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PREFACE

This document was prepared by the Institute for Defense Analyses in partial fulfillment of the Task Order entitled "Analysis Support for the Military Operations in Urban Terrain (MOUT) Advanced Concept Technology Demonstration (ACTD)," sponsored by the Deputy Under Secretary of Defense for Advanced Technology (DUSD(AT)).

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EXECUTIVE SUMMARY

This document is the second of two documents that describe a needs-generation and evaluation methodology that was developed and implemented in support of the Military Operations in Urban Terrain (MOUT) Advanced Concept Technology Demonstration (ACTD). This document describes this methodology as it has been applied to date to a proposed follow-on program to the MOUT ACTD, whereas its companion document, "The Incubator Process: Methodology" (IDA D-2779), presents the general Incubator methodology that was developed.

A. BRIEF PROGRAM DESCRIPTION

The proposed follow-on program to the MOUT ACTD was intended to be a warrior-centric, Battalion Task Force and below (tactical level) program that supported the Army Interim Brigade and the Army's Chief of Staff vision of an Infantry-centric Objective Maneuver Force. Having learned from the experiences of the MOUT ACTD, the follow-on adopted a needs-based approach. The Incubator Process developed concurrent with the creation of an overall program concept and proposal in order to execute the preliminary stage of this envisioned needs-based approach.

B. SELECTED M&S TOOLS

Logical Decisions (LD) and the Joint Conflict and Tactical Simulation (JCATS) are the two M&S tools that were selected for incorporation into the application of the Incubator Process for the follow-on program to the MOUT ACTD. LD is a software decision support tool that was chosen to assist in creating Capability Assessment Process (CAP) models to determine to what degree a particular capability satisfies a warfighter need. JCATS is a multi-sided, interactive, single-entity-level combat simulation. It was chosen to provide an opportunity for force-on-force analyses based on its suitability to represent the characteristics and traits of an urban environment.

C. PROPOSED FOLLOW-ON PROGRAM'S INCUBATOR IMPLEMENTATION EXPERIENCE

The Incubator Process was applied to the proposed follow-on program to the MOUT ACTD between January and April 2001. During this time, the first three workshops, corresponding to warfighter needs definition and prioritization, warfighter needs development, and warfighter capabilities development, were implemented. A narrative is provided for each of these three workshops that includes information on the workshop's dates and location, participants and observers, activities, support work, and deliverables.

D. JCATS-SPECIFIC SUPPORT WORK

A large portion of the support work for the Incubator Process revolved around the use of JCATS for data generation and the evaluation of capabilities. The planning for JCATS use involved identifying those warfighter needs conducive to modeling and then describing the M&S approach for each. Of the 31 warfighter needs defined for the proposed follow-on, 15 were determined suitable to M&S exploration using JCATS; a more comprehensive M&S approach description was developed for each of these warfighter needs.

Unlike the originally intended, more comprehensive application of JCATS within the Incubator Process, the purpose and scope of this effort was narrowed to that of establishing a proof-of-principle for the use of JCATS for data generation and insights, as appropriate. To support this proof-of-principle, only four out of 15 warfighter needs, identified for the follow-on program and determined to be suitable for M&S using JCATS, were selected for consideration. The JCATS analyses that were performed with respect to these four needs are presented in terms of a general description of the need and approach, the scenario and any assumptions, measures/variables, JCATS runs and results, and analysis and/or conclusions.

E. PROPOSED FOLLOW-ON PROGRAM'S INCUBATOR STATUS

As of December 2001, competing sponsor priorities and the fact that the proposed follow-on program had not been approved as an FY03 ATD forced Incubator work in support of this effort to be placed on hold. If a decision is made in the future to go forward with a follow-on program to the MOUT ACTD, Incubator work could be

restarted. The work already completed from Workshops I, II, and III, as well as the associated support work, could be used as is, or revised as appropriate. To complete the Incubator Process, some additional work would have to be done to complete Workshop III; Workshops IV and V (and associated support work) would need to be scheduled and conducted.

A. INCUBATOR PROCESS IMPLEMENTATION OVERVIEW

Although the Incubator Process was originally developed specifically for use in the proposed follow-on to the Military Operations in Urban Terrain Advanced Concept Technology Demonstration (MOUT ACTD), it was not intended to be exclusive or only suitable to the specifics of that particular science and technology program. Indeed, as was explained in the methodology description presented in IDA D-2779,[1] the intent was for this Incubator Process to feed a broader needs-based approach that could be used by any science and technology program[2] striving for a methodology to assist in determining logical focal areas for technology search and evaluation. That said, the Incubator and its overall needs-based approach remain flexible enough to be adapted to and/or modified to best address a particular science and technology program's scope, goals, and objectives. The remainder of this paper describes some details of how the Incubator has been implemented to date for the proposed MOUT ACTD follow-on.

B. PROPOSED FOLLOW-ON TO THE MOUT ACTD

1. Brief Program Description

A warrior-centric, Battalion Task Force and below (tactical level) program was proposed as the logical follow-on to the experience and success of the MOUT ACTD, while supporting the Army Interim Brigade and the Chief of Staff of the Army's vision of an Infantry-centric Objective Maneuver Force.[3] Having learned from the experiences of the previous MOUT program, the follow-on adopted a needs-based approach. The Incubator Process was originally developed simultaneously with the creation of an overall concept and proposal for this follow-on program in order to execute the preliminary stage of this envisioned needs-based approach.

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[1] W.M. Christenson, et al., *The Incubator Process: Methodology*, IDA D-2779, September 2002.

[2] As stated previously in IDA D-2779, for the purposes of the Incubator process and its description, "science and technology program" has been chosen as the term to describe the type of effort to which the Incubator Process could apply. This should not be thought of as a formal science and technology program, which has been specifically defined in terms of its purpose and technological solution focus. The use of this term is intended rather to equate to that of a science and technology program that is either newly or generically established, or still in the stage of a proposal. In order for such a program to remain true to a needs-pull, rather than technology-push, objective, the key is to implement the Incubator Process from the very beginning or as soon as possible during a program's formulation and implementation.

[3] This concept for a follow-on program was originally proposed as an FY02 ACTD, but then morphed into a proposed FY03 Advanced Technology Demonstration (ATD). The proposed FY03 ATD did not move forward.

2. Selected M&S Tools

Logical Decisions and the Joint Conflict and Tactical Simulation are the two M&S tools that were selected for incorporation into the application of the Incubator Process for the follow-on program to the MOUT ACTD. The remainder of this section addresses both of these M&S tools with a brief explanation of why each was chosen, what each is and does, and how each was intended for use within the Incubator Process.

a. Logical Decisions

Why Logical Decisions? The MOUT ACTD used Logical Decisions (LD) for its Technology Assessment Process (TAP) to assist in addressing the essential question: How does one use the data collected for technology nominations to determine the best technologies for each requirement? The proposed follow-on found itself faced with a very similar proposition, only instead of a TAP, it required the development and execution of a Capability Assessment Process (CAP) to determine to what degree a particular capability satisfies a warfighter need. Because of IDA's familiarity with the LD model and the similarity between the MOUT ACTD's TAP and the envisioned CAP, LD was chosen to perform the decision analysis support function for the Incubator Process.

What is Logical Decisions? LD is a software decision support tool based on methods associated with the field of decisions analyses. LD allows for complex problems to be broken down into more understandable segments based on preferences, and then recombined in order to evaluate alternatives to a problem quantitatively. LD allows for this decomposition of the problem to be organized into a goals hierarchy. Some key terminology related to a goals hierarchy is as follows:

- Alternatives – The objects to be ranked
- Goals – The overall reason why you are evaluating and comparing alternatives
- Sub Goals – The categories of measures that support the main goal
- Measures – That quantitative and qualitative data/information that can be used to distinguish alternatives with respect to goals
- Scales – The types and bounds of inputs for each measure
- Weights – The value judgment assigned to measures based on relative importance in supporting the main goal.

The use of LD as an analysis tool involves four basic steps. First, the problem must be structured by identifying and defining the overall goal. An example might be:

What is the best truck? Subordinate goals also are identified that contribute to the overall goal, and their measures are defined. For example, in searching for the best truck, one might have subordinate goals such as cost and performance. Measures collected could include price, resale value, fuel economy, and power. Structuring a problem using LD is facilitated by the ability to construct a goals hierarchy. Figure 1 illustrates just such a hierarchical view for the best truck example, with the goals and measures being indicated by boxes and ovals, respectively.

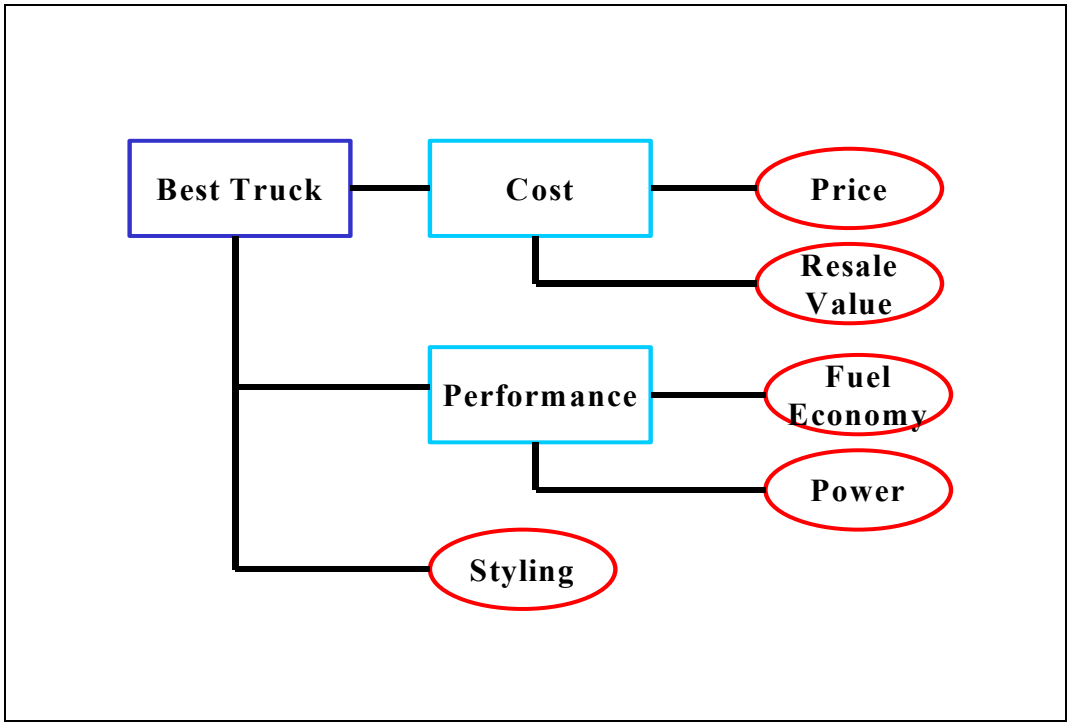

Figure 1. Logical Decisions' Goals Hierarchy, Best Truck Example

With the problem's goals and measures having been defined, there is some discretion left to the analyst in placing preferences on certain measures over others. By placing these preferences, or weights, on measures, the measures will not be treated as equals in the process of recombining the data for the analysis results. In other words, an analyst may decide that fuel economy is much more important than styling when evaluating several trucks to determine the best truck overall. Next, the data must be collected for all the defined measures for each of the alternatives under consideration. Thus, information is collected based on the established measures for all trucks being considered. Finally, LD will process the inputted measure-related data and rank the alternatives using a uniform utility ranking from zero to one (zero being the worst and

one being the best). A visual representation of the type of results readily generated by LD is found in Figure 2. Note that the three fictional trucks being considered are ranked in order of descending overall utility and are accompanied by a bar graph that visually presents the relationship between these three trucks' utility ratings. The "Coyote" truck, with a utility of .699, has been determined to be the best truck, given the previously established goals, measures, and preference set of the given truck alternatives.

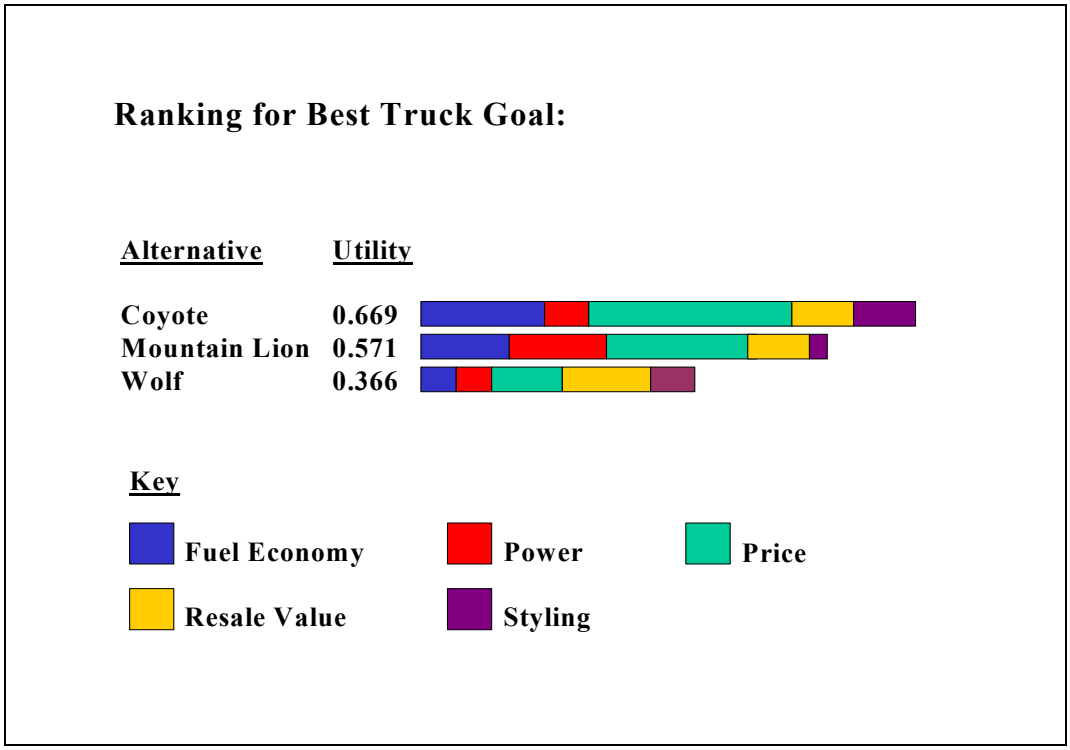

Figure 2. Logical Decisions' Analysis Results, Best Truck Example

How is Logical Decisions intended for use in the Incubator Process for the proposed follow-on program? LD is employed in this application of the Incubator Process in a similar fashion as it was in the MOUT ACTD TAP, only this time the decision support tool is intended to develop a CAP model and prioritize capabilities, rather than technologies, for each warfighter need. The development of a CAP model consists of defining the components of a LD goals hierarchy structure. In the first stages of the Incubator Process, the goals correspond to a particular warfighter need. For example, one such goal might be the need to know what is happening on the other side of a wall. Likewise, one has to understand that the CAP model evaluates whether a capability satisfies a warfighter need, and, therefore, the capabilities in this process correspond to the alternatives term used by LD. Some examples of the types of

capabilities that might be evaluated for this sample need are as follows: the ability to look through a window, the ability to fit/look under a door or through a hole, and the ability to see through a wall. Sub-goals may or may not be necessary in developing a CAP model, but could include examples such as engagement, force protection, C4I, and mobility, which may assist in directing the identification and organization of measures. Measures will vary from CAP model to CAP model, but might include such items as percentage of critical items/activities detected, operational risk, force exchange ratio, loss exchange ratio, etc. Appropriate quantitative or qualitative scales are also defined for each measure. Finally, the measures are weighted so that the CAP model will know how to evaluate the measures-related data collected for the capabilities being evaluated. An example of weighting is represented by establishing that the data collected for the "force exchange ratio" measure have more of an impact on the degree to which a capability satisfies a need than the data collected for the "operational risk" measure.

