26–63

Additional Resource:

Available for purchase at
https://www.pearsonclinical.com/psychology/products/100000251/beck-anxiety-inventory-bai.html#tab-pricing.

Reference citation:

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology, 56*(6), 893-897.

Assessment: Overall Anxiety Severity and Impairment Scale

Summary: The Overall Anxiety Severity and Impairment Scale (OASIS) is frequently encountered in clinical assessment as a screening tool for psychology referral, but not directly related to TBI RTD. Research shows that scores are stable across repeated administration. Scores correlate with those from clinically valid assessment tools (e.g., State Trait Anxiety Impression Inventory). Research has not been conducted with a military population.

Description: The OASIS is a 5-item self-report instrument intended to indicate the severity of anxiety and the impairment caused by anxiety.

Equipment needed: N/A

Time to administer: 5 minutes

Administration and scoring instructions: Self-administered. Maximum of 20 and a minimum of 0. Response options range from 0 “not at all” to 4 “nearly every day.” Item scores are summed to find total score. According to Norman et al. (2011), scores greater than 8 indicate abnormal levels of anxiety. However, cut-off scores validated with a healthy sample were not available at time of publication.

Additional Resource:

Available at
https://www.jpshealthnet.org/sites/default/files/november_2013_-_anxiety.pdf.

Reference citation:

Norman, S. B., Cissell, S. H., Means-Christensen, A. J., & Stein, M. B. (2006). Development and validation of an Overall Anxiety Severity and Impairment Scale (OASIS). *Depression and Anxiety*, *23*, 245-249.

Norman, S. B., Campbell-Sills, L., Hitchcock, C. A., Sullivan, S., Rochlin, A., Wilkins, K. C., & Stein, M. B. (2011). Psychometrics of a brief measure of anxiety to detect severity and impairment: the Overall Anxiety Severity and Impairment Scale (OASIS). *Journal of psychiatric research*, *45*(2), 262-268.

Concussion Symptoms, Occupational Performance, and Personality Assessments

General Comments

When assessing the concussion symptoms, occupational performance, and personality aspects of RTD after neurosensory injury, standard clinical assessment tools can provide useful information regarding severity and prognosis. Only one measurement in this area has been validated for RTD use – the Canadian Occupational Performance Measure (COPM). The table below provides a listing of clinical assessments that may be relevant to RTD decision-making (including the COPM), as well as other standardized measures likely to be performed as part of a comprehensive workup, as well as less common assessments that may be useful. On the pages that follow, additional detailed information is provided for selected assessments to assist the care provider in understanding how the technique can assist in RTD decision-making.

Note that the assessment methods can be performed in the primary care provider's office if the necessary equipment and instructions are provided. In some cases, the primary care provider routinely performs qualitative versions of the specified assessments, but specialist referral is necessary to properly quantify and document the result, as well as to ensure proper follow-up on abnormal screening tests.

Assessment Category	Assessment	Specialty Referral Required for Administration*	Additional Details Provided In This Chapter
RTD Assessment Tool (validated for RTD evaluation)	Canadian Occupational Performance Measure (COPM)	No	Page 76
Standard Clinical Assessments (not specifically proven as an RTD assessment)	Military Acute Concussion Evaluation (MACE)	No	Page 78
	Patient's Global Impression of Change (PGIC)	No	Page 80
Other Assessments (less common tests that may be used)	Mild Brain Injury Atypical Symptom Scale (mBIAS)	No	Page 81
	Validity-10	No	Page 82
	Structured Inventory of Malingered Symptomatology (SIMS)	No	Page 83
	Millon Clinical Multiaxial Inventory-III (MCMI-III)	No	Page 85
	Personality Assessment Inventory (PAI)	No	Page 87
	Personality Assessment Screener (PAS)	No	Page 89

* Note that screening or qualitative versions of these tests may be suitable for office use by the primary care provider, but specialty referral is often necessary to quantify the test results, or to ensure proper clinical follow-up after an abnormal screening test.

Return to Duty Assessment Tool

Assessment: Canadian Occupational Performance Measure

Summary: The Canadian Occupational Performance Measure (COPM) can help TBI patients with identifying meaningful occupational performance goals and is used for identifying problem areas relative to occupational performance and for planning occupational therapy interventions (Pippen, 2013). Therapists can use the COPM to help design occupation-based and client centered intervention programs and measure outcomes. According to a review by Carswell et al. (2004), although there are limitations discussed in the review, the conclusion is that the COPM is a valid (scores correlate with similar measures including the Sickness and Disability Impact Profiles), reliable (stable across repeated administration), clinically useful, and responsive outcome measure acceptable for occupational therapist practitioners and researchers. The COPM is used with a wide variety of clients, enables client-centered practice, facilitates evidence-based practice, and supports outcomes research. Interviews with OTs find that the COPM is more geared toward civilians but is sensitive to specific military requirements (i.e., self-care) and research has evaluated the COPM with military patients. COPM scores give therapists insight into a patient's motivation level and readiness to change.

Description: The COPM is a semi-structure interview that enables patients to identify activities they find important and have difficulty performing. The COPM is used to direct occupational therapy interventions and measure client-centered outcomes.

Equipment needed: N/A

Time to administer: Approximately 30 minutes

Administration and scoring instructions: Administered by a trained occupational therapist. The interview focuses on the activities the patient wants, needs, or is expected to perform. The outcome measure is the average performance and satisfaction ratings from the top five important activities.

For scoring, activities are first rated by the patient for importance on a scale from 1 (not important at all) to 10 (extremely important). The patient then selects the five most important activities, which are then rated on a 10-point scale from 1 (not at all able) to 10 (able to perform extremely well). These five activities are also rated for satisfaction from 1 (not at all satisfied) to 10 (extremely satisfied). While the precise scoring is copyright protected, lower scores are less favorable and higher scores indicate better ability and satisfaction. The intent is a test-retest format to document improvement in the specific activities that are most important to the individual being tested.

Information and purchase of the COPM is available at **http://www.thecopm.ca/buy/**.

Reference citations:

Carswell, A., McColl, M. A., Baptiste, S., Law, M., Polatajko, H., & Pollock, N. (2004). The Canadian Occupational Performance Measure: a research and clinical literature review. *Canadian Journal of Occupational Therapy, 71*(4), 210-222.

Cup, E. H. C., Scholte op Reimer, W. J. M., Thijssen, M. C. E., & van Kuyk-Minis, M. A. H. (2003). Reliability and validity of the Canadian Occupational Performance Measure in stroke patients. *Clinical Rehabilitation*, *17*, 402-409. doi: 10.1191/0269215503cr635oa

Dedding, C., Cardol, M., Eyssen, I. C., & Beelen, A. (2004). Validity of the Canadian Occupational Performance Measure: a client-centred outcome measurement. *Clinical rehabilitation, 18*(6), 660-667.

Pippin, K. (January 2013). *A case study of occupational therapists serving military personnel: identifying therapeutic approaches to be considered when assessing the occupational performance of military service members with mild traumatic brain injury* (Master's Thesis, East Carolina University). Retrieved from the Scholarship. (http://hdl.handle.net/10342/4341.)

Standard Clinical Assessments

Assessment: Military Acute Concussion Evaluation

Summary: The Military Acute Concussion Evaluation (MACE) is the first-line concussion assessment tool in the DoD and essential component of concussion evaluation, sometimes used to follow patients post-concussion. When results of MACE are normal or improving, it can provide valuable information; susceptible to negative malingering. The MACE has been evaluated for validity with military populations and research has found that MACE scores are lower for warfighters with mTBI within 24 hours of injury than those for normal controls. Research has also shown that MACE scores correlate with scores on the King-Devick test (page 63). The stability of scores across repeated administration of the MACE has not been established.

Description: The MACE is a TBI diagnostic tool designed for use in the acute injury period. The assessment tool is composed of neurocognitive tasks (e.g., reverse digit recall) and a symptom checklist.

Equipment needed: N/A

Time to administer: 10 minutes

Administration and scoring instructions: Anyone trained on the MACE can administer the evaluation, however, scores less than 25 require referral to a medical provider. Maximum score of 30 and minimum score of 0. Higher scores indicate less impairment/symptoms. Item scores are summed.

- Possible concussion/impairment: 0–24
- Healthy: 25–30

Additional resource:

MACE is available at **https://dvbic.dcoe.mil/material/mace-military-acute-concussion-evaluation-pocket-card**.

Reference citations:

French, L., McCrea, M., & Baggett, M. (2008). The military acute concussion evaluation (MACE). *Journal of Special Operations Medicine, 8*(1), 68-77.

Galetta, K. M., Brandes, L. E., Maki, K., Dziemianowicz, M. S., Laudano, E., Allen, M., … & Messner, L. V. (2011). The King-Devick test and sports related concussion: Study of a rapid visual screening tool in a collegiate cohort. *Journal of the Neurological Sciences, 309*(1), 34-39.

Kennedy, C. H., Porter Evans, J., Chee, S., Moore, J. L., Barth, J. T., & Stuessi, K. A. (2012). Return to combat duty after concussive blast injury. *Archives of Clinical Neuropsychology, 27*(8), 817-827.

McCrea, M., Guskiewicz, K., Doncevic, S., Helmick, K., Kennedy, J., Boyd, C., … Jaffee, M. (2014). Day of injury cognitive performance on the Military Acute Concussion Evaluation

(MACE) by U.S. military service member in OEF/OIF. *Military Medicine, 179*(9), 990-997. doi: 10.7205/MILMED-D-1300349.

Assessment: Patient's Global Impression of Change

Summary: The Patient's Global Impression of Change (PGIC) was originally developed for the assessment of headaches. More recently, it has been included among the National Institute of Health / DoD outcome common data elements and is one of two standard outcome tools adopted by all three services (the other is the NSI). The PGIC is frequently used to follow recovery. The PGIC has been used with military populations and research has found that PGIC scores are moderately accurate in categorizing patients who have and have not improved. The stability of scores across repeated administration of the PGIC has not been established.

Description: The PGIC is a single item scale used to assess a patient's perception of change since the beginning of treatment. The PGIC can be used across a range of conditions that require the assessment of patient perceived treatment efficacy.

Equipment needed: N/A

Time to administer: < 1 minute

Administration and scoring instructions: Self-report, single-item questionnaire. The patient checks a box that most closely corresponds to how his or her condition has changed since treatment. Scale ranges from 1 (no change or condition has gotten worse) to 7 (a great deal better, and a considerable improvement that has made all the difference). Higher scores indicate more positive change.

- Scores >= 6 indicate "clinically significant change"

Reference citations:

Farrar, J. T., Young, J. P., LaMoreaux, L., Werth, J. L., & Poole, M. (2001). Clinical importance of changes in chromic pain intensity measured on an 11-point numerical pin rating scale. *Pain, 94*, 149-158.

Hurst, H., & Bolton, J. (2004). Assessing the clinical significance of change scores recorded on subjective outcome measures. *Journal of Manipulative Psychological Therapeutics*, *27*, 26-35.

Raskind, M. A., Peskind, E. R., Kanter, E. D., Petrie, E. C., Radant, A., Thompson, C. E., … McFall, M. M. (2003). Reduction in nightmares and other PTSD symptoms in a combat veterans by prazosin: A placebo-controlled study. *The American Journal of Psychiatry*, *160*(2), 371-373.

Other Assessments

Assessment: Mild Brain Injury Atypical Symptom Scale

Summary: The Mild Brain Injury Atypical Symptom (mBIAS) Scale is a quick assessment tool intended to detect symptom exaggeration. Stability of the measure across repeated administration has not been established. However, the measure has been evaluated with a military population and research shows that the scale is tapping into a set of symptoms not typically associated with PTSD and mTBI (e.g., complete deafness, lack of color vision, loss of feeling in both arms, difficulty swallowing due to lump in throat, completely losing voice for more than one minute). Additional research has shown that the scale did not detect symptom exaggeration in approximately 83% of the sample tested (U.S. military Service members who sustained an mTBI). Taken together, this evidence suggests that the measure does include symptoms outside the scope of PTSD and mTBI, thus appropriate for detecting over-reporting, however, does not demonstrate adequate sensitivity.

Description: The mBIAS is a 5-item self-report measure used to identify TBI symptom over-reporting. The items are composed of five symptoms that are uncommonly endorsed by patients following mTBI.

Equipment needed: N/A

Time to administer: 1–2 minutes

Administration and scoring instructions: Self report. Patients rate each of the five symptom statements from 1 (not at all) to 5 (extremely). Scores from each symptom statement are summed. Scores range from 5–25. A combined score >= 8 is indicative of symptom over-reporting.

Reference citations:

Cooper, D. B., Nelson, L., Armistead-Jehle, P., Bowles, A. O. (2011). Utility of the mild brain injury atypical symptoms scales as a screening measure for symptom over-reporting in operation enduring freedom/operation Iraqi freedom service members with post-concussive complaints. *Achieves of Clinical Neuropsychology*, *26*(8), 718-727. doi:10.1093/arclin/acr070

Lange, R. T., Brickell, T. A., & French, L. M. (2015). Examination of the mild brain injury atypical symptom scale and the validity-10 scale to detect symptom exaggeration in US military service members. *Journal of Clinical and Experimental Neuropsychology*, *37*(3), 325-337.

Assessment: Validity-10

Summary: The Validity-10 is a 10-item assessment tool intended to detect symptom exaggeration embedded in the Neurobehavioral Symptom Inventory (page 5). The Validity-10 has been evaluated with a military population and research shows that the scale is able to detect symptom exaggeration with a moderate level of accuracy (research results range from 61 to 81% accurate detection). Note that the optimal cut-off score has not been determined. Also, research shows that the scale is tapping into a unique set of symptoms not typically associated with PTSD and mTBI. At the time of publication, stability of the assessment across repeated administration had not been established. This assessment tool is designed for use alongside symptom inventories (e.g., the Neurobehavioral Symptom Inventory [page 5], PTSD Checklist [page 69]).

Description: The Validity-10 is a 10-item self-report instrument used to identify TBI symptom over reporting. The items are composed of ten symptoms included in the Neurobehavioral Symptom Inventory.

Equipment needed: N/A

Time to administer: 1–2 minutes

Outcome measures: Total score*

Reference citations:

Lange, R. T., Brickell, T. A., & French, L. M. (2015). Examination of the Mild Brain Injury Atypical Symptom Scale and the Validity-10 Scale to detect symptom exaggeration in US military service members. *Journal of clinical and experimental neuropsychology*, *37*(3), 325-337.

Lippa, S. M., Lange, R. T., Bailie, J. M., Kennedy, J. E., Brickell, T. A., & French, L. M. (2016). Utility of the Validity-10 scale across the recovery trajectory following traumatic brain injury. *Journal of Rehabilitation Research & Development*, *53*(3), 379-391.

Vanderploeg, R. D., Cooper, D. B., Belanger, H. G., Donnell, A. J., Kennedy, J. E., Hopewell, C. A., & Scott, S. G. (2014). Screening for postdeployment conditions: Development and cross-validation of an embedded validity scale in the neurobehavioral symptom inventory. *The Journal of Head Trauma Rehabilitation*, *29*(1), 1-10.

* Optimal cut-off criteria have not been established, however, preliminary evidence supports a cut-off criteria of 18 as the most appropriate such that scores above 18 are suggestive of symptom exaggeration.

Assessment: Structured Inventory of Malingered Symptomatology

Summary: The Structured Inventory of Malingered Symptomatology (SIMS) is a self-report measure designed to screen for malingering of psychiatric symptoms (e.g., depression and psychosis) and/or cognitive impairments (e.g., low intelligence and memory complaints). The SIMS may not be able to differentiate between somatoform disorders and malingering, because both involve the identification of a broad range of symptoms, for which there is no identifiable cause. The SIMS has been evaluated with a military population and research shows that scores are stable across repeated administration. Research shows good internal consistency such that items that measure the same construct produce similar scores or outcomes. Scores correlate with those from similar assessment tools (e.g., Miller Forensic Assessment of Symptoms Test). Research also suggests good diagnostic efficiency.

Description: The SIMS is a 75-item self-report measure developed to screen for malingered psychopathology and neuropsychological symptoms. All items are true and false.

Equipment needed: NA

Time to administer: 15 minutes

Administration and scoring instructions: Self-report measure. Administered and interpreted by trained clinicians. Outcome measures include:

- SIMS total score
- Psychosis
- Neurologic impairment
- Amnestic disorders
- Low intelligence
- Affective disorders

Scoring is conducted per the manual. All items are true or false. Total scores range from 0 to 75 and individual scales range from 0-15. Higher scores indicate a higher probability of malingering (further classified by type according to the subscales). The cutoff scores vary by subscale: Abnormal is anything above 1.5 in Psychosis, 2.5 in Neurologic Impairment, Amnestic Disorders, and Low Intelligence, and 5.5 in Affective Disorders.

Reference citations:

Freeman, T., Powell, M., & Kimbrell, T. (2008). Measuring symptom exaggeration in veterans with chronic posttraumatic stress disorder. Psychiatry Research, 158(3), 374-380.

Merckelback, H., & Smith, G. P. (2003). Diagnostic accuracy of the structured inventory of malingered symptomatology (SIMS) in detecting instructed malingering. Archives of Clinical Neuropsychology, 18, 145-152.

Smith, G. P., & Burger, G. K. (1997). Detection of malingering: validation of the Structured Inventory of Malingered Symptomatology (SIMS). Journal of the American Academy of Psychiatry and the Law Online, 25(2), 183-189.

Wisdom, N. M., Callahan, J. L., & Shaw, T. G. (2010). Diagnostic utility of the structured inventory of malingered symptomatology to detect malingering in a forensic sample. Archives of Clinical Neuropsychology, 25(2), 118-125.

Assessment: Millon Clinical Multiaxial Inventory-III

Summary: The primary intent of the Millon Clinical Multiaxial Inventory-III (MCMI-III) is to provide information about persons with emotional and interpersonal difficulties. Administration is simple and has rapid computer scoring and interpretation. MCMI-IV was published in 2015 and has changes that align with DSM-5 and includes ICD 10 codes. Research has been conducted with a military population and shows that scores are stable across repeated administration. Research shows acceptable internal consistency such that items that measure the same construct produce similar scores or outcomes. Scores correlate with those from similar assessment tools (Minnesota Multiphasic Personality Inventory) and the test is moderately accurate with respect to diagnostic efficiency.

Description: The MCMI-III is a 175 item, true-false, self-report questionnaire that measures 14 personality disorders and 10 clinical syndromes. The scales quantify how well respondents match or fit the constructs being assessed.

Equipment needed: N/A

Time to administer: < 30 minutes

Administration and scoring instructions: Self-report, but interpreted by a trained clinician. Outcome measures include:

- Total Weighted Scores for each of the Personality Disorder Scales:
  - Schizoid
  - Avoidant
  - Depressive
  - Dependent
  - Histrionic
  - Narcissistic
  - Antisocial
  - Aggressive
  - Compulsive
  - Passive-aggressive
  - Self-defeating
  - Schizotypal
  - Borderline
  - Paranoid
- Total Weighted Scores for each of the 10 Clinical Syndromes Scales:
  - Anxiety
  - Somatoform
  - Bipolar: Manic
  - Dysthymia
  - Alcohol dependence
  - Drug dependence
  - Thought disorder
  - Major depression

- PTSD
- Delusional disorder

Scores are corrected according to clinical norms. Core items pertaining to the scale are weighted a 2 and peripheral (overlapping with other scales) are rated a 1. Scoring is done per the manual. Raw scores are converted to base rate scores, the conversion of which is relatively complex.

- Base rate scores 75–84 indicate "significant personality trait or mental health concern"
- Base rate scores >= 85 indicate "persistent, significant clinical concern or personality disorder"

Reference citation:

Rossi, G., Van den Brande, I., An, T., Sloore, H., & Hauben, C. (2003). Convergent validity of the MCMI-III personality disorder scales and the MMPI-2 scales. *Journal of Personality Disorders*, *17*, 330-340.

Assessment: Personality Assessment Inventory

Summary: The Personality Assessment Inventory (PAI) is used to establish meaningful patterns of behavioral and personality characteristics that are detected in active warfighters following TBI and are used to determine the most efficacious rehabilitation strategies (Kennedy, Cooper, Reid, Tate, & Lange, 2015). Research has been conducted with a military population and shows that scores are stable across repeated administration. Research shows good internal consistency such that items that measure the same construct produce similar scores or outcomes. Findings with respect to sensitivity to psychopathologies have been inconsistent.

Description: The PAI is a 344 item self-report personality assessment with the following scales: four scales for assessing response bias, 11 scales assessing clinical syndromes, five scales for assessing treatment-related characteristics, and two scales assessing interpersonal style. The PAI provides information for diagnosis, treatment planning, and screening for psychopathology. The PAI covers constructs related to a broad range of mental disorders.

Equipment needed: N/A

Time to administer: 50–60 minutes

Administration and scoring instructions: Self-report. Administered by a trained clinician. Outcome measures include:

- Raw scores and *T*-scores from the 22 scales:
  - Somatic complaints
  - Anxiety
  - Anxiety-related disorders
  - Depression
  - Positive impression
  - Paranoia
  - Schizophrenia
  - Borderline
  - Antisocial
  - Alcohol problems
  - Drug problems
  - Aggression
  - Suicidal ideation
  - Stress
  - Mania
  - Nonsupport
  - Treatment rejection
  - Dominance
  - Warmth
  - Inconsistency
  - Infrequency
  - Negative impression

The PAI is scored according the manual. Participants rate each statement on a four-point scale (1 = very true, 2 = mainly true, 3 = slightly true, 4 = false). Items are summed and transformed into *T* scores. Higher scores indicate higher probability of psychopathology. Interpretation guidelines are provided in codebook available at: **http://www.pathwaysstudy.pitt.edu/codebook/pai-sf.html**. To summarize, an average score on the borderline scale of 59T or below indicates emotional stability, whereas a score from 60T–69T indicate a moody, sensitive, and uncertain person. A score of 70T or above indicates impulsivity and feeling misunderstood. Average scores on the antisocial scale of 59T or below indicates a warm and empathetic person. Scores of 60T through 69T indicate impulsivity and risk-taking. At or about 70T, persons are likely impulsive and hostile, while at or above 82T indicates prominent features of antisocial personality behavior.

Reference citations:

Boyle, G. L., & Lennon, T. J. (1994). Examination of the reliability and validity of the personality assessment inventory. *Journal of Psychopathology and Behavioral Assessment, 16*(3), 173-187.

Calhoun, P. S., Earnst, K. S., Tucker, D. D., Kirby, A. C., & Beckham, J. C. (2000). Feigning combat-related posttraumatic stress disorder on the Personality Assessment Inventory. *Journal of Personality Assessment, 75*(2), 338-350.

Kennedy, J. E., Cooper, D. B., Reid, M. W., Tate, D. F., & Lange, R. T. (2015). Profile analyses of the Personality Assessment Inventory following military-related traumatic brain injury. *Archives of Clinical Neuropsychology, 30*(3), 236-247.

Assessment: Personality Assessment Screener

Summary: The Personality Assessment Screener (PAS) is a subset of the PAI items (see above) and assesses similar psychopathology and personality domains. Research has been conducted with a military population and shows that scores are adequately stable across repeated administration (some subscales are more stable than others). Research shows acceptable internal consistency such that items that measure the same construct produce similar scores or outcomes. Scores correlate with those from similar assessment tools (e.g., Patient Health Questionnaire [page 73], Alcohol Use Disorders Identification Test [page 74]). Research also suggests good diagnostic efficiency.

Description: The PAS is a 22-item self-report measure that screens for patients who will likely achieve scores of clinical significance on the PAI.

Equipment needed: N/A

Time to administer: 10 minutes

Administration and scoring instructions: Self-report measure. Administered and interpreted by trained clinicians. Outcome measures:

- Raw scores and the corresponding probability values associated with reaching clinical significance on the PAI for each scale:
  - PAS total
  - Negative affect
  - Acting out
  - Psychotic features
  - Social withdrawal
  - Hostile control
  - Suicidal thinking
  - Alienation
  - Alcohol problems
  - Anger control

Scoring is conducted per the manual. Items are rated on the same scale as the PAI (page 91) (1 = very true, 2 = mainly true, 3 = slightly true, 4 = false). Raw scores are generated and probability values are assigned to the raw scores to reflect the likelihood that the respondent would obtain a problematic PAI profile is he/she did the full PAI. Higher scores on the PAS indicate a higher probability of scoring clinically significant on the PAI. Interpretation guidelines are available for purchase at: **http://www.hogrefe.co.uk/personality-assessment-screener-pas.html.**

Reference citations:

Creech, S. K., Evardone, M., Braswell, L., & Hopwood, C. J. (2010). Validity of the Personality Assessment Screener in veterans referred for psychological testing. *Military Psychology, 22*, 465-473.

Porcerelli, J. H., Kurtz, J. E., Cogan, R., Markova, T., & Mickens, L. (2012). Personality

Assessment Screener in a primary care sample of low-income urban women. *Journal of Personality Assessment, 94*(3), 262-266. doi: 10.1080/00223891.2011.650304

Military-Specific Assessments/Tasks

General Comments

These military-specific assessments/tasks were developed to evaluate functional performance specific to military duties that may be impacted by symptoms associated with concussion/mTBI (e.g., vestibular, neurocognitive, behavioral, psychological, vision). The assessments/tasks in this section are divided into and organized by three military-specific task batteries: Military Functional Assessment Program (10 tasks), Dynamic Marksmanship Battery (4 tasks), and Assessment of Military Multitasking Performance (6 tasks). The objective of these assessments/tasks was to provide the clinician and RTD decision maker with information that bridges the gap between clinical deficits and performance in order to increase confidence in decisions regarding suitability for RTD. Many of these (i.e., Military Functional Assessment Program [MFAP] and Assessment of Military Multitasking Performance [AMMP]) have been used by clinicians to make RTD recommendations, and some have shown promising results supportive of utility for RTD decision making. These tasks tax multiple symptom domains and systems, and are reflective of military duties, thus, providing a degree of ecological validity (or relevance to real-life military duties) to military leadership. The degree to which these tasks have been studied is summarized below.

Tasks for RTD	Task Batteries for RTD	Specialty Referral Required for Administration*	Additional Details Provided In This Chapter
Military Functional Assessment Program (MFAP) Tasks	Warrior Task Battle Drill (WTBD)	No	Page 98
	High Mobility MultiPurpose Wheeled Vehicle Egress Assistance Trainer (HEAT)	No	Page 100
	Land Navigation Preparation	No	Page 102
	Land Navigation	No	Page 103
	Virtual Convoy Operations Trainer (VCOT)	No	Page 104
	Shoot/No-Shoot Scenarios	No	Page 105
	IED [Improvised Explosive Device] Lane – Tactical Mission Scenario	No	Page 106
	Medical Simulation Training Center – Mass Casualty Scenario	No	Page 108
	Weapons Qualification	No	Page 110
Dynamic Marksmanship Battery Tasks	Kneel and Shoot	No	Page 112
	Traverse Beam and Shoot	No	Page 114
	Pickup and Shoot	No	Page 116
Assessment of Military Multitasking Performance (AMMP)	Patrol-exertion	No	Page 118
	Charge of Quarter Duty	No	Page 120
	Instrumented Stand and Walk – Grid Coordinates	No	Page 121
	Load Magazine – Radio Chatter	No	Page 123

* Note that screening or qualitative versions of these tests may be suitable for office use by the primary care provider, but specialty referral is often necessary to quantify the test results, or to ensure proper clinical follow-up after an abnormal screening test.

Military Functional Assessment Program Tasks

The Military Functional Assessment Program (MFAP) MFAP is a unique program only available at Fort Campbell, KY, at the time of publication; other similar but less studied programs exist elsewhere in the DoD, and may be available for warfighter assessment. Modifications to reduce resources required to administer these tasks have not been studied as of publication. The 10 MFAP tasks were derived from the Soldier Manual of Common Tasks (Warrior Skill Level 1). An additional ungraded confidence-building exercise is conducted as part of the MFAP and is described in the MFAP standard operating procedure (labeled as "ropes course") (Appendix J). Note that the MFAP has only been implemented as a whole program and the individual tasks in isolation have not been evaluated. Evaluation of the MFAP tasks has been conducted with warfighters at the completion of a rehabilitation program following concussion/mTBI. A study of the predictive validity of the MFAP showed an association between MFAP ratings and self-reported satisfaction and performance at 6-months post-MFAP participation such that favorable MFAP ratings corresponded to higher levels of satisfaction and performance (Kelley et al., 2018). Many of the MFAP tasks require specialized equipment (e.g., Virtual Convoy Operations Trainer, High Mobility MultiPurpose Wheeled Vehicle Egress Assistance Trainer, Engagement Skills Trainer 2000), some of which may be available on other military installations. The MFAP tasks provide additional supplemental information for RTD decision makers.

Task: Warrior Task Battle Drill

Summary: The Warrior Task Battle Drill (WTBD) is a component of the MFAP, created and administered at the National Intrepid Center of Excellence Intrepid Site III (Fort Campbell, KY). The task appears to stress vestibular (WTBD performance ratings correlate with Dizziness Handicap Inventory [page 57] scores) and cognitive function revealing deficits important to successful military performance, thus informing RTD decisions. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD. Preliminary research suggests that agreement between raters on this task/assessment is low.

Description: This task is a collection of individual and independent subtasks including physical tasks, Drill & Ceremony (D & C) procedures, gas mask donning, Mission-Oriented Protective Posture suit donning, casualty evacuation, and leading and following commands.

Domain(s) assessed:

Vestibular demands identified: Log rolls, increased physiologic response to approximately 70% of maximum exertion (at the will of the participant using Borg's Rating of Perceived Exertion [RPE] scale), balance is challenged through agility ladder which incorporates cognitive demands with the physical performance.

Cognitive demands identified: Following 3-step commands, planning, short term memory recall, sequencing, visual motor coordination, processing speed.

Equipment needed:

- Clipboards
- Agility ladder
- Stopwatch
- Mission-Oriented Protective Posture (MOPP) suit
- Army Combat Uniform
- Aid bag (Sam Splint, ace wrap, gauze)
- Skedco
- Gas Mask

Time to administer: Approximately 2 hours

Administration instructions: See SOP (Appendix J).

Scoring instructions: See SOP (Appendix J).

Scoring/interpretation: Scale of 1 (performance is accurate and within military standards) to 5 (task could not be completed by warfighter) (Appendix K).

Reference citation:

Thurman, N. (November, 2011). *Fort Campbell's TBI clinic validates patient rehabilitation*. Retrieved from https://www.army.mil/article/69312/fort_campbells_tbi_clinic_validates_patient_rehabilitation.

Task: High Mobility Multipurpose Wheeled Vehicle Egress Assistance Trainer

Summary: The High Mobility Multipurpose Wheeled Vehicle (HMMWV) Egress Assistance Trainer (HEAT) is a component of the MFAP, created and administered at Fort Campbell, KY. It incorporates elements that may highlight aspects of vestibular (performance ratings correlate with outcomes from the Sensory Organization Test [page 41]), visual, cognitive, and psychological function, revealing deficits important to successful military performance, thus informing RTD decisions. Preliminary research suggests that agreement between raters on this task/assessment is low. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD.

