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MISSION MEASURES OF EFFECTIVENESS FOR SMALL UNIT INFANTRY OPERATIONS

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Task Authorization No. 001
Technical Authority: Linda Bossi
Contractor's date of publication: November 2017

Defence Research and Development Canada

Contract Report
DRDC-RDDC-2018-C141
October 2018

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Canada

IMPORTANT INFORMATIVE STATEMENTS

This document was reviewed for Controlled Goods by Defence Research and Development Canada using the Schedule to the *Defence Production Act*.

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Task Authorization No. 001

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November, 2017

Abstract

The goal of this project was to develop an analytical model to evaluate small Unit mission effectiveness with sufficient diagnosticity at the task and capability levels, to support the evaluation of dismounted soldier information systems, or more generally, the impact of any intervention (technology, training, doctrine, etc.) on small unit effectiveness.

Three different approaches to measuring dismounted mission effectiveness were reviewed for their suitability for assessing Dismounted Soldier System digital information capabilities. The strengths of these approaches were considered and combined with the results of two subject matter expert workshops to develop a new mission effectiveness model that meets the small Unit information systems aims of this project: the Dismounted Soldier System – Measures of Mission Effectiveness model or DSS-MOME.

The proposed DSS-MOME provides a framework and analytical summation process for aggregating up to 122 MOPs to produce mission effectiveness and outcome measures, while enabling detailed traceability and diagnosticity to the task and capability levels. Opportunities for refining and further developing the model are discussed.

Executive Summary

Mission Measures of Effectiveness for Small Unit Infantry Operations.

David Tack and Edward Nakaza, Human*Systems*® Incorporated; Contractor Report submitted in partial fulfillment of PWGSC Contract No. W7701-166107/001/QCL Task Authorization No. 001; for Defence R&D Canada – Toronto Research Centre; November, 2017.

BACKGROUND: The development of ubiquitous battlefield digital networks, down to the individual soldier, and the miniaturization of robust new computing, sensing, and communications technologies has seen an explosion of new information products and capabilities for the future dismounted soldier. These new products and capabilities claim to bring increased performance and effectiveness to the battlefield but there is a paucity of objective data available on small Unit performance to support or refute these claims. Despite a long history of evaluating soldier system effectiveness, a comprehensive model of dismounted small Unit mission effectiveness for digital information systems is still lacking. Such a model of mission effectiveness will be required to support assessments to compare alternative dismounted soldier systems, alternative means of employment of such systems, and future capability development initiatives, in both laboratory and field environments.

AIMS: The aims of this project were to:

a) Determine a method to objectively compare Platoon mission and task effectiveness to an operational infantry baseline capability.

b) Develop an analytical model for evaluating mission effectiveness of small combat teams (up to Pl level) for use in assessing team performance in both laboratory and field environments.

c) Develop a model that is diagnostic down to the task and capability level.

d) Target the content of the model to support the evaluation of Dismounted Soldier System (DSS) digital information capabilities.

APPROACH: Three approaches to assessing soldier system effectiveness were reviewed for their strengths and limitations for use as a mission effectiveness model. These included the Future Force Warrior Integrated Analysis and Experimentation Framework, the SIREQ-TD project framework, and the NATO Dismounted Soldier Systems Measurements for Analysis. Two workshops were held at the Infantry School, Combat Training Centre at CFB Gagetown to review past approaches and to develop a new dismounted soldier system mission effectiveness model.

RESULTS: Three different approaches to measuring mission effectiveness were reviewed for their suitability for evaluating DSS digital soldier information capabilities. The strengths of these approaches were considered and combined with the results of the two subject matter expert

workshops to develop a new mission effectiveness model that meets the small Unit information systems aims of this project: the Dismounted Soldier System – Measures of Mission Effectiveness model or DSS-MOME.

This model aggregates 122 Measures of Performance (MOP), using 150 measurements, into 73 Measures of Effectiveness (MOEs), which combine into 23 Mission Measures of Effectiveness (MMOEs) in 6 Groupings. The proposed DSS-MOME provides a framework and analytical summation process for aggregating MOPs to produce numeric mission effectiveness and outcome measures or scores, while enabling detailed traceability and diagnosticity to the task and capability levels. Groupings and MMOEs were prioritized according to their importance to mission quality and success, according to each of five different mission types: hasty attack, deliberate attack, deliberate defense, reconnaissance patrol, and cordon & search. A method of aggregating performance effectiveness through the tree model was developed using a bottom-up summation scoring model, where the performance effectiveness measurements would be aggregated and summed according to the weighted importance of each measurement to arrive at Measures of Outcome (MOO).

DISCUSSION: Issues of model customization and analyses are discussed. Further refinement and model development options are also presented. Finally, opportunities for exploiting the model for other interventions (such as other technologies, training, doctrinal changes, changes in tactics techniques and procedures, or personnel interventions) are identified.

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Acknowledgements

The authors would like to acknowledge the Infantry School, Combat Training Centre, and the Canadian Army Test and Evaluation Unit, both of Canadian Forces Base Gagetown, for their significant contributions to the development of the measures of mission effectiveness model described in this report.

1. Background

The development of ubiquitous battlefield digital networks, down to the individual soldier, and the miniaturization of robust new computing, sensing, and communications technologies has seen an explosion of new information products and capabilities for the future dismounted soldier. These new products and capabilities claim to bring increased performance and effectiveness to the battlefield but there is little objective data available on small Unit performance to support or refute these claims. As well, significant concerns exist regarding the true costs/benefits of these systems, the best way to employ these systems and capabilities, and the potential burden of distracting or overloading soldiers with information on the battlefield, and any associated loss of combat effectiveness.

Defense Research and Development Canada (DRDC) has a long history of objectively evaluating new and emerging dismounted soldier systems (DSSs) at the individual soldier and small Unit levels. Canada's Soldier Information Requirements Technology Demonstration (SIREQ-TD) program undertook ground-breaking research to develop human factors requirements for the Canadian Army's new Integrated Soldier System Suite (ISS-S). The ISS-S will be introduced to two Battalions in 2018. DRDC's ongoing Soldier Systems Effectiveness (SoSE) project and upcoming Human System Performance (HSP) project will also continue to evaluate new DSS products and capabilities at the individual soldier and small Unit levels.

Despite a long history of evaluating soldier system effectiveness, DRDC lacks a comprehensive model of dismounted small Unit mission effectiveness to support the analyses forecasted in the ISS-S rollout and the future HSP studies. Any model of mission effectiveness will be required to support the following assessments in both laboratory and field environments (e.g., Live Simulation[1]):

1. **Compare Alternative DSS Capabilities:** New and emerging technologies can insert or modify capabilities of the soldier and small Unit force. A method of measuring their impact on small Unit mission effectiveness is required to inform the cost/benefit analyses of these new technologies.

2. **Compare Alternative Methods of Employment:** Prior to the ISS-S introduction, new Tactics Techniques and Procedures (TTPs) will need to be developed by the Combat Training Centre – Infantry School, CFB Gagetown. An objective method of comparing the effectiveness of alternative TTPs and other means of employment (e.g. different capabilities by role, alternative force structures) is required.

3. **Assess Future Capability Directions:** Future DSS capabilities can be assessed long before a physical product exists by exploiting DRDC's immersive virtual soldier system testing environments (e.g., Constructive Simulation[2]). Information content and display interfaces can also be manipulated in virtual space to evaluate alternative design concepts and

1 Live simulation consists of "real people in a simulated environment using real equipment but with simulated effects (e.g. soldiers in full battle dress with actual tank or gun at an outdoor training environment with [usually simulated] ammunition)" (Capuano, 2015).
2 Constructive simulation consists of "real people controlling simulated units, platforms or systems with simulated equipment, in a simulated environment generating simulated interactions and effects (e.g. soldiers in full battle dress controlling a simulated battle via a virtual battlespace that can include aspects of land, sea and air)" (Capuano, 2015).

methods of employment. To effectively evaluate these future capabilities, against a known baseline, requires an objective model for measuring mission effectiveness.

Therefore, an assessment model that can enable objective measurement and scoring of mission effectiveness of small Unit dismounted infantry missions, while being sufficiently detailed and diagnostic at the task and capability level, is required to support future DSS testing.

1.1 Aims

The aims of this project were to:

a) Determine a method to objectively compare Platoon mission and task effectiveness with a capability intervention to an operational infantry baseline capability.

b) Develop an analytical model for evaluating mission effectiveness of small combat teams (up to Pl level) for use in assessing team performance in both laboratory and field environments.

c) Develop a model that is diagnostic down to the task and capability level so that mission effectiveness outcomes can be better understood at the level of tasks and activities.

d) Target the content of the model to support the evaluation of Dismounted Soldier System (DSS) digital information capabilities.

1.2 List of Acronyms/Abbreviations

ATEC	Army Test and Evaluation Command
CATEU	Canadian Army Trials and Evaluation Unit
CFB	Canadian Forces Base
COPPED	Cover/Concealment, Obstacles, Position for Fire, Position for observation, Enemy, Distance
CTA	Cognitive Task Analysis
DRDC	Defense Research and Development Canada
DSS	Dismounted Soldier System
DSS-MOME	Dismounted Soldier System – Measures Of Mission Effectiveness
EEA	Essential Elements of Analysis
ET	Experimentation Team
FFW	Future Force Warrior
HSP	Human System Performance
ISS-S	Integrated Soldier System Suite
ITA	In Theater Assessment
LCG	Land Capability Group
MILES	Multiple Integrated Laser Engagement System
MMOE	Mission Measure of Effectiveness
MOE	Measure of Effectiveness
MOO	Measures of Outcome
MOP	Measure of Performance
MOUT	Military Operations in Urban Terrain
NATO	North Atlantic Treaty Organization
NCO	Non-Commissioned Officer
NIE	Network Integration Evaluations
Pl	Platoon
RTCA	Real-Time Casualty Assessment
SCU	Small Combat Unit
SIREQ-TD	Soldier Information Requirements Technology Demonstration
SME	Subject Matter Expert
SoSE	Soldier System Effectiveness
SS	Soldier System
TBC	To Be Confirmed
TTP	Tactics Techniques and Procedure

2. Approach

The following approach was undertaken to fulfill the aims of this project.

2.1 Review Models of Effectiveness

Three approaches to assessing soldier system effectiveness were reviewed for their strengths and limitations for use as a mission effectiveness model. These included the Future Force Warrior Integrated Analysis and Experimentation Framework (Schamburg, 2005), the SIREQ-TD project framework (Tack & Angel, 2005), and the North Atlantic Treaty Organization (NATO) Land Capability Group-1 (LCG1) Dismounted Soldier Systems Measurements for Analysis (NATO LCG1, 2011).

2.2 'Strawman' Model Development

An initial 'strawman' framework, grouping measures of performance, effectiveness, and mission outcome measures, was created based on the structure and content of mission effectiveness measures for dismounted infantry developed in the SIREQ-TD program (Tack & Angel, 2005), and content from each of the NATO Dismounted Soldier Systems Measurements for Analysis (NATO LCG1, 2011), and Integrated Analysis and Experimentation Framework (Schamburg, 2005) documents. This 'strawman' framework was intended as a starting point for discussion and review by workshop participants.