In order to execute a CAP model run, measure-related data are collected for all capabilities under consideration for a particular need. These data can then be electronically imported or manually entered into the appropriate need's CAP model. Once the data have been entered, an analysis is performed to generate the rating and ranking of the capabilities for that need.

This process of goals hierarchy definition, data collection, data input, and analysis generation has to be performed individually for each of the identified warfighter needs. LD is also used in the same manner to develop and execute an overarching CAP model that allows for a single, additional rating and ranking of all capabilities based on overall programmatic constraints.

b. Joint Conflict and Tactical Simulation (JCATS)

Why JCATS? Conceptualization of the proposed follow-on to the MOUT ACTD envisioned being able to interject some measure(s) of operational payoff into the evaluation of whether a capability satisfies a particular need. This resulted in the idea of using a force-on-force combat simulation to investigate what the operational result might be if a unit were equipped with a particular capability identified to address a need. Experience had been gained in performing analyses for technologies using JCATS during the MOUT ACTD. More importantly, however, JCATS remained the best fit for the proposed follow-on program's focus, since, of all the force-on-force simulations today, it has the most complete representation of urban operations.

What is JCATS? JCATS is a multi-sided, interactive, single-entity-level combat simulation that provides a tool for analysis, training, and mission planning. The model was developed and continues to be enhanced by Lawrence Livermore National Laboratory (LLNL). It is the most recent model of the Janus legacy developed by LLNL.

Within JCATS, many different types of systems — humans, wheeled and tracked vehicles, fixed and rotary wing aircraft, surface ships, submarines — can be modeled and equipped with a variety of sensors, weapons, and munitions. In addition to interacting with one another, these systems interact within the model on terrain based on National Imagery and Mapping Agency (NIMA) terrain data.[4] Specific surface features, such as different types of roads, vegetation, water, etc., also can be added to the JCATS terrain, and impact trafficability and probability of line-of-sight blockage. Environmental conditions, human factors, logistics, and types of system kills also affect various aspects of system performance.

The JCATS terrain may be viewed in perspectives from broad (including coastal) areas (660km x 660km) down to the interiors of individual buildings. Figure 3 illustrates a wide coastal view and a more narrowly zoomed building view. Specific to its suitability to represent characteristics and traits of an urban area or environment, JCATS offers the following capabilities:

- Representation of enhanced buildings, including multiple floors, roofs, interior walls, windows, and doors (but no furniture)
- Blockage of movement and line-of-sight by buildings
- Movement between floors within a building (but no stairways)
- See and move through windows
- Breach through doors and walls
- Damaging of buildings and resulting building rubble
- Engagement within buildings
  - Projectiles penetrate walls
  - Booby traps inside buildings
- Representation of basements and tunnels.

To use JCATS for a specific study, its General User Interface (GUI) and mouse are used to prepare the appropriate operational scenario. Scenario preparation can be

[4] JCATS readily accepts NIMA's DTED level 1 (100m) and 2 (30m) terrain data, with the option of being able to insert one meter resolution for small, specified areas.

done both before and during a simulation run. Some activities that can be planned for a scenario are entity movement routes, position and status, aggregation or deaggregation of entities, mounting or dismounting of entities from larger systems, etc.

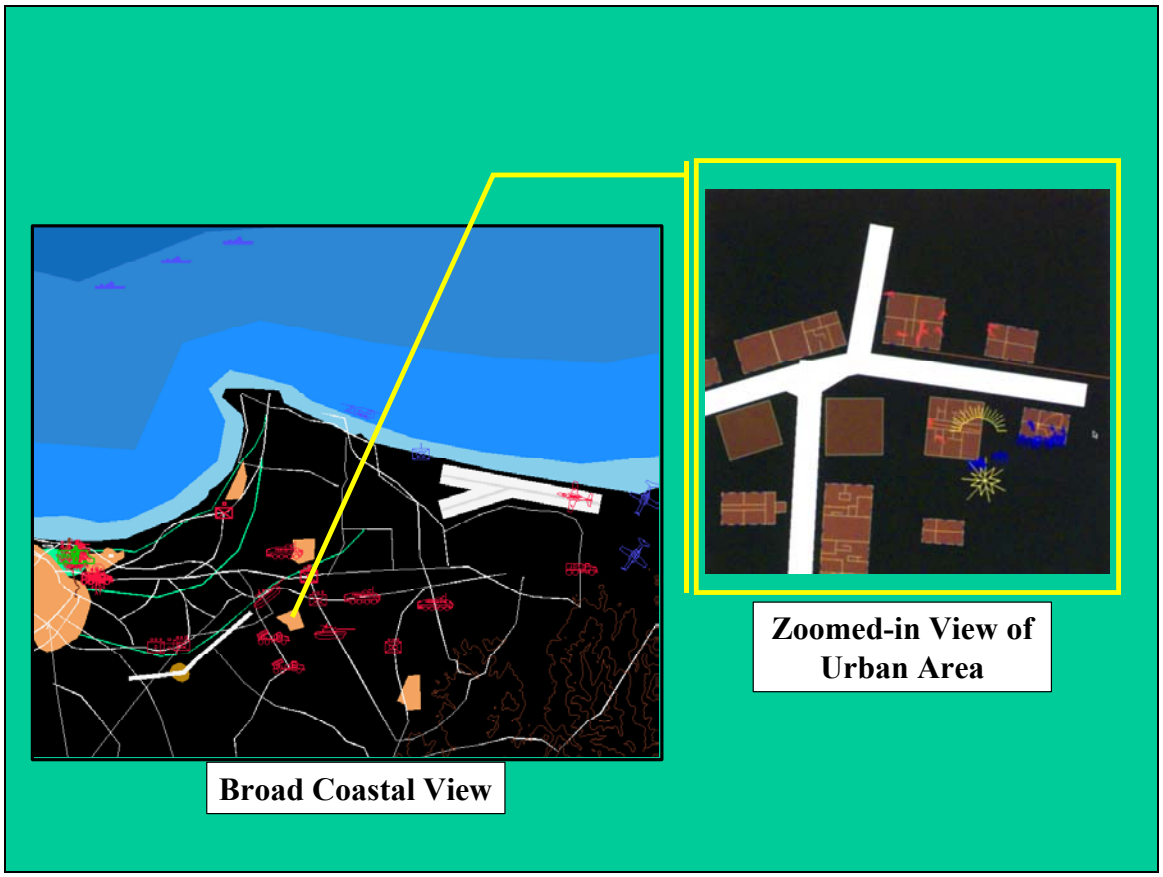

Figure 3. JCATS Wide and Narrow Screen Views

How was JCATS intended for use in the Incubator Process for the proposed follow-on program? JCATS was intended to provide the opportunity to compare different capabilities for a warfighter need within an operational context. Being able to investigate capabilities in this force-on-force model would be beneficial in two ways. First, using JCATS would enable different capabilities to be compared in terms of their operational pay-offs. So, for example, two capabilities may seemingly satisfy the defined warfighter need, but through JCATS analyses it may be discovered that one capability is far superior to the other in terms of its contribution to individual and unit force effectiveness. Second, JCATS could be used to perform some sensitivity analysis to try to bound the parameters for a capability. JCATS could be used to investigate and compare the operational pay-offs that might be experienced between different capability levels.

For example, it may be assumed that a warfighter needs to have perfect knowledge of what is on the other side of the wall (i.e., what it is, where it is, is it armed/unarmed, etc.); through JCATS analyses, this could be investigated to see if this is the case, or even to determine if you get less in terms of additional operational pay-off due to different aspects of the capability. Although it was felt that JCATS could prove useful in both of these areas, its involvement in the first was considered the most relevant to the Incubator Process.

It was recognized up front that not all capabilities and/or warfighter needs would be suitable for modeling. However, it was determined that having these types of operational pay-off assessments when and where possible would be of benefit to the program management of the proposed follow-on.

In order to perform these JCATS-enabled analyses for the Incubator Process, an appropriate operational scenario and performance parameters for each of the capabilities would be entered into the model. A series of runs would be conducted for a given operational scenario and would include different capabilities.

3. Proposed Follow-on Program's Incubator Implementation Experience

As of April 2001, the first three workshops of the Incubator Process were implemented, under the auspices of the MOUT ACTD and its extensions, for the proposed follow-on program. Further details associated with the execution and deliverables of these workshops, as well as their associated support work, on behalf of this program are as follows.

a. Workshop I

Date and Location. 8-9 January 2001; IDA – Alexandria, VA

Participants. 10 warfighter SMEs with MOUT experience. The warfighter SMEs were a combination of active duty and retired soldiers and Marines. Six warfighter SMEs were representative of the U.S. Army; the remaining four were representative of the U.S. Marine Corps.

Participants/Observers. Two VIP warfighter SMEs,[5] both retired Generals with extensive MOUT and other relevant warfighter experience.

[5] Two VIP warfighter SMEs joined the second day of Workshop I's proceedings as participants/observers. Initially they were brought up to speed on the proposed follow-on program, Incubator Process, and the work accomplished by the other warfighter SMEs during day one of Workshop I. They then participated in the brainstorming exercises throughout the remainder of that workshop's second day. These two SMEs

Observers. Thirteen technology SMEs, with experience in the MOUT ACTD's System Integration Team (SIT); they also are expected to serve in a similar capacity in the proposed follow-on program's Searchers for Capabilities and Opportunities for Urban Technologies (SCOUT) team.

Summary of Activities. Workshop I's activity kicked off with an overview of the proposed follow-on program and an introduction of the Incubator methodology and its terminology to the assembled warfighter and technology SMEs. During this introductory period, the attendees were also told that the warfighter SMEs would serve as the primary participants in this first workshop to identify MOUT needs from the perspective of the warfighter.

As a departure point for the discussion and brainstorming of MOUT needs, the warfighter SMEs began Workshop I by reviewing the frustrated and partially met requirements[6] resulting from the MOUT ACTD. These two lists of requirements may be found in Tables A-1 and A-2, respectively, of Appendix A. This review consisted of roughly three steps: 1) a decision on whether the frustrated or partially met requirement still represented a valid MOUT need; if not, it was removed from further consideration; 2) a decision on whether any frustrated or partially met requirement should be broken out and/or combined in order to better represent valid MOUT needs; and 3) a rewording of each of the remaining valid frustrated or partially met requirements into a need statement. Table A-3 of Appendix A captures how each of these already existing, frustrated, and partially met requirements was initially dispositioned by the warfighter SMEs during Workshop I.

Having thoroughly reviewed and revised the MOUT ACTD's frustrated and partially met requirements, the warfighter SMEs then began to brainstorm additional MOUT needs. These new needs were added to those formulated from the MOUT ACTD's already existing frustrated and partially met requirements. All of the needs were reviewed an additional time before producing a final list of 32 needs to be considered for the proposed follow-on program. This resulting list of needs is shown in Table 1.

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were involved from the beginning as a means for attaining buy-in for the scope and direction of the proposed follow-on from high-level and well-respected members of the warfighter community.

[6] "Frustrated and partially met requirements" are two terms that were used to express the status of a requirement within the MOUT ACTD. A "frustrated requirement" represents a requirement for which no suitable technology solution could be identified within the time constraints of the ACTD. A "partially met requirement" represents a requirement for which a suitable technology solution was found that addressed only a portion of the originally defined requirement.

Table 1. List of Needs

Need Title	Need Definition
Identify Friendlies	To identify friendly combatants during all conditions.
Identify Enemy	To identify enemy combatants during all conditions.
Identify Non-Combatants	To identify non-combatants during all conditions.
Knowledge of Other Side of Wall	To know what is on the other side of an opaque wall.
Designate Persons/Items	To reversibly designate persons or items of interest to friendly forces under all conditions on-site or remotely.
Detect Explosives/Explosive Devices	To detect explosives/ explosive devices/ mines inside buildings or in/ around built up areas.
Neutralize Explosive/Explosive Devices	To neutralize explosives/ explosive devices/ mines inside buildings or in/ around built up areas.
Sniper Detection	To detect sniper location under all conditions and situations proactively (and reactively).
Target Designation	To enable target designation and/or hand-off targeting data to off-site shooters, across all branches and services.
Defeat Armored Vehicles, Bunkers, Reinforced Structures	To enable individual soldiers/ Marines to defeat armored vehicles, neutralize bunkers, and penetrate reinforced structures/ walls/ bunkers from a confined space.
Position Location in Complex and Restrictive Terrain	To provide platoon leader with position location for his squads in complex and restrictive terrain.
Near Real-time, Scaleable Map	To produce a near real-time, scaleable map for dissemination to individual soldiers and Marines.
See While Inside Buildings/ Structures	To be able to see while inside buildings/structures at all times.
Improved MOUT Obscurants	To improve MOUT obscurants at individual soldier/ Marine level.
Get on Top of Buildings	To be able to put/get soldiers and Marines on top of buildings.
Oxygen Depleted Environment	To operate in oxygen-depleted and NBC contaminated environments.
Intelligence	To provide remote surveillance and detection of activity in the urban area.
Casualty Treatment	To provide means for enhanced casualty treatment.
Casualty Evacuation	To provide means for enhanced casualty evacuation.
Deny Use of Electrical Equipment	To deny the enemy the use of his electrical equipment.
Communication All Levels	To communicate across all levels below combined arms task force.
Personal Full Protection	To improve personal full protection system usable in both training and operation.
Power Source Efficiency	To improve efficiency of battlefield power sources.
Precision Direct Fire	To improve precision direct fire.
Rapid Counter-Mobility	To provide rapid counter-mobility.
Forcible Entry	To improve forcible entry capability.
MOUT Logistics	To improve logistics capability in the urban environment.
Vehicular Survivability	To enhance vehicular survivability within an urban operation.
Indirect Fires	To enhance indirect fires.
Non-Violent Crowd Dispersal	To provide non-violent means to disperse a crowd.
Soldier/Marine Individual Operational Effectiveness	To provide improved approach to individual soldier/ Marine operational effectiveness.
Realism of MOUT Training	To improve realism of training in urban environment.