Description: This task includes a 30-minute class preparation on roll-over crashes and procedures followed by three egress exercises from a simulated HMMWV rollover while wearing kit (body armor and helmet). The warfighter serves a different role in each exercise (e.g., vehicle command, driver, medic).

Domain(s) assessed:

> **Vestibular demands identified:** Vestibular disturbances occur from positional rotation including movement through the frontal plane in all 360 degrees. Additionally, the visual component is reduced/eliminated with black out goggles in 1 of 3 iterations.
>
> **Vision demands identified:** Vergence, saccades, pursuits
>
> **Cognitive demands identified:** Planning and organizing, processing speed, working memory, short-term memory recall, attention (sustained and alternating).
>
> **Psychological demands identified:** Simulated environment, may provoke anxiety or PTSD symptoms.

Equipment needed:

- HMMWV Egress Assistance Trainer
- Interceptor body armor and advanced combat helmet
- Lecture video
- Aid bag
- Black out goggles

Time to administer: 90 minutes for a group of 3

Administration instructions: See SOP (Appendix J).

Scoring instructions: See SOP (Appendix J).

Scoring/interpretation: Scale of 1 (performance is accurate and within military standards) to 5 (task could not be completed by warfighter) (Appendix K).

Reference citation:

Thurman, N. (November, 2011). *Fort Campbell's TBI clinic validates patient rehabilitation*. Retrieved from https://www.army.mil/article/69312/fort_campbells_tbi_clinic_validates_patient_rehabilitation.

Task: Land Navigation Preparation

Summary: The Land Navigation Preparation is a component of the MFAP, created and administered at Fort Campbell, KY. It incorporates elements that may highlight aspects of cognitive function (performance ratings correlate with the total scores on the Repeatable Battery for the Assessment of Neuropsychological Status [page 22]), revealing deficits important to successful military performance, thus informing RTD decisions. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD. Preliminary research suggests that agreement between raters on this task/assessment is low.

Description: This task is composed of classroom instruction using PowerPoint slides and hands-on application (e.g., plotting points on map).

Domain(s) assessed:

Vision demands identified: Oculomotor control (saccades)

Cognitive demands identified: Visual Memory, acuity, working memory, calculation (mathematics), spatial orientation, color perception

Equipment needed:

- Non-permanent marker
- Watch/Stopwatch
- Map (division land navigation site)
- 3x5 notecard
- Protractor
- Compass
- PowerPoint slide deck

Time to administer: 60 minutes

Administration instructions: See SOP (Appendix J).

Scoring instructions: See SOP (Appendix J).

Scoring/interpretation: Scale of 1 (performance is accurate and within military standards) to 5 (task could not be completed by warfighter) (Appendix K).

Reference citation:

Thurman, N. (November, 2011). *Fort Campbell's TBI clinic validates patient rehabilitation.* Retrieved from https://www.army.mil/article/69312/fort_campbells_tbi_clinic_validates_patient_rehabilitation.

Task: Land Navigation

Summary: The Land Navigation is a component of the MFAP, created and administered at Fort Campbell, KY. It incorporates elements that may highlight aspects of vestibular (performance ratings correlate with Dynamic Visual Acuity scores [page 47]) and cognitive function, revealing deficits important to successful military performance, thus informing RTD decisions. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD. Preliminary research suggests that agreement between raters on this task/assessment is low.

Description: In this task, the warfighter must execute a land navigation task including three points.

Domain(s) assessed:

> **Vestibular demands identified:** Traverse uneven surfaces including incline and decline a creek bed (approximately 10 feet elevation difference), tangled vegetation, physiological demand is estimated at 60% of maximum exertion using Borgs RPE scale. Distractibility is high and visual focus is dynamic.
>
> **Cognitive demands identified:** Organization of materials (executive function), flexibility, attention (sustained and alternating), and problem solving.

Equipment needed:

- Non-permanent marker
- Watch/Stopwatch
- Map (division land navigation site)
- 3x5 notecard
- Appropriate gear for seasonal weather
- Insect repellant
- Protractor
- Compass
- Water source

Time to administer: 60 minutes

Administration instructions: See SOP (Appendix J).

Scoring instructions: See SOP (Appendix J).

Scoring/interpretation: Scale of 1 (performance is accurate and within military standards) to 5 (task could not be completed by warfighter) (Appendix K).

Reference citation:

Thurman, N. (November, 2011). *Fort Campbell's TBI clinic validates patient rehabilitation.* Retrieved from https://www.army.mil/article/69312/fort_campbells_tbi_clinic_validates_patient_rehabilitation.

Task: Virtual Convoy Operations Trainer

Summary: The Virtual Convoy Operations Trainer (VCOT) is a component of the MFAP, created and administered at Fort Campbell, KY. It incorporates elements that may highlight aspects of vestibular (performance ratings correlated with Dynamic Visual Acuity scores [page 47]), cognitive, and psychological function, revealing deficits important to successful military performance, thus informing RTD decisions. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD. Preliminary research suggests that the level of agreement between raters on this task/assessment is moderate.

Description: In this task, a warfighter completes three exercises in a virtual reality simulation convoy trainer. The exercises include serving as a 50-caliber gunner and communicating a SALUTE report, serving as a driver, including identification of RPGs (rocket-propelled grenades) and IEDs (improvised explosive devices), and serving as vehicle command (VC) communicating with squad and radio communication to Tactical Operations Center (TOC). Complexity is progressively increased in each exercise as enemy engagement and mission route difficulty is increased.

Domain(s) assessed:

> **Vestibular demands identified:** Virtual reality goggles utilized for the task can create dizziness from both vestibular response and secondary response to anxiety from realism.
>
> **Cognitive demands identified:** Spatial orientation, visual memory, oculomotor control (acuity and saccades), sustained attention, and working memory.
>
> **Psychological demands identified:** Virtual reality goggles utilized for the task can create dizziness from both vestibular response and secondary response to anxiety from realism.

Equipment needed:

- Virtual Convoy Operations Trainer

Time to administer: 60–90 minutes for a group of 3

Administration instructions: See SOP (Appendix J).

Scoring instructions: See SOP (Appendix J).

Scoring/interpretation: Scale of 1 (performance is accurate and within military standards) to 5 (task could not be completed by warfighter) (Appendix K).

Reference citation:

Thurman, N. (November, 2011). *Fort Campbell's TBI clinic validates patient rehabilitation*. Retrieved from https://www.army.mil/article/69312/fort_campbells_tbi_clinic_validates_patient_rehabilitation.

Task: Shoot/No-Shoot Scenarios

Summary: The Shoot/No-Shoot Scenarios (in an Engagement Skills Trainer 2000) is a component of the MFAP, created and administered at Fort Campbell, KY. It incorporates elements that may highlight aspects of vestibular (performance ratings correlate with Dizziness Handicap Inventory scores [page 57]), visual, cognitive, and psychological function, revealing deficits important to successful military performance, thus informing RTD decisions. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD. Preliminary research suggests that agreement between raters on this task/assessment is low.

Description: In this task, the warfighter completes a set of collective, interactive videotaped scenarios with the marksmanship trainer that place the warfighter in lifelike shooting scenarios requiring on-the-spot judgment.

Domain(s) assessed:

> **Vestibular demands identified:** Positional tolerance. Visual stimulation through intense distance focus with accommodative function to transition from sight posts to target acquisition.
>
> **Vision demands identified:** Acuity, recognition, accommodation, depth perception (however, not stereopsis)
>
> **Cognitive demands identified:** Processing speed, sound localization, decision making, inhibition response, problem solving, and fixation.
>
> **Psychological demands identified:** Simulated weapons trainer may provoke an anxiety response.

Equipment needed:

- Engagement Skills Trainer 2000

Time to administer: 30 minutes

Administration instructions: See SOP (Appendix J).

Scoring instructions: See SOP (Appendix J).

Scoring/interpretation: Scale of 1 (performance is accurate and within military standards) to 5 (task could not be completed by warfighter) (Appendix K).

Reference citation:

Thurman, N. (November, 2011). *Fort Campbell's TBI clinic validates patient rehabilitation*. Retrieved from https://www.army.mil/article/69312/fort_campbells_tbi_clinic_validates_patient_rehabilitation.

Task: IED Lane – Tactical Mission Scenario

Summary: The IED Lane – Tactical Mission Scenario is a component of the MFAP, created and administered at Fort Campbell, KY. It incorporates elements that may highlight aspects of vestibular (performance ratings correlate with Dizziness Handicap Inventory [page 57] and Sensory Organization Test [page 41] scores), visual, cognitive, and psychological function, revealing deficits important to successful military performance, thus informing RTD decisions. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD. Preliminary research suggests that agreement between raters on this task/assessment is low.

Description: This task is a group activity where the squad completes a real-time simulation under field conditions involving ambush with paintballs (squad is capable of returning fire with paintball rounds). The squad must move casualties out of combat/IED lanes to a safe location and address injuries.

Domain(s) assessed:

> **Vestibular Demands Identified:** Task performed on uneven surfaces (gravel road, small incline/decline ditch), mud, and loose surfaces (leaves/debris). Task requires participant to perform short sprints and "bound" forward toward enemy fire while seeking cover/shelter behind immobilized vehicles or other large objects. Vision is somewhat obstructed through use of safety facemasks.
>
> **Vision Demands Identified:** Acuity, recognition, accommodation, and depth perception.
>
> **Cognitive Demands Identified:** Vision (acuity, recognition, accommodation, depth perception), processing speed, sound localization, decision making, inhibition response, problem solving, and fixation.
>
> **Psychological Demands Identified:** Simulated combat environment may evoke an anxiety response.

Equipment needed:

- Paintball guns
- Paintballs
- Safety glasses
- IED simulator
- .50 caliber simulator
- Opposing force participates (confederates)
- Aid bag (Sam Splint, ace wrap, gauze)

Time to administer: 90 minutes for a group of up to 6

Administration instructions: See SOP (Appendix J).

Scoring instructions: See SOP (Appendix J).

Scoring/interpretation: Scale of 1 (performance is accurate and within military standards) to 5 (task could not be completed by warfighter) (Appendix K).

Reference citation:

Thurman, N. (November, 2011). *Fort Campbell's TBI clinic validates patient rehabilitation*. Retrieved from https://www.army.mil/article/69312/fort_campbells_tbi_clinic_validates_patient_rehabilitation.

Task: Medical Simulation Training Center – Mass Casualty Scenario

Summary: The Medical Simulation Training Center – Mass Casualty Scenario is a component of the MFAP, created and administered at Fort Campbell, KY. It incorporates elements that may highlight aspects of vestibular (performance ratings correlate with Dizziness Handicap Inventory [page 57] and Sensory Organization Test [page 41] scores), visual, cognitive, and psychological function, revealing deficits important to successful military performance, thus informing RTD decisions. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD. Preliminary research suggests that agreement between raters on this task/assessment is low.

Description: This task is composed of three phases, each increasing in environmental stress (crawl-walk-run). This real-time simulation task is completed individually in a medical training environment where participant must treat lifelike mannequins. These mannequins cannot move on their own in the first phase. In the second and third phases, the mannequins are powered electronically to perform "life-like" movements.

Domain(s) assessed:

Vestibular demands identified: Environmental exposures include darkness with smoke and flashlights, loud distracting noises, elevated temperatures (approximately 90 degrees), slick floors from fake blood as well as tripping hazards from "blast" simulation debris up to and including dismembered body parts. The participant is required to locate casualty and manage interventions from equipment in aid bag. Participant adjusts from kneeling to standing (and vice versa) repeatedly to care for casualty and reposition the casualty for safety.

Vision demands identified: Vergence, saccades, pursuit.

Cognitive demands identified: Processing speed, working memory, short-term memory recall, attention (sustained and alternating).

Psychological Demands Identified: Simulated combat environment may evoke an anxiety response.

Equipment needed:

- Moulage
- Strobe lamp
- Manikins
- Stereo
- Flashlight
- Fog machine
- Aid bag (Sam Splint, ace wrap, gauze)
- Interceptor body armor and advanced combat helmet

Time to administer: 120 minutes for a group of 3

Administration instructions: See SOP (Appendix J).

Scoring instructions: See SOP (Appendix J).

Scoring/interpretation: Scale of 1 (performance is accurate and within military standards) to 5 (task could not be completed by warfighter) (Appendix K).

Reference citation:

Thurman, N. (November, 2011). *Fort Campbell's TBI clinic validates patient rehabilitation*. Retrieved from https://www.army.mil/article/69312/fort_campbells_tbi_clinic_validates_patient_rehabilitation.

Task: Weapons Qualification

Summary: The Weapons Qualification is a component of the MFAP, created and administered at Fort Campbell, KY. It incorporates elements that may highlight aspects of vestibular (performance ratings correlate with Dizziness Handicap Inventory [page 57], Sensory Organization Test [page 41], and Dynamic Visual Acuity [page 47] scores), cognitive, and psychological function, revealing deficits important to successful military performance, thus informing RTD decisions. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD. Preliminary research suggests that agreement between raters on this task/assessment is low.

Description: In this task, warfighter must zero weapon on the EST 2000 and complete 40-shot qualification task.

Domain(s) assessed:

Vestibular demands identified: Positional tolerance (prone weapon supported and unsupported); kneeling, and standing. Visual stimulation through intense distance focus with accommodative function to transition from sight posts to target acquisition.

Vision demands identified: Acuity, recognition, accommodation, depth perception (however, not stereopsis).

Cognitive demands identified: Processing speed, sound localization, decision making, inhibition response, problem solving, fixation.

Psychological demands identified: Simulated weapons trainer may provoke an anxiety response.

Equipment needed:

- Engagement Skills Trainer 2000

Time to administer: 60 minutes for a group of up to 6

Administration instructions: See SOP (Appendix J).

Scoring instructions: See SOP (Appendix J).

Scoring/interpretation: Scale of 1 (performance is accurate and within military standards) to 5 (task could not be completed by warfighter) (Appendix K).

Reference citation:

Thurman, N. (November, 2011). *Fort Campbell's TBI clinic validates patient rehabilitation*. Retrieved from https://www.army.mil/article/69312/fort_campbells_tbi_clinic_validates_patient_rehabilitation.

Dynamic Marksmanship Battery Tasks

The Dynamic Marksmanship Battery consists of four tasks and was developed by researchers at the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL. The tasks require a weapons simulator (Engagement Skills Trainer 2000) which may be available on other military installations. Modifications to reduce resources required to administer these tasks have not been studied as of publication. The tasks were designed to mimic naturalistic movements given that static shooting positions are not representative of the shooting positions used in combat situations. Design of the tasks was based on the Berg Balance Scale, Dynamic Gait Index, and Functional Gait Assessment. Evaluation of the tasks has included testing with a normal, healthy military population as well TBI patients displaying vestibular symptoms to varying degrees. Qualitative evaluation (i.e., observed instability, falls, trips) is warranted but has not been validated as have been the quantitative performance outcomes (i.e., throughput, accuracy, and reaction time).

It is important to note that ability and performance on these tasks vary greatly in a normal, healthy military population depending on individual marksmanship skills, military occupational series (MOS), and frequency of marksmanship training. These tasks are presented in order from strongest to weakest scientific support.[*] These tasks are designed to provide additional supplemental information for RTD decision makers. Normative data have not been established for these tasks. However, if overall marksmanship ability is known, then accuracy on these tasks may be useful to identify impact of vestibular disturbances on a military relevant task. Also, these tasks may help identify the impact of vestibular disturbances through visual indices of imbalance (e.g., stumble, falls).

[*] Note that two tasks from the original battery are not presented as the scientific evidence does not support utility of these tasks.

Task: Kneel and Shoot

Summary: The Kneel and Shoot is a component of the Dynamic Marksmanship Battery, created by USAARL, Fort Rucker, AL. It incorporates elements that may highlight aspects of vestibular function, revealing deficits important to successful military performance, thus informing RTD decisions. Preliminary research suggests that performance on this task is stable across repeated administration and can distinguish between those with and without vestibular disturbance. Satisfactory performance may reassure decision makers and military leaders that a warfighter is able to RTD.

Description: Perform kneeling portion of U.S. Army standard weapons qualification with a narrow stance (knee to heel).

Figure 2. Kneel and Shoot.

Domain(s) assessed:

Vestibular demands identified: Positional tolerance. Head movements.

Equipment needed:

- Engagement Skills Trainer 2000

Time to administer: 10 minutes

Administration instructions: Per Lawson et al., 2016, instructions for administration and set-up are summarized as follows.

- Participant instructions:
  Stay aimed at last target until next pops up
  Kneel at location (90 inches from screen)

- EST Scenario:
  3 lane configuration
  1 target at a time, 10 targets total, targets appear at 75m;
  Targets appear at extremes of lane width
  Target appear for 2 seconds, 2 seconds between targets

Scoring instructions: Scoring based on performance with respect to reaction time, accuracy, and throughput (shots per second).

Scoring/interpretation: Higher reaction times indicate poorer performance. Higher throughput and accuracy suggest stronger performance. Normative data have not been established.

Reference citations:

Grandizio, C., Lawson, B., King, M., Cruz, P., Kelley, A., Erickson, B., ... & Chiaramonte, J. (2014). *Development of a Fitness-for-Duty Assessment Battery for Recovering Dismounted Warriors.* USAARL Technical Report No. 2014-18.

Lawson, B., Ranes, B., Kelley, A.M., Erickson, B., Milam, L., King, M., ... & Campbell, J. (2016). *Mild Traumatic Brain Injury and Dynamic Simulated Shooting Performance.* USAARL Technical Report No. 2016-16.

Task: Traverse Beam and Shoot

Summary: The Traverse Beam and Shoot is a component of the Dynamic Marksmanship Battery, created by USAARL, Fort Rucker, AL. It incorporates elements that may highlight aspects of vestibular function, revealing deficits important to successful military performance, thus informing RTD decisions. Preliminary research suggests that performance on this task is somewhat stable across repeated administration and can distinguish between those with and without vestibular disturbance. Satisfactory performance may reassure decision makers and military leaders that a warfighter may RTD.

Description: Walk on narrow beam parallel to screen, fire as many accurate shots as possible at target.

Figure 3. Traverse Beam and Shoot.

Domain(s) assessed:

Vestibular demands identified: Balance required to traverse beam. Head movements.

Equipment needed:

- Engagement Skills Trainer 2000
- Beam (suggested dimensions are 4” wide, 16’ long, 5” high)

Time to administer: 5 minutes

Administration instructions: Per Lawson et al. (2016), instructions for administration and set-up are summarized as follows.

- Participant instructions:
  Goal is to walk across the beam as quick as possible while accurately hitting all targets.

- EST Scenario:
  3 lane configuration
  4 targets from left to right
  Targets appear at 25m

Scoring instructions: Scoring based on performance with respect to reaction time, accuracy, and throughput (shots per second).

Scoring/interpretation: Higher reaction times indicate poorer performance. Higher throughput and accuracy suggest stronger performance. Normative data have not been established.

Reference citations:

Grandizio, C., Lawson, B., King, M., Cruz, P., Kelley, A., Erickson, B., ... & Chiaramonte, J. (2014). *Development of a Fitness-for-Duty Assessment Battery for Recovering Dismounted Warriors.* USAARL Technical Report No. 2014-18.

Lawson, B., Ranes, B., Kelley, A.M., Erickson, B., Milam, L., King, M., ... & Campbell, J. (2016). *Mild Traumatic Brain Injury and Dynamic Simulated Shooting Performance.* USAARL Technical Report No. 2016-16.

Task: Pickup and Shoot

Summary: The Pickup and Shoot is a component of the Dynamic Marksmanship Battery, created by USAARL, Fort Rucker, AL. It incorporates elements that may highlight aspects of vestibular function, revealing deficits important to successful military performance, thus informing RTD decisions. Preliminary research suggests that performance on this task is somewhat stable across repeated administration and can distinguish between those with and without vestibular disturbance. Satisfactory performance may reassure decision makers and military leaders that a warfighter is able to RTD.

Description: Pick up weapon from floor, aim and shoot at target at top of screen as quickly as possible; place weapon back on ground and await instructions to pick up and shoot again.

Figure 4. Pickup and Shoot.

Domain(s) assessed:

Vestibular demands identified: Head movements and transition to pick-up weapon.

Equipment needed:

- Engagement Skills Trainer 2000

Time to administer: 5 minutes

Administration instructions: Per Lawson et al. (2016), instructions for administration and set-up are summarized as follows.

- Participant instructions:
  Pick up rifle with 2 hands
  Center behind projector
  Start facing perpendicular to screen

- EST Scenario:
  3 lane configuration
  1 target at top of screen, maximum of 2 shots allowed
  Altitude set at 7 and -3
  Targets appear at 40m

Scoring instructions: Scoring based on performance with respect to reaction time, accuracy, and throughput (shots per second).

Scoring/interpretation: Higher reaction times indicate poorer performance. Higher throughput and accuracy suggest stronger performance. Normative data have not been established.

Reference citations:

Grandizio, C., Lawson, B., King, M., Cruz, P., Kelley, A., Erickson, B., ... & Chiaramonte, J. (2014). *Development of a Fitness-for-Duty Assessment Battery for Recovering Dismounted Warriors.* USAARL Technical Report No. 2014-18.

Lawson, B., Ranes, B., Kelley, A.M., Erickson, B., Milam, L., King, M., ... & Campbell, J. (2016). *Mild Traumatic Brain Injury and Dynamic Simulated Shooting Performance.* USAARL Technical Report No. 2016-16.

Assessment of Military Multitasking Performance

The Assessment of Military Multitasking Performance (AMMP) is a program that was developed by researchers and physical therapists at the Courage Kenny Research Center, Minneapolis, MN, with input from military medical and non-medical personnel. The tasks have been evaluated with a military population as well as with TBI patients. Modifications to simplify the administration of these tasks have not been studied as of publication. Administration instructions and further details are provided in Appendix L. The AMMP tasks provide additional supplemental information for RTD decision makers.[*] Normative data have not been established for these tasks.

Assessment: Patrol-exertion

Summary: The Patrol-exertion task is a component of the AMMP program, created and administered by the Courage Kenny Research Center, Minneapolis, MN. The task is a simulated patrol task in a virtual Afghanistan environment. It incorporates elements that may highlight aspects of visual function, revealing deficits important to successful military performance, thus informing RTD decisions. Satisfactory performance of these tasks may reassure decision makers and military leaders that a warfighter may RTD. Research suggests that the level of agreement between raters on this task/assessment is good.

Description: The warfighter is challenged to gather intelligence in a recorded video depicting a virtual Afghanistan patrol environment while reporting observed IED markers based on a briefing provided at the beginning of the video. The warfighter then uses the information to answer specific questions from memory at the end of the patrol video. The warfighter performs continuous step-ups on an exercise step at an intensity of 65–85% of heart rate (HR) maximum throughout the activity while being monitored for effort level via a Polar HR monitor and performance observation. The warfighter wears a combat helmet, eye protection, and carries a simulated M16 weapon equipped with a trigger switch connected via Bluetooth to a computer configured to record reaction time (RT). The warfighter is required to press the switch each time a beep tone stimulus is heard throughout the video as a measure of RT during a divided attention multitask.

Domain(s) assessed:

Vision demands identified: Scanning

Equipment needed:

- Laptop
- Video monitor
- Helmet
- Simulated weapon

[*] Note that two tasks from the original battery are not presented as the scientific evidence does not support utility of these tasks.

- Patrol video
- Audio-recorder
- Eye-protection
- Audio speakers
- Aerobics step
- Heart-rate monitor with chest strap

Time to administer: Approximately 30 minutes

Administration instructions: See Administration manual (Appendix L).

Scoring instructions: See Administration manual (Appendix L).

Scoring/interpretation: Scored on scale of 0 (does not do task) to 2 (100% accurate). Normative data have not been established.

Reference citation:

Radomski, M. V., Weightman, M. M., Davidson, L. F., Finkelstein, M., Goldman, S., McCulloch, K., Roy, T. C., Scherer, M., & Stern, E. B. (2013). Development of a measure to inform return-to-duty decision making after mild traumatic brain injury. *Military Medicine, 178*(3), 246-253.

Assessment: Charge of Quarter Duty

Summary: The Charge of Quarter Duty is a component of the AMMP program, created and administered by the Courage Kenny Research Center, Minneapolis, MN. The task mimics charge of quarter duty thus providing ecological validity (or relevance to real-life military duties). It incorporates elements that may highlight aspects of cognitive function (performance correlates with clinical assessments of executive function, planning, and attention), revealing deficits important to successful military performance, thus informing RTD decisions. Research suggests that the level of agreement between raters on this task/assessment is good. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD.

Description: The warfighter is challenged to develop and execute a work plan for completing an array of interleaving tasks (supply inventory, PVC foot stool assembly, providing information to superiors, prospective memory tasks) associated with his/her hypothetical assignment to Charge of Quarters Duty.

Domain(s) assessed:

Cognitive demands identified: Memory, attention

Equipment needed:

- Clipboard
- Pencils
- Stopwatch
- Blue painters tape
- Administration manual and score sheet
- Tape measure

Time to administer: Approximately 30 minutes

Administration instructions: See Administration manual (Appendix L).

Scoring instructions: See Administration manual (Appendix L).

Scoring/interpretation: Scored on scale of 0 (does not do task) to 2 (100% accurate). Normative data have not been established.

Reference citations:

Radomski, M. V., Weightman, M. M., Davidson, L. F., Finkelstein, M., Goldman, S., McCulloch, K., Roy, T. C., Scherer, M., & Stern, E. B. (2013). Development of a measure to inform return-to-duty decision making after mild traumatic brain injury. *Military Medicine, 178*(3), 246-253.

Scherer, M. R., Weightman, M. M., Radomski, M. V., Davidson, L. F., & McCulloch, K. L.(2013). Returning service members to duty following mild traumatic brain injury: exploring the use of dual-task and multitask assessment methods. *Physical Therapy*, *93*(9), 1254-12.

Assessment: Instrumented Stand and Walk – Grid Coordinates

Summary: The Instrumented Stand and Walk – Grid Coordinates is a component of the AMMP program, created and administered by the Courage Kenny Research Center, Minneapolis, MN. The task is a simulated patrol mission briefing. It incorporates elements that may highlight aspects of cognitive function (performance correlates with clinical assessments of memory/attention), revealing deficits important to successful military performance, thus informing RTD decisions. Research suggests that the level of agreement between raters on this task/assessment is good and that performance on the task distinguishes between injured and uninjured warfighters. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD.

Description: The warfighter is challenged to perform the Instrumented Stand and Walk (ISAW) test (developed by APDM Wearable Technologies, Inc.), which includes an instrumented and timed assessment of quiet standing for 30 seconds, assessment of dynamic stability during walking for two 7 m (23 foot) lengths with a 180 degree turn at midpoint. The warfighter will next memorize an 8-digit alphanumeric grid coordinate provided within the context of a simulated patrol mission brief and report the exact sequence back to the examiner after 45 seconds. Finally, both the ISAW and the grid memorization tasks are performed simultaneously. Accuracy of grid coordinate recall, postural sway area, gait path variability, and time to complete the ISAW (i.e., gait speed) are measured in single and dual-task conditions.

Domain(s) assessed:

Cognitive demands identified: Memory, attention

Equipment needed:

- Clipboard
- Pencils
- Stopwatch
- Blue painters tape
- Administration manual and score sheet
- Opal or NexGen inertial sensor, software, and wireless data collection port with computer

Time to administer: Approximately 18 minutes

Administration instructions: See Administration manual (Appendix L).

Scoring instructions: See Administration manual (Appendix L).

Scoring/interpretation: Accuracy and time to complete. Normative data have not been established.

Reference citation:

Radomski, M. V., Weightman, M. M., Davidson, L. F., Finkelstein, M., Goldman, S., McCulloch, K., Roy, T. C., Scherer, M., & Stern, E. B. (2013). Development of a measure to inform return-to-duty decision making after mild traumatic brain injury. *Military Medicine, 178*(3), 246-253.

Assessment: Load Magazine – Radio Chatter

Summary: The Load Magazine – Radio Chatter is a component of the AMMP program, created and administered by the Courage Kenny Research Center, Minneapolis, MN, and mimics basic warfighter tasks. It incorporates elements that may highlight aspects of cognitive performance (correlates with total score on the Repeatable Battery for the Assessment of Neuropsychological Status [page 22] and auditory function), revealing deficits important to successful military performance, thus informing RTD decisions. Research suggests that the level of agreement between raters on this task/assessment is good and performance on the task distinguishes between injured and uninjured warfighters. Satisfactory performance of this task may reassure decision makers and military leaders that a warfighter may RTD.

Description: The warfighter completes a relatively automatic manual task choosing from a bin of mixed size dummy rounds (5.56 and 7.62 caliber) and loading 5.56-caliber training rounds into magazines as fast as possible both in a single and in a dual task condition. The dual-task condition requires monitoring radio communication and verbally announcing when radio chatter is relevant to scenario instructions.

Domain(s) assessed:

Cognitive demands identified: Executive function, attention

Auditory demands identified: Auditory to signal-to-noise ratio

Equipment needed:

- 2 1-gallon open bins or tubs
- 100 snap cap dummy rounds (M16)
- Cue sheets
- Speakers to play radio chatter audio files at sufficient volume
- 5 magazines for M16 caliber weapon
- 100 snap cap dummy rounds (M16)
- Radio chatter Audio files (3 versions of prerecorded ambient mock radio chatter)
- Computer or audio-player such as an I-pod or MP3 player
- 50 snap cap dummy rounds (M20) as foils

Time to administer: Approximately 22 minutes

Administration instructions: See Administration manual (Appendix L).

Scoring instructions: See Administration manual (Appendix L).

Scoring/interpretation: Time to complete, total correct, total distractors/errors. Normative data have not been established.

Reference citation:

Radomski, M. V., Weightman, M. M., Davidson, L. F., Finkelstein, M., Goldman, S., McCulloch, K., Roy, T. C., Scherer, M., & Stern, E. B. (2013). Development of a measure to

inform return-to-duty decision making after mild traumatic brain injury. *Military Medicine*, *178*(3), 246-253.

References

Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment, 6*(4), 284.

Cooper, D. B., Chau, P. M., Armistead, P., Vanderploeg, R. D., & Bowles, A. O. (2012). Relationship between mechanism of injury and neurocognitive functioning in OEF/OIF service members with mild traumatic brain injuries. *Military Medicine, 177*(10), 1157-1160.

Cooper, D. B., Mercado-Couch, J. M., Critchfield, E., Kennedy, J., Vanderploeg, R. D., DeVillibis, C., & Gaylord, K. M. (2010). Factors influencing cognitive functioning following mild traumatic brain injury in OIF/OEF burn patients. *NeuroRehabilitation, 26*(3), 233-238.

Craig, R. J. (1999). Overview and status of the Millon Clinical Multiaxial Inventory. *Journal of Personality Assessment, 72*, 390-406.