2.3 Subject Matter Expert Workshops

Two workshops, separated by about a month for review and reflection, were held at the Combat Training Centre at CFB Gagetown. Workshop participants included six Senior Non-Commissioned Officer (NCO) instructors from the Infantry School and a Technical Staff trained infantry Captain from each of the Infantry School and the Canadian Army Trials and Evaluation Unit (CATEU).

2.3.1 Workshop 1:

Workshop 1 set the stage, reviewed the 'strawman' framework, and developed a preliminary model. Activities included:

a) Briefing to the Workshop Team:

   Participants were briefed on future soldier system developments and the ISS-S system. The NATO LCG1 (2011) and Schamburg (2005) models were reviewed and discussed. Mission measures and groupings of effectiveness from SIREQ-TD (Tack & Angel, 2005) were briefed and reviewed in light of current infantry operations.

b) Review of 'Strawman' Framework:

   The 'strawman' framework was briefed and reviewed for both structure and content.

c) Development of Initial Model:

The 'strawman' framework was re-organized for effectiveness groupings and measures of performance and effectiveness. Measures were carefully defined, detailed, and methods of measurement identified. Measures of effectiveness were prioritized for five mission types, according to primary, secondary, and tertiary effects on mission effectiveness.

2.3.2 Workshop 2:

Workshop 2 reviewed the product of Workshop 1, refined the preliminary model, and developed a final model. Activities included:

a) Review of Workshop 1 Products:

Workshop 2 began with a careful review of the preliminary model, structure, and content of Workshop 1. The model was reviewed for balance, consistency, completeness, and usability.

b) Development of Final Model:

Functional groupings were re-aligned and measures were balanced for functional level in the model. All measures and measurements were reviewed for relevance, accuracy, and completeness. The tree structure of the model was re-balanced to ensure the prioritization weightings were categorically matched according to the level of measure in the tree model. Measures of effectiveness were prioritized in the new model structure for five mission types: hasty attack, deliberate attack, deliberate defense, reconnaissance patrol, and cordon & search.

3. Results

The following section reviews three approaches to a mission effectiveness model; proposes a new analytical model (Dismounted Soldier System Measures of Mission Effectiveness (DSS-MOME)); describes its' structure, content, and weightings; outlines the summation method of scoring aggregation; and offers some approaches to applying the model.

3.1 Models of Effectiveness

Evaluating mission performance and mission effectiveness is a task that is regularly undertaken by military organizations, where the "contributing effects to the outcome of the mission are measured" (NATO Land Capability Group 1, 2011) in some way. These evaluations are commonly carried out in-situ, where the Measures of Effectiveness (MOEs) (i.e., "the important output measures that are used to compare the overall effectiveness of missions" (Schamburg, 2005)), and Measures of Performance (MOP) (i.e., "Measures that are believed to support MOEs" (Schamburg, 2005)) are frequently (or appear to be) collected in an ad-hoc manner, and not within a comprehensive analytical process model.

As stated by Nakaza (2015), *the U.S. Army Test and Evaluation Command (ATEC) which is responsible for all Army developmental and operational testing, is currently undertaking a multiyear, multi-faceted, assessment (including human systems integration evaluations) of the Nett Warrior dismounted leader situational awareness system*[3] *for use during combat operations. As part of the Network Integration Evaluations (NIE)*[4]*, these large-scale exercises*[5] *incorporate operational and live fire test and evaluations. Although not clearly documented, metrics collected during these evaluations appear to have included interoperability (i.e. transmit/receive messages), system reliability (i.e. operating hours), operational range (i.e. "the infantry company was hampered by the short range of the SRW on the AN/PRC-155 Manpack radio in woodland terrain"), and battery life (i.e. 2 – 6 hours). Subjective comments through observation, surveys and interview type questions, however, seem to account for the largest proportion of information (e.g. "use of the Nett Warrior improved situational awareness at the platoon level and continues to enhance pre-mission planning tasks, land navigation, and command and control"; "the infantry company did not have complete situational awareness because the Manpack radio did not transmit position location information in a consistent manner"; "leaders stated that voice communications were good until a terrain feature blocked line-of-sight"; "soldiers experienced discomfort from hot batteries"; and "screen brightness can inadvertently disclose the user's location to the enemy"). Other metrics collected include complexity of use, mission success based on After Action Reporting such as time and position tracking and casualty calculations through the use of Real-Time Casualty Assessment (RTCA)*

3 Nett Warrior system consists of a smartphone end user device, AN/PRC-154A rifleman radio, conformal battery, and connecting cables

4 NIE: "A series of semi-annual evaluations designed to establish a Network Baseline and then rapidly build and mature the Army's tactical Network…The NIE will provide a means to evaluate relevant capabilities in parallel and make incremental improvements based upon a disciplined and professional feedback cycle [i.e. what can be learned when the capabilities are put in the hands of Soldiers in the field]." (Brigade Modernization Command, September 2015).

5 "NIE 16.1 consisted of over 9,000 Soldiers, 14 partner nations including a United Kingdom brigade headquarters, 300 platforms and 20 command posts…including an opposing force" (Jones-Bonbrest, September 2015).

Instrumentation and Multiple Integrated Laser Engagement System (M.I.L.E.S) (Director Operational Test and Evaluation, 2014; 2015).

Human systems integration evaluations have also been conducted in theatre (i.e. In Theater Assessments or ITAs). For example, prior to the Nett Warrior system evaluation, the Land Warrior – Manchu system was assessed for performance in combat. Functional needs analyses were conducted based on a "combination of operational lessons learned, United States Army Infantry Center student surveys, subject matter expert input, and experimental results" (Rosen and Walsh, 2011). Metrics gathered during these ITAs included the number of captured targets, mission time, and system features used (e.g. digital chemlights and breadcrumbing). Once again however, subjective comments through observation, surveys, interview type questions, and AAR seem to account for the largest proportion of information (e.g. "[Land Warrior system] enabled precise navigation, fratricide mitigation, collaborative operations, and…allowed for greater situational awareness and faster decision-making up and down the chain of command" (TCM–S, 2008 as cited by Rosen and Walsh 2011).

Similar to the team studies in the SIREQ-TD programme, many of these assessments of mission effectiveness have relied on subjective feedback and judgement, and have lacked both detailed quantitative measures and a comprehensive model to organize both subjective and objective measures into a holistic, diagnostic view of small Unit mission effectiveness. To address this need, three approaches were reviewed for their suitability for use as a mission effectiveness model. These approaches included the Future Force Warrior Integrated Analysis and Experimentation Framework (as described by Schamburg, 2005), the Canadian SIREQ-TD project (Government of Canada, 2016 June 20), and the NATO Dismounted Soldier Systems Measurements for Analysis (NATO Land Capability Group 1, 2011). Each of these approaches is discussed below, followed by a summary table of strengths and limitations.

3.1.1 Integrated Analysis and Experimentation Framework

The purpose of the Integrated Analysis and Experimentation Framework[6] (Schamburg, 2005) was to develop a systematic methodology for evaluating mission performance and effectiveness across multiple missions. This framework consists of an iterative sequence of seven steps over four phases, as listed in Table 1.

6 The Integrated Analysis and Experimentation Framework was originally developed to support the Design, Build, and Integration Phase of the Future Force Warrior program.

Table 1: Integrated Analysis and Experimentation Framework

Phase	Step
I. Initial Phase	1. Development, refinement and prioritization of the Essential Elements of Analysis (EEAs)
	2. Development and refinement of the soldier functional decomposition
II. Measures of Effectiveness (MOE) and Measures of Performance (MOP) Development Phase	3. Development and refinement of the primary Measures of Effectiveness (MOE)
	4. Development and refinement of the Measures of Performance (MOP) Hierarchy
III. Integrated Analysis and Experimentation Framework Development Phase	5. Capability and MOP mapping to the EEAs
	6. Analysis and Experimentation Team event feasibility in addressing EEAs and Mapping A&ET Tools to EEAs
IV. Analysis and Experimentation Team Plan Development Phase	7. Analysis and Experimentation Team event planning

As described by Schamburg (2005):

Step 1: "…involves the development, refinement and prioritization of the EEAs," where the EEAs outline the problem space and "help focus the analysis and experimentation and help determine the solution space." 50 EEAs have been developed and categorized into the following eight groupings:

a) Information Superiority
b) Lethality
c) Sustainability
d) Mobility
e) Embedded Training
f) Survivability
g) Flexibility and Interoperability
h) Tactics, Techniques, and Procedures

Step 2: "…involves the development and refinement of the soldier functional decomposition," where functional requirements of the individual soldier are subdivided into discrete sets of tasks.

Step 3 and 4: involves the development and refinement of the MOEs and MOPs in order for "results [to] be integrated and compared." Common, composite MOE variants for a MOUT vignette including relative weighting factor have been developed. These MOEs were developed "to compare the overall performance of alternative…small combat unit designs." A common set of primary MOPs for Information Superiority, Lethality, Sustainability, Mobility, Survivability, Training, Flexibility & Interoperability, and Cost have also been defined.

Step 5: "capabilities are mapped to the EEAs to identify modeling requirements associated with the respective EEAs. Also, MOPs are mapped to the EEAs to identify data collection requirements that are associated with the respective EEAs."

Step 6: "Based upon step 5, step 6 forms the basis of appropriate A&ET event identification and feasibility associated with the respective EEAs. As a whole, steps 5 and 6 result in the…Integrated Analysis and Experimentation Framework."

Step 7: "A&ET events are selected based on consideration of steps 1 and 6, [and] input from [stakeholders]."

For detailed information, the reader is referred to the paper by Schamburg (2005).

There are several positive attributes to this framework[7] in addition to the adoption of the systematic approach. These include its simplistic approach, the development of the 50 EEAs categorized into their respective groupings, common MOEs and developed relative weightings, priority MOPs, the ability to assess soldier and small combat unit capability and Platoon level missions. However, this approach appears to be more of a framework than a mission effectiveness model. Although it is an excellent framework, several modifications would be needed to adapt it to a model for evaluating mission performance and effectiveness across missions. This includes:

- Defining Measures Of Outcome (MOO),
- Establishing more prescriptive Mission Measure Of Effectiveness (MMOE) and MOEs. The current MOEs are very broad and overly general (e.g., Lethality). For example, the current MOEs could be fleshed out based on the MOP hierarchical categories.
- Establishing the scoring of common, composite MOEs and their relative weightings for all types of scenarios, and
- Designing a more prescriptive analytical model for evaluating mission effectiveness by means of creating a summation model for the new MMOEs and MOEs (as discussed above).

Table 2 lists the strengths and limitations of the Integrated Analysis and Experimentation Framework.

7 Based on this framework, it appears that the Maneuver Battle Lab experiment for the Nett Warrior enabled platoon (as discussed above), may have adopted this methodology (Harris and Alexander, 2006).