Workshop I concluded with the prioritization of the identified needs for the proposed follow-on program. This segment of the workshop began with the warfighter SMEs defining the context in which to prioritize the needs. The warfighter SMEs combined four missions (sector, open areas, key terrain, and buildings) and three types of

operations (attack, defend, and Standby and Support Operations (SASO)) to produce the following twelve mission area contexts:

- Sector – Attack
- Sector – Defend
- Sector – SASO
- Open Areas – Attack
- Open Areas – Defend
- Open Areas – SASO
- Key Terrain – Attack
- Key Terrain – Defend
- Key Terrain – SASO
- Buildings – Attack
- Buildings – Defend
- Buildings – SASO

Each of the warfighter SMEs then ranked these mission area contexts in order of importance from one (the most) through twelve (the least) from the perspective of one's branch and/or personal experience. Each warfighter then individually ranked all of the identified needs[7] within each of these previously ranked mission areas.

Summary of Support Work. Support work for Workshop I took place immediately upon the conclusion of the warfighter SMEs' individual prioritization of the needs. A prioritization methodology combined the mission area and need rankings from all of the warfighter SMEs to produce a prioritized list of the needs for each type of operation and a combined overall list.[8] These prioritized lists of needs were reviewed by the warfighter SMEs and adjustments were made based on any discrepancies between the initial prioritization and the priority expected. Upon review, the warfighter SMEs made only one adjustment in the prioritization, which was to move the Casualty Evacuation need into the top ten needs overall. Table 2 contains both the initial prioritizations and the final overall prioritization of the proposed follow-on program needs. At this point, to further distinguish and identify the needs from one another, each was assigned a distinct warfighter need (WN) number corresponding to its final overall priority. For example,

[7] In the case of the proposed follow-on program, only 31 of the original 32 needs were actually considered for prioritization. The originally defined Realism in MOUT Training need was not prioritized because it was decided that this need was actually at a very different level than the other needs identified. More information will be provided on how this need was handled in the description of the "Summary of Activities" section that follows for Workshop II.

[8] A quick analysis of the results indicated that there was very little differentiation between the rankings of the missions within the operation types, for example, between attacking sectors and attacking buildings.

Intelligence may also be referred to as WN01; Knowledge of the Other Side of Wall is WN15.

Deliverables.

- List of warfighter needs
- Prioritized list of warfighter needs.

Table 2. Initial and Final Prioritization of Needs

Final Overall Priority/WN	Need Title	Initial Attack Priority	Initial Defend Priority	Initial SASO Priority	Initial Overall Priority
1	Intelligence	1	1	2	1
2	Identify Friendly	2	2	1	2
3	Communication All Levels	3	3	3	3
4	Near Real-Time, Scaleable Maps	4	4	6	4
5	Sniper Detection	5	5	7	5
6	Position Location in Complex and Restrictive Terrain	6	9	4	8
7	Identify Enemy	7	10	8	6
8	Target Designation	8	8	9	12
9	Precision Direct Fire	9	13	5	18
10	Casualty Evacuation	17	18	13	14
11	See Inside Buildings/Structures	10	7	14	13
12	Designate Persons/Items	11	15	11	9
13	Forcible Entry	12	6	30	23
14	Defeat Armored Vehicles, Bunkers, Reinforced Structures	13	11	17	28
15	Knowledge of Other Side of Wall	14	12	24	22
16	Personal Full Protection	15	20	10	11
17	Detect Explosives/Explosive Devices	16	14	27	15
18	Get on Top of Buildings	18	17	18	16
19	Indirect Fires	19	19	12	25.5
20	Identify Non-Combatants	20	23	15	7
21	Improved MOUT Obscurant	21	16	26	29
22	Casualty Treatment	22	22	16	19
23	Neutralize Explosives/Explosive Devices	23	21	25	20
24	Vehicular Survivability	24	26	19	17
25	MOUT Logistics	25	25	21	25.5
26	Power Source Efficiency	26	24	28	27
27	Soldier/Marine Individual Operational Effectiveness	27	29	22	21
28	Non-Violent Crowd Dispersal	28	31	23	10
29	Rapid Counter-Mobility	29	30	20	24
30	Oxygen-Depleted Environment	30	28	29	31
31	Deny Use of Electrical Equipment	31	27	31	30

b. Workshop II

Date and Location. 10-12 January 2000; IDA – Alexandria, VA

Participants. 10 warfighter SMEs (same as participated in Workshop I)

Observers. 13 technology SMEs (same as participated in Workshop I)

Summary of Activities. During the course of Workshop II, the warfighter SMEs took part in an initial brainstorming of measures and important technical characteristics[9] that they deemed would be important in determining to what degree a need had been addressed or satisfied by a given capability. This initial warfighter SME brainstorming effort surfaced such possible measures as range, signature, fratricide casualties, operational security, accuracy, etc. The resulting list of possible measures and additional technical characteristics for each need is captured in Appendix B.

In addition to brainstorming possible measures and technical characteristics, the warfighter SMEs also separately addressed the originally defined need, Realism in MOUT Training, which was not prioritized along with the other needs. This need was dealt with uniquely because it appeared to relate to many, if not all, of the other 31 needs, while also possessing aspects that were recognized to be well beyond the scope, anticipated funding levels, etc., of the proposed follow-on program. A decision was made to handle this need in two ways: 1) apply some form of training realism measure or consideration to all other applicable needs; and 2) include an overall recommendation by the proposed follow-on program about the need for realism in MOUT training, which would then be forwarded to appropriate people in the training community. Appendix C contains a more detailed account of the brainstorming that took place to assist in formulating the MOUT training recommendations.

Summary of Support Work. Support for Workshop II began immediately upon the conclusion of the Workshop with a review of the initial possible measures and technical characteristics brainstormed by the warfighter SMEs for each need. It was quickly concluded that the majority of these measures and characteristics were at a slightly lower level than had been intended for addressing capabilities. Therefore, these measures were fine-tuned and additional measures identified, as appropriate. This process of identifying a preliminary set of Measures of Effectiveness (MOEs) and Measures of

[9] The original intent of Workshop II was to brainstorm initial measures only. During the implementation of Workshop II for the follow-on to the MOUT ACTD, however, the warfighter SMEs also developed a series of comments, which were not operational performance-based measures. These additional comments were more technical in nature and have therefore been referred to as "technical characteristics."

Performance (MOPs) for each need was facilitated by addressing each need based on four Measures of Outcome (MOOs) — engagement, force protection, C4I, and mobility. MOEs/MOPs were then identified within each of these MOOs, as appropriate, and an attempt was made to determine those measures for which the data inputs could be obtained either via JCATS or non-JCATS means. Appendix D contains the resulting preliminary sets of MOEs/MOPs (broken out based on MOO categories and whether input data are intended to be JCATS- or non-JCATS-generated) for each need.

The next phase of the support work involved developing preliminary scales for the MOEs/MOPs and using the MOEs/MOPs and corresponding scales to construct a preliminary goals hierarchy using Logical Decisions (LD) for each need. Appendix E consists of a table of MOOs/MOEs/MOPs, scales, and LD goals hierarchy for each need. To be consistent, great care was taken to ensure that the MOEs/MOPs were defined in a consistent way regardless of the need or needs with which it was associated. Tables F-1 through F-5 in Appendix F document the distinct MOEs/MOPs and corresponding scales by MOO. Again during this period, some preliminary thought was given as to which needs might prove suitable for investigation via JCATS.

Deliverables.

From Workshop II

- An initial set of possible measures and additional technical characteristics, as brainstormed by the warfighter SMEs, for each need
- Brainstormed notes to assist in formulating recommendations for the issue of MOUT training.

From Support Work

- Preliminary set of MOEs/MOPs for each need
- Preliminary scales for MOEs/MOPs for each need
- Preliminary CAP model using LD for each need.

c. Workshop III

Date and Location. 2-5 April 2001; IDA – Alexandria, VA

Participants. Technology and warfighter SMEs (all individuals had participated in and/or observed the activities of Workshops I and/or II)

Observers. NA

Summary of Activities. Unlike the activities of Workshops I and II, the technology SMEs actively participated in Workshop III, along with several representatives of the previously engaged warfighter SMEs. The objective of this workshop was to brainstorm different capabilities or generic approaches, which could possibly address or satisfy a need. The participants were encouraged to avoid technology-specific items, but a compromise was reached whereby technology characteristics (and in some cases even actual technical solutions) which were identified would also be collected for future use, in addition to capabilities for each need. The brainstorming was approached one need at a time with capabilities, technology characteristics, and technical solutions (as appropriate) being captured, along with more general notes relevant to that need. Appendix G documents the specific information that was brainstormed for each need. While considering each need individually, the SMEs also decided to make some revisions to the needs first developed during Workshop I (and as shown previously in Table 1). The types of revisions that were made included changes in the need title and definition, merging needs, breaking a need into sub-needs, and the identification of those needs that would be better addressed by an already existing program. Table 3 summarizes the transformation of the needs that took place.

Summary of Support Work. After the completion of Workshop III, circumstances necessitated that the support work planned be reviewed and revised. It was decided that until further instructions, support work associated with finalizing a set of measures, scales, and weights to be used to rate and rank capabilities via a CAP model for each need would cease. Instead, the focus has been the use of JCATS to generate data and evaluate capabilities and their ability to address a need. This JCATS effort, although a part of this post-Workshop III support work, will be described in a following section.

Workshop III

- List of capabilities for each need.

Table 3. Workshop III Transformation of Workshop I Needs

Workshop I			As of Workshop III			
Need #	**Need Title**	**Need Definition**	**Disposition**	**New Need Title**	**New Need Definition**	**Other Notes/ Comments**
WN01	**Intelligence**	To provide remote surveillance and detection of activity in the urban area.	New Need Title	Urban Surveillance and Detection	NA	NOTE: Both inside and outside of structures
WN02	**Identify Friendly**	To identify friendly combatants during all conditions.	New Need Title	Identify Friendlies	NA	NOTE: Real-time, may be linked to position-location
WN03	**Communication All Levels**	To communicate across all levels below combined arms task force.	New Need Title and Definition	Urban Communication All Levels	To communicate across all levels below combined arms task force in urban/ complex terrain.	NOTE: Communication with all platforms in the battalion task force
WN04	**Near Real-Time, Scaleable Maps**	To produce a near real-time, scaleable map for dissemination to individual soldiers and Marines.	New Need Title and Definition and broken into 2 sub-needs	Near Real-time, Scaleable Map Information for Production and Dissemination	To produce near real-time, scaleable map information for dissemination to individual soldiers and Marines.	2 sub-needs: a) Produce b) Disseminate
WN05	**Sniper Detection**	To detect sniper location under all conditions and situations proactively (and reactively).	Unchanged	NA	NA	NOTE: Determine location of sniper that you cannot see NOTE: May depend on our definition of sniper
WN06	**Position Location in Complex and Restrictive Terrain**	To provide platoon leader with position location for his squads in complex and restrictive terrain.	New Need Definition and broken into 2 sub-needs	NA	To provide platoon/ squad leader with position location for his squads/ fire team leaders in complex and restrictive terrain.	2 sub-needs: a) Locate b) Disseminate
WN07	**Identify Enemy**	To identify enemy combatants during all conditions.	Unchanged	NA	NA	NA
WN08	**Target Designation**	To enable target designation and/or hand-	New Need Title and Definition	Improved Target Designation	To enable target designation and/or	2 sub-needs: a) Designate

Workshop I			As of Workshop III			
Need #	**Need Title**	**Need Definition**	**Disposition**	**New Need Title**	**New Need Definition**	**Other Notes/ Comments**
		off targeting data to off-site shooters, across all branches and services.	and broken into 2 sub-needs		hand-off targeting data to off-site shooters, across all arms and services.	b) Hand-off
WN09	**Precision Direct Fire**	To improve precision direct fire.	New Need Title	Improved Precision Direct Fire	NA	NOTE: Unique to the MOUT environment
WN10	**Casualty Evacuation**	To provide means for enhanced casualty evacuation.	New Need Title	Enhanced Casualty Evacuation	NA	NA
WN11	**See Inside Buildings/ Structures**	To be able to see while inside buildings/ structures at all times.	New Need Title and Definition	See While Inside Buildings/ Structures	To be able to see while inside buildings/ structures at all times.	NOTE: Includes needing both a visible light and non-visible light solution (refers to the tech search; idea is to combine)
WN12	**Designate Persons/ Items**	To reversibly designate persons or items of interest to friendly forces under all conditions on-site or remotely.	New Need Title	Improved Designation of Persons/ Items	NA	NA
WN13	**Forcible Entry**	To improve forcible entry capability.	New Need Title and Definition and broken into 3 sub-needs	Improved Forcible Entry	To improve forcible entry capability (specifically obstacle reduction, interior and exterior building and structure entries; includes need for mechanical breaching kit, remote breaching device, breach trainer).	NOTE: Includes everyone within the combined arms task force having a breach and counter-breach capability NOTE: Want vehicles to be able to move as seamlessly as infantry 3 sub-needs: a) Infantry Forcible Entry into Buildings b) Vehicle Breach of Walls c) Vehicle Ability to Clear/ Reduce Obstacles
WN14	**Defeat Armored Vehicles,**	To enable individual soldiers/ Marines to defeat armored vehicles,	Broken into 2 sub-needs	NA	NA	2 sub-needs: a) Defeat of Lightly Armored and Wheeled Vehicles