Craig, R. J., & Olson, R. (1997). Assessing PTSD with the Millon Clinical Multiaxial Inventory-III. *Journal of Clinical Psychology, 53*(8), 943-952. doi:10.1002/(SICI)1097-4679(199712)53:8<943::AID-JCLP20>3.0.CO;2-J

Davidson, M. (2014). Known-groups validity. In *Encyclopedia of Quality of Life and Well-Being Research* (pp. 3481-3482). Springer Netherlands.

Estrada, A., Crowley, J. & Stokes, E. (2013). Proceedings of the Military Operational Research Program Return-to-Duty Research Workshop Group Meeting. 19-20 September 2012. USAARL Technical Report No. 2013-15.

Galetta, K. M., Mengling, L., Leong, D. F., Ventura, R. E., Galetta, S. L., & Balcer, L. J. (2016). The King-Devrick test of rapid number naming for concussion detection: Meta-analysis and systematic review of the literature. *Concussion, 1*(2).

Grandizio, C., Lawson, B., King, M., Cruz, P., Kelley, A., Erickson, B., ... & Chiaramonte, J. (2014). Development of a Fitness-for-Duty Assessment Battery for Recovering Dismounted Warriors. USAARL Technical Report No. 2014-18.

Grills, C. E., & Armistead-Jehle, P. (2016). Performance validity test and neuropsychological assessment battery screening module performances in an active-duty sample with a history of concussion. *Applied Neuropsychology: Adult, 23*(4), 295-301.

Kelley, A. M., Ranes, B. M., Estrada, A., & Grandizio, C. M. (2015). Evaluation of the Military Functional Assessment Program: Preliminary assessment of the construct validity using an archived database of clinical data. *Journal of Head Trauma Rehabilitation, 30*(4), E11-E20.

Kelley, A.M., Estrada, A., King, M., Erickson, B., Hayes, A., & Basso, J. (2017). Proceedings of the Military Operational Medicine Research Program Return To Duty (RTD) toolkit expert

panel workshop, 16–17 February 2017. USAARL Technical Report No. 2017-15.

Kelley, A.M., Ranes, B., Thornson, C., King, M., Erickson, Chiaramonte, J., & Showers, M. (2018). *Evaluation of the Military Functional Assessment Program: A longitudinal study*. (Report No. 2018-03). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Leary, M. R. (2016). *Introduction to behavioral research methods*. Pearson.

Management of Post-Traumatic Stress Working Group. (2010). VA/DoD clinical practice guideline for management of post-traumatic stress. Washington (DC): Veterans Health Administration, Department of Defense, 1-251.McKay, C., Casey, J. E., Werteimer, J., & Fichtenberg, N. L. (2007). Reliability and validity of the RBANS in a traumatic brain injured sample. *Archives of Clinical Neuropsychology, 22*(1), 91-98. doi: 10.1016/j.acn.2006.11.003.

Meeker, M., Du, R., Bacchetti, P., Privitera, C. M., Larson, M. D., Holland, M. C., & Manley, G.(2005). Pupil examination: Validity and clinical utility of an automated pupillometer.*Journal of Neuroscience Nursing, 37*(1), 34-40.

Millon, T. (2006). *Millon Clinical Multiaxial Inventory-III (MCMI-III) manual* (3rd ed.).Minneapolis, MN: Pearson Assessments.

Morey, L. C. (1991). *The Personality Assessment Inventory: Professional manual*. Odessa, FL: Personality Assessment Resources.

Nelson, L. D., LaRoche, A. A., Pfaller, A. Y., Lerner, E. B., Hammeke, T. A., Randolph, C., ... & McCrea, M. A. (2016). Prospective, head-to-head study of three computerized neurocognitive assessment tools (CNTs): reliability and validity for the assessment of sport-related concussion. *Journal of the International Neuropsychological Society, 22*(1), 24-37.

Parikh, R., Mathai, A., Parikh, S., Sekhar, G. C., & Thomas, R. (2008). Understanding and using sensitivity, specificity and predictive values. *Indian Journal of Ophthalmology, 56*(1), 45.

Plach, H. P., & Sells, C. H. (2013). Occupational performance needs of young veterans. *The American Journal of Occupational Therapy, 67*, 73-81. doi: 10.501/ajot.2013.003871

Rizzo, J., Hudson, T., Dai, W., Birkemeier, J., Pasculli, R. M., Selesnick, I., … Rucker, J. C. (2016). *Annals of Clinical and Translational Neurology, 3*(10), 801-811. doi: 10.1002/acn3.345

Rousson, V., Gasser, T., & Seifert, B. (2002). Assessing intrarater, interrater and test–retest reliability of continuous measurements. *Statistics in Medicine, 21*(22), 3431-3446.

Schinka, J. A. (2010). Personality Assessment Inventory scale characteristics and factor structure in the assessment of alcohol dependency. *Journal of Personality Assessment, 64*(1), 101-111.

Smith, L. B., Radomski, M. V., Davidson, L. F., Finkelstein, M., Weightman, M. M., Scherer,

M. R., & McCulloch, K. (2014). Development and preliminary reliability of a multitasking assessment following concussion. *American Journal of Occupational Therapy, 68,* 439-443.

Stepanek, J., Pradhan, G. N., Cocco, D., Smith, B. E., Bartlett, J., Studer, M., … Cevette, M. J. (2014). Acute hypoxic hypoxia and isocapnic hypoxia effects of oculometric features. *Aviation, Space, and Environmental Medicine, 85*(7), 700-707. doi: 10..3357/ASEM.3645.2014

Strack, S., & Millon, T. (2007). Contribution to the dimensional assessment of personalitydisorders using Millon's model and the Millon Clinical Multiaxial Inventory (MCMI-III). *Journal of Personality Assessment, 89*(1), 56-69.

Streiner, D. L. (2003). Starting at the beginning: an introduction to coefficient alpha and internal consistency. *Journal of Personality Assessment, 80*(1), 99-103.

Thornson, C., Basso, J., McCulley, N., & King, M. (2016). Proceedings of the Military Operational Medicine Research Program Return-to-Duty Toolkit Working Group Symposium, 1-2 September 2015. USAARL Technical Report No. 2016-21.

Zgaljardic, D. J., & Temple, R. O. (2010). Reliability and validity of the Neuropsychological Assessment Battery-Screening Module (NAB-SM) in a sample of patients with moderate-to-severe acquired brain injury. *Applied Neuropsychology, 17*(1), 27-36.

Appendix A. Term Definitions

The following terms are used throughout the report. For your convenience, we provide a definition of each here.

Term	Definition
Objective assessment	The assessment or task yields a measurement of an observable behavior or performance. Scores cannot be influenced by opinions and/or bias of the patient. Scores may be influenced by lack of motivation or intentional poor performance.
Subjective assessment	The assessment or task yields a measurement that is, at least in part, possible to be influenced by the opinions, motivation, and/or bias of the patient. These are primarily self-report.
Validity	The extent to which the instrument measures what it is intended to measure (Leary, 2008)
Sensitivity	The accuracy of a measure to correctly identify individuals with a condition or variable of interest (Parikh, Mathai, Parikh, Sekhar, & Thomas, 2008)
Specificity	The accuracy of a measure to correctly identify individuals without a condition or variable of interest (Parikh, Mathai, Parikh, Sekhar, & Thomas, 2008)
Known-groups	The extent to which a measure can discriminate between two groups known to differ on the construct/variable of interest (Davidson, 2014)
Construct	The extent to which measurements relate to measurements from other valid instruments (Leary, 2008)
Convergent	Measurements relate positively to measurements from instruments of the same construct (Leary, 2008)
Divergent	Measurements do not relate to measurements from instruments of conceptually different constructs (Leary, 2008)

Criterion	The extent to which measurements distinguish between individuals based on a behavioral criterion (Leary, 2008)
Concurrent	Agreement of measurements with behavioral criterion determined by independent, valid measure at the same time (Leary, 2008)
Predictive	The extent to which a measurement can distinguish between individuals on a behavior criterion at some point in the future (Leary, 2008)
Reliability	Consistency of scores/outcome measures or measurement technique (Leary, 2008)
Inter-rater	Consistency of scores/ratings between individual, independent raters (Leary, 2008)
Intra-rater	Consistency of scores/ratings by a single rater over repeated administration (Rousson, Gasser, & Seifert, 2002)
Internal consistency	The extent to which the items of an instrument/assessment measure the same construct (Streiner, 2003)
Test-retest	Consistency of an individual's scores/outcome measures over time or repeated administration (Leary, 2008)

Appendix B. Neurobehavioral Symptom Inventory

Neurobehavioral Symptom Inventory (NSI)

Please rate the following symptoms with regard to how much they have disturbed you IN THE LAST 2 Weeks.
The purpose of this inventory is to track symptoms over time. Please do not attempt to score.

0 = None – Rarely if ever present; not a problem at all

1 = Mild – Occasionally present, but it does not disrupt my activities; I can usually continue what I'm doing; doesn't really concern me.

2 = Moderate – Often present, occasionally disrupts my activities; I can usually continue what I'm doing with some effort; I feel somewhat concerned.

3 = Severe – Frequently present and disrupts activities; I can only do things that are fairly simple or take little effort; I feel I need help.

4 = Very Severe – Almost always present and I have been unable to perform at work, school or home due to this problem; I probably cannot function without help.

Symptoms	0	1	2	3	4
Feeling Dizzy	O	O	O	O	O
Loss of balance	O	O	O	O	O
Poor coordination, clumsy	O	O	O	O	O
Headaches	O	O	O	O	O
Nausea	O	O	O	O	O
Vision problems, blurring, trouble seeing	O	O	O	O	O
Sensitivity to light	O	O	O	O	O
Hearing difficulty	O	O	O	O	O
Sensitivity to noise	O	O	O	O	O
Numbness or tingling on parts of my body	O	O	O	O	O
Change in taste and/or smell	O	O	O	O	O
Loss of appetite or increased appetite	O	O	O	O	O
Poor concentration, can't pay attention, easily distracted	O	O	O	O	O
Forgetfulness, can't remember things	O	O	O	O	O
Difficulty making decisions	O	O	O	O	O
Slowed thinking, difficulty getting organized, can't finish things	O	O	O	O	O
Fatigue, loss of energy, getting tired easily	O	O	O	O	O
Difficulty falling or staying asleep	O	O	O	O	O
Feeling anxious or tense	O	O	O	O	O
Feeling depressed or sad	O	O	O	O	O
Irritability, easily annoyed	O	O	O	O	O
Poor frustration tolerance, feeling easily overwhelmed by things	O	O	O	O	O

Appendix C. Epworth Sleepiness Scale

Epworth Sleepiness Scale

Name: _____ Today's date: _____

Your age (Yrs): _____ Your sex (Male = M, Female = F): _____

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently try to work out how they would have affected you.

Use the following scale to choose the **most appropriate number** for each situation:

0 = would **never** doze
1 = **slight chance** of dozing
2 = **moderate chance** of dozing
3 = **high chance** of dozing

It is important that you answer each question as best you can.

Situation	**Chance of Dozing (0-3)**
Sitting and reading	___
Watching TV	___
Sitting, inactive in a public place (e.g. a theatre or a meeting)	___
As a passenger in a car for an hour without a break	___
Lying down to rest in the afternoon when circumstances permit	___
Sitting and talking to someone	___
Sitting quietly after a lunch without alcohol	___
In a car, while stopped for a few minutes in the traffic	

THANK YOU FOR YOUR COOPERATION

Appendix D. Insomnia Severity Index

Insomnia Severity Index

The Insomnia Severity Index has seven questions. The seven answers are added up to get a total score. When you have your total score, look at the 'Guidelines for Scoring/Interpretation' below to see where your sleep difficulty fits.

For each question, please CIRCLE the number that best describes your answer.

Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of your insomnia problem(s).

Insomnia Problem	None	Mild	Moderate	Severe	Very Severe
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problems waking up too early	0	1	2	3	4

4. How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
0	1	2	3	4

5. How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

Not at all Noticeable	A Little	Somewhat	Much	Very Much Noticeable
0	1	2	3	4

6. How WORRIED/DISTRESSED are you about your current sleep problem?

Not at all Worried	A Little	Somewhat	Much	Very Much Worried
0	1	2	3	4

7. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY?

Not at all Interfering	A Little	Somewhat	Much	Very Much Interfering
0	1	2	3	4

Guidelines for Scoring/Interpretation:

Add the scores for all seven items (questions 1 + 2 + 3 + 4 + 5 +6 + 7) = _____ your total score

Total score categories:
0–7 = No clinically significant insomnia
8–14 = Subthreshold insomnia
15–21 = Clinical insomnia (moderate severity)
22–28 = Clinical insomnia (severe)

Used via courtesy of www.myhealth.va.gov with permission from Charles M. Morin, Ph.D., Université Laval

Appendix E. King-Devick Test Administration Instructions

1. Subject should sit at a table and should be wearing corrective lenses if they need them.
2. Pace the demonstration card in front of the subject on the table. Ask the subject to call out all of the numbers on the card as quickly and as carefully as possible. During the demonstration, point to the upper left, then the second left hand number and the third number, etc.
3. Caution the subject not to use his/her finger as a marker during each of the tests.
4. Place card #1 in front of the subject
5. Use a stopwatch to identify the number of seconds it takes to complete each card.
6. Record number of errors as well
7. Repeat the process with the final two cards. Do not include the time between cards in the total time.

Appendix F. Vestibular Oculomotor Test (Vestibular Oculomotor Screening) Instructions

Baseline Symptoms – Record: Headache, Dizziness, Nausea & Fogginess on 0-10 scale prior to beginning screening

Smooth Pursuits - Test the ability to follow a slowly moving target. The patient and the examiner are seated. The examiner holds a fingertip at a distance of 3 ft. from the patient. The patient is instructed to maintain focus on the target as the examiner moves the target smoothly in the horizontal direction 1.5 ft. to the right and 1.5 ft. to the left of midline. One repetition is complete when the target moves back and forth to the starting position, and 2 repetitions are performed. The target should be moved at a rate requiring approximately 2 seconds to go fully from left to right and 2 seconds to go fully from right to left. The test is repeated with the examiner moving the target smoothly and slowly in the vertical direction 1.5 ft. above and 1.5 ft. below midline for 2 complete repetitions up and down. Again, the target should be moved at a rate requiring approximately 2 seconds to move the eyes fully upward and 2 seconds to move fully downward. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test.

Saccades – Test the ability of the eyes to move quickly between targets. The patient and the examiner are seated.

Horizontal Saccades: The examiner holds two single points (fingertips) horizontally at a distance of 3 ft. from the patient, and 1.5 ft. to the right and 1.5 ft. to the left of midline so that the patient must gaze 30 degrees to left and 30 degrees to the right. Instruct the patient to move their eyes as quickly as possible from point to point. One repetition is complete when the eyes move back and forth to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test.

Vertical Saccades: Repeat the test with 2 points held vertically at a distance of 3 ft. from the patient, and 1.5 feet above and 1.5 feet below midline so that the patient must gaze 30 degrees upward and 30 degrees downward. Instruct the patient to move their eyes as quickly as possible from point to point. One repetition is complete when the eyes move up and down to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test.

Convergence – Measure the ability to view a near target without double vision. The patient is seated and wearing corrective lenses (if needed). The examiner is seated front of the patient and observes their eye movement during this test. The patient focuses on a small target (approximately 14 point font size) at arm's length and slowly brings it toward the tip of their nose. The patient is instructed to stop moving the target when they see two distinct images or when the examiner observes an outward deviation of one eye. Blurring of the image is ignored. The distance in cm. between target and the tip of nose is measured and recorded. This is repeated a total of 3 times with measures recorded each time. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test. Abnormal: Near Point of convergence $\geq$ 6 cm from the tip of the nose.

Vestibular-Ocular Reflex (VOR) Test – Assess the ability to stabilize vision as the head moves. The patient and the examiner are seated. The examiner holds a target of approximately 14 point font size in front of the patient in midline at a distance of 3 ft.

Horizontal VOR Test: The patient is asked to rotate their head horizontally while maintaining focus on the target. The head is moved at an amplitude of 20 degrees to each side and a metronome is used to ensure the speed of rotation is maintained at 180 beats/minute (one beat in each direction). One repetition is complete when the head moves back and forth to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea and Fogginess ratings 10 sec after the test is completed.

Vertical VOR Test: The test is repeated with the patient moving their head vertically. The head is moved in an amplitude of 20 degrees up and 20 degrees down and a metronome is used to ensure the speed of movement is maintained at 180 beats/minute (one beat in each direction). One repetition is complete when the head moves up and down to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea and Fogginess ratings after the test.

Visual Motion Sensitivity (VMS) Test – Test visual motion sensitivity and the ability to inhibit vestibular-induced eye movements using vision. The patient stands with feet shoulder width apart, facing a busy area of the clinic. The examiner stands next to and slightly behind the patient, so that the patient is guarded but the movement can be performed freely. The patient holds arm outstretched and focuses on their thumb. Maintaining focus on their thumb, the patient rotates, together as a unit, their head, eyes and trunk at an amplitude of 80 degrees to the right and 80 degrees to the left. A metronome is used to ensure the speed of rotation is maintained at 50 beats/min (one beat in each direction). One repetition is complete when the trunk rotates back and forth to the starting position, and 5 repetitions are performed. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test.

Appendix G. Northeastern State University College of Optometry Administration and Scoring Instructions

- Administration:
  - Patients should be standing with feet shoulder width apart directly in front of the examiner.
  - Test distance from the patient should be no more than 40 cm and no less than the distance from the subject's middle knuckle to his/her elbow.
  - No instructions are given to the patient to move or not to move his/her head.
  - Patients view the targets binocularly
  - Movement of target
    - Directional:
      - Saccades are performed in the horizontal meridian only
      - Pursuits are performed rotationally both clockwise and counter clockwise
    - Distances:
      - Saccades should be performed with the targets at 10 cm on each side of the patient's midline.
      - Pursuit path should be approximately 20 cm in diameter. The upper and lower extent of the circular path should coincide with the patient's midline.
  - Saccades:
    - "When I say red (or color of target), look at the red ball. When I say green, look at the green ball. Remember, don't look until I tell you to"
    - Complete five round trips of saccades.
  - Pursuits:
    - "Watch the ball as it goes around. Try to see yourself in the ball. Don't ever take your eyes off the ball."
    - Complete two clockwise and two counterclockwise rotations
- **Scoring**:
  - Scoring is based on the examiner's ratings in four categories (ability, accuracy, head movement, body movement) ranging from 1 to 5 with 5 indicating better performance for both saccades and pursuits.

  - **Ability:** Can the patient keep his attention under control to complete five round trips for saccades and two clockwise and the two counter clockwise rotations for pursuits?
    - Saccades:
      - Completes less than two round trips
      - Completes two round trips
      - Completes three round trips
      - Completes four round trips
      - Completes five round trips
    - Pursuits

        - Cannot complete ½ rotation in either the clockwise or counterclockwise direction
        - Completes ½ rotation in either direction
        - Completes on rotation in either direction but not in two directions
        - Completes two rotation in one direction but less than two rotation in the other direction
        - Completes two rotations in each direction
- **Accuracy: Both pursuits and saccades are graded alike.** Can the patient accurate and consistently fixate so that no noticeable correction is needed in the case of saccades, or track the target that no noticeable fixation is needed when doing the pursuits?
    - Saccades:
        - Large over-or under shooting is noted one or more times
        - Moderate over- or undershooting noted at one or more times
        - Consistent slight over- or under shooting noted (greater than 50% of the time)
        - Intermittent slight over or under shooting noted (less than 50% of the time)
        - No over- or undershooting noted
    - Pursuits:
        - No attempt to follow the target or requires greater than 10-refixations
        - Re-fixations five to 10 times
        - Re-fixations three or four times
        - Re-fixation two times or less
        - No re-fixations
- **Head <u>and</u> body movement:** Can the patient accomplish the saccade or pursuit test without moving his/her head or body? Both Saccade and pursuit scoring use the same criteria for this aspect of the test.
    - Saccades and Pursuits:
        - Large movement of the head (body) at any time
        - Moderate movement of the head (body) at any time
        - Slight movement of the head (body) (greater than 50% of the time)
        - Slight movement of the head (body) (less than 50% of the time)
        - No movement of the head (body)

- Norms for age and sex are reported by Maples, Atchley, and Ficklin (1992). Scores below these indicate failure for adults (age >= 14).

Saccades

	Ability	Accuracy	Head movement	Body movement
Males	5	4	3	5
Females	5	3	4	5

Pursuits

	Ability	Accuracy	Head movement	Body movement
Males	5	5	4	5
Females	5	4	4	5

Appendix H. Patient Health Questionnaire – 9

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems? *(Use "✔" to indicate your answer)*	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING 0 + _____ + _____ + _____

=Total Score: _____

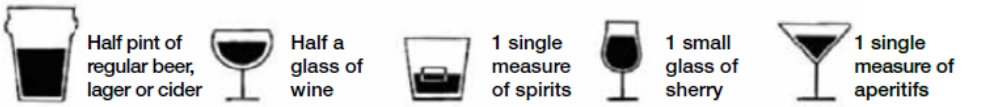
If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke and colleagues, with an educational grant from Pfizer Inc. No permission required to reproduce, translate, display or distribute.

Appendix I. Alcohol Use Disorder Identification Test

This is one unit

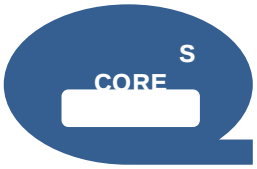


...and each of these is more than one

AUDIT	Scoring system					Your score
	0	1	2	3	4	
How often do you have a drink containing alcohol?	Never	Monthly or less	2 - 4 times per month	2 - 3 times per week	4+ times per week	
How many units of alcohol do you drink on a typical day when you are drinking?	0 -2	3 - 4	5 - 6	7 - 9	10+	
How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
How often during the last year have you found that you were not able to stop drinking once you had started?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
How often during the last year have you failed to do what was normally expected from you because of your drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
How often during the last year have you needed an alcoholic drink in the morning to get yourself going after a heavy drinking session?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
How often during the last year have you been unable to remember what happened the night before because you had been drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
Have you or somebody else been injured as a result of your drinking?	No		Yes, but not in the last year		Yes, during the last year	

Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested that you cut down?	No		Yes, but not in the last year		Yes, during the last year	

Scoring: 0 – 7 Lower risk, 8 – 15 Increasing risk, 16 – 19 Higher risk, 20+ Possible dependence



Appendix J. Military Functional Assessment Program Standard Operating Procedure

MFAP SOP

MCXD-TBI 27July2017

MEMORANDUM FOR RECORD

SUBJECT: Military Functional Assessment Program (MFAP) Standard Operating Procedures

TO: Medical Providers

1. References: FM 3-21.5, FM 3.22.9, FM 3-25.26, FM 4-25.11, FM 7-22; SMCT Task Numbers 031-503-1015, 071-100-0001, 071-100-0003, 071-100-0004, 071-100-0005, 071-100-0006, 071-100-0007, 071-100-0008, 071-329-1000, 071-329-1001, 071-329-1002, 071-329-1003, 071-329-1005, 071-329-1006, 071-329-1008, 071-329-1009, 071-329-1011, 071-440-0028, 081-831-1001, 081-831-1026, 081-831-1032, 113-57-1022, 071-326-3002, 071-326-0510, 071-326-0541, 071-326-0542, 071-410-0002, 081-831-1001, 081-831-1026, 081-831-1032, 081-831-1046, GTA (Government Training Aid) 55-03-030.

2. Establish Standard Operating Procedures for the Military Functional Assessment Program.

3. Scope: MFAP is a five day program that has been adopted at Fort Campbell, KY. It is under continual developments and refinement and it is understood that this program may be difficult to replicate at other locations due to the variable availability of and cooperation among the many parties involved. However, the concept of “performance validation” and “demonstrated competence” is central to occupational therapy intervention related to determining a service member’s readiness to return to duty.

4. Responsibilities and Procedures:

a. Summary:

(1) Using the well-known paradigm typical of wholistic Army training, MFAP activities may be more simplistic initially and followed by increased complexity resulting in a final grade of GO/NO GO. The progression of tasks most accurately replicates duty demands and therefore provides the most robust recommendation regarding RTD. Service members participate in both didactic and real-life application based training activities. Many of the training activates are those that are supported by the installation and regularly used by units for training. During the activities, Service members are evaluated based on overall performance and their level of independence. Military personnel (NCOIC), occupational therapy, physical therapy, and mental health providers assess behavior according to his/her scope of practice. Specifically, the military focuses on ability to perform tasks in compliance within military standards, occupational therapists comment on visual, cognitive, and fine motor skills; physical therapists comment on balance and vestibular reactions; and mental health provider comment on management of psychological stress and anxiety. See the Final Reports Grading Sheet (Appendix K).

(2) The MFAP sessions are arranged to present Service members with gradually increasing task complexity and psychological demand. In doing so, occupational therapists can assess the Service members' ability to generalize strategies learned and implemented on the clinic to approximations of real-world situations. Service members are monitored closely by mental health providers and participate in weekly biofeedback sessions to learn to actively control adverse reactions to stress. Likewise, if Service members display balance deficits that impact their task performance, they then participate in physical therapy sessions targeting compensatory strategies.

(3) The 'critical tasks' involved during MFAP are outlined below. Once again, it is important to note that this progression may not be possible to replicate everywhere based on the availability of the required training and equipment. Therefore, this task list may be modified to incorporate other common tasks that are deemed appropriate and for which resources are more readily available. It should be re-emphasized that tasks should address wholistic duty environment, which is to say, measuring 1 of 10 tasks as a determinant for RTD would be insufficient.

b. Performance Measures:

(1) It is important to note that the Final Reports Grading Sheet (Appendix K) is a tool developed specifically for the MFAP at Ft. Campbell, KY. It is not yet validated and is merely a proposed option for performance assessment. Overall Go/No-Go status for each program is documented and all involved providers meet to discuss patient performance and discharge recommendations. Each participant is then invited to meet with the team to go over these recommendations on an individual basis.

c. Activity Preparation:

(1) Each Soldier receives the following brief: “You have been selected to participate in a therapeutic program designed to determine your Post-Therapy status. This program will serve as the capstone of your therapy and will incorporate all elements of your rehabilitation thus far. The multi-disciplinary assessment team includes occupational therapy, physical therapy, and mental health. The physicians involved in your care will use input from participating therapists to customize your treatment and discharge plans, which may include returning you to duty or initiating an MOS/Medical Retention Board (MMRB) or Medical Evaluation Board (MEB).

(2) Each Soldier is given an orientation packet (can be provided by contacting undersigned) to complete and return prior to starting MFAP.

(3) The recommended equipment for the above-mentioned tasks include clipboards, stopwatches, compasses, protractors, military maps, training aids, mannequins, moulage, small arms generator and simulated IEDs from the Training Support Center, water cooler, sunscreen, bug spray, smoke machine, flashlights, paint ball guns, ACH, IBA, face shields and paintball guns (provided at the site). Access to the following training entities is also recommended: HMMWV Egress Assistance Trainer (HEAT), Engagement Skills Trainer (ETS), Virtual Convoy Operations Trainer (VCOT), Land Navigation course, and Medical Skills Training Center (MSTC).

5. MFAP Tasks:

a. Didactic review of Tactical Combat Casualty Care (TCCC) skills followed by practical exercise Warrior Task Battle Drills (WTBD):

(1) Review of TCCC via PowerPoint presentation and discussion. Practical exercises consist of basic casualty simulations to rehearse application of tourniquet, pressure dressing, and occlusive dressing for open chest wound to include the sequence in which a patient is to be assessed from initial arrival of the scene to the 9-line medevac request. Minimal environmental distractions/stressors are present to facilitate learning.

(a) Verbalizes understanding of the difference between the 3 levels of care:

i. Care under fire

ii. Tactical field care

iii. Casualty evacuation (CASEVAC)

(b) Able to correctly call up a 9-line medical evacuation (MEDEVAC) request based on given scenario(s)

(c) Utilize the use of a tourniquet if indicated

(d) Evaluates casualty using “CBA”

i. Checks circulation

ii. Checks breathing

iii. Checks airway

(e) Checks for exit wound

(f) Seals an open chest wound

(g) Opens and maintains airway

i. Head tilt, chin lift or jaw thrust (when appropriate)

(h) Identify and treat tension pneumothorax

(2) Physical tasks and demonstrated competence in drill and ceremony

(a) Complete group calisthenics and Army PRT preparation drill each exercise is led by a different Soldier. Borg's RPE scale is used to perform wind sprints of 50%-75%.

(b) Ladder drill in 3 sequences (forward, lateral, alternating lateral steps), log roll (3 each direction), and Army crawl maneuvers (low crawl, high crawl)

(c) Casualty drag on skedco 40 yards followed immediately by donning gas mask under 9 seconds.

(d) Utilize Appendices H & I (may be provided by contacting the undersigned).

(e) Document GO or NO-GO and calculate the average based on score out of 16 for Drill and Ceremony commands with a passing rating of more than 10 correct movements; also documenting any variances of performance based on patient's rank and time in service (TIS). Warrior Task Battle Drills are graded on the ability to follow directions, perform exercises, and recall proper military bearing/ exercise nomenclature.

b. HMMWV Egress Assistance Trainer (HEAT)

(a) Coordination for this event needs to be requested from the Hospital Schools NCO and logged into RFFMUS. Once the request is accepted then the site needs to be coordinated as soon as possible with HEAT personnel.

(b) Classroom instruction, to be given by the NICOE staff, on Division standards for rollover training and education with safety brief.

(c) Utilize patients by rank or MOS to help instruct class and evaluate their leadership skills.

(d) Implement three rollovers in accordance with 101st Division standards:

i. First rollover will go to 25 degrees for critical rollover with combat load, then 30 degrees to for critical rollover CONUS. There will be a mannequin embedded with the crew

at all times. During the rollover all Soldiers must yell “rollover”, try to secure the gunner and then brace for impact. The rollover will then go two complete rotations landing upside down at 180 degrees where the patients will implement proper techniques for egressing. After the rollover is complete the TC will obtain the status of his crew. Once outside the vehicle they will pull security and make proper radio contact.

ii. On the second rollover the Soldiers will be blindfolded and the machine will rotate two rotations landing upside down at 180 degrees. This will simulate night time driving or limited visibility and will also challenge the vestibular system. During the rollover all Soldiers must yell “rollover” and try to secure the gunner. After the rollover has stopped the Soldiers remain blindfolded and egress from the vehicle. After the rollover is complete the TC will obtain the status of his crew. Once outside the Vehicle they will pull security and make proper radio contact.

iii. On the third and final rollover the Soldiers are no longer blindfolded and the machine will roll two and a half rotations landing on its side. During the rollover all Soldiers must yell “rollover.” After the rollover has stopped the Soldiers will egress from the vehicle out the turret. After the rollover is complete the TC will obtain the status of his crew. Once outside the vehicle they will pull security and make proper radio contact. This rotation the Soldiers will have to evacuate the notional casualty to a CCP point behind the vehicle. Once at the CCP they must evaluate the casualty and treat them appropriately then call a 9-line for MEDEVAC.

c. High Ropes Confidence Course (The Odyssey)

(a) The purpose of this exercise is to identify each patient’s ability to work in a team, face their fears, and conquer them. The group will work as a team to navigate through both the lower and higher levels of the Odyssey with limited assistance using their safety devices while maintaining a group integrity approach to accomplishing the mission.

d. Land Navigation Preparation

(a) Patients will receive a refresher PowerPoint class on land navigation to include familiarization with terrain features, legend, scale, how to plot a point, measure the distance between two points, shoot an azimuth using map and protractor, shoot a back azimuth, measure distance on a road, and identify key landmarks on a map using pre-plotted points listed within the PowerPoint presentation through hands-on practical exercises.