Table 2: Strengths and Limitations of Integrated Analysis and Experimentation Framework

Strengths	Limitations
Systematic framework and methodology	Framework (not a mission effectiveness model that can be easily applied)
Simplicity	Undefined Measures Of Outcome (MOO)
Validated by soldiers – To Be Confirmed	Analytical model for evaluating mission effectiveness should be refined to: - Establish more prescriptive MOEs. - Establish the scoring of common MOEs and their relative weightings (scoring of select MOEs have been defined) - Establish relative weighting of all MOEs (relative weightings of select MOEs have been calculated)
50 EEAs have been developed categorized into eight groupings (similar in scope to Mission Measure Of Effectiveness (MMOE) groupings)	Scientifically validated results – To Be Confirmed
Common, composite MOE variants for a MOUT vignette have been developed	
Developed MOE relative weighting factor (i.e., “Mission Response Function” has been developed for current MOUT scenario, as well as other vignettes)	
Common set of priority MOPs have been developed for Information Superiority, Lethality, Sustainability, Mobility, Survivability, Training, Flexibility & Interoperability, and Cost.	
Ability to assess Platoon level missions	
Ability to assess soldier and small combat unit capability	
Systematic approaches in identifying and characterizing methods and metrics for assessing and reporting on soldier system individual and small combat unit objectives	

Harris and Alexander (2006) utilized the Integrated Analysis and Experimentation Framework to perform comparative analysis of the Future Force Warrior to several base case conditions. Additionally, they calculated the ‘Maximum Potential Benefit’ as the “sum of a factor’s main effect with all beneficial second-order effects (Alexander, 2005 as cited by Harris and Alexander, 2006). A cost-benefit analysis looking at 18 experimental factors was also undertaken.

3.1.2 SIREQ-TD Project

The SIREQ-TD project was Canada's cornerstone project for the development and validation of both individual and team requirements for information for the future Soldier System (i.e. who needs what information, when, and how best should that information be acquired and displayed). The SIREQ Cognitive Task Analysis (CTA) (Tack and Angel, 2005) formed the project foundation set of measures, which defined and organized individual soldier and team tasks into seven common task groupings. Each of the task groupings were further decomposed into categorical descriptions, and 145 Measures of Effectiveness (MOE) were identified. These were then used to characterize, capture and compare soldier and team tasks, workload, situation awareness and performance in order to identify what information technologies or capabilities would offer the most "bang for the buck" for future Canadian Soldier Systems investment. Over 70 scientific studies were conducted during the SIREQ-TD project (Government of Canada, 2016).

The strengths behind this approach included defined Mission Measure Of Effectiveness (MMOE), identified MOEs and several MOPs, and the capability to assess individual and team capability at the Section and Platoon levels in a Company context. However, SIREQ was largely focused on information requirements, it was overly complex, and an analytic model would need to be developed before it could be used to evaluate mission effectiveness. That is;

- Designing an analytical model for evaluating mission effectiveness by means of creating a summation model for MMOEs, and
- Establishing the scoring of common MOEs and MOPs, and their relative weightings.

This finding is similar to the Integrated Analysis and Experimentation Framework discussed above. Table 3 lists the strengths and limitations of the SIREQ-TD project.

Table 3: Strengths and Limitations of SIREQ CTA Mission Effectiveness Model

Strengths	Limitations
Validated by the Infantry School	Focus on information requirements
Defined Mission Measure Of Effectiveness (MMOE) - Individual soldier and team tasks organized into seven common task groupings	Complex
145 identified MOEs	Analytical model for evaluating mission effectiveness has not been refined - No scoring of measures - No weighting of measures - No summation model
Collected and analyzed Measures of Performance (MOPs) - Several MOP measurements defined	
Ability to assess team at the Platoon level in the Company context	
Ability to assess individual and team requirements	
Systematic approaches in identifying and characterizing methods and metrics for assessing and reporting on soldier system individual and team objectives	
Backed by scientifically validated results	

3.1.3 NATO Dismounted Soldier Systems Measurements for Analysis

The NATO Dismounted Soldier Systems Measurements for Analysis (NATO LCG1, 2011), provides a framework for trials, modelling, and simulations to quantify the performance of individual soldiers and groups of soldiers when undertaking dismounted tasks. This framework provides a methodology for 1) Creating representations of future operations, 2) Assessing performance and effectiveness, and 3) Comparing and exchanging the output.

This thoroughly written guide, offers an overview of the measurement framework, data capture methodology, and analysis framework. An extensive set of annexes is also provided which incorporates a practitioner's guide, missions, metric measurements, analysis tools and modelling, and a methodology for the integration of user opinion. The numerous strengths of this mission effectiveness model, as well as limitations, are summarized below. The reader is referred to this paper for further information):

Strengths

a) Methodology addresses 'mission level measurement' in realistic, complex environments (i.e., "field trials, modelling runs, simulations or, as is more commonly the case, hybrids involving two or more of these disciplines").

b) A simple universal scale of measurement is used to score metrics.

c) All metrics are normalised to the same units (i.e. percentage change relative to Baseline).

d) The adoption of the Mission Pair system [i.e. all tests and their measurements are therefore comparative, they measure the difference between the 'enhanced' or Assessment system and a defined standard or 'Baseline'] within the methodology means that the measurement requirement changes from absolute to relative scores. These scores quantify how much a metric has changed without the need to know the underlying units or scale.

e) To normalize experimental results and to facilitate comparisons between other programs, a mathematical process is used to apportion MMOE scores to the NATO capability headings (i.e., Lethality, Survivability, C4I, Mobility, Sustainability). This has both advantages and disadvantages.

f) 20 MMOEs have been defined as well as their metrics.

g) Developed 30 generic vignettes, with a list of common associated tasks. The list contains a wide selection of typical dismounted operations but it is not exhaustive.

h) Each of the vignettes are mapped back onto the MMOEs (i.e., MMOE measurement opportunities are indicated for each vignettes).

Limitations

a) Methodology is primarily focussed on assessment at the Mission Level (NATO Level 1) and assessments can be made at two sub-levels within this level; Measure of Outcome (MOO) (i.e., measure of success (or failure) of the mission), and Mission Measure of Effectiveness (MMOE) (i.e., contributing effects to the outcome of the mission are measured). The resulting assessment is therefore fairly gross.

b) Low level measurements (i.e., MOEs and MOPs) are not covered/addressed in this methodology. Measurement at this level has never been covered in detail in this methodology although the importance of these constituent parts has always been recognised.

c) The heritage of the methodology is soldier modernisation with a focus on Command and Control (C2). This means that C2 has a more in-depth coverage than other capability areas to the extent that the methodology only contains C2 metrics at Level 2.

d) Twenty MMOEs are defined in the framework but when you start examining the different MMOEs, it becomes apparent that there is an imbalance/bias in terms of choice of MMOE and priority of importance (e.g., MMOE 7: "Ambush" is the only combat mission type listed as an MMOE and is rated disproportionately higher than the other MMOE categories.). MMOEs also tend to focus more on high-level logistic activities (e.g. resupply, traffic flow, re-equipping) and less on elements of small Unit combat activities.

e) Several small Unit capability areas appear absent (e.g. measures of Situation and Terrain Awareness, Mission planning, Navigation and Mobility, Communication/Information Exchange).

f) The normalization process used in the NATO model risks an overly generic analysis that provides general outcomes at the MMOE level but lacks diagnosticity at the MOE and MOP levels. The NATO document acknowledges this shortcoming for cases with a specific focus and a need for lower-level, detailed analyses.

Table 4: Strengths and Limitations of NATO Dismounted Soldier Systems Measurements for Analysis Framework

Strengths	Limitations
Systematic framework and methodology	Methodology is primarily focussed on assessment at the Mission Level (NATO Level 1)
Simple universal scale of measurement is used to score metrics	Low level measurements (i.e., MOE and MOPs) are not addressed
Extensive documentation to guide users in the application of the methodology	Skewed placement of importance for MMOEs
All metrics are normalized to the same units (percentage change relative to Baseline)	Normalization of MMOE scores to NATO capability headings (also a strength)
20 defined MMOE and associated metrics	
30 developed vignettes and list of associated tasks	
Mapping of MMOEs to vignettes	
Normalization of MMOE scores to NATO capability headings (also a limitation)	

As stated in the NATO LCG1 (2011) document, this methodology is "a complex process yet its comprehension is directly proportional to its potential exploitation." It also provides one of the most detailed methodologies, however, the main limitation to this framework for assessing mission performance and effectiveness is that the resulting assessment is overly gross, and not sufficiently diagnostic to be able to identify the source (i.e., individual role, technology insertion, or interface design issue) of any benefits or detriments (e.g. "This methodology is optimised at Level 1…It offers no real guidance on measurement at Level 0 but there is some coverage at Level 2, especially in the C2 area" (NATO LCG1, 2011)). This becomes evident, especially when related to the assessment of Dismounted Soldier System (DSS) digital information capabilities in small Unit operations (i.e., where assessing aspects of small Unit command, control, communication, and information exchange are required). For example, aggregated total scores at the mission level for the insertion of a particular technology may show only a marginal overall improvement but, by having more diagnosticity down to the task, activity, or phase of battle levels, we may find that certain tasks are very positively impacted by the technology while others are not. Total mission-level scores can wash out positive and negative effects at the task level. A model with greater diagnosticity can tease out where changes are beneficial or detrimental and help shed light on what is influencing these outcomes.

Table 5 presents a comparison of the three approaches used to assess mission effectiveness.

Table 5: Three Approaches to Assess Mission Effectiveness – Comparison

Criteria	**Integrated Analysis and Experimentation Framework**	**SIREQ CTA**	**NATO Measurements for Analysis**
Systematic framework and methodology	✓		✓
Simplistic model	✓		✓
Validated by soldiers	TBC	✓	TBC
Scientifically validated		✓	TBC
Defined MMOEs		✓	✓ (unbalanced)
Defined MOEs	✓ (for MOUT only)	✓	✓ (for C2 only)
Defined MOPs	✓ (for MOUT only)	✓ (several)	✓ (for C2 only)
Ability to assess Platoon level missions	✓	✓	✓
Ability to assess soldier and small combat unit capability	✓	✓	
Analytical model for evaluating mission effectiveness	✓ (needs to be refined)	Lack of simple universal scale of measurement to weight/score metrics	✓
Other notable deficiencies	Lack of comprehensive model to organize subjective/objective measures into a holistic, diagnostic view of small Unit mission effectiveness	Focus on information requirements Lack of comprehensive model to organize subjective/objective measures into a holistic, diagnostic view of small Unit mission effectiveness	Lack of comprehensive model to organize subjective/objective measures into a holistic, diagnostic view of small Unit mission effectiveness
Overall Benefit to Approach	Conducive to M&S	Very diagnostic at the level of MOE	Detailed measurement framework, data capture methodology, and analysis framework

Each of the three approaches have inherent strengths. However, it can also be seen that a comprehensive assessment model that can objectively measure the mission effectiveness of small Unit dismounted infantry missions, and be sufficiently detailed and diagnostic at the task and capability level to support future DSS testing, currently does not exist.

3.2 Mission Effectiveness Model Outline

This section provides a general outline of a proposed mission effectiveness model. An aggregating tree structure is depicted for the Dismounted Soldier System Measures of Mission Effectiveness (DSS-MOME) (Figure 1). Measures of Performance (MOP) are the building blocks of the mission effectiveness model. MOPs are measurable performance attributes of soldiers and small Unit teams. Several MOPs can aggregate to represent the construct of a single task capability or Measure of Effectiveness (MOE) for a task. Similarly, several MOEs can aggregate to represent a mission-level capability or Mission Measure of Effectiveness (MMOE). MMOEs aggregate into functional groupings where the Groupings represent the core capabilities required of any small Unit to perform a given mission.