Workshop I			As of Workshop III			
Need #	**Need Title**	**Need Definition**	**Disposition**	**New Need Title**	**New Need Definition**	**Other Notes/ Comments**
	Bunkers, Reinforced Structures	neutralize bunkers, and penetrate reinforced structures/ walls/ bunkers from a confined space.				b) Defeat of Reinforced Structures/ Bunkers, etc.
WN15	**Knowledge of Other Side of Wall**	To know what is on the other side of an opaque wall.	Unchanged	NA	NA	NA
WN16	**Personal Full Protection**	To improve personal full protection system usable in both training and operation.	New Need Title and Definition and broken into 8 sub-needs	Improved Personal Protection	To improve personal protection system (specifically improvement in head, torso, hands, eyes, ear protection against flame, cuts/ puncture, overpressure, ballistic, laser, environmental) usable in both training and operation.	NOTE: Spirit of this need is to address the urban-specific protection needs (with OFW to address full spectrum individual protection overall) 8 sub-needs: a) Ballistic Protection b) Respiratory Protection against Toxic Fumes (should capture present WN30) c) Eye Protection d) Cut/ Puncture Protection e) Flash/ Flame Protection f) Ear Protection g) Impact Protection h) Signature Reduction
WN17	**Detect Explosives/ Explosive Devices**	To detect explosives/ explosive devices/ mines inside buildings or in/ around built up areas.	Unchanged	NA	NA	NOTE: Link to WN23
WN18	**Get on Top of Buildings**	To be able to put/ get soldiers and Marines on top of buildings.	Unchanged	NA	NA	NA
WN19	**Indirect Fires**	To enhance indirect fires.	New Need Title	Enhanced Indirect Fires	NA	NOTE: Clarification of need – means to control effects of indirect fire
WN20	**Identify Non-**	To identify non-	New Need	NA	To identify non-	NA

Workshop I			As of Workshop III			
Need #	**Need Title**	**Need Definition**	**Disposition**	**New Need Title**	**New Need Definition**	**Other Notes/ Comments**
	Combatants	combatants during all conditions.	Definition		combatants under all conditions.	
WN21	**Improved MOUT Obscurants**	To improve MOUT obscurants at individual soldier/ Marine level.	New Need Title and Definition	Concealment	To conceal movement, activity and/ or position.	
WN22	**Casualty Treatment**	To provide means for enhanced casualty treatment.	New Need Title and broke into 2 sub-needs	Enhanced Casualty Treatment	NA	NOTE: Link to position-location need 2 sub-needs: a) Ways of administering aid b) Types of aid
WN23	**Neutralize Explosives/ Explosive Devices**	To neutralize explosives/ explosive devices/ mines inside buildings or in/ around built up areas.	New Need Title and Definition	Improved Neutralization of Explosives/ Explosive Devices	To improve neutralization of explosives/ explosive devices/ mines inside buildings or in/ around built up areas.	NOTE: Not necessarily to be deployed by infantry but within the battalion task force; closely linked to position location and marking NOTE: Need does not include non-explosive devices
WN24	**Vehicular Survivability**	To enhance vehicular survivability within an urban operation.	New Need Title	Enhanced Urban Vehicular Survivability	NA	NA
WN25	**MOUT Logistics**	To improve logistics capability in the urban environment.	New Need Title and Definition	Improved MOUT Logistics	To improve logistics capability (Fuel, Fix, Replace, Move, Arm, and Feed) in the urban environment.	NA
WN26	**Power Source Efficiency**	To improve efficiency of battlefield power sources.	New Need Title and consider as Overarching Imperative	Improved Power Source Efficiency	NA	NOTE: Should consider this need as an overarching imperative to be applied to capabilities in other needs; Refers to two areas: 1) power management and 2) system efficiencies
WN27	**Soldier/ Marine Individual Operational Effectiveness**	To provide improved approach to individual soldier/ Marine operational	Completely changed this need making more an	Enhanced Individual and Collective Urban Tactical Training	To provide enhanced individual and collective urban tactical training.	NOTE: Changing this need; remove from numbering scheme as a stand-alone, more of and imperative;

Workshop I			As of Workshop III			
Need #	**Need Title**	**Need Definition**	**Disposition**	**New Need Title**	**New Need Definition**	**Other Notes/ Comments**
		effectiveness.	Overarching Imperative			Remember to renumber rest of needs
WN28	**Non-Violent Crowd Dispersal**	To provide non-violent means to disperse a crowd.	New Need Title and Definition	Non-Violent Crowd Control	To provide non-violent means to control a crowd.	NOTE: Defer to/ leverage other work in this area by Crowd Control CEP NOTE: The follow-on program will track Crowd Control CEP progress and incorporate findings as appropriate
WN29	**Rapid Counter-Mobility**	To provide rapid counter-mobility.	Unchanged	NA	NA	NOTE: Leverage ongoing work (non-lethal aspects) by Area Denial to Vehicles CEP (not watercraft) and Area Denial Personnel CEP NOTE: The follow-on program will track Area Denial Vehicles CEP and Area Denial Personnel CEP progress and incorporate findings as appropriate
WN30	**Oxygen-Depleted Environment**	To operate in oxygen-depleted and NBC contaminated environments.	Merges into appropriate sub-need under WN16	NA	NA	NA
WN31	**Deny Use of Electrical Equipment**	To deny the enemy the use of his electrical equipment.	New Need Title and Definition	Control Use of Electrical Equipment	To selectively control electrical equipment in the urban environment.	NA

C. JCATS-SPECIFIC SUPPORT WORK

Support work for the Incubator Process with respect to the use of JCATS was intended to focus on the generation of data and the evaluation of capabilities and their capability to address warfighter needs. In summary, the planning for JCATS use involved identifying those warfighter needs conducive to modeling and describing the M&S approach for each warfighter need.

Of the 31 warfighter needs for the proposed follow-on program to the MOUT ACTD, 15 were determined to be suitable for M&S exploration using JCATS. These are as follows:

- WN01 Urban Surveillance and Detection
- WN02 Identify Friendlies
- WN05 Sniper Detection
- WN07 ID Enemy
- WN08 Improved Target Designation
- WN10 Enhanced Casualty Evacuation
- WN13 Improved Forcible Entry
- WN15 Knowledge of Other Side of Wall
- WN17 Detect Explosives/Explosive Devices
- WN18 Get on Top of Buildings
- WN19 Enhanced Indirect Fires
- WN20 Identify Non-Combatants
- WN21 Concealment
- WN23 Improved Neutralization of Explosives/Explosive Devices
- WN25 Improved MOUT Logistics

An M&S approach description was developed for each of these warfighter needs; the complete M&S approach descriptions for each warfighter need suitable for M&S using JCATS may be found in Appendix H. A summary of the types of information captured in these M&S approach descriptions is as follows:

- *Capabilities* — a list of capabilities that might address a warfighter need
- *General approach* — a basic description of how JCATS will be used to investigate capabilities for a warfighter need, including any particular strengths that JCATS may possess
- *MOUT Verification and Validation (V&V) Considerations* — additional information for those needs that can be used in the Validation portion of the MOUT ACTD sponsored MOUT V&V
- *Hypothesis* — a statement about how the use of identified capabilities will or will not impact (positively or negatively) force effectiveness
- *Does this need require gaming?* — an assessment of whether a warfighter need must be gamed rather than modeled through pre-planned scenarios
- *Scenario outline* — a description of the entities, characteristics, and features of a scenario that could be used to compare capabilities for a warfighter need
- *Assumptions* — a record of any assumptions that will be made with respect to the capabilities and/or use of JCATS
- *Measures* — a list of measures that could be used to compare capabilities for a warfighter need
- *Experimental design* — a plan for the number of different cases and runs to be conducted
- *Data requirements* — a list of data requirements needed in order to appropriately represent the capabilities in JCATS
- *Questions* — a record of any additional, outstanding questions that would need to be resolved prior to conducting analysis using JCATS for a warfighter need.

Unlike the originally intended more comprehensive application of JCATS within the Incubator Process, the purpose and scope for this effort to date, with respect to the follow-on program to the MOUT ACTD, was narrowed to that of establishing a proof-of-principle for the use of JCATS for data generation and insights, as appropriate. To support this proof-of-principle effort, only four of the 15 warfighter needs, identified for the follow-on program and determined to be suitable for M&S using JCATS, were selected for consideration in JCATS at this time. These are:

- WN01 Urban Surveillance and Detection
- WN05 Sniper Detection
- WN08 Improved Target Designation
- WN10 Enhanced Casualty Evacuation

1. WN01 Urban Surveillance and Detection

a. General

With only two exceptions, the capabilities identified for the Urban Surveillance and Detection need all represented different types of sensors — thermal, day camera, acoustic, RF, radar, motion, etc.[10] During the initial review to determine warfighter need suitability for M&S using JCATS, it was determined that JCATS would not be able to represent the characteristics of and/or distinctions between these different sensor types. It was postulated, however, that JCATS would prove of greater use in investigating a technology solution space in terms of the types of platforms and mode of employment that could be used for the identified sensor packages. The JCATS work in support of this warfighter need focused on the latter.

b. Scenario and Assumptions

The scenario for this warfighter need comprised two Red squads and five Red vehicles (Armored Personnel Carrier (APC), tank, trucks) situated in an area in and around buildings, and Blue assets to survey the area. While the Red vehicles were all situated outside the buildings, one Red squad was inside a building. The scenario was for the Blue unit to survey, but not interact with, the Red units as they surveyed the area.

Unmanned Ground Vehicles (UGVs), Unmanned Aerial Vehicles (UAVs), and fixed ground sensors were chosen as the three capabilities for comparison. Specifically, 1 UAV, 3 UGVs, and 12 fixed ground sensors were incorporated for consideration within this scenario. A brief description of each of the four cases conducted is as follows:

- Base Case: Two Blue soldiers watch Red unit activity from a distance through binoculars; both are located in the tree line, one to the southwest and the other to the northeast of the Red units.
- UGV (Robot) Case: Three UGVs are deployed, one from the northwest and two from the southwest locations of the Blue soldiers in the Base Case. Each UGV explores a different portion of the area where the Red units are located and/or moving.
- Fixed Sensors Case: 12 unattended ground sensors are positioned in a grid around the buildings in the MOUT site, where the sensors are 30 meters apart.

[10] The Urban Surveillance and Detection (WN01) need provides an example of how the "capabilities" brainstormed by the warfighter and technology SMEs for each need did not always conform to what capabilities were intended to be within the Incubator Process. Nevertheless, these were the different types of technologies and solutions identified during Workshop II and are referred to in this paper as "capabilities."

- UAV Case: A single UAV is launched from a distance of no more than one kilometer from the area of Red unit movement and/or occupation. The UAV flies multiple figure eights over this area before returning to its launch site.

c. Measures/Variables

- Measure: Acquisition of Red Units/Entities by Blue (by percentage of time visible)[11]
- Variable: The type of Blue Unit/Entity used to perform surveillance
  - ❖ Base Case = 2 soldiers
  - ❖ UGV Case = 3 Matilda robots
  - ❖ Fixed Sensors Case = 12 fixed sensors
  - ❖ UAV Case = 1 UAV.

d. JCATS Runs and Results

Four JCATS runs were performed for this warfighter need, one corresponding to each of the cases previously described. Table 4 documents the filename and prefix used for each run, as well as the duration of the scenario and other relevant comments.

Table 4. Urban Surveillance JCATS Runs

Filename	Prefix	Duration	Comment
urban_survey.setup	us	25 min.	with soldiers watching from afar (base case)
urban_survey_ugv.setup	us_ugv	25 min.	with robots
urban_survey_fixed_sense.setup	us_fix	25 min.	fixed sensors
urban_survey_uav.setup	us_uav	18 min. 30 sec.	with UAV

Figure 4 plots the performance of each of the four modes of performance — human from a stand-off position, movable UGVs, movable UAV, and fixed sensors — in terms of the percentage of time that each Red entity was visible to Blue.

[11] The original intent of the analysis was to determine the total time a particular Red entity was seen by any Blue entity. Due to the difficulty of this calculation, the measure instead considered the minimum time a particular Red entity was seen among all of the Blue entities.

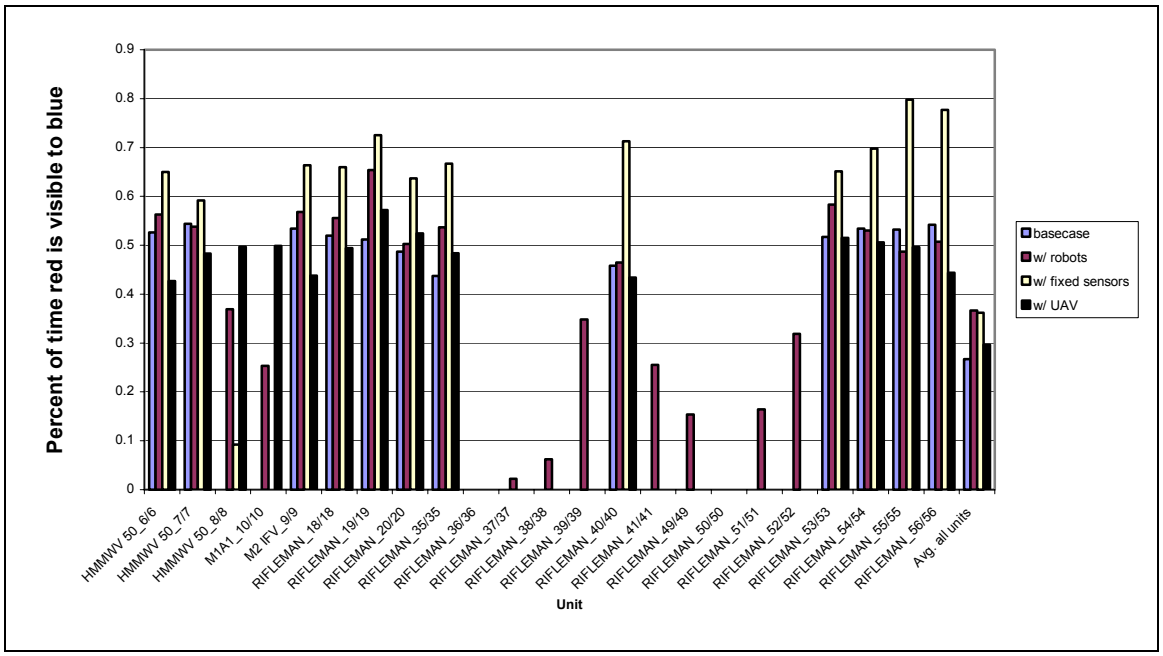

Figure 4. Urban Surveillance: Percentage of Time Red Entity is Acquired by Blue Surveillance Asset

Table 5 corresponds to Figure 4, detailing the location and movement status of the individual Red entities.