(b) Each patient is evaluated on their ability to maintain their working memory, application of lessons learned throughout the presentation, and their cognitive ability to complete each task with limited amount of assistance.

e. Virtual Convoy Operations Trainer (VCOT)

(a) Patients will get into groups of three, each filling the role of a TC, gunner, and driver while completing three rotations for each new mission dictated by the NCOIC.

(b) The NCOIC will give the mission brief.

(c) Conduct each rotation while focusing on the patient's role in each position and their overall performance based on rank, experience, MOS, and time in service. Be sure to document the patient's ability to see targets, engage or refrain based on decision making from ROE, and assess the patient's ability to give SALUTE reports over the radio using appropriate radio etiquette. Assess the patient's ability to maintain HMMWV speed and awareness of surroundings while navigating through the virtual city with an emphasis on their ability to arrive at the rally point with as little help as possible.

f. Land Navigation at TA2 South (Ft. Campbell Division Land Navigation)

(a) Coordination for this event needs to be made through the hospital Schools NCO to reserve TA 2 South. Once you have a RCNI number, you can then proceed to Range Control in order to finalize your reservation.

(b) Each patient will be accompanied by one healthcare provider or NCO. The patient will be given a map, compass, protractor, 3x5 notecard, non-permanent marker, and have the ability to do a 100 meter pace count upon arrival to the course.

(c) Each patient will be given a score sheet which includes their start point, and three other points at a distance of no greater than 2000 meters total. The patient will have one hour to find as many points as possible using their pace count and methods learned in the Land Navigation Prep course.

(d) When the patient finds their final point, they will then shoot an azimuth to the original start point, notify the provider or NCO that is accompanying them of that distance, and focus on their pace count to determine the amount of distance that differentiates between pace count distance and actual straight-line distance; this will be documented and noted for each patient and used as part of the evaluation.

g. Engagement Skills Trainer – Group, Zero, Qualify

(a) Coordination for this training is to be made through the Battalion Land Manager and requested through RFFMUS; be sure to coordinate with the facility NLT 10 days prior to training event to ensure the reservation is still valid. This is part of Fort Campbell policy.

(b) Each patient will be given an orientation on the EST facility, their M-4 weapon that will be used, and any other pertinent information.

(c) Each patient will be given '6' three round magazines to effectively group and then zero their weapon. After zeroing, each patient will conduct a qualification using prone, prone unsupported and kneeling IAW with FM 3-22.9. Each score will be documented and used for evaluative purposes.

h. Engagement Skills Trainer – Collective and Shoot/No-Shoot Scenarios

(a) The group will then go through the following collective training scenarios Quarry 40, 2 BMP Day Duck Shoot, UAB Day Terrorist, DMT Helicopter, LOIO Execute Defend

Scout, JRF Defend, and FPW Defend. The goal of this exercise is for the patient's to establish sectors of fire, abide by those limitations, and effectively engage and destroy the enemy within each scenario. Evaluation will be based on the before mentioned along with the percentage of hits, visual scanning of sector, auditory attention/processing, communication with team members, follow the rules of engagement, and response to a weapons malfunction.

(b) The group will then move into 'shoot/no-shoot' scenarios with filmed actors of varying nationalities and varying backgrounds escalating to Arabic attackers and urban/desert scenes using the following scenarios: J002 Vehicle Search Option 3, JOIIL Drive By, JO28F/A Cordon Search, J030A Ground Assault Convoy, JO26B Vehicle Checkpoint, J029D Blocking Position/Alternate: JO29A, J025D Installation Security- Escalate, JO25A Installation Security- IP Station (no intro), J032B React to Contact Yellow Van. Evaluation will be based on the before mentioned along with the percentage of hits, visual scanning of sector, auditory attention/processing, communication with team members, follow the rules of engagement, and response to a weapons malfunction.

i. Medical Skills Training Center (MSTC) – Mass Casualty Scenario

(a) TCCC with mannequins in dark room with sounds and moulage at the MSTC. Evaluate and treat casualties in three escalating stages per Division standards taking into consideration MOS, skill level, experience, etc.

(b) There will be three mannequins set up, each with varying levels of injuries to include but not limited to lower and upper extremity amputation, tension pneumothorax with both an entrance and exit wound, burn on the inside of either right or left hand, evisceration, double amputations, and burns to the face. Each patient will rotate to a new mannequin upon each phase of crawl, walk, run, to ensure their level of knowledge and skill can be assessed on the most appropriate level.

1. Crawl:
    a. Lights on
    b. Mannequins on litters
    c. Soft music
    d. Some assistance from Division instructor, health care providers and NCOIC

2. Walk:
    a. Lights on
    b. Mannequins on litters
    c. Combat sounds
    d. Smoke
    e. Strobe lights slow
    f. No assistance from Division instructor, health care providers and NCOIC

3. Run:
    a. Identify a team leader for this phase

b. Lights off
c. Mannequins, with more arterial bleeding, thrown on floor with debris and objects in the way to simulate after effects of an explosion
d. Escalated combat sounds
e. Smoke
f. Strobe lights fast
g. No assistance from Division instructor health care providers and NCOIC
h. Upon the completion of patient care, team leader will gather information from each team member and report an accurate 9-line MEDEVAC request

j. MSTC – Tactical Mission Scenario

(a) Mission brief is given to the patients.

(b) Patients are briefed on the operation and functionality of the paintball guns, rules of engagement for the facility, and off-limits areas throughout the training area.

(c) Patients will operate as a squad on a foot patrol to complete the mission based on the initial brief.

(d) Tools and training aids used for this scenario are paintball guns, paintballs, safety glasses (for providers too), aid bags, IED simulator, .50 cal simulator, and OPFOR.

(e) Upon arrival to the city, the IED simulator will be triggered. The goal is to have the team leader move their squad under suppressing fire to a safe area, quickly identify and move casualties to an established CCP.

(f) Patients are evaluated on an individual basis in the role that they are designated, such as medic, platoon leader, and rifleman.

6. Evaluations and medical documentation – Patient out briefs

a. Each provider from each discipline will establish their performance outcomes for each patient throughout the week and discuss these scores amongst all providers at a meeting to be determined upon completion of the week's training events.

b. The patient scores will be documented on Appendix K. This is the official document that is used in documenting the patients overall performance throughout the week and whether or not they should 'return to duty', be recommended for a medical evaluation board (MEB), or identified needing to receive further treatment and clinical evaluation.

7. The point of contact for this memorandum is the undersigned at (270) 412-9075.

Appendix K. Military Functional Assessment Program Scoring Materials

Independence Level (IL) Rating Scale**	
1	Independent; no adaptations: SM (service member) is able to complete all of the tasks making up the activity safely, without modification/compensations, and within reasonable time. No cues required (Exceeds Course Standards)
2	Independent; with adaptations/modifications: SM requires increased time to complete tasks, use of compensatory strategies/techniques, indirect verbal guidance or gestural guidance. (Meets Course Standards).
3	Acceptable level of Assistance: SM requires no more help than direct verbal assistance or physical assistance. SM performs at a level that is acceptable based on rank/experience. Will benefit from additional training. (Marginally Achieves Course Standards).
4	Unacceptable level of Assistance: SM requires that a part of the task (<25%) be completed for them by clinician and/or SM performs at a level that is unacceptable based on his/her rank and/or experience (Failed to Meet Course Standards).
5	Dependent: SM requires that 25% or more of activity be done for them by clinician. SM requires psychological intervention. SM unable to complete task due to physical restrictions/limitations. (Failed to Meet Course Standards).

NCO Grading Sheet	Date	IL	Pass/fail	**Comments** *(attention, visual skills, hearing/language skills, memory, multi-tasking, planning, organization, sequencing, flexibility, prediction, problem solving, self-monitoring, judgment, safety)*
Name:				
Eagle first responder review				
WTBD				
HEAT				
VCOT				
Land Navigation Prep				
Confidence Course				
Land Navigation Course				
EST				
MSTC/TC3				
Tactical Mission Scenario				

Appendix L. Assessment of Military Multitasking Program Instructions

ASSESSMENT OF MILITARY MULTITASKING PERFORMANCE

ADMINISTRATION MANUAL

November 2015

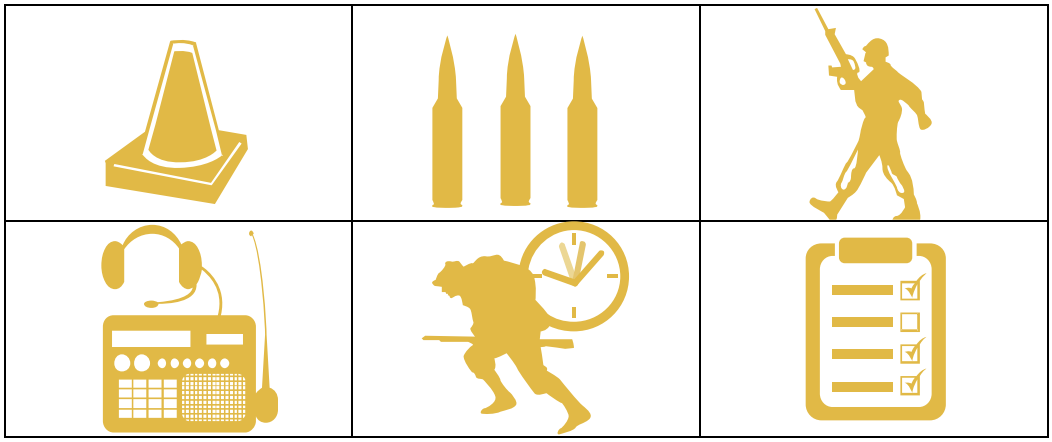


TABLE OF CONTENTS

INTRODUCTION

Overview and Purpose of the *Assessment of Military Multitasking Performance (AMMP)*

The *Assessment of Military Multitasking Performance* (AMMP) is a recently-developed performance-based test battery that has been subjected to preliminary validation to evaluate inter-rater reliability and known-groups discrimination. The AMMP was developed by an interdisciplinary team of civilian and military rehabilitation researchers to help inform duty-readiness decision-making for Service Members (SM) who have sustained a concussion/mild traumatic brain injury.

Introduction to the AMMP Test Tasks

The test tasks that compose the AMMP were developed using either a dual-task or multitasking paradigm. All test tasks employ observational metrics and some test tasks also utilize inertial sensor data to characterize SM performance. At present, there is no prescribed task administration order.

AMMP Multitasks

Charge of Quarter Duty

The SM is challenged to develop and execute a work plan for completing an array of interleaving tasks (supply inventory, PVC foot stool assembly, providing information to superiors, prospective memory tasks) associated with his/her hypothetical assignment to Charge of Quarters Duty.

Patrol-Exertion

The SM is challenged to gather intelligence in a recorded video depicting a virtual Afghanistan patrol environment while reporting observed IED markers based on a briefing provided at the beginning of the video. The SM then uses the information to answer specific questions from memory at the end of the patrol video. The SM will perform continuous step-ups on an exercise step at an intensity of 65-85% of HR maximum throughout the activity while being monitored for effort level via a Polar HR monitor and performance observation. The SM will be wearing a combat helmet, eye protection, and be carrying a simulated M16 weapon equipped with a trigger switch connected via Bluetooth to a computer configured to record reaction time (RT). The SM is required to press the switch each time a beep tone stimulus is heard throughout the video as a measure of RT during a divided attention multitask.

AMMP Dual-tasks

Instrumented Stand and Walk – Grid Coordinates

The SM is challenged to perform the Instrumented Stand and Walk (ISAW) test (developed by APDM) which includes instrumented and timed assessment of quiet standing for 30 seconds, assessment of dynamic stability during walking for two 7 m (23 foot) lengths with a 180 degree turn at midpoint. The SM will next memorize an 8 digit alphanumeric grid coordinate provided within the context of a simulated patrol mission brief and report the exact sequence back to the examiner after 45 seconds. Finally, both the ISAW and the grid memorization tasks will be performed simultaneously. Accuracy of grid coordinate recall, postural sway area, gait path variability, and time to complete the ISAW (i.e. gait speed) will be measured in single and dual-task conditions.

Load Magazine – Radio Chatter

SM completes a relatively automatic manual task choosing from a bin of mixed size dummy rounds (5.56 and 7.62 caliber) and loading 5.56 caliber training rounds into magazines as fast as possible both in a single and a dual task condition. The dual-task condition requires monitoring radio communication and verbally announcing when radio chatter is relevant to scenario instructions.

Structure of the AMMP Manual

In this Manual, there is a chapter for each of the aforementioned AMMP test tasks. The following sections compose each test-task specific chapter:

- Task Description and Set Up
- Examiner Instructions and Script
- Score Sheet
- Scoring Guide
- Materials

Guidance for Use of the AMMP Manual

Administration of the AMMP requires that examiners understand the theoretical foundation of the test tasks and are competent in conducting and scoring the test tasks.

- To understand the theoretical foundations of the AMMP, examiners should be familiar with papers that have been published on this test (e.g., Radomski et al., 2013; Scherer et al., 2013; Smith et al., 2014).
- To assure competence, examiners should first read the AMMP Manual in its entirety. Next, examiners should watch the AMMP Training Modules. After doing so, at least three practice administrations of each test task are recommended before administering the test task on a subject or patient. This will enable the examiner to become comfortable simultaneously reading the administration script, managing any equipment, and observing performance.

References

Radomski MV, Weightman MM, Davidson LF, Finkelstein M, Goldman S, McCulloch K, Roy TC, Scherer M, Stern EB (2013). Development of a measure to inform return-to-duty decision making after mild traumatic brain injury. *Military Medicine, 178*(3), 246-253

Scherer, M. R., Weightman, M. M., Radomski, M. V., Davidson, L. F., & McCulloch, K. L.(2013). Returning service members to duty following mild traumatic brain injury: exploring the use of dual-task and multitask assessment methods. *Physical Therapy, 93*(9), 1254-1267.

Smith, LB, Radomski, MV, Davidson LF, Finkelstein, M, Weightman, MM, Scherer, MR, McCulloch, K (2014). Development and preliminary reliability of a multitasking assessment following concussion. *American Journal of Occupational Therapy, 68,* 439-443.

CHARGE OF QUARTERS DUTY

Charge of Quarters Duty
Task Description and Set Up

Description
The SM is challenged to develop and execute a work plan for completing an array of interleaving tasks associated with his/her hypothetical assignment to CQ duty.

Purpose
This multi-task provides an opportunity to observe and quantify planning and implementing a plan; specifically, how a SM with mTBI approaches an unstructured complex task when only task parameters and outcome are specified.

mTBI-related task challenges: Primary ● Secondary ○

Cognitive				Sensory			Physical			
Executive function	Memory	Attention	Reaction time	Eye gaze tracking	Scanning	Vestibular	Balance	Exertion	Bend-lift	Manual UE Speed
●	○				○				○	○

Source
Adapted from *Multiple Errands Test-Simplified Version* (Alderman et al., 2003)
Alderman, N., Burgess, P.W., Knight, C., & Henman, C. (2003). Ecological validity of a simplified version of the multiple errands test. Journal of the International Neuropsychological Society, 9, 31-44.

Materials and Supplies
Set up and administration items:
- Blue painters tape
- Tape-measure
- Clipboard
- Administration manual and scoresheet
- Stopwatch
- Pencils

Test task items:
Laminated signs to be posted in each work area (Assembly Area, Supply Closet, Bulletin Board, CQ Desk)
Wall clock
Assembly area –
- Table

Examiner sits or stands in a location to fully observe the table in order to observe rule adherence regarding number of PVC parts in the Assembly Area at any given point in time.

Supply closet

- Basket to carry items
- 5-drawer unit for footstool parts/tools with drawers labeled as follows –
    - Drawer/Bin 1 – 1" diameter PVC pipe (4, 12" in length; 6, 8" in length; 10, 4.5" in length)*
    - Drawer/Bin 2 – Elbow and T-Connectors (6, 1" diameter 90 degree elbow PVC connectors; 7, 1" diameter T- PVC connectors)
    - Drawer/Bin 3 – End Caps (4, 1" diameter external PVC endcaps)
    - Drawer/Bin 4 – 3-Way Connectors (8, 1" diameter 3-way elbow PVC connectors)
    - Drawer 5 – Other (sandpaper, masking tape, tape measure, labels, timer)
- Fully Stocked Inventory List sign posted over the 5-drawer unit
- Table on which to place 5-drawer unit is optional

The footstool inventory list is affixed to the side of the drawer unit so that it is not be visible while the subject is standing in any of the other work zones.

*PVC pipe, connectors may be purchased at local home improvement stores or ordered directly from Formufit, Inc. http://www.formufit.com/

Bulletin board

Signs posted on the wall: barrack lay-out, CQ duty roster, monthly calendar, diagram for foot stool assembly, 2 foils (information not relevant to the task) (see Figure 5 for layout). Blue tape must extend for the length of the posted materials and be ~ 4 feet from the wall (to prevent subjects from reading the contents from outside the designated area). **Select a space in which information posted in the Bulletin Board area cannot be read while the subject is standing in any of the other work zones.**

CQ desk

Table or desk
Chair
2 walkie talkies**
Basket for walkie talkies
Plastic hanging file box with 10 file folders labeled as follows:
    Blank CQ Duty Reports
    Completed CQ Duty Reports
    Inventory Forms
    Completed Inventory Forms
    Incidence Reports
    Blank CQ Duty schedules
    Past CQ schedules (past 4 months)
    Emergency contacts
    2 blank folders
Laminated Contact List (placed such that it is visible/upright in the File box)
Laminated Communications Roster (positioned on desk top)
Laminated Walkie Talkie instructions (positioned on desk top)**

**Walkie talkies may be purchased at local home improvement stores. Laminated Walkie Talkie instructions include in the Manual pertain to the Cobra MicroTalk made by Cobra Electronics. Laminated instructions may need to be modified for other models.
https://www.cobra.com/products

Test Task Set Up
Space estimate: Approximately 6 feet by 11 feet area

The CQ Duty test task can be set up in whatever configuration aligns with the available clinical or testing space (Figure 1). Work area boundaries are established by the placement of blue painter's tape. The measurements in Figures 2 – 5 are estimates. Testers should use the Checklist below to make sure that tape placement assures that SM must step into the work area in order to complete relevant test tasks.

Figure 1. Example of how the CQ Duty test task might be set up in a clinical space.

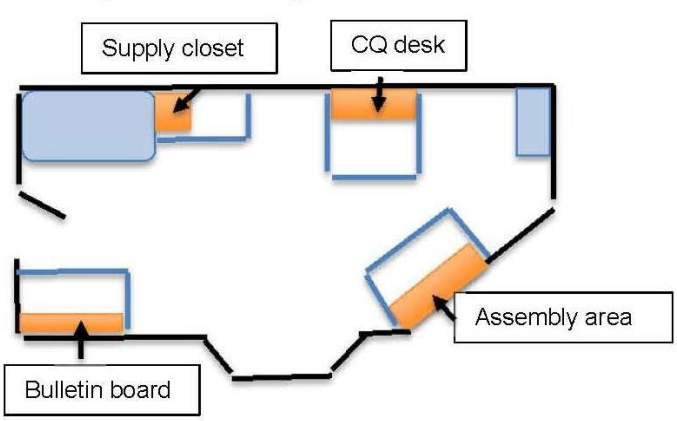


Figure 2. CQ Desk

Figure 3. Assembly area

Figure 4. Supply closet

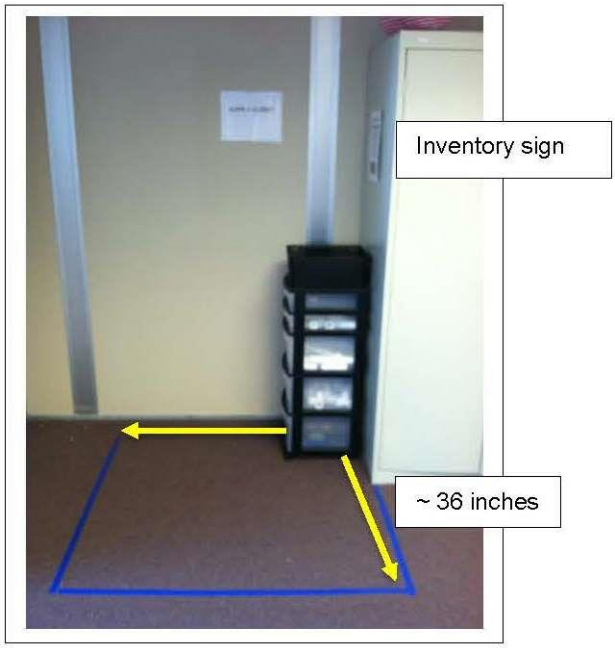


Figure 5. Bulletin board

Test Task Set Up Checklist:

____ Is the wall clock visible from all work areas?

____ Are the CQ duty schedule, barrack layout readable ONLY if standing inside the blue tape in the Bulletin Board work area? [If one or more can be read from outside the blue tape, move the tape further out.]

____ Is it impossible to view the footstool diagram (Bulletin Board) from the Assembly Area? [Select a location for the Bulletin Board in which SM cannot see the diagram from the Assembly Area.]

____ Is the Fully Stocked Inventory List readable ONLY if standing inside the blue tape in the Supply Closet work area? [If the sign can be from outside the blue taped area, move the tape further out.]

____ Is the Contact List and Communications Roster readable ONLY if standing inside the blue tape of the CQ Duty Desk work area? [If one or more can be read from outside the blue tape, move the tape further out.]

Charge of Quarters Duty
Examiner Instructions and Script

Before instructing the participant, turn on participant's walkie talkie and set to radio frequency 6 and place in the basket at the CQ desk; turn on the examiner's walkie talkie and set to radio frequency 10. Make sure a clock can be seen from all areas. During the task, sit or stand in a location that allows you to fully and easily observe the table in the Assembly Area (AA) in order to observe rule adherence regarding # of PVC parts in the AA at any given point in time.

INTRODUCTION
Provide participant with CQ Duty Report affixed to clipboard and state the following:

During this exercise, you must complete some assignments while pulling CQ duty. This is your copy of the CQ Duty Report. It describes task instructions, rules, and includes places for you to write notes. You can use it throughout the exercise along with whatever devices and techniques that you think will help you perform at your best. I will orient you to your assignments, the test spaces and the rules and you can ask questions.

INSTRUCTIONS
A. Description of assignments
Follow along as I describe your assignments.

- **Radio SPC Smith at the Guard Shack to report that you are taking over CQ duty.**
- **Assemble a PVC footstool for CPT James.**
- **After exactly 5 minutes, stop what you are doing and radio the First Sergeant to report the number of vacant barracks. Also ask if there are any additional tasks to be completed while on duty. If so, these must be added to your assignment list.**
- **On your CQ Duty Report, write down the following 4 items:**
  - **a) number of 3-way PVC connectors remaining in stock after the footstool is assembled;**
  - **b) Formufit's address (manufacturer of the footstool materials);**
  - **c) the telephone number of the Service Member who is scheduled for CQ duty next Wednesday;**
  - **d) the room # that PVT Sullivan is in.**
- **Write legibly. You will not receive full points if I cannot read your handwriting.**
- **Return all supplies and materials to their original locations and place the footstool on the CQ desk** (touch the desk surface) **at the end of the exercise.**
- **File your completed CQ Duty Report in the folder entitled, Completed CQ Duty Reports.**

- **After completing all of your tasks, radio SPC Smith at the Guard Shack and report that you've completed your assignments.**

Next, I am going to point out your Work Areas for this task. But first, do you have any general questions about your assignment so far? If yes, clarify. If no, begin orientation to testing space.

B. Orient participant to the testing space.

I will now orient you to the testing space. Everything you need to complete this exercise is located in the 4 work areas marked with blue tape.

B1.Walk to the areas with the participant to point out location of materials and area perimeter. Start by walking to the CQ Desk.

- **We are currently at the CQ Desk.**
- **Use this walkie talkie during the exercise. Push this button** (point) **to speak into the walkie talkie; push this button** (point) **to change radio frequency channels. Use these instructions if you need more help** (point).
- **Use this Communication Roster** (point) **to locate the correct radio frequency channels for various personnel that you need to contact during the task.**
- **Obtain and file required forms here** (point to file box). **Also note the pad of paper and pencil and a Contact List for those assigned to CQ duty** (point to list that sticks out of last folder).

B2. Walk over to Bulletin Board.

- **Here is the Bulletin Board. Here you will find information that you need to report to command including a map of the barracks, a CQ duty schedule, a clock, and a diagram regarding how to assemble the footstool. Note that this diagram is the only information you have about how to construct the footstool.**

B3. Walk to the Supply Closet.

- **This area is the Supply Closet. All the materials you will need for building the footrest are located in this area. Each drawer is labeled but keep in mind that there are some parts in the drawers that you do not need for the project. You may use any of the items in the last drawer** (point to drawer labeled Other). **Here is an inventory list that specifies how many parts we need to keep on hand and the address of Formufit to use for re-ordering supplies** (point to list). **Additionally, there is a basket you may use to carry items from one area to another.**

B4. Walk to the Assembly Area.

- **We are now in the Assembly Area. Assemble the footrest only in this area.**

Do you have any questions about the work spaces? (If yes, clarify. If no, continue.)

C. Review the task rules.

I will now explain the task rules. During this exercise, you must follow these rules (point out rules on CQ Duty Report).

- **You must carry out all of these tasks but may do so in any order.**
- **Assemble the footrest only in the Assembly Area.**
- **Bring only the number of PVC parts needed for the footrest from the supply closet to the assembly area.**
- **Do not move or remove any of the wall signs during the course of this exercise.**
- **In order to score the most points, your trips between work areas should be kept to a minimum. You should return to an area only if it is absolutely necessary to complete the task or follow the instructions correctly. You will get the most points if you can complete this exercise in 7 trips.**
- **Do this exercise as quickly as possible without rushing.**
- **You may not ask questions for further guidance about this exercise once the test starts.**

Do you understand these rules? If no, clarify. If yes, continue.

EXAMINER GUIDANCE:
If the SM asks whether he/she can use his alarm, phone, watch during the test, state: **"Use any strategy or device that you think will help you do your best."**
If the SM asks any questions about the test task and/or procedures BEFORE the test begins, answer the questions directly.

D. Verify that participant understands the instructions. Move outside of the designated work areas into a neutral zone. Using the CQ Duty Report, the Participant restates the task instructions and rules.

Now brief me on what you are being asked to do. Fill in any gaps that the participant may not have included.

After doing so and answering all questions about the task, place the subject on the start X outside of all taped areas. State: **Remember, you must complete all of the assigned tasks but may do so in any order. Start** and begin the timer.

[Participant begins the exercise.]

EXAMINER GUIDANCE: IF THE SUBJECT IS USING THE WRONG RF
If the SM tries to perform step 1 (radioing Guard Shack) but is not on the correct frequency, state: **I can't hear you on the radio.**
If the SM still does not figure out to change the rf, state: **you are on the wrong rf.**
See side 2 of score sheet for scoring instructions.

EXAMINER GUIDANCE: HOW TO RESPOND TO QUESTIONS ASKED DURING TESTING AND SCORE RULE BREAKS RE QUESTIONS

- Scoring: Every question asked = 1 rule break.
- If a subject asks a question during the test, state: **"Do what you think is best."**
- If the subject has not figured out a solution to his/her own question **within 1 minute**, point to the relevant information on his or her CQ Duty report and provide information to get him or her back on track. [Scoring: The item for which the subject needs this examiner assistance is scored a 0.]

E. Re-set examiner walkie talkie during task.
At the beginning of the test, the examiner's walkie talkie is set at frequency 10 (corresponding to Gate Guards/Guard Shack).

EXAMINER GUIDANCE: WALKIE TALKIE RESPONSE TO REPORT TO GUARD SHACK
Participant: "SPC Smith (or Guard Shack) this is XXX, Over"
Guard Shack: **"Xxx this is SPC Smith, go ahead over"**
Participant: "Beginning CQ duty"
Guard Shack: **"Good copy, over." Or "Roger that, Over."**
Participant: "Over"

After the subject radios to check in (**task 1** on score sheet), the examiner changes the radio to frequency 5 (corresponding to First Sergeant and **task 4** on score sheet).

[5 MINUTES INTO TASK]

F. Provide additional instructions when participant radios in after 5 minutes and asks about more tasks.

- **Get an Inventory Form from the files at the CQ desk.**
- **Inventory PVC supplies in SC using the form based on supply status once foot rest is assembled.**
- **Once this is done, file the order form in the "Completed Inventory Forms" folder at the CQ desk.**

EXAMINER GUIDANCE: WALKIE TALKIE DIALOGUE WITH FIRST SERGEANT
Participant: **"First Sergeant this is XXX, Over"**
First Sergeant: This is First Sergeant. Over.
Participant: Reporting vacant barracks as 9. Any additional assignments over?
First Sergeant:

1. **Get an Inventory Form from the files at the CQ desk.**
2. **After you complete the foot rest, inventory PVC supplies in SC using the Inventory Form.**
3. **File the form in "completed inventory forms" folder at CQ desk, how copy?"**

Participant: Repeats instructions, clarification made if error. If correct, "Good copy, Over"

After the subject completes **task 4,** the examiner resets the walkie talkie to frequency 10 (corresponding to task 18 on score sheet).

G. The task is discontinued when:
a) The Participant radio reports to the Guard Shack that he/she has finished the assignments OR;
b) The Participant states he/she does not want to continue OR;
c) Participant demonstrates behavioral contraindications as specified in IRB application OR;
d) The Participant is still performing the task at 30 minutes and does not appear to be within 2 minutes of completion.