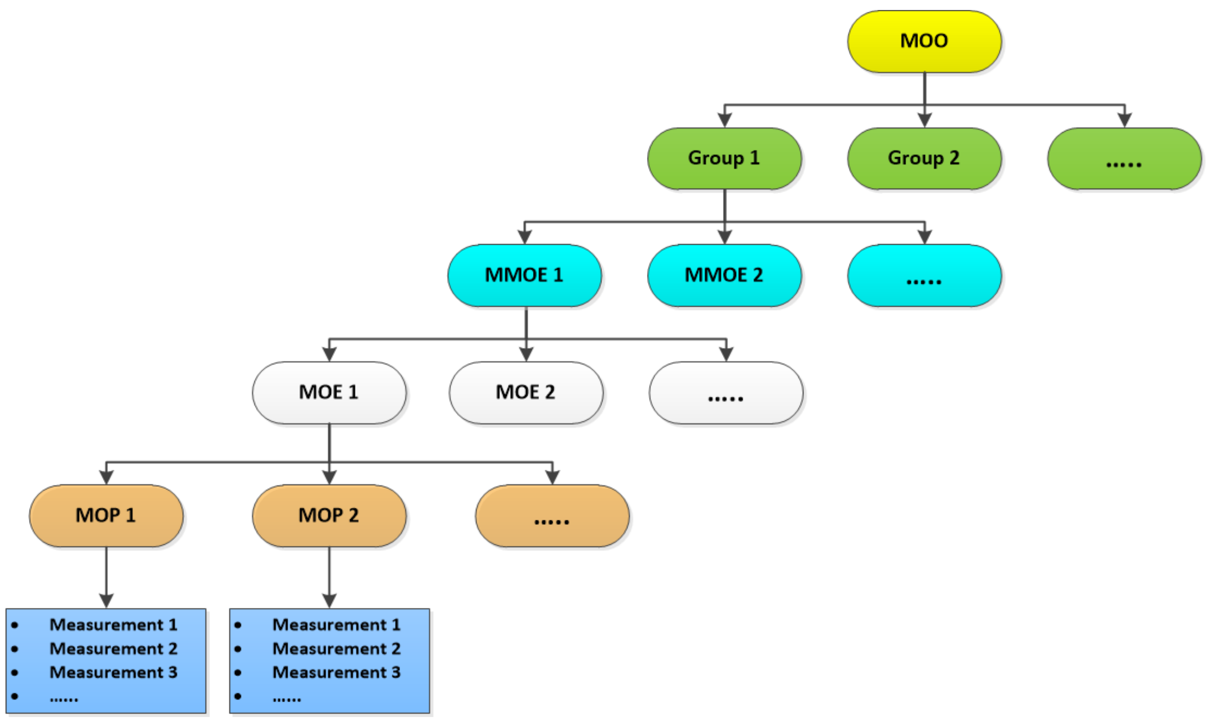

Figure 1: Outline Model Structure

For example, the grouping "Command & Control" comprises five MMOEs: Use of Terrain, Conduct Battle Coordination, Achieve Key Event Timings, Conduct Battle Administration, and Achieve Command Agility. The MMOE for "Conduct Battle Coordination" comprises four MOEs: Coordinate Movement (confliction), Coordinate Movement (tactical support), Achieve Mutual Support, and Coordinate Fires (see Figure 2 below). If we inspect the MOE for "Coordinate Movement (confliction)", as defined by "The ability of the Small Combat Unit to coordinate their movement in time and space to avoid confliction", we see that it has two possible, measurable MOPs that represent the effectiveness of movement coordination (see Annex A). Scoring aggregates from the MOP measurements through the tree to sum up to a mission measure of outcome (i.e. MOO), based on scoring relative to a known soldier and Small Combat Unit (SCU) baseline measure of performance. Groups and MMOEs are given weightings of importance for mission effectiveness in a given mission to ensure that the MOPs most relevant to a given mission type are reflected more prominently in the aggregate scoring.

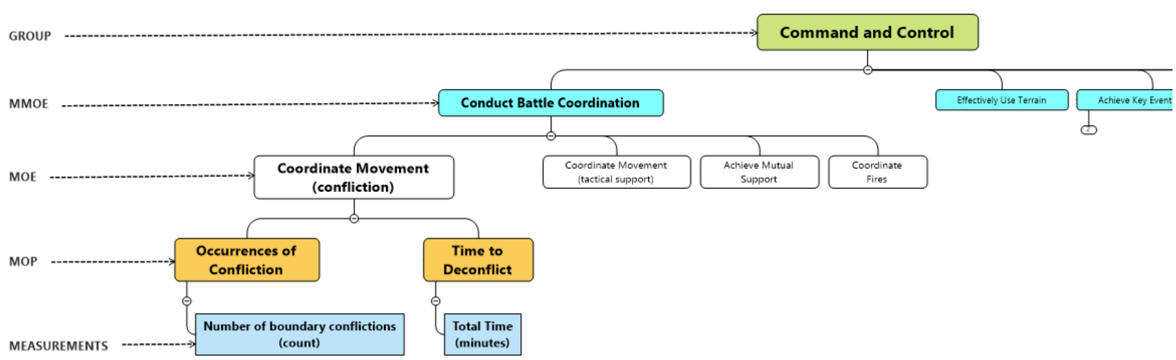

Figure 2: Example MMOE Break-out

Subsequent sections provide more details about the structure and content of the model (section 3.3), the weightings derived for different mission types (section 3.4), the method of summating scores (section 3.5), and ways to apply the model in soldier system testing (section 3.6).

3.3 Model Structure and Content

The DSS-MOME has two possible mission MOOs. The first is a simple success/failure score on whether the mission achieved the commander's intent that is not based directly on underlying measures of effectiveness. The second MOO represents Mission Quality which aggregates the summation scores of relevant, priority-weighted measures of mission effectiveness that compare a test condition to an operational baseline of performance.

The composition of MOOs, MMOEs, MOEs, and MOPs is shown below in Figure 3.

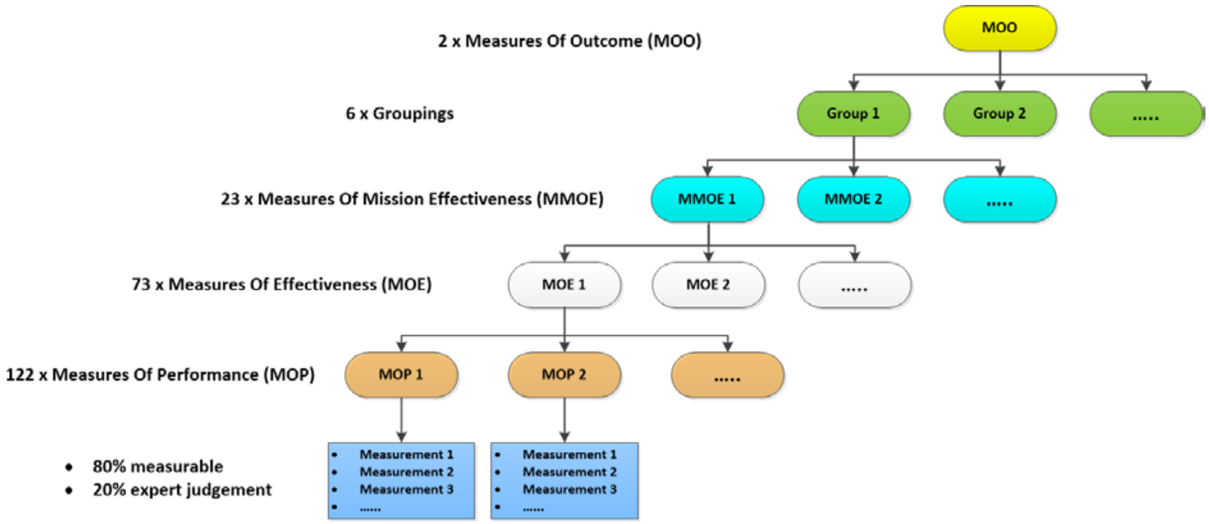

Figure 3: Model Composition

The current model aggregates 122 MOPs, using 150 measurements, into 73 MOEs, which combine into 23 MMOEs in 6 Groupings. Figure 4 provides a schematic of the 23 MMOEs in the respective Groupings, which all aggregate into the summation-based MOO for Mission Quality. MOEs and MOPs are not shown in this Figure due to the resulting size of the model, but these are fleshed out at Annex A to all levels.

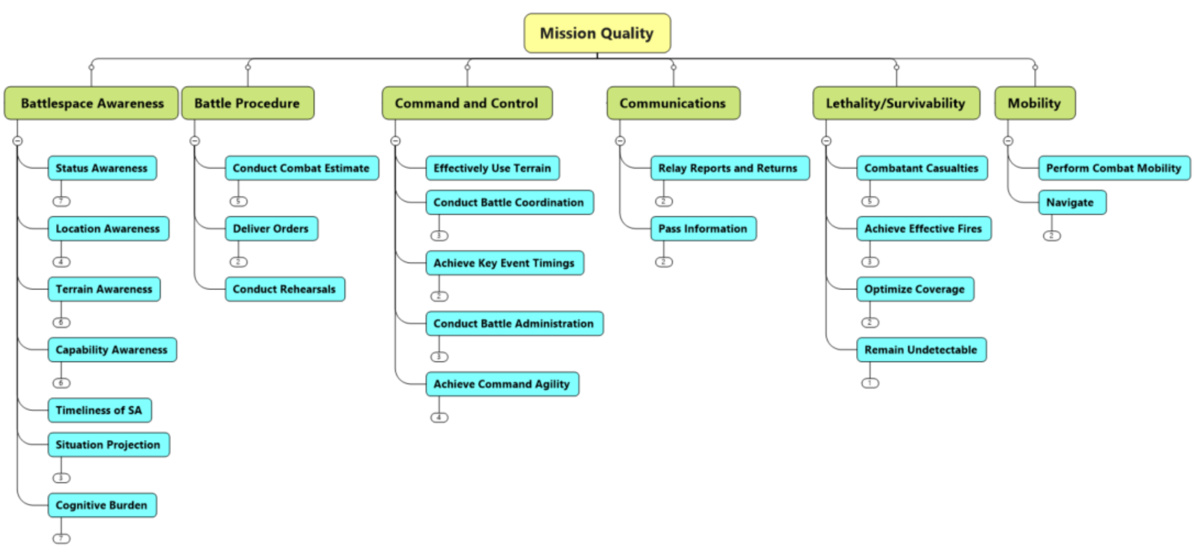

Figure 4: Groups and MMOEs

The full content of the model is represented in tabular form in Annex A. The table is organized into seven columns:

Column A – Grouping: The MOO and six Groups are listed.

Column B – MMOE: The MMOEs for each Group are listed, within the rows allotted to the group.

Column C – MOE: The MOEs for each MMOE are listed, within the rows allotted for the MMOE.

Column D – Definitions: Definitions are provided for each MOE.

Column E – MOP: The MOPs for each MOE are listed according to the measurement variable of interest, in the rows allotted for the MOE.

Column F – Measurements: Specific measurement details are provided for each MOP.

Column G – Type: The measurement type is indicated for each measurement: Subjective (S) or Objective (O).