Table 5. Location and Movement Status of Red Entities

Unit Name	Inside/Outside	Moving/Stationary
HMMWV 50_6/6	Outside	**Moving**
HMMWV 50_7/7	Outside	**Moving**
HMMWV 50_8/8	Outside	Stationary
M1A1_10/10	Outside	Stationary
M2 IFV_9/9	Outside	**Moving**
RIFLEMAN_18/18	Outside	**Moving**
RIFLEMAN_19/19	Outside	**Moving**
RIFLEMAN_20/20	Outside	**Moving**
RIFLEMAN_35/35	Outside	**Moving**
RIFLEMAN_36/36	**Inside**	Stationary
RIFLEMAN_37/37	**Inside**	Stationary
RIFLEMAN_38/38	**Inside**	Stationary
RIFLEMAN_39/39	**Inside**	Stationary
RIFLEMAN_40/40	Outside	**Moving**
RIFLEMAN_41/41	**Inside**	Stationary
RIFLEMAN_49/49	**Inside**	Stationary
RIFLEMAN_50/50	**Inside**	Stationary
RIFLEMAN_51/51	**Inside**	Stationary
RIFLEMAN_52/52	Inside	Stationary
RIFLEMAN_53/53	Outside	**Moving**
RIFLEMAN_54/54	Outside	**Moving**
RIFLEMAN_55/55	Outside	**Moving**
RIFLEMAN_56/56	Outside	**Moving**

Figure 5 illustrates the percentage of time all Red entities (as an average) were acquired by each of the Blue surveillance assets being explored. The first four bars (from the left) represent the results of the four distinct case studies previously described for this Urban Surveillance need. The fifth bar represents an approximation of the percentage of time all Red Entities might be acquired if Blue possessed and employed all three of the non-base case surveillance assets (e.g., robots, fixed sensors, and UAVs) simultaneously.[12]

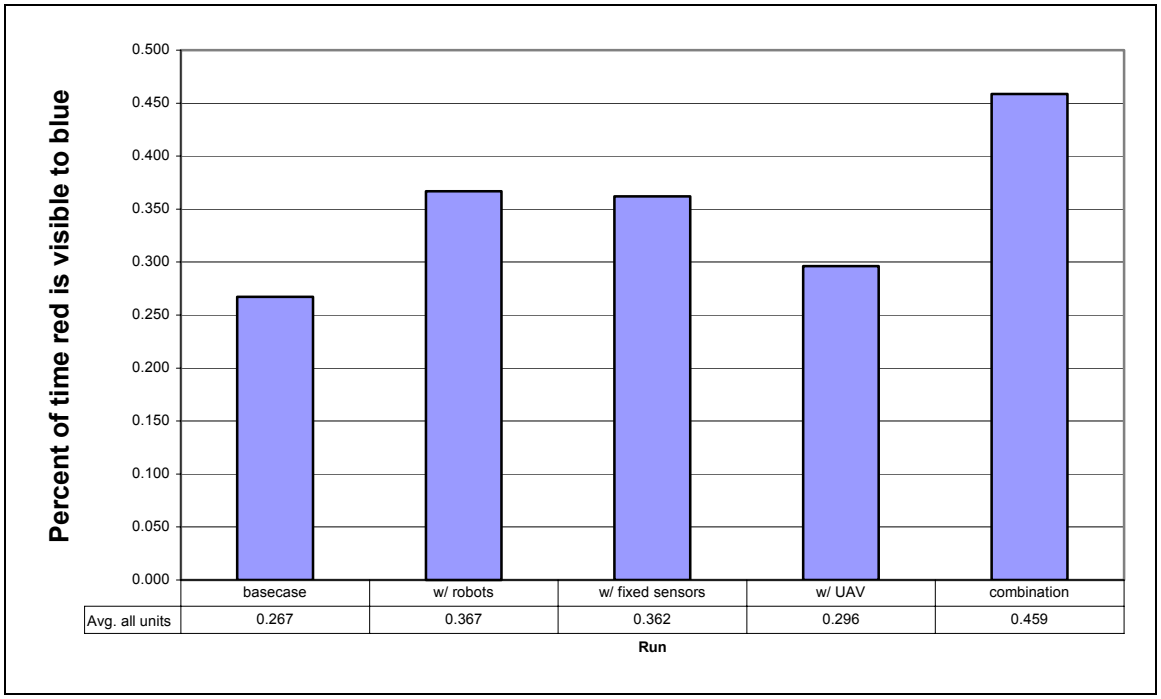

Figure 5. Urban Surveillance: Percentage of Time All Red Entities (as an average) Are Acquired by Blue Surveillance Asset

e. Analysis and/or Conclusions

- A combination of all three capabilities provides the best surveillance of the urban area, as illustrated in Figure 5.
- The robot-based sensors were most effective for surveillance inside buildings. The fixed-ground sensors and even the UAV were unable to detect individuals inside buildings.

[12] An assumption has been made that Blue has access to all three surveillance assets at all times and can select the asset that provides the best surveillance coverage. The calculation is made based on an average of the greatest percentage of time (regardless of which surveillance asset was providing the surveillance) each Red entity was seen by Blue.

- When using fixed sensors, it is important to know that anything in the sensors' blind spots will not get detected.
- The fixed ground sensors were the most effective of the three capabilities in detecting moving units.

2. WN05 Sniper Detection

a. General

Similar to WN01 Urban Surveillance and Detection, the capabilities identified for this warfighter need were different types of sensors for which JCATS is not suitable; the JCATS work in support of this warfighter need instead focused on performance characteristics of sniper detection rather than the particular sensor packages alone. The approach was to model sniper detection in terms of when and from what distance a sniper could be detected. The timing of sniper detection was considered important, according to whether it detects prior to or after a sniper shot and the amount of elapsed time that is required between the initial sniper shot and the detection of a sniper, identification of sniper's location, and returning fire on the sniper.

b. Scenario and Assumptions

The scenario for this warfighter need takes place in an urban environment[13] with two Red snipers positioned in separate buildings, and a Blue squad scattered around some large warehouse-like buildings 200 meters southeast of the urban environment. One Red sniper is situated in the church tower from which he periodically pops-up to engage the Blue forces. The other Red sniper is in a nearby building from which he alternates his firing position between two windows.[14] All nine of the Blue soldiers are equipped with M16s and have the ability to return fire once a sniper has fired on one of them. A JCATS behavior was developed and employed to ensure that the Blue forces go prone for protection after the sniper fires.

This scenario and its incorporation into JCATS require several assumptions. First, it has been assumed that the Blue soldiers are provided with perfect information about the location of a sniper via their sniper detection capabilities. Second, Blue soldiers must achieve at least a level 1 detection of a sniper before returning fire. Third, the snipers possess 8X Field Goggles, while the eyes of the Blue soldiers are unassisted.

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[13] The terrain and buildings for this scenario are the McKenna MOUT site at Ft. Benning, GA, enhanced with some additional warehouse-like buildings southeast of the MOUT site.

[14] The movement of this second sniper between two windows is represented in JCATS by the sequence Shoot, Duck down, Move to the other Window in about 30 seconds, Repeat.

The six cases for this investigation through JCATS reflect changes in the amount of time delay between a Red sniper's shot and return of fire by the Blue force. A brief description of each of the six cases conducted follows:

- Base Case: The Blue force has no sniper detection capability
- 10 Second Case: There is a 10-second delay before Blue force returns fire on the sniper
- 5 Second Case: There is a 5-second delay before Blue force returns fire on the sniper
- 3 Second Case: There is a 3-second delay before Blue force returns fire on the sniper
- 1 Second Case: There is a 1-second delay before Blue force returns fire on the sniper
- No Delay Case: There is no time delay before Blue force returns fire on the sniper.

c. Measures/Variables

- Measure: Number of Red and Blue Losses
- Variable: The length of the Blue delay in returning fire on Red sniper
  - ❖ Base Case = no return fire capability
  - ❖ 10 Second Case = 10 second delay
  - ❖ 5 Second Case = 5 second delay
  - ❖ 3 Second Case = 3 second delay
  - ❖ 1 Second Case = 1 second delay
  - ❖ No Delay Case = no delay in automatic return fire capability.

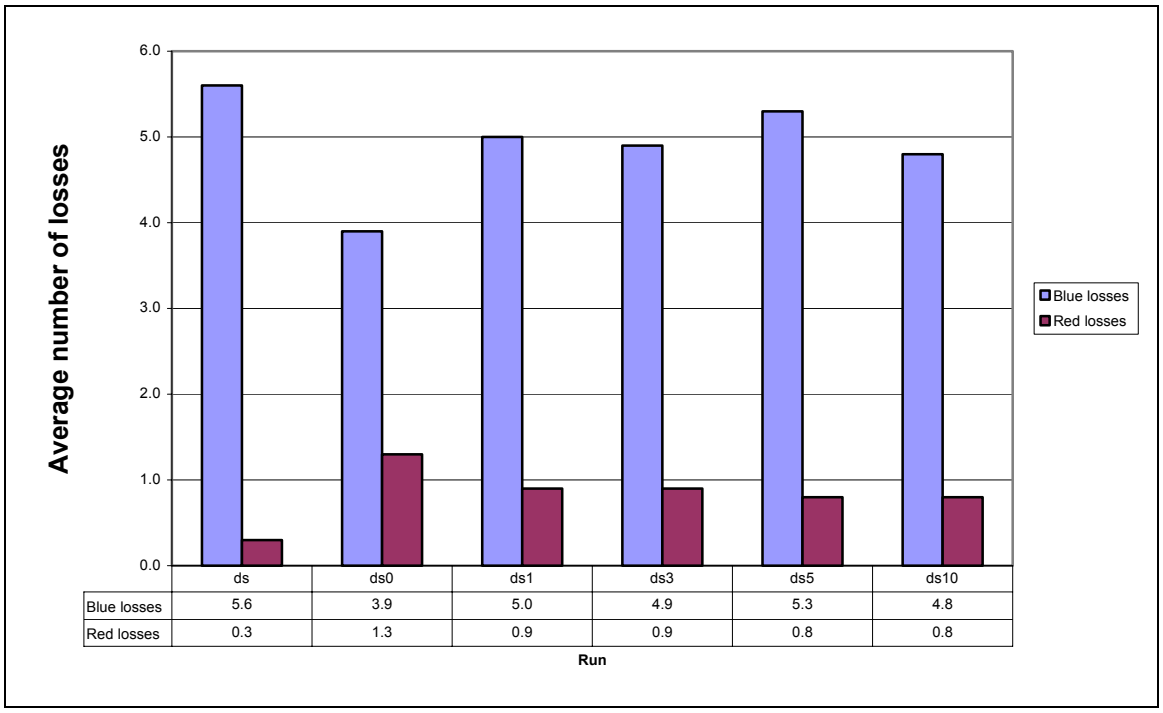
d. JCATS Runs and Results

Six JCATS runs were performed for this warfighter need, one corresponding to each of the cases previously described. Table 6 documents the filename and prefix used for each run, as well as the duration of the scenario and any other relevant comments.

Table 6. Sniper Detection JCATS Runs

Filename	Prefix	Duration	Comment
detect_sniper.setup	ds	15 min.	no added capability (base case)
detect_sniper0.setup	ds0	15 min.	immediately returns fire on sniper
detect_sniper1.setup	ds1	15 min.	returns fire 1 sec after
detect_sniper3.setup	ds3	15 min.	returns fire 3 sec after
detect_sniper5.setup	ds5	15 min.	returns fire 5 sec after
detect_sniper10.setup	ds10	15 min.	returns fire 10 sec after

Figure 6 depicts the average number of both Blue and Red losses for each of the six cases.



	ds	ds0	ds1	ds3	ds5	ds10
Blue losses	5.6	3.9	5.0	4.9	5.3	4.8
Red losses	0.3	1.3	0.9	0.9	0.8	0.8

Figure 6. Sniper Detection: Average Number of Blue and Red Losses Depending Upon Delay Between Sniper Shot and Return of Fire[15]

e. Analysis and/or Conclusions

- The greatest payoff would result from a capability that detects the sniper before his first shot is ever fired. Even using the best capability represented in this scenario, an automatic return fire capability, there was an average of 3.9 Blue losses.
- The next best alternative would be a capability that immediately returns fire on the sniper. Any sort of delayed response is less effective than an immediate one.

[15] The JCATS results noted in Figure 6, and others detailing number of losses and/or shots, may be expressed in fractions (e.g., 4.7 Blue losses) rather than a whole number (e.g., 4 or 5 Blue losses). These fractional results are due to the averaging of the number of losses incurred over a number of runs.

3. WN08 Improved Target Designation

a. General

The capabilities identified to address WN08 Improved Target Designation were originally divided into two categories as they were brainstormed. In order to incorporate this need and its capabilities into JCATS, it was determined that this need should be represented as a combination of both target designation and hand-off, rather than separately.

b. Scenario and Assumptions

In this urban scenario, a Blue unit is executing a basic room-clearing operation. Four Red snipers, located in the building across the street, can fire on the Blue unit performing the room clearing. A second Blue unit (a fire team and squad leader) is located in a building adjacent to the other Blue unit and can fire (directly or indirectly) on the Red snipers across the street.

The original plan for this need was to model and compare three different target designation capabilities: a robot-designated munition (a robot designates for the fire team); a squad-leader-designated munition (the squad leader designates for the fire team); and a base case (no target designation capability). Unfortunately, a problem with the laser designation capability inside buildings prohibited us from following the original plan (see Appendix H for more information about that plan).

As an alternative, we created scenarios to investigate the affect of time to fire on force effectiveness. Assuming that a better target designation capability would result in a shorter time to fire, we varied the time required for Blue soldiers to fire their weapons by modifying the "lay times" on their weapons (M16, M79, and SAW). "Lay time" occurs between the time the soldier acquires the target and the time he actually fires the weapon. The normal JCATS database value for "lay time" is 3.25 seconds. We chose the following cases for the scenarios. They do not correspond to any particular case (e.g., squad-leader-designated or robot-designated) since we do not know what the most appropriate delay would be for each case.