Rev. 10-15-13; 11-26-13; 12-2-13; 2-4-14; 4-1-14; 7-15-14; 9-11-14; 6-2015

Study ID:	Rater:	Date:	Order:

Did SM complete test task? _____Yes _____No (Examiner stopped) _____No (Subject requested to stop)

CQ Duty Score Sheet

Tasks 2= 100% accurate, no cues required 1= Completed but only partly correct OR *1 = Required cues (1, 3, 4, 6, 13 only*)*	**Task Score 0,1,2**	**Sub-totals**	**Scratch Pad for visits to WORK AREAs**
1-Radio SPC Smith/Guard Shack and….[rf 10] STATE*: ***I can't hear you on the radio.***			SC, AA, BB, CQ Start (outside work areas) …
2 -Report that you are taking over CQ duty.			1.To _____
3- Between 4 min 30 sec -5 min 30 sec, participant stops what he/she is doing* …. NOTE: IF THE SM DOES NOT STOP WHAT HE/SHE IS DOING BY 6 MINUTES & 30 SEC, STATE*: ***Stop and do what I instructed you to do 5 minutes into the task.***			2.To _____
4- Radio 1SG* [rf 5] *CUE: I can't hear you on the radio.* NOTE: IF THE SM DOES NOT KNOW WHAT TO DO AT THE 5 MINUTE INTERVAL, STATE*: ***Check your CQ duty report to see what you are supposed to do now.***			3.To _____
5- Report # of vacant barracks rooms. [9]		/10	4.To _____
6- Ask if there are any additional tasks to be completed while on duty*. NOTE: IF THE SM DOES NOT ASK THE QUESTION, STATE*: ***What else are you supposed to ask me?***			5.To _____
7- Get an Inventory Form from the files at the CQ desk.			6.To _____
8- Assemble PVC footrest			7.To _____
9- Put the footrest on the CQ desk before completing the exercise.		/8	8.To _____
10- *Inventory PVC supplies in SC using the form based on supply status once foot rest is assembled.*			9.To _____
11- *Files Inventory Form in "Completed Inventory Forms folder"*			10.To _____
12-Return all supplies and materials to their original locations before completing the exercise.			11.To _____
13- Radio SPC Smith/Guard Shack …. [rf 10] *STATE*: I can't hear you on the radio.*		/10	12.To _____
14- Report task completion.			13.To _____
15- Write down telephone # of SM scheduled next week at this time [Anderson @ 703-555-5564]			14.To _____
16 Write down the # of 3-way PVC elbows in stock after assembling [6]			15.To _____
17- Write down the mailing address of Formufit Inc. [15954 S. Mur Len Road #311 Olathe, KS 66602]			16.To _____
18- Write down room # that PVT Sullivan is in [308]			17.To _____
19- File completed CQ Report in "Completed CQ Duty Reports" folder		/10	18.To _____
Task performance total score	A._____/38		19.To _____

Rules (see rule break definitions on back)	**Rule break (Y/N)**	**# of rule breaks**
Do not ask questions for further guidance about this exercise once the test starts.		
Assemble the footrest only in AA.		
Bring only the number of PVC parts needed for the footrest to the Assembly area [22 parts].		
Do not remove any of the signs from the walls of the work areas.		
Performance time: E.___min___sec	B.	C.

20.To _____
21. To _____
22. To _____
23. To _____
24. To _____
25. To _____
26. To _____
27. To _____
28. To _____
29. To _____
30. To _____
31. To _____
32. To _____
33. To _____
34. To _____
35. To _____

D. Total # of visits to complete exercise: _____

Everything else must be scored in real time EXCEPT 10. 11. 15-19

Visit = any body part crosses into taped work area.

Rules	Rule break examples
Do not ask questions for further guidance about this exercise once the test starts.	1 rule break for **every question** asked. Making statements aloud ≠ rule break. ["Can you help me get this walkie talkie to work? What is the correct RF?" = 2 rule breaks]
Assemble the footrest only in AA.	Each time SM puts 2 parts together outside of AA = 1 rule break SM connects PVC elbow to 4.5" piece in SC = 1 rule break
Bring only the # of PVC parts that are needed for the footrest to the AA [only 22 PVC parts in AA at any point]	If SM has 24 PVC parts at AA = 2 rule breaks SM brings masking tape to AA = 0 rule break (not a PVC part)

Tasks	Scoring examples (1, 0)
1. Radio SPC Smith/Guard Shack and... [rf 10]	1 = radios Smith/Guard Shack after cue re rf 0= does not do this task at all **OR** requires further cueing re rf
2. Reports taking over CQ duty	1= reports something other than that he/she is taking over duty 0=does not do this task at all
3. Between 4 min 30 sec -5 min 30 sec, participant stops what he/she is doing ….	1= stops what he/she is doing between 5 min 30 seconds and 6 min 30 seconds 0= called before 4 min 30 sec **OR** didn't radio in by 6 min 30 sec **OR** examiner instructs to stop what he/she is doing now
4.Radios 1SG [rf 5]	1 = radios 1 SG after cue re rf 1 = radios after being cued by examiner to check CQ Report 0 = even with cue, SM doesn't know to radio 1SG and is instructed to do so
5. Report # of vacant barracks rooms. [9]	1= reports incorrect # of vacant barracks 0= doesn't report this information at all
6. Ask if there are any additional tasks to be completed while on duty*.	1=asks if there are additional tasks to be completed after being cued 0= even with cue, SM does not ask the question and the examiner simply provides the 3 additional instructions (7,10, 11)
7. Obtain an inventory form from the files at CQ desk	1=obtains the wrong form from CQ desk 0= doesn't get any form from CQ desk
8. Assemble PVC footrest	1= constructs footrest but made errors related to 1 – 2 parts 0 = does not do this task at all **OR** attempted with errors on 3 or more parts
9. Put the footrest on the CQ desk before completing the exercise.	1=puts the footrest on a table or desk other than the CQ desk 0 = puts footrest on the floor
10. *Inventory supplies remaining once the footrest is assembled*	1= takes inventory but some of the values are incorrect 1=takes inventory but answers are not legible 0= does not take inventory
11. *Files Inventory Form in "Completed Form" folder*	1=files the form but in the wrong folder **OR** form in hanging file but not in folder 0= does not file the form
12. Returns all supplies and materials to their original locations before completing the exercise.	1=returns some but not all supplies and materials to original locations 0= does not return any of the supplies and materials to their original locations before radioing that he/she is done with CQ duty
13. Radio SPC Smith/Guard Shack. [rf 10]	1 = radios Guard Shack after cue re rf 0= does not do this task at all **OR** requires further cueing re rf
14. …to report task completion.	1=reports something other than task completion **OR** calls in <u>before</u> completing task (ie filing CQ duty report as instructed) 0=does not do this task at all
15. Write down telephone # of SM scheduled next week at this time **[Anderson @ 703-555-5564]**	1= fills in name of Anderson but not phone # 1= fills in wrong phone number 1=fills out form but answers are not legible 0 = does not fill in this part of CQ duty report

16. Write down the # of 3-way PVC elbows in stock after assembling foot rest [6]	1=fills in the wrong # of 3-way PVC elbows
	1=identifies # but answers are not legible
	0= does not fill in this part of the CQ duty report

18. Write down the room # for PVT Sullivan [308]	1=fills in this part of CQ Report but with wrong room #
	1=identifies room # but not clearly legible
	0=does not fill in this part of CQ Report

19. File completed CQ Report in the "Completed CQ Duty Reports" folder	1=files the form but in the wrong folder **OR** form in hanging file but not in folder 0= does not file the form

Task performance is over immediately after the subject radios Guard Shack and reports task completion. Stop timer and record the performance time. **SM scores a "0" for any task completed <u>after</u> radioing Guard Shack to report task completion.**

estion asked. Making statements
you help me get this walkie talkie to
RF?" = 2 rule breaks]

Charge of Quarters Duty
Scoring Guide

Examiner scoring supplies/materials:

- 1 stopwatch
- Clipboard
- Pencil
- Subject score sheets
- Radio / walkie talkie

Definitions of key underlying concepts:

Rules – Instructions that specify HOW a task test is to be completed which could be broken > 1 time during test-task performance. These rules may be adhered to or broken.

Task performance -The extent to which the subject independently and accurately completed each task element as instructed.

Performance time - The number of minutes and seconds between when the examiner says, "Start" and when the participant a) reports to SPC Smith/Guard Shack that he/she is finished with the task OR b) reports that he/she does not want to continue.

Visit – A visit occurs whenever any body part crosses into a taped Work Area. Visits are an observable metric for work efficiency.

Scoring procedures for performance subscores:

Before starting the task

Fill out the following:

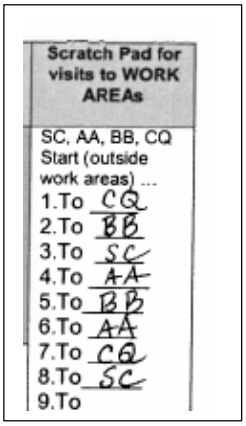
- Subject's study ID
- Your Rater ID
- Today's date
- Where in the test order the subject is performing this test-task

At task start

Performance dimension	Scoring procedures	Performance subscore
Performance time	The examiner starts stopwatch when all task questions have been answered and immediately after he/she states, "Start". After starting the task, the examiner does not cue the subject or answer questions (see Rule 1).	(See "E" below)

During task

Performance dimension	Scoring procedures	Performance subscores**
A. Task performance	There are 19 tasks listed on the score sheet. All task must be scored in real-time as the subject performs the task except 10, 11, 15-19 (which may be scored after the subject has completed the task but before set up for the next participant). The examiner assigns a 0, 1, or 2 for each of the 19 tasks based on observations of subject performance. 2 = 100% accurate, no cues required 1= Completed but only partly correct **OR** 1 = Required cues (1, 3, 4, 6, 13 only) 0 = Did not complete or perform Note: Subjects are not cued during task performance except for tasks 1, 3, 4, 6, 13. Refer to Side 2 of the score sheet for examples of performance warranting scores of 0 or 1 for each of the 19 tasks.	A = Task performance total score Scores are summed for the 19 tasks and recorded on the score sheet. A=_____/38 possible points
B. Rule breaks	There are 4 rules: • Do not ask questions for further guidance about this exercise once the test starts. • Assemble the footrest only in the AA. • Bring only the number of PVC parts needed for the footrest to the AA [22 parts]. • Do not remove any of the signs from the walls of the Work Areas. If the subject breaks rule # 1, a Y is placed in the corresponding "Rule break" column of the score sheet. If he/she does not break the rule during any part of the task, an N is placed in that column. Same for rule # 2, 3, and 4. Refer to Side 2 of the score sheet for examples of commonly broken rules.	B = Total # of rules broken Sum the # of Ys in the Rule break column B=_____/4 possible rules broken
C. # of rule breaks	Each time a rule is broken, the examiner puts a check-mark in the corresponding column labeled "# of rule breaks". For example: If the subject asks the examiner 4 questions during task performance, there would be 4 check- marks in "# of rule breaks" column for rule # 1.	C = Total frequency of rule breaks For each rule broken, the examiner counts the # of check-marks and records the total in the corresponding "# of rule breaks" column. Next, the examiner sums these

		columns to determine C. (total frequency of rule breaks).
D. Task organization, planning, efficiency	The subject begins the task positioned in the Neutral Zone (outside of the designated work areas). The examiner sequentially writes down each Work Area the subject enters throughout the task (see below), beginning with the first Work Area the subject enters after the examiner instructs him or her to "start". A visit occurs whenever any body part crosses into a taped Work Area. For 1. To_____ write the abbreviation of the first work area the subject enters after the examiner says, "start". For 2. To_____ write the abbreviation for the work area that the subject visits next (and so on). Supply closet = SC Assembly area = AA Bulletin board = BB CQ desk = CQ 	D = Total # of visits to work areas to complete the task

At task completion

Performance dimension	Scoring procedures	Performance subscore
E. Performance time	When the subject radios SPC Smith/Guard Shack OR he/she states that he/she does not want to continue, the examiner stops the stopwatch and records the length of time for task completion.	(E)Total task performance time – Time in minutes/seconds that it takes for the subject to complete the task after verifying/clarifying all instructions until he/she notifies examiner of task completion.

After subject has completed task

If you have not done so already, score tasks 10, 11, 15-19 and include those scores in (A) Task performance total score.

Also, see the Answer Sheet for the Inventory Form for correct answers.

CQ Scoring Frequently Asked Questions

Task Performance (A)

How should I score performance if the subject makes errors using the walkie talkie (such as setting it on the wrong radio frequency)?

If the SM tries to perform Task 1, 4, 13 (radioing Guard Shack) but is not on the correct frequency, state: **I can't hear you on the radio. [Score 1]**
If the SM still does not figure out to change the rf, state: **you are on the wrong rf. [Score 0]**

Why am I required to provide cues for tasks 1, 3, 4, 6, and 13 but not the rest of them?

The performance of each of these tasks is essential to ~~the~~ completing subsequent steps in the CQ Duty. Therefore, cueing may be necessary to allow the subject to complete the entire activity.

What if I can't read the subject's handwriting on the CQ Duty Report or the Inventory Form?

During your instructions, the subject was told: **Write legibly. You will not receive full-points if I cannot read your handwriting.**

Each task requiring a written answer (15, 16, 17, 18) that is not legible is scored a 1.

Rules (B & C)

What if the subject asks me a question after the test begins? What should I say and how should the rule break be scored?

Every question asked = 1 rule break. If he/she asks a question, state, "do what you think best" and record "Y" under the Rule break (Y/N) column and a slash mark for every instance in which 1 question is asked.

If the subject has not figured out a solution to his/her own question within 1 minute, point to the relevant information on his or her CQ Duty report and provide information to get him or her back on track. [Scoring: The item for which the subject needs this examiner assistance is scored a 0.]

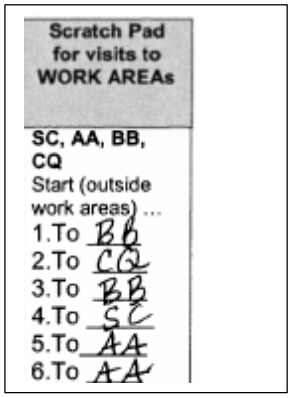
Rules (see rule break definitions on back)	Rule break (Y/N)	frequency of rule breaks
Do not ask questions for further guidance about this exercise once the test starts.	Y	//
Assemble the footrest only in AA.	N	0
Bring only the number of PVC parts needed for the footrest to the Assembly area [22 parts].	N	0
Do not remove any of the signs from the walls of the work areas.	N	0
Performance time: E___min___sec	B. Total 1	C. Total 2

How will I know how many PVC parts the subject brings to the AA?

Position yourself so that you can count the # of parts on the table as the subject works. Or observe if there are parts on the table leftover after the footstool is assembled. For each part in excess of 22 in the AA, the subject receives 1 rule break.

Rules (see rule break definitions on back)	Rule break (Y/N)	frequency of rule breaks
Do not ask questions for further guidance about this exercise once the test starts.	N	0
Assemble the footrest only in AA.	N	0
Bring only the number of PVC parts needed for the footrest to the Assembly area [22 parts].	Y	111
Do not remove any of the signs from the walls of the work areas.	N	0
Performance time: E.___min___sec	B. Total 1	C. Total 3

Visits (D)



What if the subject starts to leave a Work Area (with one foot inside the taped area and one foot outside) but remembers something else to do, turns around so that both feet are now in the Work Area?

This person never left the Work Area – no "visits" are recorded for setting 1 foot outside of the taped area.

What if the subject is able to reach into the drawers of the SC to get PVC parts without stepping across the tape into the SC Work Area?

A visit occurs any time a body part crosses the tape into a Work Area and so reaching into the SC constitutes a visit.

What if one of the PVC parts falls off the table and rolls outside the AA and the SM goes to retrieve it? Does this count as a "visit" when he walks back into the AA to continue assembling the footrest?

Yes. Every time a SM crosses the tape into a Work Area, a visit is recorded – regardless of the reason for doing so.

Performance Time (E)

What if the subject radios the Guard Shack to report task completion and then files the CQ Duty report at the CQ desk? At what point do I stop the stopwatch to record performance time?

Stop the stopwatch immediately after he/she reports that he/she completed the task and record as the performance time. Subject scores a "0" for item 9, *(Files Inventory Form in "Completed Inventory Forms" folder*) because it was not performed during the task.

ANSWER SHEET FOR EXAMINERS

[Parts inventory once the footrest has been assembled]

Inventory Form		
Item	**Current Stock**	**Needed**
3 way Elbow PVC Connectors	6	2
T- PVC Connectors	3	4
90 degree Elbow Connectors	4	2
External PVC End Caps	2	2
12” PVC pipe	4	0
8” PVC pipe	2	4
4 ½ ” PVC pipe	2	8
Sandpaper	1	0
Tape measure	1	0

CQD Forms

CQ DUTY REPORT		SUBJECT NUMBER:	
ORGANIZATION OR INSTALLATION	**LOCATION**	**PERIOD COVERED**	
		FROM	**TO**

You should do the following:	**RULES**
• Radio SPC Smith at the Guard Shack and report that you are taking over CQ Duty • Assemble a PVC footstool for CPT James. • File the CQ Duty Report in folder marked "Completed CQ Duty Reports". • Return all supplies and materials to their original locations before completing the exercise. • Place the footstool on the CQ desk at the end of the exercise. • Radio SPC Smith at the Guard Shack when you've completed the exercise. **Exactly 5 minutes after you start the exercise:** • Radio the 1SG and report the number of vacant barracks. • Ask about any additional tasks you're to complete on your shift.	• You should carry out all of these tasks but may do so in any order. • Assemble the footrest only in the Assembly Area. • Bring only the number of PVC parts needed for the footrest from the Supply Closet to the Assembly Area. • Do not remove any signs or instructions from the walls in the work areas. • Figure out how to complete the exercise in 7 transits or less. In order to score the most points, your trips between zones should be kept to a minimum. • Take as little time to complete this exercise as possible without excessively rushing. • Do not ask questions for further guidance about this exercise once the test starts.

You should obtain the following information during the exercise:	**Write the information here.**
How many 3-way PVC connectors are left in stock after the footrest has been assembled?	
What is the mailing address for Formufit Inc. (manufacturer of footstool parts)?	
What is the telephone number of the Service member who is scheduled for CQ Duty next Wednesday?	
What room number is PVT Sullivan in?	

Subject #

Inventory Form		
Item	**Current Stock**	**Needed**
3 way Elbow PVC Connectors		
T- PVC Connectors		
90 degree Elbow Connectors		
External PVC End Caps		
12” PVC pipe		
8” PVC pipe		
4 ½ ” PVC pipe		
Sandpaper		
Tape measure		

CQD Signs and Handouts

Communications Roster

Radio Holders	Radio Frequency
Military Police	7
Guard Shack	10
Staff Duty Officer	2
Troop Medical Clinic	4
Emergency Room	9
Commander	6
1SG	5
Chaplain	1
Orderly Room	8

FULLY STOCKED FOOTSTOOL

PARTS INVENTORY

Quantity	Parts
8	1” diameter 3-Way PVC Connectors
7	1” diameter T- PVC Connectors
6	1” diameter 90 Degree Elbow PVC Connectors
4	1” diameter External PVC End Caps
4	1” x 12” PVC pipe
6	1” x 8” PVC pipe
10	1” x 4 ½” PVC pipe
1	Sandpaper
1	Tape measure

Formufit Inc.
15954 S. Mur Len Rd # 311
Olathe, KS 66602

Contact List for CQ Duty

Name	Contact Number
SGT Michaels	212-756-4594
SPC Anderson	703/555-5564
SPC Jones	812/464-9804
SGT Zavala	812/484-9493
PFC Davis	410/776-2762
SGT Rains	812/278-9473
SPC Jacobs	561/957-4899

HOW TO USE THE WALKIE-TALKIE*

1. Push down the MODE button and hold it down to TURN ON.
2. Use the CHANNEL BUTTON to select the radio frequency.
3. Hold down the SIDE BUTTON and talk into the walkie talkie.

Relevant only for pictured version of Cobra MicroTalk.

CQ DUTY SCHEDULE

	THIS WEEK							NEXT WEEK						
	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
SGT Michaels					X			X						
SPC Anderson			X							X				
SPC Jones						X						X		
SGT Zavala				X					X					
PFC Davis		X									X			
SGT Rains	X													X
SPC Jacobs							X						X	

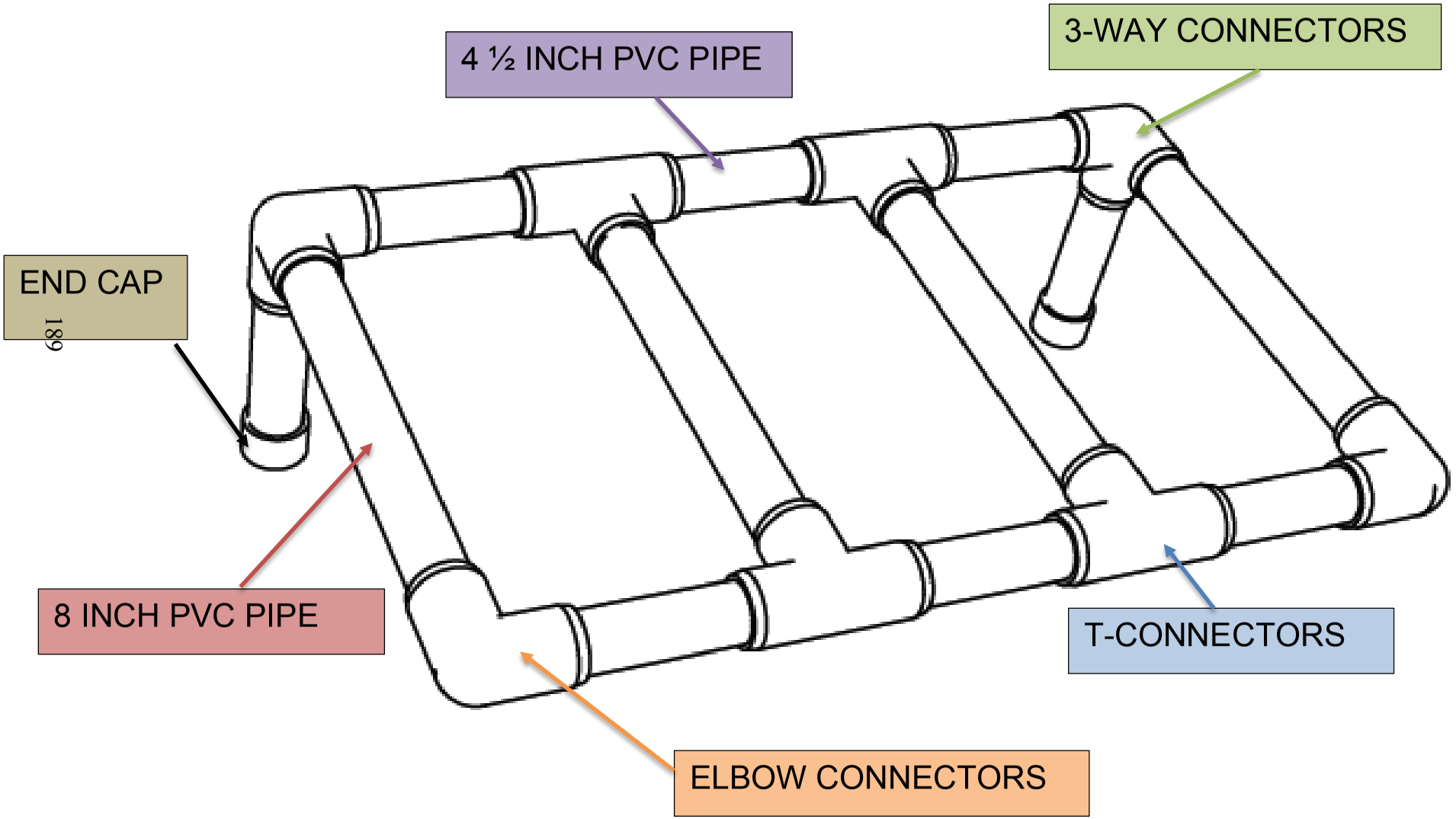
BARRACKS LAYOUT

RM 101 **PVT SMITH**	RM 102 **PFC Wright**
RM 103 **SPC Moore**	RM 104 **SPC Munroe**
RM 105 **Vacant**	RM 106 **PVT Daniels**
RM 107 **PVT Hernandez**	RM 108 **SPC Belanger**
RM 109 **PVT Thomas**	RM 110 **Vacant**
RM 111 **SPC Saunders**	RM 112 **PFC Jones**

RM 201 **SPC Mitchell**	RM 202 **Vacant**
RM 203 **PFC Jefferies**	RM 204 **SPC Alexander**
RM 205 **PFC DeLeon**	RM 206 **Vacant**
RM 207 **Vacant**	RM 208 **PFC Jefferies**
RM 209 **SPC Carlisle**	RM 210 **SPC Donohue**
RM 211 **PFC Jacobs**	RM 212 **PVT James**

RM 301 **PVT Manning**	RM 302 **Vacant**
RM 303 **SPC Bridge**	RM 304 **Vacant**
RM 305 **PFC Lowery**	RM 306 **PVT Peterson**
RM 307 **PFC Cooper**	RM 308 **PVT Sullivan**
RM 309 **Vacant**	RM 310 **SPC Mahoney**
RM 311 **Vacant**	RM 312 **PFC Zavela**

PVC FOOTREST PARTS AND ASSEMBLY



ASSEMBLY AREA

SUPPLY CLOSET

BULLETIN BOARD

CQ DESK

PATROL- EXERTION

Patrol/Exertion
Task Description and Set Up

I. Description: The SM is challenged to gather intelligence in a recorded video depicting a virtual Afghanistan patrol environment while reporting observed IED markers based on a briefing provided at the beginning of the video. The SM then uses the information to answer specific questions from memory at the end of the patrol video. The SM will perform continuous step-ups on an exercise step at an intensity of 65-85% of HR maximum throughout the activity while being monitored for effort level via a Polar HR monitor and performance observation. The SM will be wearing a combat helmet, eye protection, and be carrying a simulated M16 weapon equipped with a trigger switch connected via Bluetooth to a computer configured to record reaction time (RT). The SM is required to press the switch each time a beep tone stimulus is heard throughout the video as a measure of RT during a divided attention multitask.

II. Purpose: Visual scanning skills, attention, memory, RT, and decision-making under exertional conditions are often impaired following mTBI. This task places demands on divided and alternating attention, prospective memory, visual attention and scanning, gaze stability, and multimodal (i.e., auditory, visual, and vestibular) processing in conjunction with simultaneous exertional demands.

III. mTBI-related task challenges: Primary ● Secondary ○

Cognitive				Sensorimotor				Physical		
Executive function	Memory	Attention	Reaction time	Eye gaze tracking	Scanning	Vestibular	Balance	Bend - lift	Exertion	Manual UE Speed
○	●	●	●		●	○			●	

IV. Source: This task was created by AMMP team members as a way to challenge visual and auditory processing, reaction time, cognitive processing and attention skills in a situation involving moderate and simultaneous exertional demand.

V. Materials and Supplies
Materials:

- 4-5" high exercise step,
- heart rate monitor (sports type monitor with a chest strap and wrist watch component to allow examiner to monitor exercise heart rate),
- Table with elevated platform for positioning video monitor at eye level when subject is stepping
- laptop with Patrol video and RT programs
- video monitor with external speakers
- recording device for recording SM responses to post Patrol questions,
- standard helmet and eye protection,
- Simulated M-16 rubber weapon configured with RT switch,
- Antifog wipes for eye protection,
- Disinfecting wipes for cleaning HR monitor, helmet, eye protection and weapon between subjects

VI. Test Task Set Up

Space estimate: Approximately 6x8 foot area

Patrol Task – Exertion with Reaction Time
Examiner Instructions and Script

Open the Patrol Task application on the laptop, make a profile for subject. Use the subject ID number and click "create profile." Turn on the switch on the blue gun.

INTRODUCTION

This task involves repeated stepping onto this exercise step while you watch a virtual patrolling video set in a rural countryside. We will monitor your heart rate in order to keep you exercising at a moderate pace. How old you are so we can calculate your exercise heart rate?

Write age and calculate APMHR.

INSTRUCTIONS

A. Don Equipment

- **Please put this heart rate monitor on under your shirt at the breastbone. You will need to wet this part a little.**

Hand subject the sports HR monitor and point to the contact area on the underside of the POLAR label, that they should get a little wet, and turn the wrist watch monitor to EXE (note it takes a 10-15 seconds to start indicting HR).

You have to stay within 5 feet of the subject with the watch part; it works to clip in on to the top of your clipboard.

- **You will wear a helmet, eye protection, and carry this blue weapon.**

Hand all equipment to subject. Allow the subject to choose the size helmet he/she wants to wear. If the subject is wearing glasses, additional eye pro is not necessary.

B. Symptom Assessment

Before we start, please rate two things for me.

Point to RPE scale.

- **Using this chart from 6 (which means no feeling of exertion) to 20 (very, very hard exertion), rate how hard you are working while standing still.**

Point to vision chart.

- **Using this chart where 0 means "you see clearly or normally" and 10 means "the worst or most unstable my vision could be," rate your vision as it is now.**

I am going to ask you to rate those two items again for me while you are stepping up and down.

C. Practice Reaction Time

- **During this task we will test your reaction time. When you hear this tone**

Trigger the sound of the stimulus using the computer mouse several times—click on the BEEP icon.

- **Press this small switch as quickly as you can.**

Point to switch on blue rubber weapon, just below trigger.

- **Let's practice this a couple of times.**
- **Each time you hear the beep,** Trigger stimulus on computer by pushing the "beep" icon, **push the switch as fast as you can.** Allow subject to practice pushing the switch to manual stimulus several times.
- **Do you have any questions?**

D. Test Reaction Time in standing

- **Now let's record your reaction time. The computer will randomly trigger the "BEEP" sound a few times in the next 30 seconds.**
- **READY to push that switch as fast as you can?**

Start the RX time trial. The computer will play 2 beep sounds at 2 random times in 30 seconds; it will be at least 8 seconds for the first tone sound.
Record RT (in msec) from the computer screen on to score sheet (1a and 1b).

- If the numbers are greater than 400, try one additional trial and say **"Let's practice once more… Push the switch as fast as you can after you hear the sound."**
- Record the 2nd trial below the first on the score sheet.

E. Tactical pauses and Reporting

- **Now I will describe the video to you. The video will provide instructions and a review of common IED MARKERS that you should be looking for during each of 4 tactical pauses.**
- **Each pause begins when the patrol leader says "initiating tactical pause". The video will show a virtual 360 degree turn. You will continue stepping during the pause. During each turn, call out ANY IED MARKERS you see based on the instructions you were given. The tactical pause will end when the patrol leader says "OK, tactical pause complete, let's keep moving"**
- **At the end of the video, I will hand you a recorder and ask questions that may include intelligence concerning your unit's location, relevant times and date within the virtual scenario, as well as details about individuals, equipment, or activities you observe while on the video patrol.**

Show subject the hand held recorder.