While the entire listing of the model, with its 122 MOPs, seems rather onerous, it is very unlikely that the entire listing would ever be used in an evaluation. It is more constructive and useful to think of the entire listing, below the level of MMOE, as a library or toolbox of possible MOEs and MOPs that can be used as appropriate to the conditions being tested, the associated capability differences between the test and baseline conditions, the mission being used in the evaluation, and the data collection measurements that are planned or even possible.

3.4 Model Weightings

The success of different types of missions often relies on a different mix of key capabilities. To ensure that key MOE are prioritized according to their importance to mission quality and success, weightings of importance have been applied to each of the Groupings and associated MMOEs according to each of five different mission types: hasty attack, deliberate attack, deliberate defense, reconnaissance patrol, and cordon & search.

To begin the process, participants determined an importance weight for each of the six Groupings, in a given mission, by allocating 100 points across the groups for that mission. Then the MMOEs in each Grouping were assigned weights by allocating 100 points within the group. Participants reviewed their scoring allocations across mission types and rationalized scoring to ensure a consistent method of assignment.

The weights for Groupings and MMOEs are detailed in Table 6. As an example of the differential weightings according to the different mission types we can review the differences in weightings between a Hasty Attack and a Deliberate Attack. The highest areas of importance for the effectiveness of a Hasty Attack were command & control (35%), communications (20%), and mobility (18%) whereas a Deliberate Attack relied more on battlespace awareness (25%) and battle procedure (35%). These differences reflect the reactive, adaptive, control-in-the-moment nature of a Hasty Attack versus the careful planning, rehearsing, and organization of a Deliberate Attack.

SMEs did not see value in applying weights at the level of MOEs and MOPs, at this time, since these are likely to vary according to mission type and the choice of MOPs that are able to be measured in a given study.

Table 6: Grouping and MMOE Weightings by Mission Type

GROUPING	MMOE	HASTY ATTACK	DELIBERATE ATTACK	DELIBERATE DEFENSE	RECCE PATROL	CORDON & SEARCH
Battlespace Awareness		**7**	**25**	**25**	**20**	**15**
	Status Awareness	15	15	15	15	15
	Location Awareness	15	15	15	15	20
	Terrain Awareness	25	25	25	25	15
	Capability Awareness	25	25	30	25	20
	Timeliness of SA	5	10	5	5	10
	Situation Projection	5	5	5	5	10
	Cognitive Burden	10	5	5	10	10
Battle Procedure		**5**	**35**	**35**	**25**	**30**
	Conduct Combat Estimate	30	40	30	30	35
	Deliver Orders	70	20	50	20	40
	Conduct Rehearsals	0	40	20	50	25
Command and Control		**35**	**15**	**15**	**8**	**25**
	Effectively Use Terrain	15	10	5	35	10
	Conduct Battle Coordination	25	30	35	10	40
	Achieve Key Event Timings	20	40	25	20	25
	Conduct Battle Administration	10	10	25	5	5
	Achieve Command Agility	30	10	10	30	20
Communications		**20**	**6**	**9**	**20**	**20**
	Relay Reports and Returns	20	20	50	70	30
	Pass Information	80	80	50	30	70
Lethality/Survivability		**15**	**12**	**12**	**15**	**5**
	Combatant Casualties	10	10	10	10	10
	Achieve Effective Fires	40	40	30	0	40
	Optimize Coverage	15	15	35	55	40
	Remain Undetectable	35	35	25	35	10
Mobility		**18**	**7**	**4**	**12**	**5**
	Perform Combat Mobility	60	40	95	20	20
	Navigate	40	60	5	80	80

3.5 Summation Scoring Method

Having importance weights for all MMOEs and Groupings, a method of aggregating performance effectiveness through the tree model is needed to arrive at a score of mission effectiveness (see Figure 5). A bottom-up summation scoring model is suggested. Performance measurements for a given MOP would be summed according to the weighted importance of each measurement to that MOP (i.e. the combined weights sum to 1.0). These MOP scores would be summed according to their weighting importance for a given MOE, and so on up the tree to a final summation for the MOO for mission effectiveness. MOPs are the only level where measurements are made; all other levels (e.g. MOE, MMOE, and groupings) represent aggregations of the preceding level where weights can be applied to prioritize the contribution of the MOP measurements up through the tree. In cases where no weightings are used at the lower tree levels, the weights would be equal and sum to 1.0 or a simple average could be used. If there are situations where measures are not used then the remaining weights for measures would be re-balanced in their current proportions to still sum to 1.0.

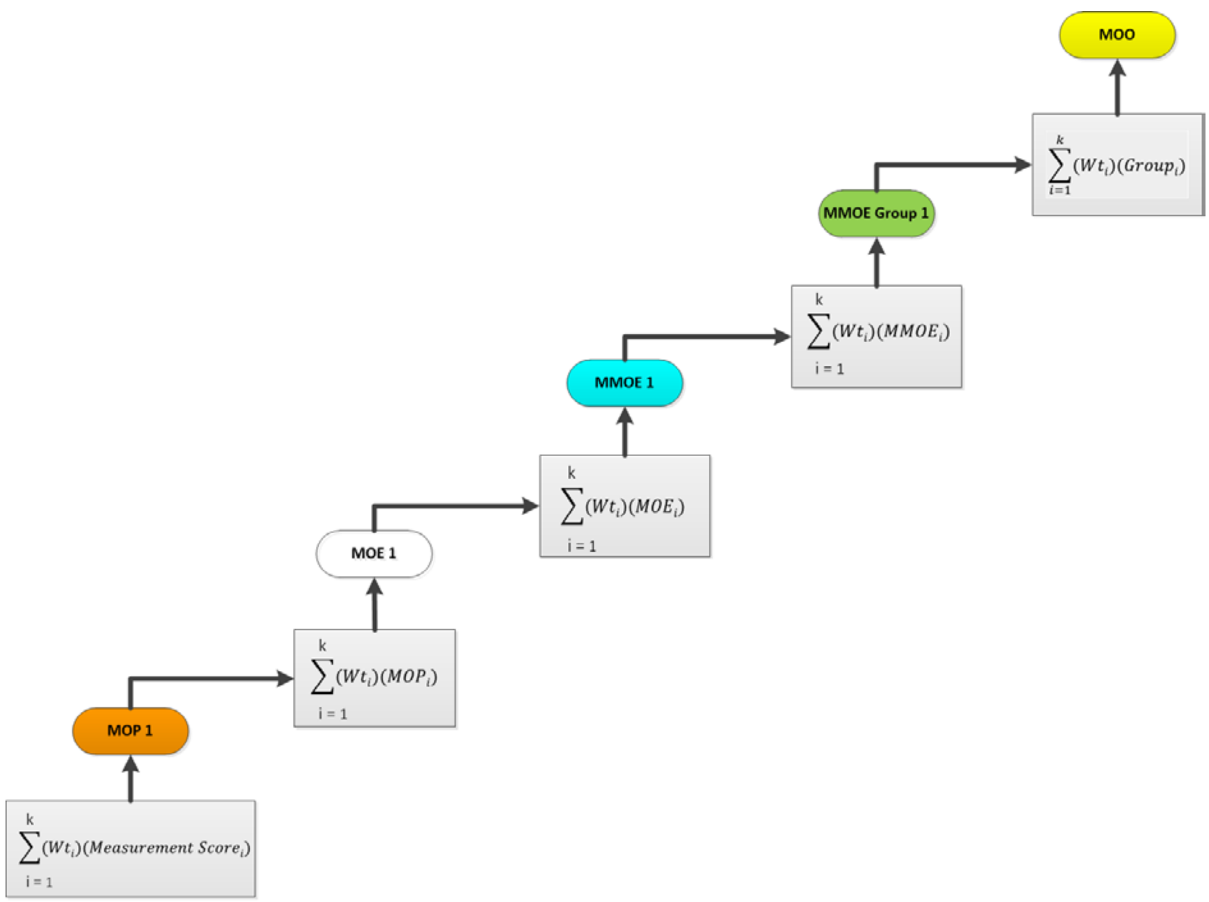

Figure 5: Summation Scoring Tree

One of the challenges is working with different performance measurements with different units, scales, and limits. This challenge is often managed through a process of normalization that places all measurement results on a common scale. Examples include setting a result in proportion to a known range of minimum to maximum values (i.e. the test condition is represented as a percent of a known range) or performance measurements can be compared to a known baseline performance (i.e. the test condition is represented as a percent of the baseline). The NATO framework of measures for analysis (NATO LCG1, 2011) recommends the latter by running a Mission Pair methodology that repeats a test condition against a baseline for any given mission and the test condition scores are normalized as a percent change from the baseline. This approach is also recommended for the DSS-MOME since minimum/maximum ranges are not always known for all DSS MOP measurements. A Mission Pair methodology that compares a test condition to a known baseline infantry soldier system is also more comprehensible and relatable in mission effectiveness terms.

The math in the summation model is fairly straight forward. The equation in Figure 6 below normalizes performance measurement value to percentage values relative to the DSS baseline value, where MS_i is the value of the i^{th} measurement of the test condition and $MS_{baseline}$ is the value for the DSS baseline system.

$$Measurement\ Score_i = \frac{MS_i - MS_{baseline}}{MS_{baseline}} \times 100$$

Figure 6: Normalizing Measurement Equation

For each MOP, the normalized scores for each associated performance measurement are then summed in proportion to their assigned weight (Wt_i) for the total number of measurements (k) for a given MOP. Weights will represent values from 0-1 and all weights for a given MOP will sum to 1.

$$\sum_{i=1}^{k} (Wt_i)(Measurement\ Score_i)$$

Figure 7: MOP Summation Equation

The preceding discussion of the summation model was set in the context of a single mission or mission vignette. A similar weighting approach could be used to combine several mission vignettes as part of a larger operational scenario, where each vignette would be assigned a weighting score according to the importance of that vignette to the larger operational outcome.

3.6 Application of the Model

Aspects of model customization and analyses are discussed in the following section.

3.6.1 Customizing the Model for Specific Testing

As indicated previously, it is unlikely that the entire listing of the model, with its 122 MOPs, would ever be used in any one evaluation. It is more constructive and useful to think of the entire listing, below the level of MMOE, as a library or toolbox of possible MOEs and MOPs that can be used as appropriate to the conditions being tested, and the associated capability differences of interest between the test and baseline conditions, the mission being used in the evaluation, and the data collection measurements that are planned or even possible.

Ideally, MOPs and MOEs would be selected where a hypothesized difference may exist between test conditions or test and baseline conditions. Including measures in the model that will not help differentiate between test conditions risks diluting the impact of the real differences in the total summation process.

3.6.2 Analyses of Model Results

One of the advantages of the DSS-MOME, over other effectiveness models, is the capability to scale the level of diagnosticity in the analysis. While the summation model does provide a single measure of mission quality or effectiveness, which compares a test condition to a baseline or another test condition, it is possible to delve deeply into the model to investigate further. Often it is insufficient to merely say one system is more effective than another without providing insights into the reasons for the difference. It is important to identify which individual and small Unit task performance measures, and associated tasks, are affected by differences in technology capabilities and which are not. The ability to diagnose why an expected enhancement did not result in improved outcomes is also important for justifying when to divest in a technology. Using the DSS-MOME, differences can be investigated at each level of effectiveness in the tree to pinpoint the source of the differences and then compare how these differences aggregate into differences in capability. This ability to pinpoint the source of the differences also enables a reduced, more targeted scope of investigation and reduced complexity and cost for future comparisons of specific technologies or upgrades to existing ones.