- 1 second lay time: Blue force has a capability which provides a 1-second lay time between acquire and engage (shorter time to engage)
- 3 second lay time: Blue force has a capability which provides a 3-second lay time between acquire and engage (which is approximately the base case)
- 5 second lay time: Blue force has a capability which provides a 5-second lay time between acquire and engage (longer time to engage).

c. Measures/Variables

- Measure: Number of Red and Blue Losses
- Variable: The length of the Blue lay time between acquiring and engaging a target
  - ❖ 1 second lay time
  - ❖ 3 second lay time
  - ❖ 5 second lay time.

d. JCATS Runs and Results

Three JCATS runs were performed for this warfighter need, one corresponding to each of the cases previously described. Table 7 documents the filename and prefix used for each run, as well as the duration of the scenarios and any other relevant comments.

Table 7. Target Designation JCATS Runs

Filename	Prefix	Duration	Comment
target_designate_1sec.setup	td1	5 min.	1 sec. lay time
target_designate_3sec.setup	td3	5 min.	3 sec. lay time
target_designate_5sec.setup	td5	5 min.	5 sec. lay time

Figure 7 depicts the average number of both Blue and Red losses for each of the three cases.

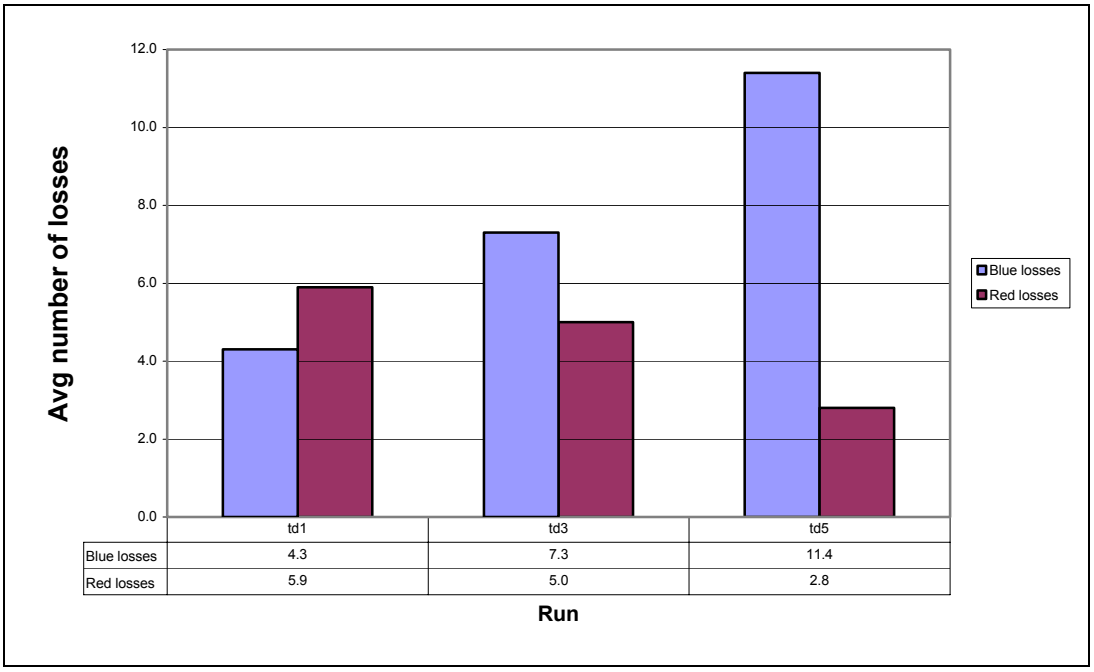


Figure 7. Target Designation: Average Number of Blue and Red Losses Depending Upon Lay Time to Acquire and Engage Targets

e. Analysis and/or Conclusions

- A consistent trend is shown in Figure 7 where a 2-second decrease in lay time results in a greater number of Red losses and fewer Blue losses.
- This chart is not meant to suggest that any given target designation capability would result in a 2-second decrease in time to fire.

4. WN10 Enhanced Casualty Evacuation

a. General

The two capabilities identified to address WN10 Enhanced Casualty Evacuation were manual[16] and mechanical. It was determined that it would be relatively simple to model and compare both manual and mechanical means for casualty evacuation. The Cas-Evac representation would allow certain parameters – with respect to the types of injuries to occur, life expectancies associated with injuries, and the location of a collection point where casualties would need to be taken – to be explored.

b. Scenario and Assumptions

In this urban scenario, similar to that used for WN08 Improved Target Designation, a Blue unit is executing a basic room-clearing operation; a member of the Blue fire team is wounded while entering through the door; the wounded individual is then extracted using either mechanical or manual means.

The three cases for this investigation through JCATS represent differences in the means of extracting and/or evacuating a casualty. This reflects not only whether the means is manual or mechanical, but also the number of Blue soldiers necessary to perform the casualty evacuation of a single casualty.[17] A brief description of each of the three cases conducted is as follows:

- Base Case: The casualty is evacuated manually by two fellow Blue fire team members once the building has been cleared. This will require that another Blue fire team moves forward and secures the positions being evacuated by the casualty and two fire team members, while under fire from two Red soldiers.
- Robotic "Mule" Case: A large Blue "mule" robot enters the building and evacuates the casualty. An additional fire team is not needed.

[16] A manual capability for this need could be thought of as the base case, since this is the current means and/or capability for casualty evacuation.

[17] The number of Blue soldiers necessary to perform the casualty evacuation of a single casualty is very important, since these soldiers would also be removed from the fight and/or exposed to injury, along with the original casualty.

- Armored "Mule" Case: A large Blue armor-reinforced "mule" robot enters the building and evacuates the casualty. The mule is reinforced, thus reducing its vulnerability to enemy fire, and an additional fire team is not needed.

c. Measures/Variables

- Measure: Number of Red and Blue Losses
- Variable: The means of evacuating the casualty and the number of Blue team members required to do so
  - ❖ Base Case = Casualty evacuated by/with two fire team members and requires a replacement fire team
  - ❖ Robotic "Mule" Case = Casualty evacuated by robotic "mule"
  - ❖ Armored "Mule" Case = Casualty evacuated by armored "mule."

d. JCATS Runs and Results

Three JCATS runs were performed for this warfighter need, one corresponding to each of the cases previously described. Table 8 documents the filename and prefix used for each run, as well as the duration of the scenarios and any other relevant comments.

Table 8. Casualty Evacuation JCATS Runs

Filename	Prefix	Duration	Comment
casevac45_basecase.setup	ce_bc	10 min.	casualty exits with team (base case)
casevac45.setup	ce	10 min.	robotic "mule" case
casevac45_strong.setup	ce_str	10 min.	mule is armored like an M113

Figure 8 depicts the average number of both Blue and Red losses for each of the three cases. Note that if the mule was destroyed in the "mule" case, it would be considered one of the Blue losses. Also note that the mule in the "strong mule" case is never destroyed because there are no Probability of Hit (PH) or Probability of Kill (PK) data associated with the small arms weapons used by the Red snipers against the armored mule (which we considered to be as vulnerable as an M113) in the data set we used for the scenarios. [18] This is because these small arms weapons are inappropriate and ineffective against such an armored vehicle.

[18] This note also applies to Figures 9 and 10.

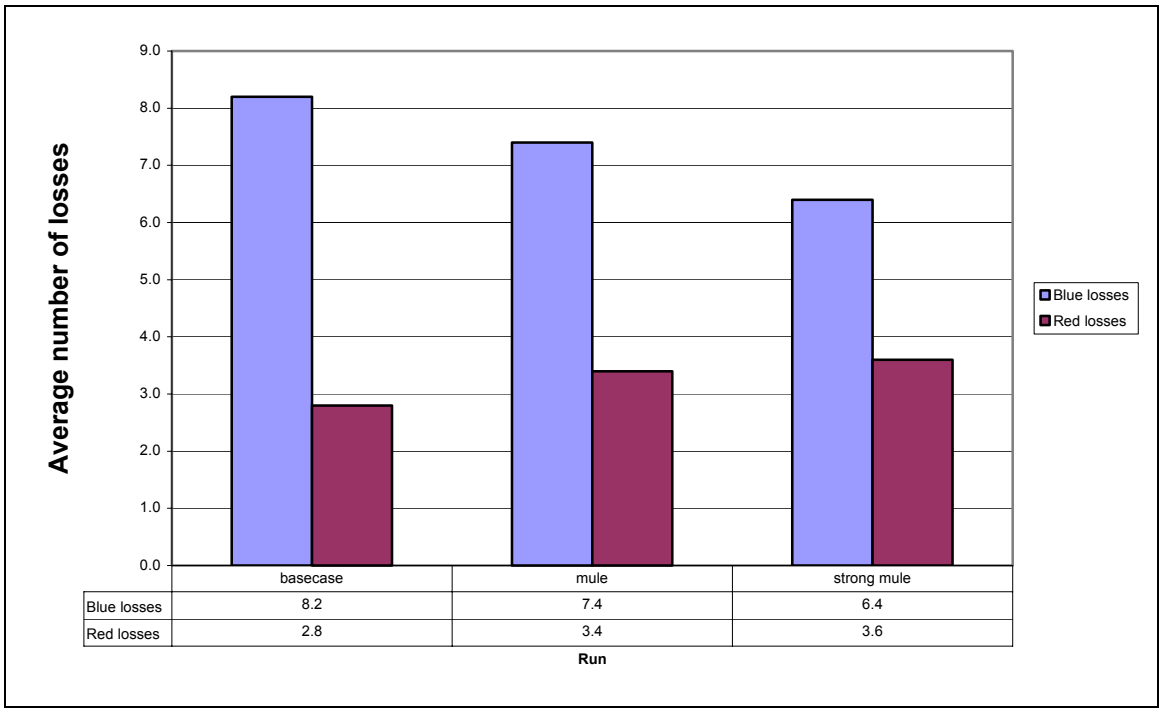


Figure 8. Casualty Evacuation: Average Number of Blue and Red Losses Depending Upon Means of Evacuation

Figure 9 represents the average number of Blue losses incurred during the evacuation portion of the scenario, as opposed to entire scenario (which is depicted in Figure 8). It shows in more detail the differences between the casualty evacuation capabilities since it considers only the losses incurred during the period of time when the capabilities were used. As in the previous figure, note that if the mule was destroyed in the "mule" case, it would be counted as one of the Blue losses.

In the base case, the evacuation portion of the scenario includes the two soldiers moving the casualty outside the building, then moving the casualty across the open corridor to an area behind the neighboring building, and ends with the replacement team traveling through the open corridor and entering the cleared building to replace the soldiers who evacuated. Seven people (the wounded individual, the two soldiers evacuating him, and the replacement fire team) are at risk because of the evacuation. In the "mule" cases, the evacuation portion of the scenario consists of the mule crossing the open corridor outside the cleared building, picking up the wounded soldier, and then once again crossing the open corridor. In the "mule" cases, only the wounded individual is at risk because of the evacuation.

As additional information, Figure 10 shows the number of shots fired on Blue (soldiers and the mule) during the evacuation portion of the scenario.

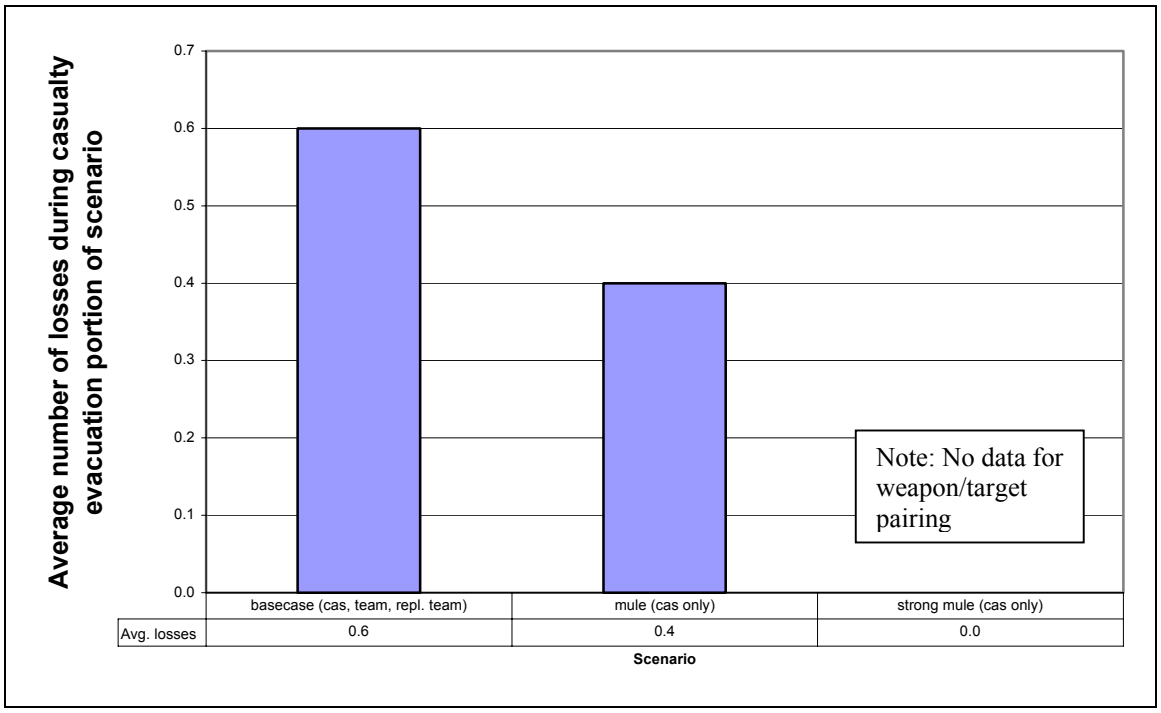


Figure 9. Casualty Evacuation: Average Number of Blue Losses During Evacuation Portion of the Scenario, Depending Upon Means of Evacuation