- **The details for the final questions must be answered from memory so pay close attention to important information during the video for this final report.**

F. Rules and Brief-Back

- **You must follow these rules:**
  - **Push the switch every time you hear the beep.**
  - **Call out the IED markers ONLY during the tactical pauses where the patrol leader says "Initiating Tactical Pause" to start, and "Tactical Pause COMPLETE" to end.**
  - **Save all other tactical observations for the questions at the end.**
  - **Step continuously throughout the video until I tell you to stop.**
  - **What are the 4 tasks you will do during this task?**

  Subject should say:
  1) Press switch in reaction to beep,
  2) Identify IED markers observed during tactical pauses,
  3) Answer questions at the end of the video
  4) Step continuously.
- **Do you have any questions? I want you to know that you won't be shooting at anyone and no one will shoot at you, and nothing blows up during this video. It is important for you to react as fast as you can and to report everything as well as you can. DO YOUR BEST!!**

G. Reaction Time during stepping

- **Now we will test your reaction time with the beeps ~~again~~ when you begin stepping.**
- **Ready? Begin stepping**
- Start the reaction time trial again.
- Record RT (in msec) from the computer screen onto score sheet (1c and 1d).

B (repeat). Symptom Assessment while stepping

Point to RPE scale.

- **Using this chart again from 6 to 20, rate how hard you are working now.**

Point to vision chart.

- **Using this chart from 0 to 10, rate your vision now.**

- **I'm going to start the video now. Keep stepping until I tell you to stop. The beep will sound multiple times during the video. Make sure you respond quickly every time you hear it.**

DURING THE TEST

Monitor HR throughout to keep in range which you take off the chart (APMHR).

Goal is 65% of APMHR (age predicted maximum heart rate) by the time the Courtyard patrol scene starts so if he/she isn't close after the first 2 minutes of instructions on video, say **Step a little faster** when nothing important is showing on the video. Rarely if the subject is over 85% of APMHR, you may have to say "**slow down a bit."** Record the HR in the HR column next to each tactical pause, as well as below the RPE score at the bottom of the score sheet.

Turn your recorder on at about the "SWITCH TO YOUR NODS" statement on the video.

END OF THE TEST

B (repeat) Symptom Assessment: Ask the Workload and Gaze stability questions again right at the end of the video while subject is stepping. Point to the wall charts when you ask these questions. Say:

- **Keep stepping and rate how hard you are working.**
- **How stable is your vision?**

Have subject stop stepping and ask post video questions (see score sheet). Press the "record" button.
State: **"Recording Patrol Report with DRAGON XXX NOW"** (where XXX is the subjects ID number) and then hand recorder to subject. Press the "STOP" button on the recorder when done with post patrol questions.

EXAMINER GUIDANCE:
IMMEDIATELY AFTER THE TEST:

- ~~R~~ecord the msec of the 11 reaction times at the end of the score sheets. NOTE that if they do not react or if it takes them longer than 2 seconds, then the screen will have "-1" which should be recorded in the appropriate blank~~.~~
- Turn the speaker switch off on the BLUE WEAPON at the end of the task.
- The battery should be changed when the battery indicator on the screen states 75% or less.
- Clean the helmet, eye pro, HR monitor and strap, and blue weapon and use the antifog wipes on the eye pro after each subject.

OTHER ADMINISTRATION TIPS

- If the eye pro fogs up, have the subject take them off during the PATROL Task.
- Close and reopen the PATROL Application between subjects. If it locks up, close and open the application again and re-do profile. Open the PATROL Application prior to turning on the switch on the blue weapon.
- There are separate instructions for the instrumented blue weapon software.

Study ID:	Rater:	**Date:**	**Order #:**

SM Completed Task? ____Yes____No (examiner stopped) ____No (subject stopped)

PATROL TASK with exertion Score Sheet

AGE_____ 220- Age = _____APMHR 65%_____ APMHR 85%
_____

Initial Reaction time (1a)_____ms (1b)_____ms (stand)(1c)_____ms (1d)_____ms (stepping)
NOTES:_____
_____

RATER: Place check mark in box to indicate correct response (No negative for extra observations)

Heart Rate	#1	OBSERVATION / IED Marker	IDENTIFIED (1 Point Ea)
	FOOT BRIDGE (NEAR SIDE)	Rock linefar side of creek that point down along the river road. (at 30°)	
		Trash Pile #1 (across bridge at 0°)	
		Conspicuous Box (at 270°)	
		Overturned earth (at 270°)	
	TOTAL # CORRECT		A. /4
	#2	OBSERVATION / IED Marker	IDENTIFIED (1 Point Ea)
	GROVE ENTRANCE	3 parallel line marks low on the wall (at 30°) (Also: "chalk marks")	
		Red prayer flag (under rock inside wall-at 330°)(Also: red cloth, flag, material…, red rug; "prayer…" or "red….")	
	TOTAL # CORRECT		B. /2
	#3	OBSERVATION / IED Marker	IDENTIFIED (1 Point Ea)
	MID GROVE	Broken tree branch (at 90°)	
		Small line of rocks just below broken branch (at 90°)	
		Small pile/bundle of sticks (also: logs, twigs, branches(at 270°)	
	TOTAL # CORRECT		C. /3
	# 4	OBSERVATION / IED Marker	IDENTIFIED (1 Point Ea)
	END GROVE	Stick bundle stacked vertically on R side of gate (at 30°)	
		3 parallel line marks low on the wall (at 330°); or "chalk marks"	
		Small line of rocks (at 330°)	
		Overturned earth (at 0 or 360° depends on when they see it)	
	TOTAL # CORRECT		D. /4
	SCANNING SUB-SCORETOTAL # CORRECT (A+B+C+D)		X.= /13
	COMMENTS (extra items/objects reported)/SYMPTOMS*:*		

Post Patrol Questions	Correct answer (Examples)	# Correct
	1 pt each unless indicated	
What enemy vehicles did you see?	Motorcycle, cycle, moped, bike, MC, Harley, any word that indicates motorcycle (1)	**/1**
What were the last grid coordinates reported?	EB 2682 (2 pt for all correct) 1 pt each for letters or numbers correct, must be exact (0, 1, or 2)	**/2**
What color clothing were the kids in the grove wearing?	White (1)	**/1**
What surveillance equipment did you see?	"binoculars", "scope", "binos", "observation device" (1)	**/1**
What weapon did the individual on the motorcycle have?	Knife, blade, sword, dagger, janbiya or khanjar (1) Accept any term that indicates they identify a type of knife	**/1**
What time did the patrol enter the grove?	Tolerances: 1700-1705 hours (1)	**/1**
What was the date that this activity occurred?	Tol: 20 June 2013 (month/day only is acceptable) (1)	**/1**
What items did you see throughout the scenario that could be used to create, arm or detonate an IED?	Tolerances: "Jugs, containers, IEDs, gas cans, water cans, red caps, fuel tanks, yellow jugs, daisy chain" (1)	**/1**
	Tolerances: "Wire", "cord", "fuse", "Det cord" (1)	**/1**
	Tolerances: "Battery", "9 volt", "power cell" (1)	**/1**
PATROL QUESTIONS SUBSCORE		**Y.= /11**
Anything else that you noticed that I should include in my report? **(Write comment(s) free form)**		
SCANNING SUBSCORE (A + B + C + D)=X	**Copy from bottom of table front side**	**X.= /13**
PATROL SUB-SCORE	**Copy from above**	**Y.= /11**
TOTAL POINTS (SCANNING +SALUTE) (X + Y)	**Total**	**Z.= /24**
Reaction time (2)_____ms (3)_____ms (4)_____ms (5)_____ms (6)_____ms (7)_____ms (8)_____ms (9)_____ms (10)_____ms (11)_____ms (12)_____ms		

Patrol-Exertion
Scoring Guidelines

Examiner scoring supplies/materials:

- Clipboard
- Pencil
- Subject score sheets and administration instructions
- Wall signs for RPE (rate of perceived exertion) and Vision Clarity (Likert Scales)
- Hand held voice recorder, heart rate monitor, Instrumented blue mock M-16 weapon with Reaction time software/hardware, helmet, eye protection.
- Computer and Monitor for playing PATROL video and to run reaction time program.
- Patrol video cued up, turn on speakers, turn on switch on blue weapon (for Rx time component)

Before starting the task, the rater fills out the following:

- Study ID, rater, date and test order (1^{st}, 2^{nd}, …6^{th} of the test tasks)
- Age
- Calculate the age predicted maximum heart rate
- Determine 65% and 85% range of APMHR for exercising—calculate or use the chart
- Enter the subject ID number into the computer program on laptop and click "*Create Profile*" (This is the program for running the baseline Reaction Time software.

1) In the left hand column of the score sheet under "Heart Rate", indicate the approximate time into the video when cues are given to the subject to "speed up" or to "slow down" in order to keep the subject's exercise HR in the 65-85% APMHR range per protocol.
2) Reaction time—Record the initial reaction time while standing (2a and 2b) and while stepping (2c and 2d). Read off computer screen after initial trial and write the milliseconds down in the appropriate spaces.
3) While standing, while initially stepping before the video starts and at the end of stepping before the post-video questions, record the subject reported number for rate of perceived exertion (RPE) from the 6-20 and vision clarity from 0-10 in the appropriate box on the score sheet. Record any other comments or reported symptoms in the appropriate blank space below the RPE and vision clarity questions.
4) Tactical pause 1-4 (AKA SPOT reports) —make a check mark in each box that the subject correctly identifies and write down in the blank space any extra words or comments that subjects makes during the tactical pause or while patrolling.
5) Add up points for each tactical pause in blanks A through D and record the total (out of 13) in box X; also record on the back side of the score sheet in box X.

6) Mark the box for each component of the Post Patrol Questions using a 1 or 2 as appropriate per the examples.
7) Add up each section of the Post Patrol Questions and record total under Y (out of 11 maximum points) and also copy the score below in the subscore section Y.
8) Add up the subscore summary boxes for the Scanning (SPOT Reports) - X, Post Patrol Questions- Y and fill in the TOTAL in Box Z.
9) Copy the Reaction time numbers (in msec) off the computer screen into Reaction time blanks 2-12 on the bottom of the page.

Patrol Scoring Guidelines/Tolerances

1. Tactical Pause: Any "items of interest" reported on the IED marker list will be credited regardless of ***when*** they are identified (during the tactical pause or after). In general, the participant should provide the examiner feedback during or immediately after the tactical pause so be prepared.

2. Erroneous identifications (markers, motorcycle track, etc.) and IED component materials (battery, jugs, and detonation cord) offered during the tactical pause (e.g. craters, out of place dirt mounds, etc.) will not be counted as errors of commission (no points deducted).

3. Description of rock lines or stick piles must denote deliberate placement by enemy forces (e.g. rock line or stick pile deliberately placed, rock cairn, etc.) not just "rocks and branches"

4. During 1st Tactical pause, subject should identify the box on the near side of the river (not the brick on the far side).

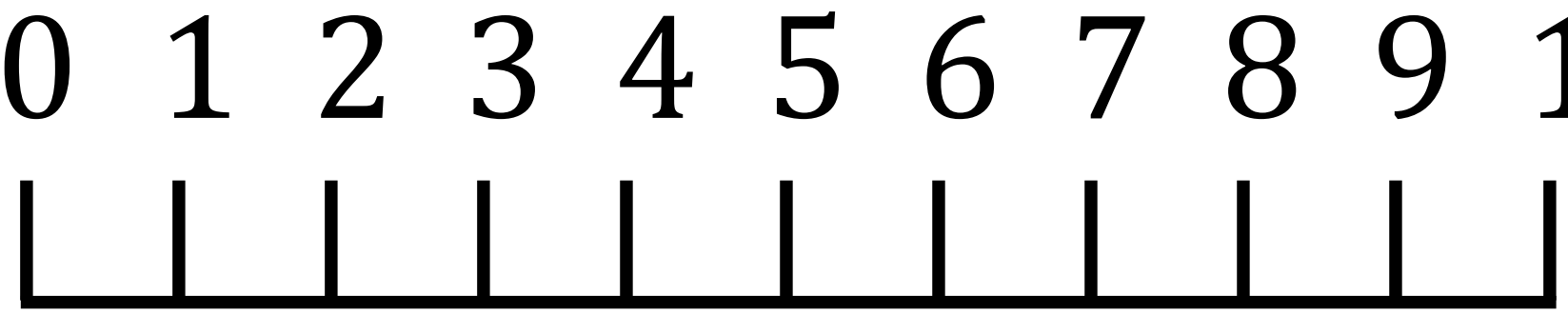
5. Post Patrol Questions—see the middle column on the scoresheet labelled "Correct answer (Examples)" for expected answers. Write any additional comments in the blank spaces. No penalty is given for additional words or answers; they are just recorded in score sheet blanks.

Patrol- Exertion
Materials

BORG RPE Scale

6	**NO EXERTION AT ALL**
7	
	EXTREMELY LIGHT
8	
9	**VERY LIGHT**
10	
11	**LIGHT**
12	
13	**SOMEWHAT HARD**
14	
15	**HARD (HEAVY)**
16	
17	**VERY HARD**
18	
19	**EXTREMELY HARD**
20	**MAXIMAL EXERTION**

VISION



207

Normal, Clear, & Stable Vision

Extremely Blurry or Jumpy Vision "The Worst It could be"

System Description

The PATROL Reaction Test measures reaction time events during a video of a patrol mission scenario. When the pre-set time event is reached in the video, reaction from the subject is prompted by an audible cue from the Trigger module. The Subject is asked to react to the audible cue by pressing a button located on the pistol grip. When the button is pressed, the reaction time is measured as the delay from the audible cue to when the button is pressed. The reaction time is calculated and logged by the PC software. Hardware as installed on rubber duck can be seen in Figure 1.

Figure 1 - Trigger installed on rubber duck

Trigger Module

The trigger module is mounted at the bottom of the magazine on the blue rubber duck, as seen in Figure 2 and consists of a bluegiga ble112 Bluetooth Low Energy module, a buzzer and a momentary push button powered by a CR2032 3V Lithium battery.

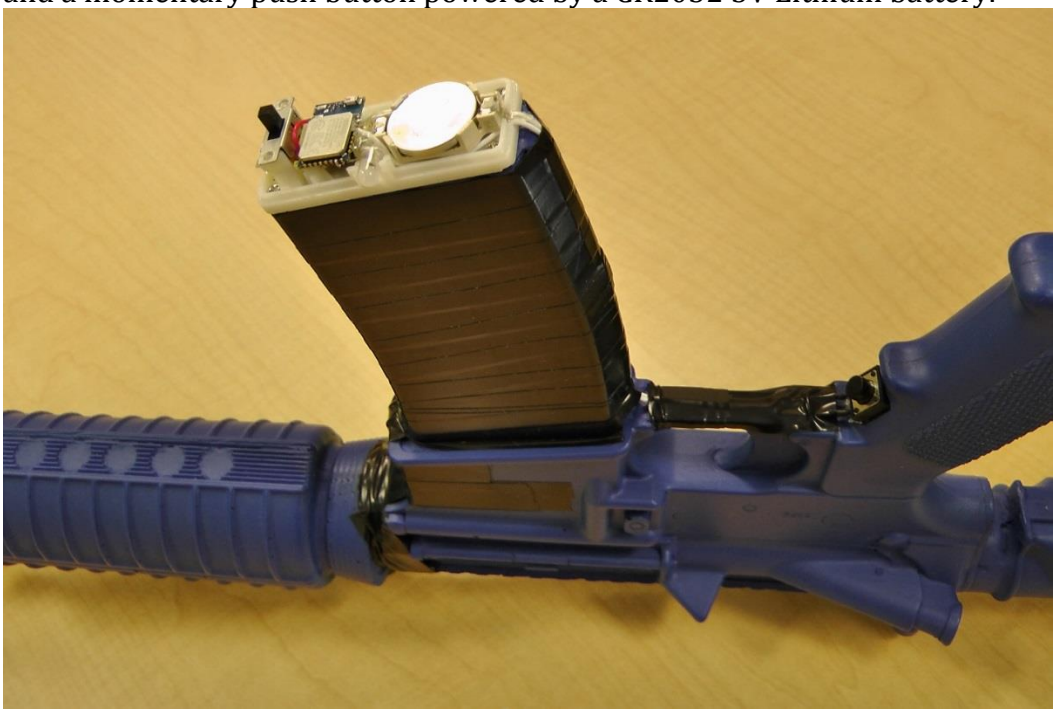


Figure 2 - Trigger module mounted on rubber duck

Electronics Design

The electronics are all wired and soldered to the ble112 module according to the schematics in Figure 3.

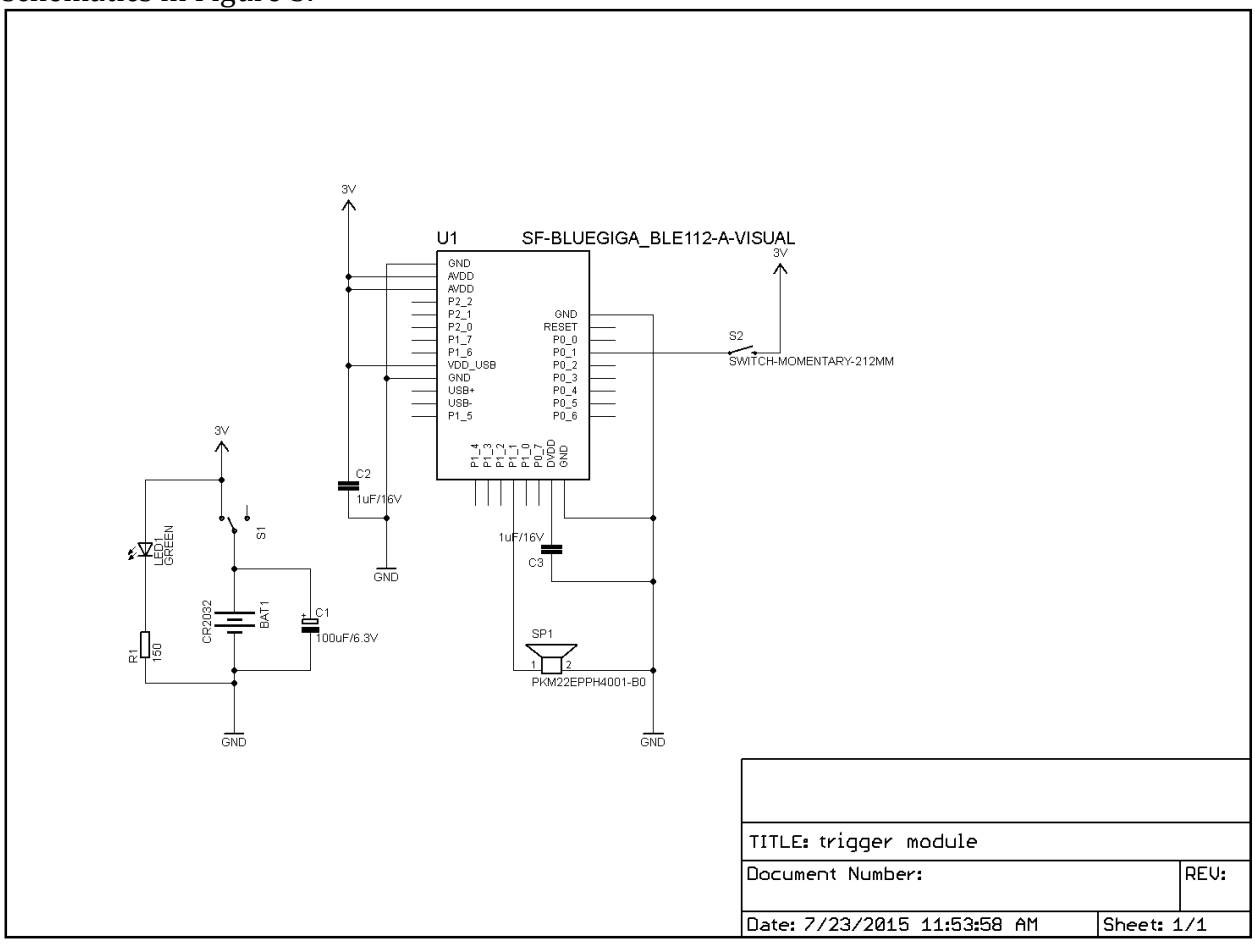


Figure 3 - Electrical schematic

Appendix A – Installation Instructions

Installation of software on PC

Make sure the latest java version is installed on the PC. The PC software in its existing folder structure should be copied to a folder on the PC, for example “C:\Patrol”. Copy rxtxSerial.dll to the JAVE_JRE/bin folder. Run the software through PATROL.jar.

User Instructions for PATROL Test

The system consists of the Trigger Module (located on the blue gun), the Dongle (mounted in a USB port) and the PATROL Software.

Setup Instructions

Preparing the system for a test involves the following steps:

1) Start the PC running the PATROL Software
2) Make sure that the Dongle is mounted in the correct USB port (the front most port on the right hand side of the PC). Any USB port used must be 2.0 compatible.
3) Turn on the Trigger Module and look for the green light to come on
   a) If the green light does not come on, please read the Troubleshooting guide on how to replace the battery
4) Start the PATROL Software located on the Desktop of the PC
5) The first dialog that comes up prompts you to select the COM-port that the Dongle is connected to, press OK
6) The Software will now try to connect to the Trigger Module, which will result in a beep from the Trigger Module.
   a) If the beep is not heard and an error dialog pops up, please read the Troubleshooting guide on how to connect the Trigger Module

Operating Instructions

As the system is set up and the Trigger Module is on with a green light and the PC running the PATROL Software. Follow these steps to run the test:

1) Use the Beep button to test the beep sound and the connection to the Trigger Module
2) Create a new profile by entering the Profile ID in the corresponding text box
3) Press Create Profile
4) Run Reaction Test and Run PATROL Test are now available
5) Press Run Reaction Test to run the reaction test, the results will populate the Results text box when the test has finished
6) Press Run PATROL Test to run the video and the automated test sequence
   a) At any time during the PATROL Test, the test can be paused by pressing SPACE
   b) At any time during the PATROL Test, the test can be aborted by pressing ESC
7) After the finished test, the results will populate the Results text box
   a) Write down the results
   b) A backup of the test results will also be saved to the hard drive of the PC
8) When done testing, TURN OFF the Trigger Module to conserve battery and exit the Software

Troubleshooting

Replacing the Trigger Module battery

The battery in the Trigger Module is a 3V CR2032 with about 200mAh capacity. The battery should last for about 10 hours of testing, please follow these steps to replace a depleted battery:

1) Turn the Trigger Module off
2) Open the bottom casing with a flat object by inserting it in the slot on the opposite side of the green light.
3) Twist the flat object so that the casing pops off
4) Use the flat object to pry the battery out of its holder
5) Insert the new battery with the positive facing towards you
6) Snap the lid back on to the Trigger Module
7) Power on and confirm that the green light comes on
    a) If the green light does not come on after replacing the battery, please contact support

Re-connecting the Trigger Module

At times, the PATROL Software will not recognize the Trigger Module. The following can be reasons for the Trigger Module not being recognized:

- The Trigger Module is not started before the Software is started
- A new Trigger Module is used
- Interference during the connection phase
- Hardware malfunction, please contact support

The following steps will describe how to connect the Trigger Module at the event of a connection failure:

1) Make sure the Trigger Module is on, the green light must be on
2) Open the configuration dialog
3) In the configuration dialog, press Discover
4) The list above the Discover button will be populated with available devices to connect to
5) Select the "PATROL Trigger" and press Connect, this should result in a beep from the Trigger Module
6) Save and Close to store the new settings
7) The configuration dialog will exit and a beep from the Trigger Module will confirm the connection.
8) If this does not work, please contact support

Rx Time Project AMMP Conceptual Design

Reaction time measuring during the PATROL scenario. The subject will be exposed to 11 auditory cues throughout the scenario and will respond by pressing a trigger in proximity to a "blue gun". The system will consist of software running on a PC and a separate Trigger Module that can output auditory cues as well as measure the delay between the cues and trigger reactions from the subject. The interface between the PC and the Trigger Module will be wireless to allow flexible mounting as well as not to interfere with the subject's movement. The Trigger module must on its own measure the time, since a PC cannot be considered a reliable real-time system, this is especially true considering communication with an external trigger button.

PC Software

The software will encapsulate the video showing the PATROL scenario. Researcher can configure software to set the time of the triggers. Configuration should be done in a configuration file. The software will track video frames and transmit a command to the Trigger Module when a pre-selected frame is reached.

Trigger Module

Trigger module will receive a command from the PC software to start an auditory cue. The on-board microcontroller will start a timer when the cue is started. The subject will press a trigger that will stop the timer and the time interval is calculated by the microcontroller. The time interval is transmitted to the PC software. The PC software presents reaction times at the end of the video.

Hardware

A PC running the software, wireless USB-dongle (or built-in Bluetooth), wireless module, microcontroller board, digital trigger button, piezo speaker (or similar), battery, battery charging circuit (or replaceable battery) and LED.

Specific Example

The PC software could be developed in C#/.NET which with existing libraries would make this process quick. The PC could have built-in Bluetooth capabilities or a separate dongle is used. The Trigger module would be a custom design optimized for size and weight. A lower-range MSP430 16-bit microcontroller would be mounted on a custom PCB together with a SMD trigger button, a Bluegiga Bluetooth RN-42 module, a status LED, a power button and a pizeo speaker. Contingent on calculations for power needs, the battery would probably be a lithium 3V coin cell battery. A custom plastic enclosure will only expose the power switch, status LED and trigger button to the user.
These recommendation are mostly based on my experience with the aforementioned technologies, depending on the developer's experience, other environments might be more familiar and preferred.

			Patrol Trigger Module		
	Contact	Daniel Nilsson			
		dasnilsson@gmail.com			
		612-702-2919			
Line #	Qty	Ref	Manufacturer/Distributer	Manufacturer Part #	Description
1	1	U1	bluegiga	BLE112-A-v1	Bluegiga BLE 112-A BLE module
2	1	SP1	Murata	PKM22EPPH4001-B0	Piezo 4kHz Buzzer
3	1	S2	Sparkfun(dist.)	COM-09190	12 mm Momentary pushbutton switch
4	1	S1	Sparkfun(dist.)	COM-00102	SPDT Mini power switch
5	1	BAT1	Renata	SMTU2032-LF	CR2032 Battery Holder
6	1	LED1	Sparkfun(dist.)	COM-09592	Green 5mm LED
7	1	R1	Yageo	MFR-25FRF52-150R	Resistor 150 ohm
8	1	C1	Panasonic	EEU-FC0J101B	Aluminum Electrolytic capacitor 100uF/6.3V
9	2	C2, C3	TDK	FK28X5R1C105K	Ceramic Capacitor 1uF/16V

ILLINOIS AGILITY TEST (IAT) – PACKING LIST

Illinois Agility Test
Description and Test Set up

I. Description: The Illinois Agility Test requires running distances of 30' with rapid direction changes and navigation of obstacles in a serpentine pattern during the middle part of the obstacle course. A memory task is also completed. Then both the agility task and the memory task are performed at the same time. Accuracy of memory recall and time to complete the agility task are measured in single and dual-task conditions.

II. Purpose: This task requires higher level mobility (rapid performance on an agility course) while performing a cognitive task (7 word list memory task) at the same time. This testing protocol is similar to the Walking and Remembering Test, which has been validated in both older adults and individuals with moderate to severe brain injury.

III. mTBI-related task challenges: Primary ● Secondary ○

Cognitive				Sensorimotor				Physical		
Executive function	Memory	Attention	Reaction time	Eye gaze tracking	Scanning	Vestibular	Balance	Bend - lift	Exertion	Manual UE Speed
	●	○					●		○	

IV. Source: Getchell B. Physical Fitness: A Way of Life (2ed). New York: Wiley and Sons, Inc. 1979.

V. Materials and Supplies

- Colored masking tape to mark start and end points of agility course
- Clipboard and Score sheet
- Stopwatch
- 6 cones
- Adjustable headband and waist band
- NexGen inertial sensors* and wireless data collection port and laptop.

*I2M Sensors can be found at this website http://www.nexgenergo.com/ergonomics/I2M-IMUs.html
Inertial sensors are placed (1) on an adjustable headband slightly to the opposite side of the forehead from the subject's eye used for sighting through the weapon scope and (2) on an adjustable waist band fitted tightly around the subject with the sensor in the mid lumbar area.

VI. Test Task Set Up
Space estimate: Wide hallway space that is 40' long and 12' wide at a minimum to allow for agility course set up and acceleration/deceleration during the agility task.

Figures 1 and 2 illustrate task set up.