4. Discussion

The goals of this project were to develop an analytical model to evaluate small Unit mission effectiveness with sufficient diagnosticity at the task and capability levels to support the evaluation and improvement of dismounted soldier information systems. Such a tool would be beneficial to anyone faced with assessing the cost/benefit of introducing any change to small Unit operations in terms of mission and task effectiveness. Examples of small Unit changes where the DSS-MOME could support an effectiveness analysis include the introduction of new or different technologies, changes to training, changes to force structure, or modified tactics, techniques, and procedures.

Three different approaches to measuring dismounted mission effectiveness were reviewed for their suitability for evaluating DSS soldier digital information capabilities. The strengths of these approaches were considered and combined with the results of two subject matter expert workshops to develop a new mission effectiveness model that meets the small Unit information systems aims of this project: the Dismounted Soldier System – Measures of Mission Effectiveness model or DSS-MOME.

The proposed DSS-MOME provides a framework and analytical summation process for aggregating up to 122 MOPs to produce mission effectiveness and outcome measures, while enabling detailed traceability and diagnosticity to the task and capability levels. However, some additional activities are required before this model can be effectively employed in field and laboratory studies.

4.1 MOP Measurement Methods

While this report provides the framework and content of the DSS-MOME MOPs and tree aggregation, it does not provide the methods for measuring those MOPs. To be able to employ the model requires clear, standardized, repeatable protocols and measurement methods for each MOP. Canada is building a compendium state-of-the-art review of tools and technologies to support these measurement methods (Nakaza et. al., 2015).

The DSS-MOME currently includes 150 measurements for 122 MOPs (80% objective and 20% subjective measures). Even seemingly simple measures like an event timing to reach a mission-critical location need to be clearly defined for start and end point conditions. Is the event complete when the first soldier reaches it, the last one reaches it, or after the Unit is securely in position at that location? Does the measurement protocol depend on the technology available for measurement? The interpretation of the measurement protocol may depend on the mission type. Given procedural differences, it may need to be different between day and night missions, and so on.

Measurement methods may be different depending on the test environment. Measurement tools and methods will often be different between an immersive virtual mission in a laboratory and the real environment in field trials. Information already exists to support the development of MOP measurement methods based on previous SoSE work to source state-of-the-art field measurement methods (Nakaza et. al., 2015, update in progress) and developed measures and methods from Canada's SIREQ-TD programme.

4.2 Exemplar Vignette Models

The Canadian Army and/or DRDC are planning to undertake TTP development and/or operational trials with the ISS-S to evaluate system effectiveness against a conventional baseline system and investigate the ISS-S implications and opportunities for TTPs. This testing offers a unique opportunity to exercise customization of the DSS-MOME structure and content for each of the planned mission vignettes.

If this were done in combination with the development of measurement methods for those MOPs selected for the customized vignette DSS-MOME models then this effort could contribute significantly to the Army's effort to trial the ISS-S.

4.3 Model Development and Optimization

The DSS-MOME is intended to be a living model that is refines and validated through its use in soldier system field trials. In its current juvenile form, it offers much potential and promise. Employment of the model will necessarily generate a spiral development and refinement process to improve and enhance the model. This process of maturation and growth will also build up data sets of model results that can be used to statistically identify the most influential MOPs and MOEs so that the model can be streamlined and optimized.

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Annex A: DSS-MOME Data Set

GROUPING	MMOE	MOE	DEFINITIONS	MOP	MEASUREMENTS	TYPE*
Battle Procedure	Conduct Combat Estimate	Develop Plan	Analysis of factors to enable the execution of a mission in time and space.	a) Quality (viability) of three Course Of Action (COAs), based on Comd's intent, according to the principles and fundementals of warfare.	a) Effectiveness rating of plan COAs by Subject Matter Experts (SMEs) (rating value). b) Actual timing outcomes against estimates in plan (delta minutes).	S O
		Planning Time	The time required to formulate and prepare the mission plan.	a) Time to prepare a mission plan.	a) Duration (minutes)	O
		Plan Coordination	Coordination with other elements, resources, adjoining units.	a) Time to coordinate. b) Ease of coordination. c) Accuracy of coordination.	a) Duration (minutes). b) Ease of coordination ratings by participants (rating value). c) Deviation of coordination in time (delta minutes). d) Deviation of coordination in space (meters).	O S O O
		Back Brief	Briefing the draft plan back to your Comd prior to undertaking detailed plan.	a) Time to deliver briefing. b) Accuracy of back brief.	a) Duration (minutes). b) Effectiveness rating by SMEs (rating value).	O S
		Prepare Orders	Prepare orders.	a) Time to prepare order.	a) Duration (minutes).	S
	Deliver Orders	Briefing Duration	The time required to brief the mission plan.	a) Time to brief the mission plan.	a) Duration (minutes).	O
		Briefing Effectiveness	The comprehension among SCU members having received the briefing.	a) Briefing comprehension by recipients. b) Effectiveness of briefing.	a) Percent of questions correct by briefing recipients in briefing questionnaire (percent). b) Effectiveness rating by SMEs for quality of the briefing (rating value).	O S
	Conduct Rehearsals	Conduct Rehearsals	Rehease mission actions on the objective, in danger areas, etc.	a) Time to rehearse. b) Rehearsal relevance/thoroughness. c) Rehearsal effectivness.	a) Time to complete rehearsal (minutes). b) SME rating of priorities and execution (rating value). c) Measure of comprehension among SCU members (percent correct).	O S O
Command & Control	Use of Terrain	Effectively Use Terrain	Use of terrain to best advantage to achieve your aims.	a) Effectiveness according to Cover & concealment, Obstacles, Position of fire, Position of obseration, Enemy position, and Distance or the COPPED framework.	a) Effectiveness rating by SMEs for each elemet of COPPED. COPPED elements would be weighted according to importance to specific mission plan (rating values).	S
	Conduct Battle Coordination	Coordinate Movement (confliction)	The ability of SCU elements to coordinate their movement in time and space, to avoid confliction.	a) Occurrences of confliction when sub-unit boundaries are crossed. b) Time to deconflict	a) Number of boundary conflictions (count). b) Total time to deconflict (minutes).	O O
		Coordinate Movement (tactical support)	The ability of SCU elements to coordinate their movement in a tactically effective mutual support.	a) Frequency of not adhering to control measures. b) Extent of not adhering to control measures. c) Mission impact of not adhering to control measures.	a) The number of times SCU elements violated report lines, limits of exploitation, boundaries, etc. (count). b) Distance or time spent in violation (meters or minutes). c) Impact rating by SMEs for mission impact of violations (rating value).	O O S
		Achieve Mutual Support	The ability of SCU elements to coordinate their movement with tactically effective mutual support.	a) Delays in SCU element synchrony. b) Effectiveness of mutual support. c) Effectiveness of supporting elements.	a) Time delays in achieving efficient, effective mutual support through fires and movement (minutes or percent of total movement time). b) Effectiveness rating by SMEs for coordination of mutual support (rating value). c) SME rating of effectiveness (rating value).	O S S
		Coordinate Fires	The ability of SCU elements to coordinate their fires to maximize tactical effects.	a) Effectiveness of fires coordination.	a) Effectiveness rating by SMEs for coordination of fires (rating value). b) Proportion of SCU fire in relation to coverage of enemy positions (percent).	S O
	Achieve Key Event Timings	Achieve Key Timings	Mission clock time to reach key events, phase lines, or locations. Note: Key event timings should be organized by mission phases: insertion, setting up on objective, actions on objective, re-organization, and extraction.	a) Time to reach key locations. b) Time difference between planned event timings and actual timings.	a) Duration (minutes). b) Delta time between planned and actual event times (delta minutes or percent).	O O
		Perform Mission Tasks	The time to complete key mission tasks (e.g. win the firefight, surveillance on objective).	a) Time to achieve key mission tasks. b) Time difference between planned task durations and actual durations.	a) Duration (minutes). b) Delta time between planned and actual task times (delta minutes or percent).	O O

***Legend:** Type of measurement - 'S' = Subjective, and 'O' = Objective

GROUPING	MMOE	MOE	DEFINITIONS	MOP	MEASUREMENTS	TYPE
	Conduct Battle Administration	Conduct CASEVAC	The timely and effective evacuation of casualties.	a) Time to issue 9-liner and MIST. b) Time to deliver first aide. c) Effective management of casualties.	a) Time to communicate CASEVAC (minutes). b) Time to render first aide (minutes). c) Effectiveness rating by SMEs for managing and prioritizing casualties (rating value).	O O S
		Conduct Reconstitution	The reconstitution of combat effectiveness/readiness following a mission or task.	a) Time to achieve reconstitution. b) Completeness of reconstitution.	a) Duration (minutes). b) SME rating (rating value)	O S
		Conduct Re-supply	The timely and effective actions to re-supply the SCU to maintain combat capability.	a) Time to issue Ammunition/Casualty report or ammo-CAS. b) Time to redistribute within the SCU.	a) Time to develop and send Ammo-CAS report (minutes). b) Time to distribute supplies within the SCU (minutes)	O O
	Achieve Command Agility		The ability of the Commander to adapt command and control efforts to execute unforeseen changes to the mission plan during the mission.			
		Exploit Information	The ability to access, compile, manage, and exchange information and orders for the purpose of contributing to successful mission outcome.	a) Time to access information. b) Usability of information. c) Time to distribute information.	a) Time to access key information, as defined by the mission. Information required to access may be prescribed as part of the exercise control effort (minutes). b) User ratings of acceptability of key information for exploitation (rating value). c) Time to distribute (minutes).	O S O
		Formulate In-situ Plan	The ability of the Commander to adapt to unforeseen and unplanned circumstances during a mission, including the execution of the planning cycle in real-time.	a) Quality (viability) of the resulting COA based on Comd's intent, according to the principles and fundementals of warfare. b) Time and space estimates against actual.	a) Effectiveness of the plan rating by SMEs (rating value). b) Timing outcomes against estimates in plan (minutes or percent).	S O
			The time required to formulate a new plan in real-time in response to an unforeseen or unplanned situation in the course of the mission.	a) Time to create a new plan from the time the SCU is faced with an unforeseen situation.	a) Time required to formulate a new plan (minutes).	O
		Issue Command Direction	Giving instructions to subordinate elements on the ground in real time.	a) Time to disseminate new orders to all elements.	a) Time to disseminate new orders (minutes).	O
		Execute Command Direction	The time required for the SCU to respond to and begin executing a new plan provided in the course of the mission.	a) Time for the entire SCU to begin executing the new plan.	a) Duration until all members of the SCU begin plan execution (minutes).	O
Communications	Relay Reports and Returns	Report Content	The quality of mission reporting.	a) Use of proper report formats. b) Accuracy of information. c) Reporting comprehension by recipient.	a) Score of mission report against templated report formats (rating value). b) Ratio of reporting errors to accuracy content (percent correct). c) Percent of report content questions answered correctly by report recipients in questionnaire (percent correct).	S O O
		Report Timely	Time to create and distribute the report.	a) Time to create the report. b) Time to send the report.	a) Duration required to create report (minutes). b) Duration required from the time the report was sent to the time that all recipients received the information (minutes).	O O
	Pass Information	Communicate Content	The accuracy and completeness of communications.	a) Accuracy of information. b) Completeness of information. c) Comprehension by recipient.	a) Accuracy of information content (percent accurate, frequency of errors). b) Completeness of information content (percent complete) c) Comprehensibility by recipient (percent correct on content test)	O O O
			The distribution of information to members of the SCU.	a) Proportion of SCU members receiving the information.	a) Percentage of the SCU that received the information in relation to the intended number of recipients (percent).	O
		Communicate Timely	The time required to disseminate information throughout the SCU.	a) Time to disseminate information throughout the SCU.	a) Time to disseminate information throughout the SCU (minutes).	O
Lethality/Survivability	Combatant Casualties	Friendly Forces	The killing, wounding, or capture of friendly force SCU members.	a) The number of killed, wounded, and captured friendly forces in a mission. b) The number of SCU members killed, wounded, or captured in a mission.	a) Number of casualties. Percent casualties. b) Number of wounded. Percent wounded. c) Number of captured. Percent captured. d) Combat capability score using NATO scoring scale of 1 for fully capable, 0.5 for suppressed, 0.15 for captured, 0-1 for degree of wounded, 0 for retasked, 0 if missing, and 0 for dead. Score would determine pre and post event levels, and the delta effect of the mission.	O O O O