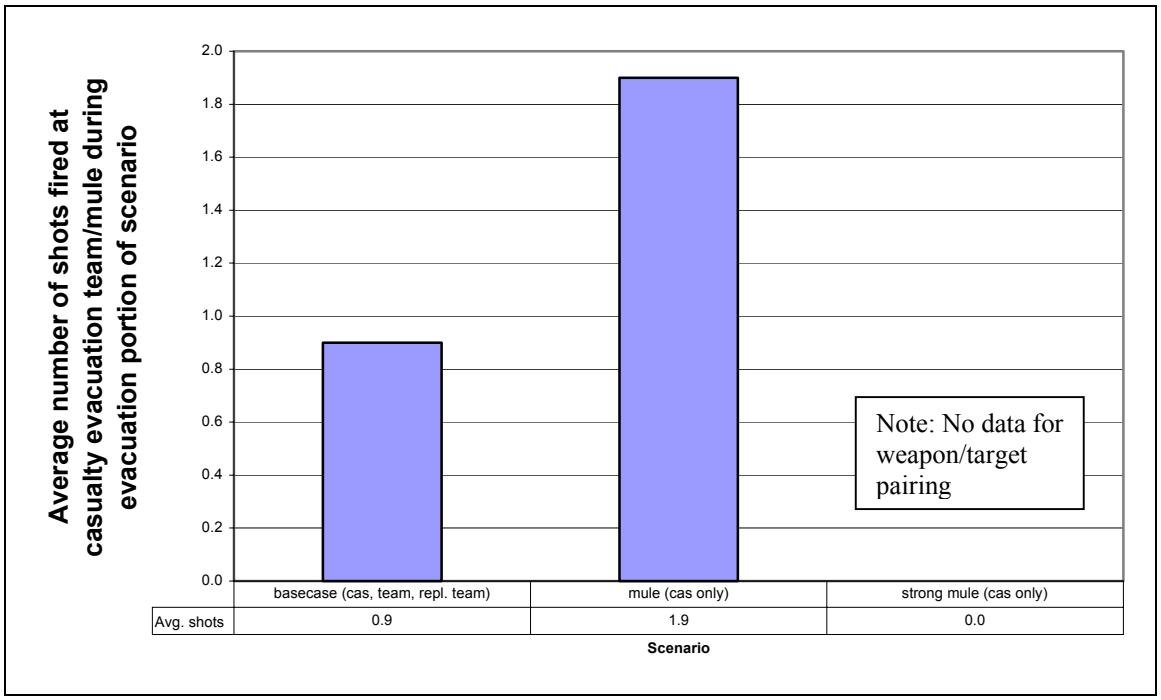


Figure 10. Casualty Evacuation: Average Number of Shots Fired at Blue During Evacuation Portion of the Scenario, Depending Upon Means of Evacuation

e. Analysis and/or Conclusions

- Use of a mule in this scenario allows six individuals to remain combat effective that otherwise would have been diverted. Using the mule removes the need for the two individuals to evacuate the injured soldier, and the requirement for the additional fire team to secure the building.
- It is important to armor the mule to better protect the wounded individual being evacuated from sniper and other small arms fire. This scenario did not include any infantry anti-armor weapons, which would likely be effective against even an armored mule.

D. PROPOSED FOLLOW-ON PROGRAM'S INCUBATOR STATUS

As of December 2001, competing sponsor priorities and the fact that the proposed follow-on program had not been approved as an FY03 ATD forced Incubator work in support of this effort to be placed, at least temporarily, on hold. If a decision is made to go forward with a follow-on program to the MOUT ACTD, Incubator work could be restarted. The Incubator work already completed from Workshops I, II, and III, as well as the associated support work, could be used as is, or revised, as appropriate. To complete the follow-on program's Incubator Process as envisioned, however, the following work would still need to be done:

- Completion of Workshop III and Related Support Work
  - ❖ Revised measures and scales for each need, based on the identified capabilities
  - ❖ Warfighter SME validation of measures and scales for each need
  - ❖ Warfighter SME assignment of measure weights for each need
  - ❖ Development of a CAP model, based on validated measures, scales, and weights, for each warfighter need
  - ❖ Additional JCATS work, as appropriate
  - ❖ Collect measure input data
  - ❖ Generate CAP ratings and rankings of capabilities for each need
- Schedule and Conduct Workshop IV and Related Support Work
- Schedule and Conduct Workshop V and Related Support Work.

APPENDIX A

MOUT ACTD Frustrated and Partially Met Requirements and their Initial Disposition for the Proposed Follow-on to the MOUT ACTD

APPENDIX A

MOUT ACTD Frustrated and Partially Met Requirements and their Initial Disposition for Its Proposed Follow-on

Table A-1. MOUT ACTD Frustrated Requirements

Req. #	Req. Title	Deficiency	Requirement
R1	Identify Friend/Foe	Hard to ID combatants/ non-combatants and friend/foe	Need to be able to identify and discriminate friendly/enemy and combatants/ non-combatants at greater ranges and during all conditions
R7	Through Wall Sensor	Unable to "look" through walls and determine if next room is occupied	Need a small, hand-held thru-wall sensor to rapidly sense through walls and determine if next room is empty or occupied by friendly/enemy or combatant/ non-combatant
R8	Remote Marking of Targets	No "good" way to mark specific individuals, specific buildings, specific vehicles, etc. Most common practice is OTS spray paint, which cannot be done remotely	Need a remote delivery marking capability. Need capability of visible marking (i.e., orange) and for non-visible (i.e., IR Chem light fluid), i.e., buildings, walls, people, vehicles, etc.
R10	Man-Portable Shield	No ability for conventional forces to acquire a heavy shield which protects entire body for movement up to doorways, down hallways, for use when extracting wounded personnel under fire, etc.	Need man-portable shield which provides Level 4 protection from head to toe, with "vision blocks" and, ideally, a visible/ IR light source
R11	Clearly Mark All Friendlies	Unable to clearly identify friendly soldiers/ Marines under all conditions (Thermal, IR/I2, Day, etc.)	Need ability to clearly mark all friendly soldiers/ Marines with non-exploitable and distinctive thermal, IR, and visual markings
R16	Detect Booby Traps	Inadequate ability to defeat (detect and disarm) booby traps, mines inside buildings or in/around built up areas	Need proactive ability to defeat (detect and disarm) booby traps and mines inside buildings
R33	Sniper Detection	Ability to detect location of sniper fire under all conditions and from moving and stationary soldiers/ Marines and vehicles	Need counterfire capability to detect location of sniper and small arms fire under all conditions and from moving and stationary soldiers/Marines and vehicles
R36	Hand Held Target Designator	Target acquisition for precision guided munitions. MOUT requires the ability to use precision-guided munitions to defeat point targets. Current target lazing/ identification systems not completely compatible	Need a light-weight, hand held, common target designator which is capable of designating or transmitting digital target data to off-side shooters, targets for USAF, Artillery, Naval Munitions, Army Aviation, and Mortars
R37	Point Munition	There is currently no lightweight, point munition for the dismounted soldiers/Marines which will defeat light armored vehicles (or heavily armored vehicles "top down" and rear); neutralize bunkers (kill enemy personnel inside); breach reinforced structures/walls/ bunkers (man-sized hole)	Need a point munition which can be issued to individual soldiers/ Marines which will defeat light armored vehicles (or heavily armored vehicles "top down" and rear), neutralize bunkers (kill enemy personnel inside), breach reinforced structures/ walls/ bunkers (man-sized hole)
R41	Position Location in Buildings	GPS doesn't work in buildings	Need position locating device which provides position location data in buildings

Table A-2. MOUT ACTD Partially Met Requirements

Req. #	Req. Title	Deficiency	Requirement
R4	Produce/ Update Maps	Unable to provide updated, accurate high resolution maps to soldiers/ Marines when deployed on contingency missions (Aerial photos available at higher levels (Bde/Div), but without grids, maps not available or not current. Maps/grids don't always translate digitally compatible with other services' systems, unable to get good quality/ high resolution. Maps of new areas (parts of city, new town, etc.) to Bn level & below in time to distribute to all req' leaders.)	Units need capability to produce maps (complete with grid lines) which are updated and accurate (based on some form of aerial imagery) and distribute to at least the squad level within 6-12 hours of notification (warning order). Ideally, these maps are 1:25,000 scale or smaller, but as a minimum, 1:50,000 scale. Maps should be produced using common datum for joint environments and be updated, GPS-true maps and geographical info.
R5	Intelligence Collection/ Dissemination	Intelligence Gap between available data and what we can put into the hands of soldiers/ Marines – Leaders and soldiers/ Marines at platoon level unable to tell the following two critical things: a) What the building/ route looks like, not just where is it (2D/map issues), but also 3D issues: 1) How high are walls, windows, etc; 2) What are obstacles enroute?; 3) What type of material for walls and doors?; and 4) How many floors/ basements/ rooms?; AND b) Is anyone inside the building/ room? What "color" are they (Friend, Foe, Non-combatants, etc.)? [Note: No IFF system will tell if someone is enemy or neutral – only if they are friendly – need the ability to see people and then let human eyes determine their status.]	Need a small unit (Platoon/ Squad) intelligence collection and dissemination tool that conducts remote route/ area/ building reconnaissance. Platform should be single-man portable and include at a minimum day/night audio/video. Ideally, the platform could accept a family of modular multi-sensor capabilities (e.g., through-wall sensors, countersniper sensors, etc.) and produce data which is compatible with higher level communications architecture.
R6	Night Vision in Buildings	Difficult for all personnel to see inside buildings at night, some can see and some can't. Several issues/ deficiencies: I2 devices get "white out" too easily in MOUT. Not all soldiers/ Marines issued PVS-7Bs [BOIP issue]. White light building clearing may be best option for some missions, but no ability to provide rapid and lasting light to an entire room (Flashlights on weapons only illuminate where pointed, not entire room). Thermal devices not helmet mountable and not fielded to all soldiers/ Marines.	All soldiers/ Marines in a building need to be able to see at all times (Day, Night, in Basements/ Tunnels; through smoke, etc.). Need a mix of systems available based on METT-T.
R13	Lightweight Mask	Extremely difficult to move with the current NBC Protection Mask – way too bid and bulky to use in MOUT operations requirement soldier/ Marine to climb up walls, go through holes in walls and ceilings, etc. … resulting in either units or soldier/ Marine deciding to not wear or to	Need a much smaller, much lighter mask which provides NBC protection and can be carried and worn in a MOUT environment. This mask should have a wide field of view and be compatible with night vision devices and hands free communications devices. In the interim, need a small, disposable mask which provides protection

		discard the mask – without the NBC mask, soldier/ Marine have the required mobility, but no protection against smoke, dust, hazardous odors and RCAs – all of which are likely to be encountered in MOUT.	against smoke, dust, RCAs, and hazardous odors.
R26	Improved Obscurant	Smoke grenades inadequate for obscurant smoke. Good tool for point smoke, but takes too many grenades to achieve sufficient volume of smoke which will obscure an entire city, street or alley.	Need a small, man-portable, improved obscurant which provides capability to obscure an entire city, street [Need to define width of streets, size/ duration, multi-spectral].
R27	Man-sized Hole	Demolitions. No good, fast and universally known way to blow a man-sized hole in concrete wall, ceilings, and floors. Can do this with C4 and shape charge, but time consuming and not universally understood.	Need a small, fast way to blow a man sized hole in any direction (up, down, sideways) through concrete walls. Needs to be modular, simple kit or round which is easily trained and understood (user friendly) and which is issued to the average soldier/ Marine before a MOUT mission (not just Engineers).
R28	Get on Top of Buildings	MOUT FMs talk about preferred method of clearing buildings is from "top down," but no good method of getting on top of buildings. Grappling hook and rope is too slow and too hard (soldiers/ Marines exposed too long and not all soldiers/ Marines can get up rope with all equipment on). Helicopter not always available and not able to land on all buildings (slope, power lines, etc.)	Need ability for average soldier/ Marine to quickly get on top of buildings – both from ground and from adjacent buildings.
R42	Telemedicine	NA	Make telemed system operate efficiently in MOUT.

Table A-3. Initial Dispositions of MOUT ACTD Frustrated and Partially Met Requirements

MOUT ACTD		Proposed Follow-on	
No./ Name	**Requirement**	**Initial Disposition**	**Need Statement**
R1 – Identify Friend/ Foe	Need to be able to identify and discriminate friendly/ enemy and combatants/ non-combatants at greater ranges and during all conditions	Remains a valid need, but need to separate into three need statements	a) To identify friendly combatants during all conditions
			b) To identify enemy combatants during all conditions
			c) To identify non-combatants during all conditions
R4 – Produce/ Update Maps	Units need capability to produce maps (complete with grid lines), updated and accurate (based on some form of aerial imagery), and distribute to at least the squad level within 6-12 hours of notification (warning order). Ideally, these maps are 1:25,000 scale or smaller, but as a minimum, 1:50,000 scale. Maps should be produced using common datum for joint environments and be updated, GPS-true maps and geographical info.	Remains a valid requirement, but renamed, Near Real-time, Scaleable Map, and restated as need	To produce a near real-time, scaleable map for dissemination to individual soldiers and Marines
R5 – Intelligence Collection/ Dissemination	Need a small unit (Platoon/ Squad) intelligence collection and dissemination tool that conducts remote route/ area/ building reconnaissance. Platform should be single-man portable and include at a minimum day/night audio/video. Ideally, the platform could accept a family of modular multi-sensor capabilities (e.g., through-wall sensors, countersniper sensors, etc.) and produce data which is compatible with higher level communications architecture.	Strike as is, but re-address broader issue of Intelligence under new need brainstorming	Deleted as is
R6 – Night Vision in Buildings	All soldiers/ Marines in a building need to be able to see at all times (Day, Night, in Basements/ Tunnels; through smoke, etc.). Need a mix of systems available based on METT-T.	Remains a valid need, but renamed, See While Inside Buildings/ Structures, and restated as need	To be able to see while inside buildings/ structures at all times
R7 – Through Wall Sensor	Need a small, hand-held thru-wall sensor to rapidly sense through walls and determine if next room is empty or occupied by friendly/ enemy or combatant/ non-combatant	Remains a valid need, but need to reword as a more generic need statement rather than specific technical solution	To know what is on the other side of an opaque wall
R8 – Remote Marking of Targets	Need a remote delivery marking capability. Need capability of visible marking (i.e., orange) and for non-visible (i.e., IR Chem light fluid), i.e., buildings, walls, people, vehicles, etc.	Remains a valid need, but renamed, Designate Persons/Items, and restated as need	To reversibly designate persons or items of interest to friendly forces under all conditions on-site or remotely