Figure 1 Task set up example

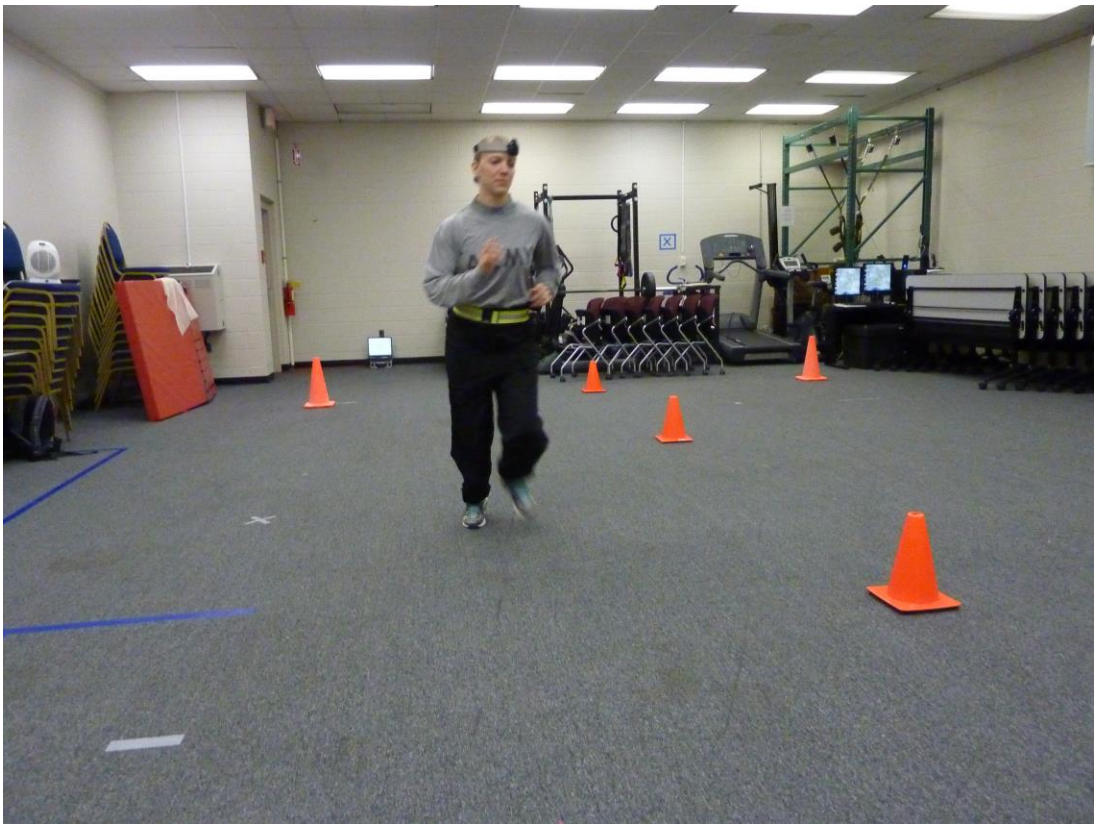
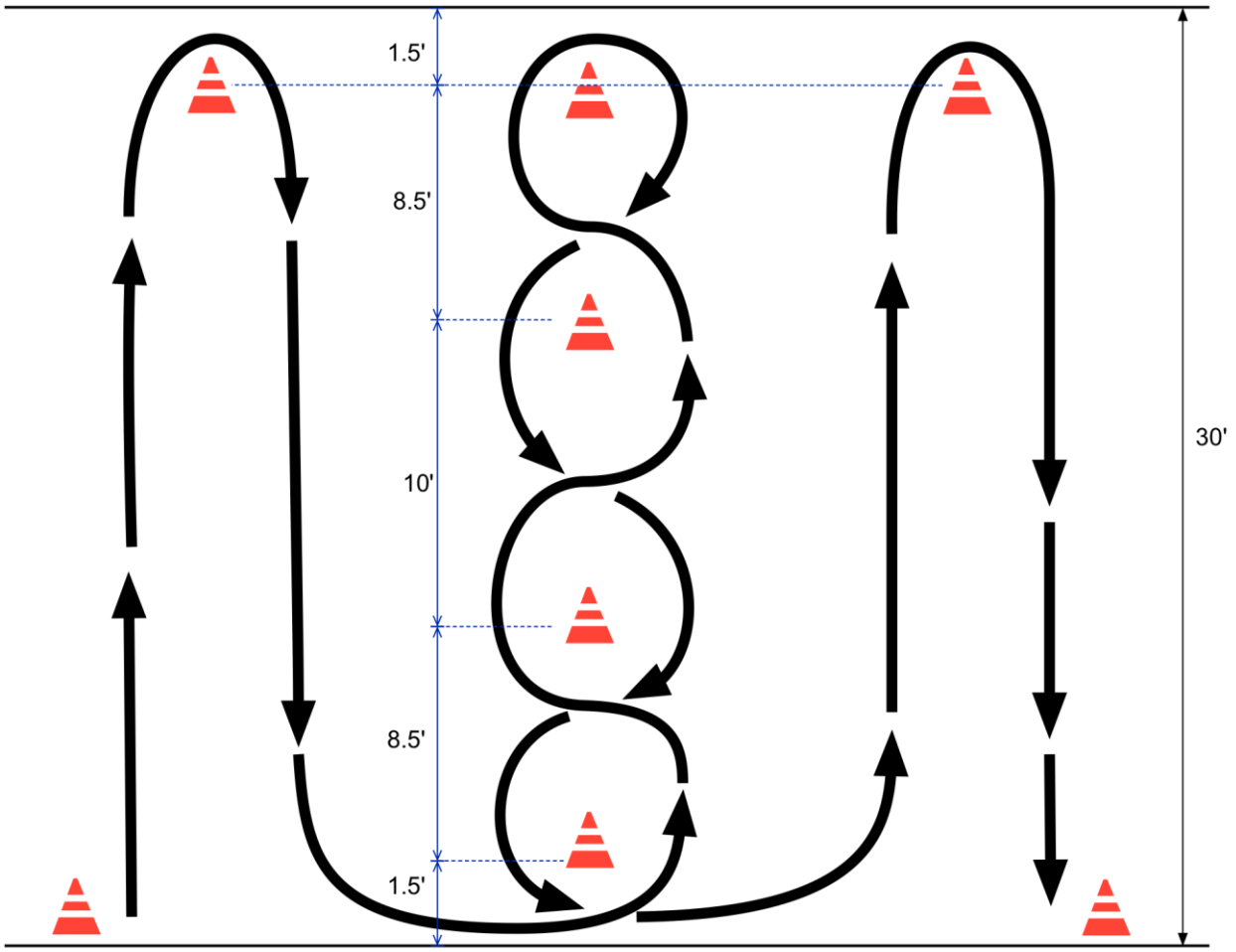


Figure 2 The starting position for the task is with the service member prone with his/her hands at the level of the starting line. The cones in the middle of the course are placed to allow sufficient room on the ends to circle the cones comfortably (in this example allowing 1.5' between end cone and far line and start/finish line, to avoid having to slow to avoid nearby obstacles just beyond the course).



STARTING POSITION COURSE END

Illinois Agility Test
Examiner Instructions and Script

Before testing, roll a die to determine the order of the word lists that will be used with the subject. Also indicate sequence of priority conditions based on the subject ID number. Trial 1 is single task word list. Trial 2 is dual-task condition without instructions. Trials 3 and 4 are priority conditions. Odd ID number subjects' priority order is words 3/agility 4. Even ID number subjects' priority order is agility 3/words 4.

INTRODUCTION

This task is called the Illinois Agility Test. It will assess your speed and agility while moving on an obstacle course, as well as your ability to recall a short list of words.

INSTRUCTIONS

Single Task Condition – Walk Through Agility Task

Show schematic of the course (on page 4 of this script).

- **You will begin here lying prone with your hands at the level of this piece of tape.**
- **When I say go, stand up and run as quickly as you can around the large cone at this end.** Trace path on schematic. **Go around it, without touching it, then move to the cones in the middle. Run serpentine, alternating around one side and then the other, through the four cones in the middle of the course both UP and BACK.** Trace path on schematic.
- **Round the fourth cone in the middle and then run on the INSIDE of the large cone on the far right, before running quickly back to the finish.** Trace path on schematic.
- **If you get the sequence mixed up, try your best to correct it by going back to where you made the mistake. If you stop during the trial, we will need to repeat it.**
- **Go as quickly as you can, but avoid touching any of the cones.**
- If space is limited, then add: **Take care that you don't go so fast that it is hard to stop at the end of the course, since space is limited in this room.**
- **Do you have any questions?**

A. Single Task Condition – Practice and Timed Agility Task

- **Now let's have you jog through the course once to make sure you have the sequence right.**
- **Now let's try a timed trial.**
- **Do you have any questions?**

Record performance time. If there are errors, the subject must repeat the timed trial a second time.

B. Single Task Condition – Word List Task / Cognitive Task

Both the examiner and subject sit for this part of the task.

- **Now I am going to read a list of 7 words to you. These are things you might pack if you were going to deploy**.

- **Listen carefully, because you need to remember them for a short delay before you repeat them back to me. The delay is the length of time it took you to complete the agility task.**
- **I will say the 7 words, then I will say "Delay".**
- **When I say "Now" tell me the words you remember. You can say the words in any order.**
- **Do you have any questions?**

Answer all questions before proceeding. Use the number of words remembered in the single task condition as the span in the dual-task condition, if the number recalled is 5 or greater. If the subject recalls fewer than 5 words, use a list of 5 words in the dual-task condition.

Read the word list from the score sheet that corresponds to the number on the first die that you rolled before testing. Read words at a rate of one per second, dropping voice inflection slightly on the last word in the sequence. When "Delay" is said, start the stopwatch. Say "Now" when the time for completion of the agility task is met. Record the order of word recall on the word list sheet for those that are correct. If a new word is added to the list, then write it down verbatim for that trial. Record errors by adding missed words (error of omission) and added words (error of commission) together.

C. Dual-Task Condition – WITHOUT priority instructions

The subject can remain seated through task instructions.

- **Now we are going to combine the agility task with remembering words. The start position will be the same, in prone with your hands at the level of this piece of tape.**
- **Each time we repeat the task it will be with a different list of** ___ (number) **words. You can forget the words that you have heard previously. Just focus on remembering the words you have heard last. We will do this task a few times.**
- **Once you have heard the last word, there will be a short delay so you can get the last word in your head. Then I will say "Ready, go".**
- **Remember the words as you run the course. When you finish, tell me the words you remember, in any order.**
- **Complete the agility course as quickly as you can, but take care not to touch any cones.**
- **Do you have any questions?**

With the subject in the starting position, read the word list from the score sheet that corresponds to the number on the second die that you rolled before testing. Read words at a rate of one per second, dropping voice inflection slightly on the last word in the sequence. Record the time it takes the subject to complete the course, and record the words recalled for each trial. Use a repeat trial if the subject does not follow instructions or stops before completing the trial.

If the subject confuses the agility course sequence and does not correct it (i.e. the subject does not follow the serpentine pattern in middle of the course in both directions) so that the motor task time is less than the single task time, then repeat the trial. If the participant recognizes and corrects the error, then record the time and make a notation that an error was

made in the course path. Any contact with cones during a trial should also be marked as an error.

If errors are made in word recall (i.e. commissions, or partial recollection of compound words), then mark those responses as errors. If the subject misunderstands how a word is pronounced, then write what he/she says verbatim. If it does not match the word recited exactly, then it is an error.

Offer a drink of water or brief rest prior to completing the remaining trials. If, after completing the agility course, the subject's respiratory rate is increased, or if the subject reports exertional symptoms of headache or dizziness, then allow him or her to normalize before a new trial.

D.1. Word List Priority This task is first for subjects with odd ID numbers.

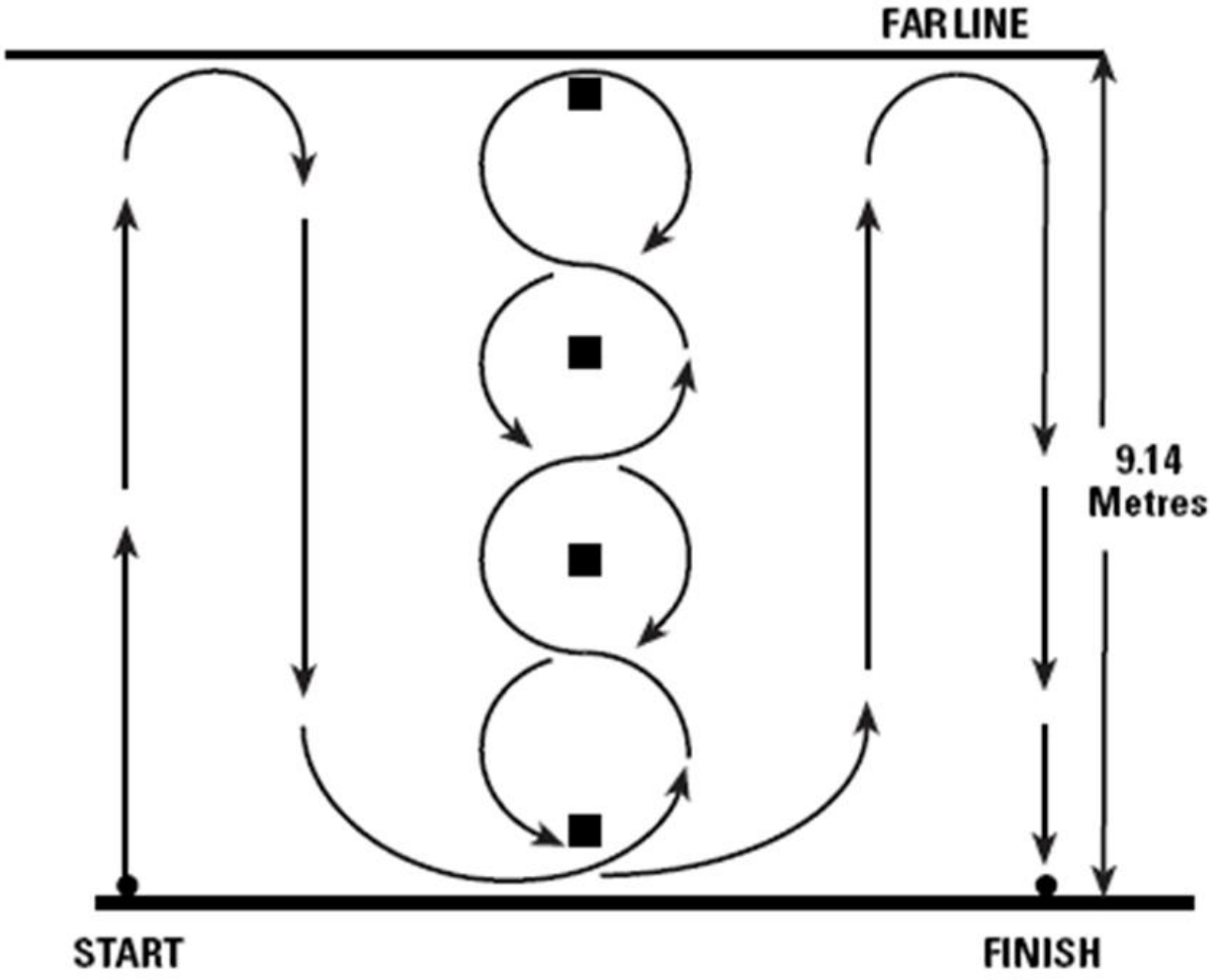
- **You are going to remember words and run again.**
- **This time I want you to focus on remembering as many words as you can while running the agility course.**
- **Let's see if you can remember all ___** (number) **words this time.**
- **Are you ready?**

Read the word list from the score sheet that corresponds to the number on the die that you rolled before testing. Read words at a rate of one per second, dropping voice inflection slightly on the last word in the sequence. Record the time it takes the subject to complete the course, and record the words recalled for each trial. Use a repeat trial if the subject does not follow instructions or stops before completing the trial.

D.2. Agility Priority This task is first for subjects with even ID numbers.

- **For this trial of words and running, I want you to focus on doing the agility task as quickly as you can while also doing the memory task.**
- **Let's see if you can beat your fastest time.**
- **Are you ready?**

Read the word list from the score sheet that corresponds to the number on the die that you rolled before testing. Read words at a rate of one per second, dropping voice inflection slightly on the last word in the sequence. Record the time it takes the subject to complete the course, and record the words recalled for each trial. Use a repeat trial if the subject does not follow instructions or stops before completing the trial.


FAR LINE
9.14
Metres
START
FINISH

Study ID:	Rater:	Date/Time:	Order:

ILLINOIS AGILITY TEST
Score Sheet

Did the subject complete the task? ☐ Yes ☐ No
If No: ☐ Examiner stopped task ☐ Subject stopped task

Did inertial sensor(s) malfunction? ☐ Yes ☐ No
If Yes: ☐ Head ☐ Trunk

A. Single Task Condition – Agility Testing
Trial 1: **Time** _____ (sec) Repeat if errors in path.
Trial 2: **Time** _____ (sec)

B. Single Task Condition – Word List Task / Cognitive Task
Complete this first word list task with a delay equivalent to the single agility task time. Then use the span of words remembered in this single word list task in future dual-task conditions.
Number of words remembered to be used in dual-task: _____

C. Dual-Task Condition – WITHOUT priority instructions
Mark correct words by number (i.e. 1, 2, 3) as they are recalled. Mark errors of omission from a list with an X. Record errors of commission (words added) to the list with an X. Words must be said verbatim or else it is an error. Note any errors from the agility course (i.e. incorrect path, contact with cones).

D1 & D2. Dual-Task Condition – WITH priority instructions
Same as C. above.

List 1: Trial # ___ ☐ single ☐ dual If dual: ☐ WITH instr. ☐ WITHOUT instr. ☐ word priority ☐ agility priority	**List 2: Trial #** ___ ☐ single ☐ dual If dual: ☐ WITH instr. ☐ WITHOUT instr. ☐ word priority ☐ agility priority
1. Rifle	1. Helmet
2. Camelbak	2. Ammo
3. Socks	3. Tourniquet
4. Notebook	4. Pen
5. Tape	5. Eye pro
6. Knee pads	6. Ruck
7. Compass	7. Chemlight
Words Recalled Correctly: _____ **Word Errors: _____** **Agility Test Time: _____** **Agility Course Errors: _____**	**Words Recalled Correctly: _____** **Word Errors: _____** **Agility Test Time: _____** **Agility Course Errors: _____**

Study ID:	Rater:	Date/Time:	Order:

List 3 Trial # ___ ☐ single ☐ dual If dual: ☐ WITH instr. ☐ WITHOUT instr. ☐ word priority ☐ agility priority	**List 4 Trial #** ___ ☐ single ☐ dual If dual: ☐ WITH instr. ☐ WITHOUT instr. ☐ word priority ☐ agility priority
1. Radio	1. Protractor
2. Flashlight	2. Knife
3. Goggles	3. Bandoleer
4. Poncho	4. Watch
5. Magazine	5. Jacket
6. Bandage	6. DEET
7. Marker	7. Lanyard
Words Recalled Correctly: _____ **Word Errors: _____** **Agility Test Time: _____** **Agility Course Errors: _____**	**Words Recalled Correctly: _____** **Word Errors: _____** **Agility Test Time: _____** **Agility Course Errors: _____**
List 5 Trial # ___ ☐ single ☐ dual If dual: ☐ WITH instr. ☐ WITHOUT instr. ☐ word priority ☐ agility priority	**List 6 Trial #** ___ ☐ single ☐ dual If dual: ☐ WITH instr. ☐ WITHOUT instr. ☐ word priority ☐ agility priority
1. E-tool	1. Ear pro
2. Boots	2. Batteries
3. Pistol	3. Sleeping bag
4. Duffel bag	4. Rope
5. Canteen	5. Cap
6. Gloves	6. Holster
7.Iodine	7. Scissors
Words Recalled Correctly: _____ **Word Errors: _____** **Agility Test Time: _____** **Agility Course Errors: _____**	**Words Recalled Correctly: _____** **Word Errors: _____** **Agility Test Time: _____** **Agility Course Errors: _____**

10-29-12
Rev 7-24-2013
Rev 9-9-2013
Rev 10-12-2013
Rev 12-2-2013
Rev 1-13-2014
Rev 2-14-14

Illinois Agility & Equipment List Dual Task
Scoring Guide

Examiner scoring supplies/materials:

- A die or other means of randomly choosing word list order
- Stopwatch
- Clipboard
- Pencil
- Scoresheet

Definitions of key underlying concepts:

Words Recalled Correctly – the number of word list items that the subject correctly reports at the end of each trial

Word Errors – the number of intrusions (new words added) or words missed from the list used in a trial

Agility Test Time – time to complete the agility course from GO signal to when the first foot crosses the finish line (to the hundredth of a second).

Agility Course Errors – the number of times within a trial that the person does not adhere to course and/or requires cues to do so) [contacts a cone during the course, misses the second serpentine pattern and stops him/herself to correct it, e.g.]

Scoring procedures for performance subscores:

Before starting the task

Fill out the following:

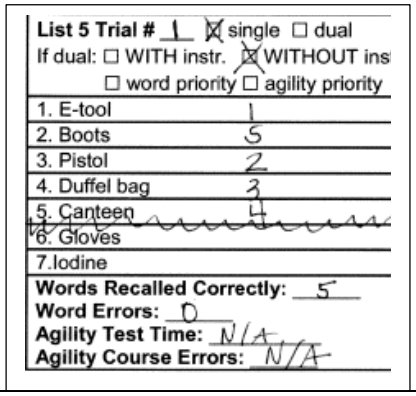
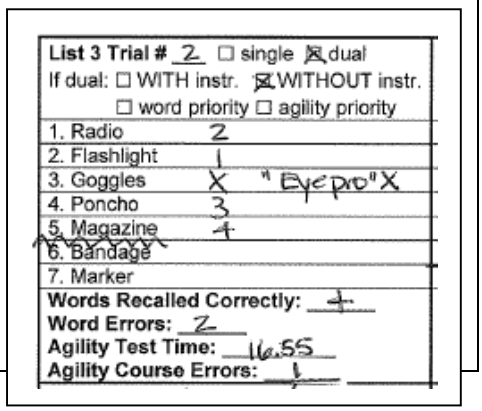
- Subject's study ID
- Your Rater ID
- Today's date
- Where in the test order the subject is performing this test-task
- Inertial sensor location(s), if applicable
- Item list order (determined by rolling die – if roll number 5 first, will use that word list for the first memory task trial)

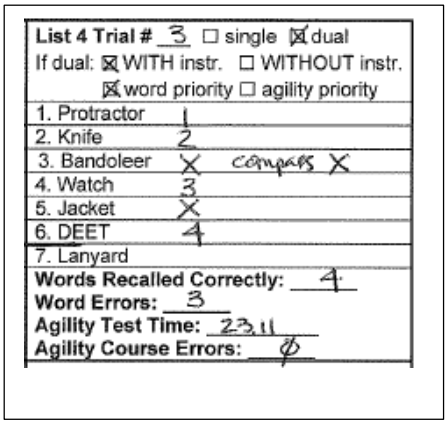
At task start

Roll a die to determine the order of the word lists that will be used with the subject; fill in the Trial # accordingly. Trial 1 is single task word list. Trial 2 is the WITHOUT instruction dual-task condition. Trials 3 and 4 are WITH Instruction priority conditions: for odd ID number subjects, Trial 3 is word priority and Trial 4 is agility priority; for even ID number subjects, Trial 3 is agility priority and Trial 4 is word priority.

During task

Performance dimension	Scoring procedures	Performance subscore
A. Single Task Condition – Agility Testing	The examiner starts the stopwatch when the participant is ready (at start line in prone position) and coincident with the "GO" cue.	Trial 1: Time = Time (in seconds) on stopwatch when the participant's first foot crosses the end line.

	If participant makes an error in the running path during the initial trial, repeat the trial in the single task conditions (A. Trial 2).	Trial 2: Time = Time (in seconds) on stopwatch when the participant's first foot crosses the end line.
B. Single Task Condition – Word List Task/Cognitive Task (Trial # 1)	Use the single task agility time from the last single task agility test as the "delay" for single task word list testing condition. After you present 7 words from the randomly chosen list, start the stopwatch. When the time for the agility task appears on the stop watch, ask for the participant to repeat the words he/she remembers. Record the words presented in order they are reciting. Write in any incorrect words that are recalled.	If SM recalls 5 or fewer words in this task, use 5 words in remaining dual-task trials. If SM recalls 6 or 7 words in this task, use that number in remaining dual-task trials. Mark this number on the first page of the scoresheet in the blank recorded for it. **Use this number as the word list length for dual-task trials. Mark this maximum word list length for each relevant trial as a reminder to stop at the correct number (e.g., only 5 words presented).**  List 5 Trial # 1 ☒ single ☐ dual If dual: ☐ WITH instr. ☒ WITHOUT ins ☐ word priority ☐ agility priority 1. E-tool 1 2. Boots 5 3. Pistol 2 4. Duffel bag 3 5. Canteen 4 6. Gloves 7.Iodine Words Recalled Correctly: 5 Word Errors: 0 Agility Test Time: N/A Agility Course Errors: N/A
C. Dual Task Condition – WITHOUT priority instructions (Trial #2)	The examiner presents the word list to the participant, pauses for 1 second, then starts trial with "Ready, set, Go" instruction. Start the stopwatch coincident with "GO". End the trial when the participant's first foot crosses the end line. After the agility task is completed, the participant reports as many words as he/she can remember from the list. In the box associated with Trial # 2, place a number next to each word in the order in which the subject reports back. Record any erroneous words that are reported as well. Count these as errors, meaning it is possible for the number of correct words and errors to add to more than the number of words provided.	In the box associated with Trial #2, fill in the following based on the definitions provided earlier in this scoring guide. • Words recalled correctly • Word errors • Agility test time (to the hundredth of a second) • Number of agility course errors  List 3 Trial # 2 ☐ single ☒ dual If dual: ☐ WITH instr. ☒ WITHOUT instr. ☐ word priority ☐ agility priority 1. Radio 2 2. Flashlight 1 3. Goggles X "Eyepro" X 4. Poncho 3 5. Magazine 4 6. Bandage 7. Marker Words Recalled Correctly: 4 Word Errors: 2 Agility Test Time: 16.55 Agility Course Errors: 1

D1. And D2. Dual Task Conditions WITH priority instructions (Trials # 3 & 4)	The priority for each condition is described before the word list is shared. The examiner presents the word list to the participant, pauses for 1 second, then starts trial with "Ready, set, Go" instruction. Start the stopwatch coincident with "GO". End the trial when the participant's first foot crosses the end line. After the agility task is completed, the participant reports as many words as he/she can remember from the list. In the boxes associated with Trials # 3 & 4, place a number next to each word in the order in which the subject reports back. Record any erroneous words that are reported as well.	In the boxes associated with Trials #3 & 4, fill in the following based on the definitions provided earlier in this scoring guide. • Words recalled correctly • Word errors • Agility test time (to the hundredth of a second) • Number of agility course errors  List 4 Trial # 3 ☐ single ☒ dual If dual: ☒ WITH instr. ☐ WITHOUT instr. ☒ word priority ☐ agility priority 1. Protractor 1 2. Knife 2 3. Bandoleer X compass X 4. Watch 3 5. Jacket X 6. DEET 4 7. Lanyard Words Recalled Correctly: 4 Word Errors: 3 Agility Test Time: 23.11 Agility Course Errors: ø

IAT Scoring Frequently Asked Questions

Word lists

How should I score word list recall if the subject reports back a word with a similar meaning as the correct word?

Word list recall must be exact to be counted as correct.

What if a SM remembers a word from the list after they've said the words they remember and you've written their responses down?

As long as they recall the word correctly before you go on to the next trial, count the recall as correct.

Agility course

How should I score Agility Course Errors if subject forgets to serpentine back toward the finish line but then self-corrects?

Count this as a single error. This often will slow their time on the agility course significantly, so the error will be accounted for in time in addition.

INSTRUMENTED STAND AND WALK-GRID COORDINATES (ISAW-Grid)

Instrumented Stand and Walk (ISAW) – Grid Coordinates
Description and Task Set Up

Description: The SM is challenged to perform the Instrumented Stand and Walk (ISAW) test (developed by APDM) which includes instrumented and timed assessment of quiet standing for 30 seconds, assessment of dynamic stability during walking for two 7 m (23 foot) lengths with a 180 degree turn at midpoint (Mancini et al 2012). The SM will next memorize an 8 digit alphanumeric grid coordinate provided within the context of a simulated patrol mission brief and report the exact sequence back to the examiner after 45 seconds. Finally, both the ISAW and the grid memorization tasks will be performed simultaneously. Accuracy of grid coordinate recall, postural sway area, gait path variability, and time to complete the ISAW (i.e. gait speed) will be measured in single and dual-task conditions.

Purpose: This task will assess balance and gait stability as well as working memory under sub-maximal exertion conditions. The ability to learn and retain operationally relevant information such as that provided in this task while moving to an assigned mission location has relevance to functional duty demands.

mTBI-related task challenges: Primary ● Secondary ○

Cognitive				Sensorimotor				Physical		
Executive function	Memory	Attention	Reaction time	Eye gaze tracking	Scanning	Vestibular	Balance	Bend-lift	Exertion	Manual UE Speed
	●	○				○	○			

Source: ISAW methods based on the work of Mancini M, King L, Salarian A, Holmstrom L, McNames J, and Horak F, Mobility Lab to Assess Balance and Gait with Synchronized Body-worn Sensors. J Bioengineer & Biomedical Sci 2012

Materials and Supplies

- Blue painter's tape to mark the initial standing position of subject's feet, the turn point at the end of the walkway and a box to stand in which is just past the start position for subject to stop in at the end of the walk (See Figure 1).
- Clipboard with Score sheet that has Grid coordinate lists
- Pencil
- Stopwatch
- Opal or NexGen inertial sensor, MobilityLab (Opal) software, and wireless data collection port with computer, Opal hand held controller. www.apdm.com/mobility

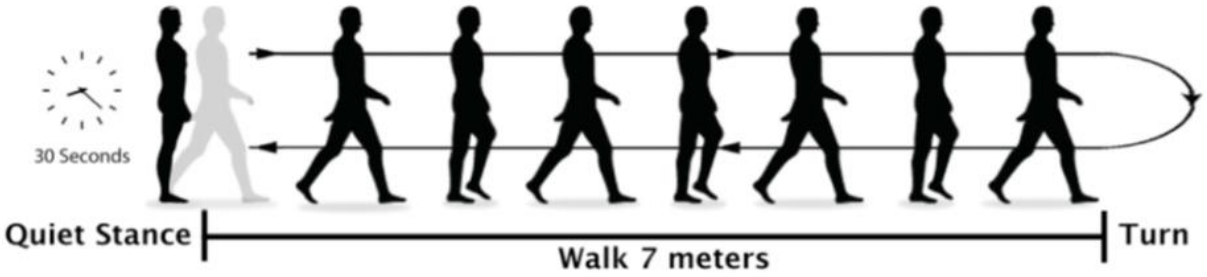
The Opal system, which is used to quantify participant position changes, velocity and acceleration, consists of three, wrist watch-sized wearable inertial sensors attached to participants at the waist and on each lower leg. These sensors record data obtained during testing, which is down loaded onto a dedicated laptop computer for analysis and output.

Test Task Set Up

- 30’ x 5’ testing area
- Laptop and set up table positioned ~ 5 feet from the activity start point for ease of monitoring and set up.
- Refer to the set-up manual from *MobilityLab User’s Guide* for the specific set up/floor markings and distances (Figure 2).

Figure 1. Subject walking towards box to stand in.

Figure 2. ISAW distances



ISAW – Grid Coordinates
Examiner Instructions and Script

Before testing roll a die to randomly pick one of the six grid coordinate combinations. Circle the number condition on the scoring sheet. This number will be standardized across all remaining test conditions.

INTRODUCTION

This dual-task is called the Instrumented Stand and Walk (ISAW) – Grid Memorization Task. It will assess your standing posture, walking and memory within the context of a military patrolling scenario. Accelerometers measure your speed and position changes during the test.

Put the Opal accelerometers on the participant's ankles and around his or her waist.

INSTRUCTIONS

This test has one practice trial and several assessment trials. The task requires standing still and walking, a memory task, and then several trials of doing both together.

I will orient you to each condition before it begins.
Do you have any questions?

- Standardize foot placement on the blue tape marks which are marked on the floor around the Opal standardization board at the start line.

Practice Stand and walk:

The walking task has two parts, standing followed by walking. Stand with your feet on these blue tape marks. Your eyes should be open and focusing on the "X" on the wall, your arms at your sides. When I say "begin" you'll stand quietly for 30 seconds.

- Point to the X marked on the wall at the end of the room, this should be put just above eye level at the far end to the testing room; tape marks on the floor should be set up ahead of time using the trapezoid like block from the Opal box).
- Demonstrate the walking and turn (see Opal video) by walking the 8-10 steps before the turn, demonstrate a correct pivot turn and then walk back toward start 8-10 steps.

Then I'll say "walk". When you hear this, walk at a brisk, comfortable pace to the tape, cross the tape, turn around and return to the box here. (Have a taped outline of a box about 18" square about 3 feet before the start line—which is past the start line on the return trip.) **Stand motionless in the box for a few seconds while the computer finishes processing the trial. I'll say "RELAX", and then you can step out of the box.**
Do you have any questions?

- Perform the PRACTICE ISAW single task condition. Use your stopwatch to time a 30 second stand and then give command "WALK" and have them stop in the tape outlined box which is behind the start line. Total time is about 45 seconds depending on their walking speed. If the subject does not perform the turn correctly (e.g., a pivot turn as demonstrated), repeat the turn instructions and verify their understanding.

1. Single Task: Motor (Balance and walk [ISAW]):

Now we are going to repeat the walking task a few times with the computer recording your movement. Do you have any questions before we begin?