GROUPING	MMOE	MOE	DEFINITIONS	MOP	MEASUREMENTS	TYPE
		Enemy Forces	The killing, wounding, or capture of enemy forces.	a) The number of killed, wounded, and captured enemy forces in a mission.	a) Number of casualties. Percent casualties. b) Number of wounded. Percent wounded. c) Number of captured. Percent captured. d) Combat capability score using NATO scoring scale of 1 for fully capable, 0.5 for suppressed, 0.15 for captured, 0-1 for degree of wounded, 0 for retasked, 0 if lost, and 0 for dead. Score would determine pre and post event levels, and the delta effect of the mission.	O O O O
		Loss Exchange Ratio	Ratio of enemy to friendly force losses.	a) Ratio of friendly force losses to enemy force losses.	a) Ratio of friendly to enemy killed (percent). b) Ratio of friendly to enemy wounded (percent).	O O
		Fratricide	Friendly losses resulting from friendly force fire.	a) Friendly forces killed or wounded by friendly force fire.	a) Number of fratricide killed or wounded (count). b) Percentage of fratricide killed or wounded in SCU (percent).	O O
		Civ / Other Casualties	The killing or wounding of civilians and other non-military personnel, within and without the Rules Of Engagement (ROEs).	a) Civilian casualties within the ROEs. b) Civilians casualties outside the ROEs.	a) Number of civilians killed or wounded within the ROEs (count). b) Number of civilians killed or wounded outside of ROEs (count).	O O
	Achieve Effective Fires	SCU Engagement Performance	Ability to generate effective fire to engage the enemy to inflict casualities.	a) Rate of hits per rounds fired. b) Proportion of SCU recruited for fires.	a) Ratio of hits per rounds fired (percent). b) Percentage of SCU engaged in fires (percent).	O O
		Suppressive Performance	Ability to generate effective suppressive fire.	a) Cordination of fire in area of the enemy positions. b) Effectiveness of enemy fire during suppression. c) Perception by enemy forces of the degree they were suppressed.	a) Proportion of all rounds fired within a specified "suppressive" zone around the enemy position to be suppressed (percent). b) Volume of fire within the "suppressive" zone for the duration of required suppression (rounds per minute). c) Enemy force ratings of effectiveness for feeling suppressed (rating value).	O O S
		Ammunition Usage	The amount and type of ammunition used in the mission.	a) Amount of ammunition used by type.	a) Amount of ammunition used by type (count).	O
	Optimize Coverage	SCU Area of Interest	The actual area the SCU can effectively surveil.	a) The area the SCU can surveil as a combination of arc and distance.	a) Horizontal area, range and bearing combined, that the SCU or key members can surveil from their position (square meters). b) Vertical area, inclination by bearing by range, that the SCU or key members can surveil from their position (square meters). c) Horizontal area of dead ground within the limits of a specified surveillance range (e.g. 500-1000 m) (square meters). d) Total Volume of battlespace, horizontal and vertical, that the SCU or key members can surveil from their position (cubic meters).	O O O O
		SCU Area of Effects	The actual area the SCU can effectively engage with fires.	a) The effective area the SCU can engage with direct/indirect engagement.	a) Horizontal area, range and bearing combined, that the SCU or key members can engage from their position, to the effective range of each weapon (square meters). b) Vertical area, inclination by bearing by range, that the SCU or key members can engage from their position, to the effective range of each weapon (square meters). c) Total Volume of battlespace, horizontal and vertical, that the SCU or key members can surveil from their position (cubic meters).	O O O
	Remain Undetectable	Non-detectability	The ability of the SCU to remain undetected by the enemy.	a) Time when detected. b) Distance when detected. c) Proportion of SCU detected. d) Element of surprise in attack.	a) Time from mission start or a given phase line to detection by the enemy (minutes). b) Distance from mission objective when detected by the enemy (meters). Distance from the enemy when detected (meters). c) Proportion of SCU detected by the enemy, when trying to move undetected (percent). d) SME rating of element of surprise in the attack. Enemy force rating of surprise (rating value).	O O O S
Mobility	Perform Combat Mobility	Combat Mobility	The capability of the SCU to overcome physical burden to undertake combat movements through terrain.	a) Mobility performance times.	a) Load Effects Assessment Program (LEAP) course timings relative to baseline system performance (seconds).	O
	Navigate	Plan Navigation	The use of space, time, and COPPED principles to develop an effective navigation plan.	a) COPPED ratings. b) Assessment of time estimate. c) Route plan vs actual.	a) See COPPED scoring under Terrain Awareness. b) Time estimate vs actual time (percent correct). c) Route deviation from planned route (total distance, root mean squared deviation)	O O O

GROUPING	MMOE	MOE	DEFINITIONS	MOP	MEASUREMENTS	TYPE
		Navigate Effectively	The ability of the SCU to keep to the planned route and successfully reach each waypoint.	a) Accuracy of route distance. b) Accuracy in making waypoint locations. c) Deviation in track from plan. d) Navigation agility (ability to adopt a new route plan on the fly).	a) Difference between total distance traveled vs total planned route distance (percent). b) Difference between estimated waypoint locations and actual waypoint locations (percent). c) Root mean squared difference between planned track and actual track (meters). d) Time required to perform route vs plan (minutes). e) Time required to plan a new route (minutes). f) SCU ratings of route quality as per COPPED (rating values).	O O O O O O
Battlespace Awareness	Status Awareness (SA)		Awareness of the state of mission-relevant entities in the battle space. Status information could include strength, posture, and behaviour.			
		Friendly Forces	Awareness of the state of friendly forces in the battle space. Status information could include strength, posture, and behaviour.	a) Accuracy of friendly status estimate based on initial orders and injects inserted during the mission.	a) Proportion of correct answers achieved for status awareness questionnaire for friendly forces, undertaken at key mission freeze timings in the misison (percent).	O
		Enemy Forces	Awareness of the state of enemy forces in the battle space. Status information could include strength, posture, and behaviour.	a) Accuracy of enemy status estimate based on initial orders and injects inserted during the mission.	a) Proportion of correct answers achieved for status awareness questionnaire for enemy forces, undertaken at key mission freeze timings in the misison (percent).	O
		Civ / Others	Awareness of the state of Civ/Others in the battle space. Status information could include strength, posture, and behaviour.	a) Accuracy of Civ/Other status estimate based on initial orders and injects inserted during the mission.	a) Proportion of correct answers achieved for status awareness questionnaire for Civ/Others, undertaken at key mission freeze timings in the misison (percent).	O
		Ammunition	Awareness of ammunition consumed and remaining in a mission.	a) Number of rounds available. b) Percent of rounds consumed.	a) Awareness of number of rounds available in the SCU by type. Collected during mission freeze or queried in-situ in real time (percent correct). b) Awareness of percent of rounds consumed by type in relation to stores at mission start (percent correct).	O O
		Water	Awareness of water consumed and remaining in a mission.	a) Litres of water available in the SCU. b) Percent of water stores remaining.	a) Awareness of number of litres of water available in the SCU. Collected during mission freeze or queried in-situ in real time (percent correct). b) Awareness of percent of water stores remaining in relation to volume at mission start (percent correct).	O O
		Power	Awareness of power consumed and remaining in a mission.	a) Percent of power stores remaining.	a) Awareness of percent of power stores remaining in relation to stores at mission start, by type of stores (percent correct).	O
		Food	Awareness of food consumed and remaining in a mission.	a) Days of food remaining.	a) Awareness of days of food per man remaning in the SCU by type. Collected during mission freeze or queried in-situ in real time (percent correct).	O
	Timeliness of SA	Timeliness of SA	The capability to access and collect pertinent SA information in a timely manner.	a) Time to access/detect/collect key SA cues in a given mission.	a) Duration (minutes).	O
	Location Awareness		Awareness of the location of mission relevant entities in the battle space.			
		Own	Awareness of own location in the battle space.	a) Accuracy of own location estimation.	a) Distance between estimated own location and actual locations (in meters). Collected during a mission freeze or in-situ map query in real time (meters).	O
		Friendly Forces	Awareness of friendly force locations in the battle space.	a) Accuracy of friendly force location estimations.	a) Distance between estimated friendly force locations and actual locations (in meters). Collected during a mission freeze or in-situ map query in real time (meters).	O
		Enemy Forces	Awareness of enemy force locations in the battle space.	a) Accuracy of enemy force location estimations.	a) Distance between estimated enemy force locations and actual locations (in meters). Collected during a mission freeze or in-situ map query in real time (meters).	O
		Civ / Others	Awareness of Civ/Other locations in the battle space.	a) Accuracy of Civ/Other location estimations.	a) Distance between estimated Civ/Other locations and actual locations (in meters). Collected during a mission freeze or in-situ map query in real time (meters).	O
	Capability Awareness	Friendly Force Surveillance	Awareness of the area the SCU can effectively surveil.	a) Awareness of the area that the SCU can surveil as a combination of arc and distance.	a) Difference between estimated and actual horizontal area, range and bearing combined, that the SCU can surveil from their position (square meters). b) Difference between estimated and actual vertical area, inclination by bearing by range, that the SCU can surveil from their position (square meters). c) Difference between estimated and actual horizontal area of dead ground within the limits of a specified surveillance range (e.g. 500-1000 m) (square meters). d) Difference between the estimated and actual total volume of battlespace, horizontal and vertical, that the SCU can surveil from their position (cubic meters).	O O O O