- Perform the ISAW single task condition. The ISAW program is started when you say "BEGIN" and it is stopped when the subject stops in the taped square box after the accelerometer tracing has essentially flat-lined. After the "3…2…1" countdown on the computer screen, say **"RELAX"** and the subject returns to the start position.
- Perform 3 recorded trials in all. After the first trial say "**We will do that same thing 2 more times"**. After the second trial say "**We will do that one more time".**
- If the subject needs a reminder of the standardized start position say **"Arms at your sides, feet on the lines, focus your gaze on the "X", READY?"**….

2. Single Task: Cognitive only (Grid Coordinates Recall and Backbrief):

Next we are going to do a memory task. In this scenario, you are a squad leader in a reconnaissance unit. Your Commander has instructed you to perform a recon operation in the vicinity of grid coordinates that will be provided. I will read 2 letters and 6 numbers to you ONLY one time

During this task there are several rules:

1) **Do what is necessary to remember the coordinates, but you may not repeat them out loud or write them down.**
2) **Listen carefully, as you need to remember them in the order that they were given.**

After 45 seconds I will say "now". At that time tell me the letters and numbers that you remember.

Do you have any questions?
Are you ready? Let's begin…

- Refer to score sheet for the script and list of grid coordinates. Use selected coordinates based on die roll.
- Read 1 digit per second. Drop vocal inflection on final digit to communicate list completion.
- Start timing on the stopwatch approximately ½ second after you say the final grid digit and at 45 seconds say **"NOW".**

During memory recall 45 seconds later, the examiner will write down the letters and numbers vocalized by the participant on the scoring sheet in the order they are provided. A maximum of 8/8 points may be achieved for this condition. If the participant ~~does~~ remembers less than half of the letters/numbers correctly, do a repeat trial to ensure they understand the instructions.

3. Dual-Task Motor Cognitive
3a. Dual Task (Walking and Grid Recall and Backbrief)

Now we'll combine the stand and walk test with the GRID recall task. FORGET the last GRID coordinates I asked you to remember. I would like you to REALLY FOCUS ON remembering the grid coordinates during these trials. I will give you a new set of grid coordinates, then I will say "Begin" for the standing portion. After 30 seconds I will say "walk". You will walk the course as before. When you get back to the box, state the letters and numbers that you remember. Wait until I say "Relax" before stepping out of the box. Do you have any questions?

- **Arms at your sides**
- **Focus your gaze**
- **Feet on the markers**
- **Remember the grid coordinates in the correct order AND be prepared to walk the course when I say "Walk" as you have done in the other stand-walk conditions.**
- **Stop in the box and when I give the command "Now", repeat the coordinates that you remember. Wait until I say "RELAX", before stepping out of the box.**
- See the score sheet for script and choice of grid coordinates.

Mission Brief: **Change in mission, new grid coordinates are**_____
Start timing on the stopwatch when you say "walk". Record the time on the scoresheet for each trial.

3b. Dual Task (Walking and Grid Brief back)
We will do that same thing 2 more times. Please FORGET the last set of GRID coordinates I asked you to remember.
Refer to score sheet for script and choice of grid coordinates.

3c. Dual Task (Walking and Grid Brief back)
This is the last trial. Again, please FORGET the last set of GRID coordinates I asked you to remember.
Refer to score sheet for script and choice of grid coordinates
Remember… (say this if they need a reminder of the start position)

- **Arms at your sides**
- **Focus your gaze**
- **Feet on the markers**

Study ID:	Rater:	Date:	Order #:

Did SM complete the task? ___Yes ____No (examiner stopped) ____No (subject stopped)

ISAW Grid Test-Task Scoring Form

1. SINGLE TASK MOTOR

a. Time to complete 7 meter walk (single task condition): _____ (sec:XX).
b. Time to complete 7 meter walk (single task condition): _____ (sec:XX).
c. Time to complete 7 meter walk (single task condition): _____ (sec:XX).

1. Median time (Middle value of a. or b. or c. here) to complete 7 m walk_____(sec:XX)

(Circle Selected Grid Assignment 1-6 for all cognitive conditions)

2. SINGLE TASK COGNITIVE "*The Recon Operation is in the vicinity of_____"*

Assigned Grid Coordinate *Reported Grid Coordinate (write exactly as spoken)*

- *1) Uniform Charlie 6-1-9-4-7-3* _____
- *2) Bravo Gulf 3-9-2-4-8-7*
- *3) Zulu Mike 5-9-1-7-4-2*
- *4) Echo Quebec 6-5-9-3-7-2*
- *5) Delta Tango 4-9-7-3-9-2*
- *6) Sierra Oscar 4-1-7-9-3-8*

Number of grid coordinates accurately recalled in correct order (single task cognitive condition):
2. _____ (Max Score 8)

3. DUAL TASK MOTOR-COGNITIVE
(Circle Randomly Selected Grid Assignment 1-6 for all cognitive conditions)

TRIAL 3A "*Change in mission, new grid coordinates are_____"*
Assigned Grid Coordinate *Reported Grid Coordinate (write exactly as spoken)*

- *1) Romeo X-Ray 3-8-2-9-5-1* _____
- *2) Whiskey Alpha 3-7-6-2-1-9*
- *3) Foxtrot Kilo 5-8-1-9-2-6*
- *4) Yankee Papa 2-7-5-8-6-2*
- *5) November India 3-5-4-8-5-1*
- *6) Oscar Hotel 7-1-3-9-4-2*

3a1. Time to complete 7 meter walk (dual task condition): _____ (sec:XX).

3a2. Number of grid coordinates accurately recalled in correct order (dual task condition):
_____ (Max Score 8)

TRIAL 3B"*Change in mission, new grid coordinates are_____"*
Assigned Grid Coordinate *Reported Grid Coordinate (write exactly as spoken)*

- *1) Charlie Tango 5-3-8-9-1-4.* _____
- *2) Lima Victor 2-4-7-5-9-1*
- *3) Delta Juliet 3-6-1-9-5-2*
- *4) Alpha November 2-5-3-9-4-1*
- *5) Yankee Quebec 8-1-4-9-6-3*
- *6) Papa Bravo 4-1-3-7-5-2*

3b1. Time to complete 7 meter walk (dual task condition): _____ (sec:XX).

3b2. Number of grid coordinates accurately recalled in correct order (dual task condition): _____ (Max Score 8)

TRIAL 3C"*Change in mission, new grid coordinates are_____"*

Assigned Grid Coordinate *Reported Grid Coordinate (write exactly as spoken)*

- *1) Mike Sierra 4-1-7-9-2-5.* _____
- *2) Hotel Echo 1-5-3-0-4-6*
- *3) Juliet Uniform 2-5-1-9-3-7*
- *4) Kilo Victor 8-3-5-9-2-4*
- *5) Gulf Whisky 9-2-5-8-3-7*
- *6) Lima India 2-6-9-3-5-1*

3c1. Time to complete 7 meter walk (dual task condition): _____ (sec:XX).

3c2. Number of grid coordinates accurately recalled in correct order (dual task condition): _____ (Max Score 8)

Grid coordinate scoring:

1) Digits correct if:

- first or last digit is correct if stated correctly in first or last place
- any digits adjacent to first or last digit is correct
- a correct sequence of three or more anywhere in span

2) Letters correct –must be in the correct position (said first or second) and order to be counted as correct.

3) If subject says grid coordinates incorrectly and then rapidly corrects him/herself, the corrected version is written down and scored.

10-29-12
Rev 7-24-2013
Rev 9-9-2013
Rev 10-12-2013
Rev 12-2-2013
Rev 1-21-2014
Rev 7-15-14

ISAW-Grid
SCORING INSTRUCTIONS

Examiner scoring supplies/materials:

- Stopwatch
- Clipboard
- Pencil
- Subject score sheets and administration instructions
- Opal Movement Monitor, laptop and sensors with ankle and waist straps
- Army Phonetic Alphabet knowledge; for example that "D" is Delta, "L" is Lima so when the subject says "Delta" you write down "D".

At the start of the task the rater has the subject set up with the sensors in place (ankles and waist) and has the OPAL (ISAW) computer and system turned on.

Before starting the task, the rater fills out the following:

Subject's study ID
Your Rater ID
Today's date
Test order (testing 1st, 2nd …6th of the test tasks)

Section 1) For **the SINGLE TASK MOTOR**, the rater times how long it takes the subject to walk from the "WALK" verbal signal until his or her front foot crosses the start line, then fills in the blank 1a, 1b, or 1c on the score sheet, depending on trial. The examiner records the time to the nearest second using a stopwatch (1.a, 1.b, 1.c).

The MEDIAN TIME is the median or middle value of the 3 (1a, 1b, or 1c) and is filled in after the 3rd single task walking trial (BLANK 1).

Section 2) The rater circles which one of the "Assigned Grid Coordinate" choices for **SINGLE TASK COGNITIVE** was presented to the subject at the beginning of the trial (random choice by use of a dice to determine grid coordinate 1-6 for each trial). At the end of the elapsed time, the examiner says "NOW" and the rater writes exactly what the subject says on the blank line for Single Task Cognitive (for example, "BE 3 9 4 2 8 7").

In Blank 2, the examiner writes the # of grid coordinates recalled in the correct order.

NOTE: The examiner should count the number of alpha-numeric digits reported and scored per the scoring instructions on the score sheet (scoring rules included below also).

Grid coordinate scoring:

1) Digits correct if:
   - first or last digit is correct if stated correctly in first or last place
   - any digits adjacent to first or last digit is correct
   - a correct sequence of three or more anywhere in span

2) Letters correct –must be in the correct position (said first or second) and order to be counted as correct.

3) If subject says grid coordinates incorrectly and then rapidly corrects him/herself, the corrected version is written down and scored.

Section 3 A, B, C) The rater circles which one of the "Assigned Grid Coordinate" choices for **DUAL TASK MOTOR-COGNITIVE Trial 3A** was presented to the subject at the beginning of the trial. At the end of the elapsed time during which the subject is standing and walking the course, the examiner says "NOW" and writes down exactly what the subject says on the blank line for Dual Task Trial 3A (for example "BE 3 9 4 2 8 7"). This is repeated for Dual Task 3B and 3C.

For 3a1, 3b1, 3c1 – Record the amount of time to complete the 7 meter stand and walk to the nearest second (use hand held stopwatch).

For 3a2, 3b2, 3c2 – Write down the # of grid coordinates recalled in the correct order using the Grid Coordinate scoring rules described above.

<u>After subject has completed task</u>

- Name each data file on the OPAL system laptop using the participant's unique study ID number, task (single task/ dual task) condition, and trial (1,2, or 3) (e.g., 046#4_ST2 or 046#4_ DT3)
- Validate and save the Opal recordings at the completion of each test condition
- If not already complete, record the number of correctly identified grid coordinates in the appropriate fields (cognitive demand) on the scoring sheets.
- Ensure all motor performance scores (times in seconds) are correctly and legibly recorded on the scoring sheets.
- Note that Dual-Task Costs for motor and cognitive task performance will be calculated automatically within the data base spread sheet.

EXAMPLES FOR COUNTING GRID COORDINATE Letters and Numbers:

Subject B was able to report 7 of the 8 letters/digits from the chosen grid coordinate. If for example the subject is given:

"A (alpha)-Z (zulu)-4-8-1-6-2-9" The response is "A-Z-8-4-1-6-2"

[first two are correct (A,Z), second two transposed (both incorrect), next three correct (1,6,2), one digit omitted (9)].

The total number of correct numbers/digits is 5 of 8.

Subject C was able to report 8 letters/digits from the chosen grid coordinate. If for example the subject is given:

"*<u>J</u>uliet <u>U</u>niform 2-5-1-9-3-7*" The response is "U-I-*2-5-1-9-3-7*" (i.e., "Uniform-India_2-5-1-9-3-7")

[U is transposed (incorrect); I is incorrect, the remainder of the digits are correct].

The total number of correct numbers/digits is 6 of 8.

LOAD MAGAZINE-RADIO CHATTER

Load Magazine-Radio Chatter Listening
Task Description and Set Up

Description: SM completes a relatively automatic manual task choosing from a bin of mixed size dummy rounds (5.56 and 7.62 caliber) and loading 5.56 caliber training rounds into magazines as fast as possible both in a single and a dual task condition. The dual-task condition requires monitoring radio communication and verbally announcing when radio chatter is relevant to scenario instructions.

Purpose: The purpose of this task is to assess the cost of a cognitive task overlay on the speed of a relatively automated upper extremity manual task. This task is intended to challenge attention allocation (divided attention), sustained attention, executive function, manual dexterity/speed, and auditory processing.

mTBI-related task challenges: Primary ● Secondary ○

Cognitive				Sensorimotor				Physical		
Executive function	Memory	Attention	Reaction time	Eye gaze tracking	Scanning	Vestibular	Balance	Bend - lift	Exertion	Manual UE Speed
○		●								●

Source: Based on the work of Cicerone (1996) assessing dual task measures in persons with mTBI. Cicerone, K. D. (1996). Attention deficits and dual task demands after mild traumatic brain injury. *Brain Injury, 10*(2), 79-89.

Materials and Supplies

- 1-gallon open bin or tub for holding snap cap 5.56 caliber (M16) and 7.62 caliber (foil) dummy rounds
- 2nd empty bin for emptying magazine(s) to allow for counting the number of rounds loaded
- 100 snap cap dummy rounds (M16)
- 50 snap cap dummy rounds (M20) as foils
- 5 magazines for M16 caliber weapon
- Computer or audio-player such as an I-pod or MP3 player
- Speakers to play radio chatter audio files at sufficient volume.
- 3 versions of prerecorded ambient mock radio chatter.
- Radio chatter Audio files
- Cue sheets-set of 3 laminated sheets for reminding subjects of "key words" they are responding to during each trial (Practice, single task, dual task)

Test Task Set Up
Space estimate: 6x6 foot area with rectangular table and 2 chairs

Table is set up so that 4 M16 magazines are directly in front of subject with the bin of mixed rounds either to right or left side depending on subject preference. Speakers and audio player are close enough to play the sound directly in front of the subject. (See Figure 1.)

Figure 1: Load-Magazine-radio chatter set up. NOTE: M16 dummy rounds are kept in the bin during the trials, they are displayed here to show what they look like.

Load Magazine-Radio Chatter Listening
Examiner Instructions and Script

INTRODUCTION

- **For this task you will load M-16 dummy rounds into magazines and will listen to recorded radio chatter for specific *key* words.**
- **First you will practice both tasks by themselves. Then you will perform a recorded trial for each task separately, and then do both tasks simultaneously.**

Allow SM to practice loading rounds for 10-50 seconds or so as you are setting up, if you are already set up, you can skip this practice and just move straight in to the two 60 second trials.

Make sure that the volume is turned up relatively loudly so that the white noise is audible and slightly distracting.

INSTRUCTIONS

1. Magazine Loading Practice:

- **I want you to load M16 rounds from this bin into these magazines as *FAST* as you can for 60 seconds. I'll time you and then we will count them. If one of the magazines jams or gets stiff, just set it down and pick up a different one. If you drop a round on the floor don't try to get it, just pick up another round from the bin and keep loading. Start at magazine "1" and go through "4". The magazines hold 30 rounds.**
- **Any questions?**
- **Ready?…GO.**
- Time for 60 seconds with the stopwatch and call out **"STOP".**
- Empty filled magazines into the padded blue bin and count them, recording the total rounds loaded on score sheet.
- Return dummy rounds to the full bin and REPEAT.

- **Now for a 2nd 60 second practice trial, remember load as *FAST* as you can.**
- **Ready? ….GO**
- Record the number of rounds loaded in the 2nd practice trial on the score sheet.

NOTE: If, over time the magazines start malfunctioning, move to using #4 first and go to #1. The point is that it needs to be with the same magazines in single and dual task trials. For example, brand new magazines are much stiffer and harder to fill than the used ones.

2. Single Task Magazine Loading:

- **Again, I want you to load M16 rounds as *FAST* as you can.**
- **This time I'll use a recording that has radio static and a BEEP TONE sound. Start loading at the first BEEP and Stop when it BEEPS again. You will load for a little more than 2 minutes this time. Remember, if the magazine jams or gets stiff, set it down and pick up a different one. If you drop a round, keep going. We will get it later.**
- **Do you have any questions?** Answer all questions.

- **Ready?** Start the recording.

After the 2nd BEEP and subject stops loading, empty filled magazines into the padded blue bin and count them, recording the total rounds loaded on score sheet. Return dummy rounds to the full bin.

3.Radio Chatter Responses Practice:

Hand the TRAINING Scenario Sheet to the subject and review Key Words while pointing them out.

- **Now I am going to play a recording of radio chatter about the logistics of an FTX for several platoons. This is for practice.**
- **You are a radio operator monitoring the company communications network for an upcoming "Whiskey" Company FTX. Ignore the BEEP tones in the recording.**
- **Your task will be to report Specific Key Words in the chatter regarding the FTX.**
    - **When WOLF 7 says "OVER" whenever he is speaking, Say *"CHECK" LOUDLY***
    - **When WOLF 2 says "ROGER" whenever he is speaking, Say "CHECK"*LOUDLY***
    - **"Other people will say these words; ONLY respond to WOLF 7 and WOLF 2**
- **Do you have any questions?** (Answer all questions.)
- **What words are you responding to?** Make sure subject is correct. ASK THIS QUESTION BOTH with the Training Scenario in view and again with the sheet out of sight.
- **Ready?**

After the recording is completed, review the score sheet with the subject and tell them where their errors were made.

If the subject is 100% correct or makes a maximum of 1 mistake on the first practice trial and he/she does not want to run through the practice trial a 2nd time, then only play the TRAINING Scenario once.

If a 2nd practice is needed, replay the recording and mark the training score sheet in the second column. Again review the score sheet with the subject and tell them where their errors were made.

EXAMINER GUIDANCE/REMINDER:

- If the SM speaks softly during first trial, instruct him/her to speak louder and/or move closer.
- If the SM makes 0 or 1 mistake, he/she does not need a 2nd practice.
- If the SM makes 2 or more mistakes, he/she must complete a 2nd practice.

4. Radio Chatter Responses (Test 1: Single Task Condition) (Test_Script_1):
Hand the TEST1 Scenario Sheet to the subject and review Key Words while pointing them out.

- **Now I am going to play a new recording of radio chatter about a different FTX. Please ignore the BEEPS in this recording.**
- **You are now monitoring communications for a "Tango" Company FTX. Your task is the same as in the practice but the key words are different.**

    - **When TIGER 4 says "OVER", Say "CHECK" LOUDLY**
    - **When TIGER 7 says "BREAK", Say "CHECK" LOUDLY**

- **Do you have any questions?** Answer all questions.
- **What words are you responding to?** Make sure subject is correct, with scenario sheet in view and again with it out of view. The point is to make sure the last thing the subject is thinking about is the KEY WORDs and not about other off task topics. This must remain consistent throughout all trials.
- **Ready?**

Start the tape, and mark the score sheet.

5. Dual-Task: Magazine Loading and Radio Chatter (Test_Script_2):
Hand the TEST2 Scenario Sheet to the subject and review Key Words while pointing them out

- **Now we are going to combine loading M16 magazines and reporting on KEY words.**
- **Load rounds as fast as you can. If a magazine jams just set it down and start a new one. If you drop a round, don't chase it, just keep loading. Start loading with the first BEEP TONE. Keep loading after the radio chatter stops until the 2nd BEEP sounds.**
- **You are now monitoring communications for a "Sierra" Company FTX.**
    - **When STRIKER 2 says "OVER", say *"CHECK"LOUDLY***
    - **When STRIKER 7 says "BREAK", say "CHECK" LOUDLY.**

- **Do you have any questions?** Answer all questions.
- **What words are you responding to?** Make sure subject is correct, once with scenario sheet in front of them and once with it out of sight.
- **Ready?**

Start the tape and mark the score sheet.

Study ID:	Rater:	Date:	Order #:

Did SM complete the task? ____Yes ____ No (examiner stopped) ___No (subject stopped)

Military Radio Chatter Test-Task Scoring Form (Training Script)

Rounds loaded Practice 1 (60 s)	
Rounds loaded Practice 2 (60 s)	
Rounds Loaded Single Task (130 s)	**1.**
Rounds Loaded Dual Task (130 s)	**2.**

Correct Responses: **"Check"** when **Wolf 7 says "OVER"** or **Wolf 2 says "ROGER".**

Graded Script	**Over/Roger Points**	
	Time 1	Time 2
Wolf 2: Wolf 7 this is Wolf 2, **over**.		
Wolf 1: Wolf 7 this is Wolf 1, **over**.		
Wolf 7: This is Wolf 7. Battalion has authorized Whiskey Company to commence with FTX in 3 weeks, **OVER**.		
Wolf 2: This is Wolf 2.**ROGER, over**.		
Wolf 1: This is Wolf 1. Copy on the FTX. **Break**.		
Be advised, we are down 1 squad and 3 vehicles at this time, **over.		
Wolf 7: This is Wolf 7. Wolf 1, Coordinate with the NCOIC from second platoon to cross level the troops and vehicles you'll need for the op **OVER**.		
Wolf 1: This is Wolf 1. **Roger** that. **Break**.		
Our other training challenge is that the additional M-16 range we requested for the FTX is already occupied by C Battery that week, **over.		
Wolf 2: This is Wolf 2. **ROGER**,		
Weapons qual is a challenge for us too. If we don't identify another range, two of our squads will be RED on their training status for the Commander's QTB, **over.		
Wolf 7: This is Wolf 7. Schedule the second range the week after the FTX. **Break**.		
I will clear it with Battalion S-3, **OVER.		
Wolf 1: This is Wolf 1. **Roger** that, **over**.		
Wolf 2: This is Wolf 2. Copy last transmission. We'll take the lead on the second range, **over**.		
Wolf 7: This is Wolf 7. **Roger** that.		
Wolf 2, have LT Smith come see me for the range book. **Break.		
Also, have operations contact range control to re-confirm availability of our primary range during the FTX, **OVER.		
Wolf 1: This is Wolf 1. WILCO, **over**.		
Wolf 2: This is Wolf 2. **ROGER, over**.		
Wolf 7: Wolf 7, **OVER** and out.		
Totals: 5 –"over" 3 – "Roger" Possible Distractors: (13 of both Over and Roger or Break)	**Correct ___/8** **Distract ___/13**	**Correct ___/8** **Distract ___/13**

**continuation of speaker from prior line

RATER INFORMATION:

-Clear area is correct check mark; shaded area is error check mark.

-Indicate in box if Subject says "CHECK" for any phrase, before the next keyword.

Study ID:	Rater:	Date:	Order #:

***Military Radio Chatter Grading Sheet (*Test Script 1-Single)**

Correct Responses: **"Check"** when **Tiger 4 says "OVER"** or **Tiger 7 says "BREAK".**

Graded Script	Over/Break Points
Tiger 3: Tiger 7 this is Tiger 3, **over**.	
Tiger 7: Tiger 3 this is Tiger 7, go ahead, **over**.	
Tiger 4: Tiger 7 this is Tiger 4. **OVER**.	
Tiger 7: This is Tiger 7. Next week's training exercise will be conducted in training area XZ. **BREAK.**	
Key leaders need to give me a SITREP on their status by 1600 today, **over.	
Tiger 4: This is Tiger 4. **Roger, OVER**.	
Tiger 3: This is Tiger 3. Copy last transmission. **Break**.	
Are we still covering Class I for all phases of the exercise, **over?	
Tiger 7: This is Tiger 7. Negative. The initial piece is yours but resupply will be on Tiger 4 at Day 3, **over**.	
Tiger 3: This is Tiger 3. **Roger, over**.	
Tiger 4: This is Tiger 4. Copy last transmission. **Break**.	
Tiger 7, can you verify that our assets are also tasked to provide the command group transport to and from the FTX, **OVER.	
Tiger 7: This Tiger 7. Affirmative, **over**.	
Tiger 3: This is Tiger 3. Tiger 4, be advised the DFAC has 10 cases of water and MRE's ready for pick up, **over**.	
Tiger 4: This is Tiger 4. **Roger** that, **OVER**.	
Tiger 7: This is Tiger 7. Tiger 3 also be prepared to transport the Class V to the training area if we receive final approval that the qualification range is a "go", **over**.	
Tiger 3: This is Tiger 3. **Roger** that, **over**.	
Tiger 4: This is Tiger 4. Battalion tasked out our supply vehicles through the end of next week. **Break**.	
We will need two additional vehicles to cover the resupply mission while keeping a vehicle open to transport the command group **OVER.	
Tiger 7: This is Tiger 7. Tiger 4, coordinate with the Tiger 3 to cross level 2 vehicles for the mission. **BREAK**.	
We need that done by COB today, **over.	
Tiger 4: This is Tiger 4. Roger Top, we will tap SGT Jones on that at the planning meeting **OVER**.	
Tiger 7: This is Tiger 7. Tiger 3, what is your status on drivers at this time? **BREAK**.	
Can you assist Tiger 4 with additional personnel for his taskers, **over?	
Tiger 3: Tiger 7, this is Tiger 3, We'll cover it Top, **over**.	
Tiger 7: Tiger 7, **over** and out.	
TOTALS	**3. Correct ____/ 9** **4. Distractors _____/17**

**continuation of speaker from prior line

RATER INFORMATION:
-Clear area is correct check mark; shaded area is error check mark.
-Indicate in box if Subject says "CHECK" for any phrase, before the next keyword.

Study ID:	Rater:	Date:	Order #:

Military Radio Chatter Grading Sheet **(Test Script 2-Dual)**

Correct Responses: **"Check"** when **Striker 2says "OVER"** or **Striker 7 says "BREAK".**

Graded Script	Over/Break Points
Striker 7: Striker 2 this is Striker 7, **over**.	
Striker 2: Striker 7 this is Striker 2. Go ahead, **OVER**.	
Striker 7: This is Striker 7. Day 1 Ops at the FTX will include establishing all tactical checkpoints and setting up the bivouac site. **BREAK**.	
Striker 2 NCO's will teach immediate action drills: reaction to ambush; react to indirect & direct fire, **over.	
Striker 2: This is Striker 2. **Roger, OVER**.	
Striker 7: This is Striker 7. On days 2 & 3 Striker 2 NCO's will teach their elements small unit patrolling, individual & squad movement techniques, and first aid training. **BREAK**.	
They will also cover communications and UXO training, **over.	
Striker 2: This is Striker 2. **Roger, OVER**.	
Striker 1: This is Striker 1. We are responsible for teaching Land Nav on day 3. **Break**.	
Can we move that block of instruction today 4, **over?	
Striker 7: This Striker 7. Negative, cover it on day 3but coordinate the start time with Striker 2, **over**.	
Striker 1: This is Striker 1.**Roger**, **over**.	
Striker 2: This is Striker 2.**Roger**, **OVER**.	
Striker 7: This is Striker 7. Striker 1on days 4 & 5 your NCO's will teach NBC decon, SALTE reports, and MEDEVAC lanes, **over**.	
Striker 1: This is Striker 1.**Roger**, **over**.	
Striker 2: This is Striker 2. Striker 1, we have the training plans and materials from last year's FTX if you need them. **Break**.	
****SGT Jones will be the POC if you want to sign for the training materials, **OVER**.	
Striker 1: This is Striker 1.WILCO. **Break**.	
Have SGT Jones set it to the side and we'll sign for it later today, **over**.	
Striker 2: This is Striker 2, Roger I'll let him know, **OVER**.	
Striker 7: This is Striker 7. FTX ends on day 6.**BREAK**.	
Striker 1, your element is tasked to transport personnel and training assets back to garrison and will police and close the training site, **over.	
Striker 1: This is Striker 1.**Roger** that, **over**.	
TOTALS	**5. Correct_____/9** **6. Distractors _____/14**

**continuation of speaker from prior line

RATER INFORMATION:
-Clear area is correct check mark; shaded area is error check mark.
-Indicate in box if Subject says "CHECK" for any phrase, before the next keyword.

Load Magazine-Radio Chatter Dual Task
Scoring Instructions

Examiner scoring supplies/materials:

- Clipboard
- Pencil
- Subject score sheets
- Stopwatch
- Radio recording (iPod) and speakers

Before starting the task
Fill out the following:

- Subject's study ID
- Your Rater ID
- Today's date
- Test order (testing 1st, 2nd …6th of the test tasks?)

Count number of rounds for each of 2 timed 60 second practice trials and record on score sheet at the top. **Note** that this is to reduce the practice effect and provides general information to see if there is a major practice effect in the number of rounds loaded (for example, if during the first practice trial the subject loads 10 rounds and the 2nd trial the subject loads 28 rounds, this information will aid data analysis).
NOTE that the ROUNDS LOADED information is all recorded on the TOP of the TRAINING Script.
Rounds Loaded ST
Play the White Noise recording which has tones for start/stop of loading rounds. When finished, empty the magazines into the padded bin. Count the number of dummy rounds loaded in the single task condition and record under 1._____. Return rounds to the start bin.
TRAINING SCRIPT
Play the Training Script recording, score and repeat according to the instructions. Place a check mark on the score sheet for each phrase when the subject says "CHECK". Practice script is played twice unless SM is 100% correct or up to 1 wrong on 1st trial and does not want a 2nd practice trial. If subject makes more than 1 error on first Training Script, then they automatically do a second practice round. Record the number of correct checks (white box) and the number of distractors (shaded box) at the bottom under either Trial 1 or Trial 2 as appropriate. [Note: distractor/shaded represent errors.]

TEST SCRIPT 1
Play Test Script 1 recording. Place a check on the score sheet for each phrase when the subject says "CHECK".
3._____ is the number of correct checks (white rows)
4._____ is the number of distractors (shaded rows)

TEST SCRIPT 2/ Rounds Loaded DT

When playing Test Script 2, the subject is also loading rounds. Play the **Test Script 2-Dual** recording which has tones for start/stop of loading rounds. Place a check on the score sheet for each phrase when the subject says "CHECK". When finished, empty the magazines into the padded bin. Count the number of dummy rounds loaded in the dual task condition and record under 2._____ on the front page of the scoresheet (at the top of the form). Return rounds to the start bin.

5._____ is the number of correct checks (white rows)

6._____ is the number of distractors (shaded rows)

After subject has completed task

- Write down any comments the subjects made about the strategies they used or other comments.
- Calculation of dual-task costs for motor and for cognitive costs will be done during analysis
- Return any dummy rounds to the start bin

July 26, 2013
REV: 22Sept2014
REV: June 2015

Load Magazine-Radio Chatter Dual Task
Cue Sheets

Practice

Say **"CHECK"** when you hear:

Wolf 7 **"OVER"**

Wolf 2 **"ROGER"**

T1

Say **“CHECK”** when you hear:

Tiger 4 **“OVER”**

Tiger 7 **“BREAK”**

T2

Say **“CHECK”** when you hear:

Striker 2 **“OVER”**

Striker 7 **“BREAK”**

Department of the Army
U.S. Army Aeromedical Research Laboratory
Fort Rucker, Alabama 36362-0577
www.usaarl.army.mil

U.S. Army Medical Research and Materiel Command