GROUPING	MMOE	MOE	DEFINITIONS	MOP	MEASUREMENTS	TYPE
		Friendly Force Engagement	Awareness of the area the SCU can effectively engage with fires.	a) Awareness of the effective area the SCU can engage with line-of-sight organic engagement.	a) Difference between estimated and actual horizontal area, range and bearing combined, that the SCU can engage from their position, to the effective range of each weapon (square meters). b) Difference between estimated and actual vertical area, inclination by bearing by range, that the SCU can engage from their position, to the effective range of each weapon (square meters). c) Difference between the estimated and actual total volume of battlespace, horizontal and vertical, that the SCU can engage from their position (cubic meters).	O O O
		Enemy Force Surveillance	Awareness of the area the enemy can effectively surveil.	a) Awareness of the area that the enemy can surveil as a combination of arc and distance.	a) Difference between estimated and actual horizontal area, range and bearing combined, that the enemy can surveil from their position (square meters). b) Difference between estimated and actual vertical area, inclination by bearing by range, that the enemy can surveil from their position (square meters). c) Difference between estimated and actual horizontal area of dead ground within the limits of a specified surveillance range (e.g. 500-1000 m) (square meters). d) Difference between the estimated and actual total volume of battlespace, horizontal and vertical, that the enemy can surveil from their position (cubic meters).	O O O O
		Enemy Force Engagement	Awareness of the area the enemy can effectively engage with fires.	a) Awareness of the effective area the enemy can engage with line-of-sight organic engagement.	a) Difference between estimated and actual horizontal area, range and bearing combined, that the enemy can engage from their position, to the effective range of each weapon (square meters). b) Difference between estimated and actual vertical area, inclination by bearing by range, that the enemy can engage from their position, to the effective range of each weapon (square meters). c) Difference between the estimated and actual total volume of battlespace, horizontal and vertical, that the enemy can engage from their position (cubic meters).	O O O
	Terrain Awareness	Cover and Concealment	Make best use of terrain features and ground cover to avoid detection by the enemy.	a) Expert effectiveness rating for use of terrain to avoid detection by the enemy.	a) Effectiveness rating by SMEs (rating value).	S
		Obstacles	Use of man-made or natural features that can stop, delay, canalize, or disturb your actions to avoid or use to your advantage.	a) Expert effectiveness rating for use or avoidance of obstacles.	a) Effectiveness rating by SMEs (rating value).	S
		Position of Fire	Best positioning of fire assets to engage the enemy with maximum effect.	a) Expert effectiveness rating for positioning of fire assets.	a) Effectiveness rating by SMEs (rating value).	S
		Position of Observation	Best positioning of surveillance assets to observe activity in an area of interest.	a) Expert effectiveness rating for positioning of surveillance assets.	a) Effectiveness rating by SMEs (rating value).	S
		Enemy Position	Best use of ground to avoid enemy positions.	a) Expert effectiveness rating for best use of ground to avoid enemy positions.	a) Effectiveness rating by SMEs (rating value).	S
		Distance	Awareness of mission-critical distances.	a) Expert effectiveness rating for awareness of mission-critical distances.	a) Effectiveness rating by SMEs (rating value).	S
	Situation Projection		The ability to project the future state, actions, and locations of mission-relevent entities in the battle space based on interpretation of known information.		Combination of subjective ratings and objective measures comparing projections against actual outcomes.	
		Friendly Forces	The ability to project the future state, actions, and locations of friendly forces in the battle space based on interpretation of known information.	a) Projection of future friendly forces state. b) Projection of future friendly force actions. c) Projection of future friendly force locations.	a) Accuracy of projected friendly force state as determined by SME rating (rating value). b) Accuracy of projected friendly force actions as determined by SME rating (rating value). c) Distance between projected friendly force locations and actual locations (in meters).	S S O
		Enemy Forces	The ability to project the future state, actions, and locations of enemy forces in the battle space based on interpretation of known information.	a) Projection of future enemy forces state. b) Projection of future enemy force actions. c) Projection of future enemy force locations.	a) Accuracy of projected enemy force state as determined by SME rating (rating value). b) Accuracy of projected enemy force actions as determined by SME rating (rating value). c) Distance between projected enemy force locations and actual locations (in meters).	S S O

GROUPING	MMOE	MOE	DEFINITIONS	MOP	MEASUREMENTS	TYPE
		Civ / Others	The ability to project the future state, actions, and locations of Civ/Others in the battle space based on interpretation of known information.	a) Projection of future Civ/Others state. b) Projection of future Civ/Others actions. c) Projection of future Civ/Others locations.	a) Accuracy of projected Civ/Others state as determined by SME rating (rating value). b) Accuracy of projected Civ/Others actions as determined by SME rating (rating value). c) Distance between projected Civ/Others locations and actual locations (in meters).	S S O
	Cognitive Burden	Mission Performance	Perception of the effectiveness of the team in performing the mission.	a) Team-based NASA-TLX score for mission effectiveness.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Time Pressure	Perception of the time pressure experienced while performing team tasks in the mission.	a) Team-based NASA-TLX score for mission time pressure.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Mental Demand	Perception of the complexity and mental demands in performing the mission.	a) Team-based NASA-TLX score for mission complexity and mental demand.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Physical Demand	Perception of the physical demands required to perform the mission.	a) Team-based NASA-TLX score for mission physical demands.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Effort	Perception of the level of effort necessary to perform the mission.	a) Team-based NASA-TLX score for mission level of effort.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Frustration	Perception of the level of frustration experienced to perform the mission.	a) Team-based NASA-TLX score for mission levels of frustration.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Information Access	The freqency and duration of consultation of information sources in the mission.	a) Frequency of accessing information sources. b) Total duration of time spent accessing information sources.	a) Frequency of accessing information sources in a given mission phase, by type of source. b) Total duration of time spent accessing information sources during a given mission phase, by type of source.	O O

GROUPING	MMOE	MOE	DEFINITIONS	MOP	MEASUREMENTS	TYPE
	Situation Projection	Friendly Forces Enemy Forces Civ / Others	The ability to project the future state, actions, and locations of mission-relevent entities in the battle space based on interpretation of known information.	a) Projection of enemy forces.	Combination of subjective ratings and objective measures comparing projections against actual outcomes.	O S O S O S
	Cognitive Burden	Mission Performance	Perception of the effectiveness of the team in performing the mission.	a) Team-based NASA-TLX score for mission effectiveness.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Time Pressure	Perception of the time pressure experienced while performing team tasks in the mission.	a) Team-based NASA-TLX score for mission time pressure.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Mental Demand	Perception of the complexity and mental demands in performing the mission.	a) Team-based NASA-TLX score for mission complexity and mental demand.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Physical Demand	Perception of the physical demands required to perform the mission.	a) Team-based NASA-TLX score for mission physical demands.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Effort	Perception of the level of effort necessary to perform the mission.	a) Team-based NASA-TLX score for mission level of effort.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Frustration	Perception of the level of frustration experienced to perform the mission.	a) Team-based NASA-TLX score for mission levels of frustration.	a) Team-based NASA-TLX score for mission phases and total mission.	O
		Information Access	The freqency and duration of consultation of information sources in the mission.	a) Frequency of accessing information sources. b) Total duration of time spent accessing information sources.	a) Frequency of accessing information sources in a given mission phase, by type of source. b) Total duration of time spent accessing information sources during a given mission phase, by type of source.	O O

DOCUMENT CONTROL DATA

*Security markings for the title, authors, abstract and keywords must be entered when the document is sensitive

1. ORIGINATOR (Name and address of the organization preparing the document. A DRDC Centre sponsoring a contractor's report, or tasking agency, is entered in Section 8.) HumanSystems® Incorporated 111 Farquhar Street Guelph, ON N1H 3N4	2a. SECURITY MARKING (Overall security marking of the document including special supplemental markings if applicable.) CAN UNCLASSIFIED 2b. CONTROLLED GOODS NON-CONTROLLED GOODS DMC A

3. TITLE (The document title and sub-title as indicated on the title page.)

MISSION MEASURES OF EFFECTIVENESS FOR SMALL UNIT INFANTRY OPERATIONS

4. AUTHORS (Last name, followed by initials – ranks, titles, etc., not to be used)

Tack, D.; Nakaza, E.

5. DATE OF PUBLICATION (Month and year of publication of document.) November 2017	6a. NO. OF PAGES (Total pages, including Annexes, excluding DCD, covering and verso pages.) 42	6b. NO. OF REFS (Total references cited.) 12

7. DOCUMENT CATEGORY (e.g., Scientific Report, Contract Report, Scientific Letter.)

Contract Report

8. SPONSORING CENTRE (The name and address of the department project office or laboratory sponsoring the research and development.)

DRDC – Toronto Research Centre
Defence Research and Development Canada
1133 Sheppard Avenue West
Toronto, Ontario M3K 2C9
Canada

9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.) 02ab SoSE	9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.) W7701-166107/001/QCL Task Authorization No. 001
10a. DRDC PUBLICATION NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document.) DRDC-RDDC-2018-C141	10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.)

11a. FUTURE DISTRIBUTION WITHIN CANADA (Approval for further dissemination of the document. Security classification must also be considered.)

Public release

11b. FUTURE DISTRIBUTION OUTSIDE CANADA (Approval for further dissemination of the document. Security classification must also be considered.)

12. KEYWORDS, DESCRIPTORS or IDENTIFIERS (Use semi-colon as a delimiter.)

Soldier Systems; Measurement; Infantry Platoon Effectiveness; Mission Performance; Measures of Performance; MOP, MOPs, Meaures of Effectiveness, MOE, MOEs, Measures of Outcome, MOO, MOOs, Dismounted Situation Awareness, DSA, SA, MMOE, Platoon Effectiveness Score

13. ABSTRACT/RÉSUMÉ (When available in the document, the French version of the abstract must be included here.)

The goal of this project was to develop an analytical model to evaluate small Unit mission effectiveness with sufficient diagnosticity at the task and capability levels, to support the evaluation of dismounted soldier information systems, or more generally, the impact of any intervention (technology, training, doctrine, etc.) on small unit effectiveness.

Three different approaches to measuring dismounted mission effectiveness were reviewed for their suitability for assessing Dismounted Soldier System digital information capabilities. The strengths of these approaches were considered and combined with the results of two subject matter expert workshops to develop a new mission effectiveness model that meets the small Unit information systems aims of this project: the Dismounted Soldier System – Measures of Mission Effectiveness model or DSS-MOME.

The proposed DSS-MOME provides a framework and analytical summation process for aggregating up to 122 MOPs to produce mission effectiveness and outcome measures, while enabling detailed traceability and diagnosticity to the task and capability levels. Opportunities for refining and further developing the model are discussed.

L'objectif de ce projet était d'élaborer un modèle analytique permettant d'évaluer l'efficacité des missions des petites unités avec une diagnosticité suffisante au niveau des tâches et des capacités pour appuyer l'évaluation du système de soldat débarqué, ou de manière plus générale, l'incidence de toute intervention (technologie, formation, doctrine, etc.) sur l'efficacité des petites unités.

On a examiné trois approches différentes pour mesurer l'efficacité des missions débarquées afin de déterminer si elles convenaient à l'évaluation des capacités d'information numérique du système de soldat débarqué. Les points forts de ces approches ont été étudiés et combinés aux résultats de deux ateliers d'experts en la matière afin d'élaborer un nouveau modèle d'efficacité de la mission qui répond aux objectifs des systèmes d'information des petites unités de ce projet : système de soldat débarqué – modèle de mesure de l'efficacité de la mission (SSD-MMEM).

Le SSD-MMEM proposé fournit un cadre de travail et un processus de synthèse analytique pour regrouper jusqu'à 122 mesures de rendement afin d'évaluer l'efficacité et les résultats d'une mission, tout en favorisant une traçabilité et une diagnosticité détaillées au niveau des tâches et des capacités. Les possibilités de peaufiner et de développer davantage le modèle sont abordées.