R10 – Man-Portable Shield	Need man-portable shield which provides Level 4 protection from head to toe, with "vision blocks" and, ideally, a visible/ IR light source	Strike as is, but re-address issue of providing protection (i.e., while extracting wounded personnel) under new need brainstorming	Deleted as is
R11 – Clearly Mark All Friendlies	Need ability to clearly mark all friendly soldiers/ Marines with non-intrusive, non-exploitable, and distinctive thermal, IR, and visual markings	Remains a valid need, but determined to be adequately addressed by needs based on R1 – Identify Friend/ Foe and R8 – Remote Marking of Targets	Deleted
R16 – Detect Booby Traps	Need proactive ability to defeat (detect and disarm) booby traps and mines inside buildings	Remains a valid need; need to separate into two needs, Detect Explosives/ Explosive Devices and Neutralize Explosives/ Explosive Devices AND consider providing a simulated booby trap device for training purposes under new need brainstorming	a) To detect explosives/ explosive devices/ mines inside buildings or in/ around built up areas
			b) To neutralize explosives/ explosive devices/ mines inside buildings or in/ around built up areas
R26 – Improved Obscurant	Need small, man-portable, improved obscurant which provides capability to obscure an entire city, street [Need to define width of streets, size/duration, multi-spectral].	Remains valid need, but renamed, Improved MOUT Obscurants, and restated as need	To improve MOUT obscurants at individual soldier/ Marine level
R27 – Man-sized Hole	Need a small, fast way to blow a man sized hole in any direction (up, down, sideways) through concrete walls. Needs to be modular, simple kit or round which is easily trained and understood (user friendly) and which is issued to the average soldier/ Marine before a MOUT mission (not just Engineers).	Strike as is, but readdress as part of broader forcible entry issue under new need brainstorming	Deleted as is
R28 – Get on Top of Buildings	Need ability for average soldier/ Marine to quickly get on top of buildings – both from ground and from adjacent buildings.	Remains a valid need, but restated as need	To be able to put/ get soldiers and Marines on top of buildings
R33 – Sniper Detection	Need counterfire capability to detect location of sniper and small arms fire under all conditions and from moving and stationary soldiers/ Marines and vehicles	Remains a valid need, but restated as need	To detect sniper location under all conditions and situations proactively (and reactively)
R36 – Hand Held Target Designator	Need a light-weight, hand held, common target designator capable of designating or transmitting digital target data to off-side shooters, targets for USAF, Artillery, Naval Munitions, Army Aviation, and Mortars	Remains a valid need, but renamed, Target Designation, and restated as need	To enable target designation and/or hand-off targeting data to off-site shooters, across all branches and services
R42 - Telemedicine	Make telemed system operate efficiently in MOUT	Remains a valid need, but refocused in direction of greater warfighter payoff	To improve casualty evacuation in MOUT

APPENDIX B

Initial Warfighter SME Brainstorming of Measures/Technical Characteristics, by Need

APPENDIX B

Initial Warfighter SME Brainstorming of Measures/Technical Characteristics, by Need

WN01 - Intelligence

Possible Measures:

RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RESPONSIVENESS
DURATION OF SURVEILLANCE
DETECTION RATES
COLLECTION RANGE
INTEROPERABILITY
LOCATIONS INSIDE BUILDINGS
EARLY DETECTION
LIMIT FRIENDLY EXPOSURE

Technical Characteristics:

- Survivability
- Compatibility with current/planned communications
- Facilitate leaders recons
- Accuracy
- Size
- Weight
- Timeliness
- Range
- Operational conditions
- Simple
- Durability
- Simplicity in training
- International Coalition capable
- Power source
- MOUT capable
- Training capability

WN 02 – ID Friendlies

Possible Measures:

FRATRACIDE CASUALTIES
-function of how accurately the capability identifies friendlies
RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
NOT ENEMY EXPLOITABLE
SIGNATURE
RESPONSIVENESS TO THE INTERROGATOR

Technical Characteristics:

- Accuracy
- Size
- Weight
- Probability of being friendly
- False negatives/accuracy
- Timeliness
- False positives
- Range
- Operational conditions
- Weight
- Simple
- Not take sights off
- Durability
- Simplicity in training
- Longevity
- Not be an additional piece of equipment
- Individual to individual
- Interoperability
- International Coalition capable
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- Eliminate fratricide
- Situational awareness tool
- Control measure
- On demand
- Close proximity
- Not MOUT specific

WN03 – Communication All Levels

Possible Measures:

INTEROPERABILITY
RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RUGGEDNESS
EFFECTIVENESS WITHIN BUILDINGS AND STRUCTURES

Technical Characteristics:

- Hands free
- Size
- Weight
- Simple
- Durability
- Simplicity in training
- Individual to individual
- International Coalition capable
- Power source
- Dual function
- Situational awareness tool
- Control measure
- MOUT capable
- Proximity requirements
- Vehicle compatibility

WN04 – Near Real-Time, Scaleable Maps

Possible Measures:

SCALABLE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
RESPONSIVENESS
ACCURACY
RAPID DISSEMINATION
RESOLUTION

Technical Characteristics:

- Compatible with N11
- Shared electronic whiteboard
- Show relief
- Update
- Timeliness
- Size
- Weight
- Simple
- Durability
- Simplicity in training
- Interoperability
- Operational security
- Signature
- Power source
- Dual function
- Situational awareness tool
- MOUT specific

WN05 – Sniper Detection

Possible Measures:

DETECT BEFORE SNIPER FIRING
ACCURACY OF LOCATION
RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RESPONSIVENESS

Technical Characteristics:

- Through all wall materials/barriers
- Standoff capability
- Accuracy
- Size
- Weight
- False negatives/accuracy
- Timeliness
- False positives
- Range
- Operational conditions
- Weight
- Simple
- Durability
- Simplicity in training
- Longevity
- Not be an additional piece of equipment
- Individual to individual
- Interoperability
- International Coalition capable
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- Control measure
- On demand

WN06 – Position Location in Complex and Restrictive Terrain

Possible Measures:

3 DIMENSIONAL POSITION
RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RESPONSIVENESS
LOCATION WITHIN BUILDINGS AND STRUCTURES
ACCURACY

Technical Characteristics:

- Update
- Size
- Weight
- Timeliness
- Weight
- Simple
- Durability
- Simplicity in training
- Individual to individual
- Handoff capability
- Interoperability
- International Coalition capable
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- Eliminate fratricide
- Situational awareness tool
- Control measure
- MOUT specific
- Resolution
- Proximity requirements

WN07 – ID Enemy

Possible Measures:

IDENTIFY ENEMY
    -function of how accurately the capability identifies enemy?
RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
NOT ENEMY EXPLOITABLE
SIGNATURE
RESPONSIVENESS TO INTERROGATOR

Technical Characteristics:

- Accuracy
- Size
- Weight
- False negatives/accuracy
- Timeliness
- False positives
- Range
- Operational conditions
- Weight
- Simple
- Not take sights off
- Durability
- Simplicity in training
- Longevity
- Not be an additional piece of equipment
- Individual to individual
- Interoperability
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- Eliminate fratricide
- Situational awareness tool
- Control measure
- On demand
- Close proximity
- Not MOUT specific

WN08 – Target Designation

Possible Measures:

RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RESPONSIVENESS
DURATION OF MARKING
RECOGNIZABILITY
INTEROPERABILITY

Technical Characteristics:

- Accuracy
- Size
- Weight
- Timeliness
- Range
- Operational conditions
- Weight
- Simple
- Durability
- Simplicity in training
- Not be an additional piece of equipment
- International Coalition capable
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- Control measure
- On demand
- Close proximity
- MOUT capable
- Safety
- Training capability

WN09 – Precision Direct Fire

Possible Measures:

RANGE
FOV
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
SIGNATURE
EFFECTIVENESS
ENGAGEMENT TIME
LETHALITY
ACCURACY

Technical Characteristics:

- Ability to determine range
- Max effect range
- Target exposure time
- Fire and forget
- Arming distance
- Standoff
- Scalable/selectable effects
- Accuracy
- Size
- Weight
- Timeliness
- Range
- Operational conditions
- Multispectral smoke (compatibility N14)
- Day/Night
- Comp ability with all sighting system
- Weight
- Simple
- Durability
- Simplicity in training
- Interoperability
- International Coalition capable
- Operational security
- Signature
- Life expectancy
- Battery power
- Control measure
- On demand
- Close proximity
- Multiple targets
- Maintain universal zero
- Maintain location (grenade)
- Training
- Elevation
- Depression
- Ability to fire in confined spaces
- Munitions effectiveness
- Maintain zero

WN10 – Casualty Evacuation

Possible Measures:

DIED OF WOUNDS RATE
SPEED OF EVACUATION
MOUT SPECIFIC SITUATIONS
REDUCTION IN COMBAT FORCE
TIME TO CCP
TIME TO LOCATE CASUALTIES
TIME TO REACH CASUALTIES

Technical Characteristics:

- Security of route and CCP
- Movement method
- Ease of movement to CCP
- Vertical and horizontal
- Vulnerability in transport
- Size
- Weight
- Burns
- Psychological casualties
- Eye injury
- Lacerations
- Crushing's
- Joint injuries
- Overpressure injuries
- Amputations
- Smoke inhalations
- SA of injury
- Organization training
- Make to medical community
- Triage
- System of evacuation
- Training for medics and training for individuals

WN11 – See While Inside Buildings/Structures

Possible Measures:

RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
SIGNATURE

Technical Characteristics:

- Magnification
- Adjustable field of view
- Don't lose the image
- Compatible with N5 and N9
- Image fusion
- Non spectrum specific
- Operational conditions
- Size
- Weight
- Simple
- Durability
- Simplicity in training
- Longevity
- Compatible with current or new targeting device
- Operational security
- Resolution
- Life expectancy
- Power source
- Dual function
- Close proximity
- MOUT specific
- Adjustable
- Comfort of use

WN12 – Designate Persons/Items

Possible Measures:

RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RESPONSIVENESS
DURATION OF MARKING
REVERSIBILITY
RECOGNIZABILITY

Technical Characteristics:

- Accuracy
- Size
- Weight
- Timeliness
- Range
- Operational conditions
- Weight
- Simple
- Durability
- Simplicity in training
- Not be an additional piece of equipment
- Individual to individual
- Interoperability
- International Coalition capable
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- Situational awareness tool
- Control measure
- On demand
- Close proximity
- MOUT specific

WN13 – Forcible Entry

Possible Measures:

MULTIPLE BREACHING MODES
OBSTACLES REDUCTION
TIME TO REDUCE OBSTACLE
TIME TO PREPARE
TIME ON BUILDING ENTRY
EFFECTIVENESS

Technical Characteristics:

- Number of soldiers/marines to employ
- Portability
- Scalability
- Simplicity
- Signature
- Use in confined space
- Collateral damage
- Range
- Stand-off
- Weight
- Size
- Type of target can be defeated
- Method of employment (mounted and dismounted)
- Training (devices and facilities)
- Include in video

WN14 – Defeat Armored Vehicles, Bunkers, Reinforced Structures

Possible Measures:

RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
SIGNATURE
EFFECTIVENESS

Technical Characteristics:

- Target exposure time
- Fire and forget
- Arming distance
- Standoff
- Scalable/selectable effects
- Accuracy
- Size
- Weight
- Timeliness
- Range
- Operational conditions
- Weight
- Simple
- Durability
- Simplicity in training
- Interoperability
- International Coalition capable
- Operational security
- Signature
- Life expectancy
- Battery power
- Control measure
- On demand
- Close proximity

WN 15 – Knowledge of Other Side of Wall

Possible Measures:

THROUGH ALL WALL MATERIALS/BARRIERS
RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RESPONSIVENESS

Technical Characteristics:

- Standoff capability
- Accuracy
- Size
- Weight
- False negatives/accuracy
- Timeliness
- False positives
- Range
- Operational conditions
- Weight
- Simple
- Durability
- Simplicity in training
- Longevity
- Not be an additional piece of equipment
- Individual to individual
- Interoperability
- International Coalition capable
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- Situational awareness tool
- Control measure
- On demand
- Close proximity
- MOUT specific

WN16 – Personal Protection

Possible Measures:

REDUCTION IN KIA
WIA EVACUATED
WIA RETURNED TO DUTY
NON-BATTLE RELATED INJURIES
COMBAT EFFECTIVENSS (measured by LER?)
    -maintain ability to shoot, move and communicate
    -ability to maintain mobility
MISSION ACCOMPLISHMENT

Technical Characteristics:

- Not going to be able to completely fill this body protection need with one capability
- Level of injury reduction and effect on mission accomplishment together should apply to any of the many types of personal protection?
- Very broad measure as it stands
  -A family of needs
  -Should be broken out into separate needs?
  -How to compare an active system versus a passive system (also depends on the threat?)
- LER does not include information about mission accomplishment
  -Didn't accomplish mission, but 0 losses?
  -Accomplished mission with terrible casualty rate
- At some point, casualty rate and mission accomplishment are correlated
  -Not good enough just to seize the building, need to hold it too (relationship of mission success and casualty rate)
- Effect on transportation?
- Mobility has a huge impact on combat effectiveness
- How much better is he able to defeat an enemy?
- Range of motion (a part of combat effectiveness)
- Measuring ability to maintain mobility?
  -Tasks completed like rooms cleared, streets crossed
  -Time to complete mission (in a collective sense)
  -Movement rate (use an obstacle course to measure that)
  -Less effort, less fatigue
- Example about one way to measure: send a person into a building with new vest and talk to them about how much it slowed them down
- Level of repeated protection. A vest that could take 3 hits but not 4? Failure rate? Reusability
- Personal injury from non-battle related actions
- Losses only in terms of what you are evaluating. Like losses due to a glove that did not perform the way we wanted it to.
- Non-purple heart injuries?
- Can we have measures that are only applicable to some capabilities
  -Number of eye wounds
- Personal Injuries?
- Casualty rate
- Severity of wounds?
- If measuring the effectiveness of body armor, would have looked at where the hits occurred.
- What parts of the body are protected—measures depend on that

- Ease of movement
- Compatibility in transport
- Multifunctionality
- Modularity
- Size
- Weight
- Burns
- Psychological casualties
- Eye injury
- Lacerations
- Crushings
- Joint injuries
- Overpressure injuries
- Amputations
- Smoke inhalations

WN17 – Detect Explosives/Explosive Devices

Possible Measures:

DETECT ALL TYPES OF EXPLOSIVES
RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RESPONSIVENESS
ACCURACY

Technical Characteristics:

- Link to N26
- Standoff capability
- Size
- Weight
- Timeliness
- Range
- Operational conditions
- Weight
- Simple
- Durability
- Simplicity in training
- Longevity
- Not be an additional piece of equipment
- Interoperability
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- Situational awareness tool
- Control measure
- On demand
- Close proximity
- MOUT specific

WN18 – Get on Top of Buildings

Possible Measures:

HEIGHT
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
EFFECTIVENESS
SURVIVABILITY
TIME TO EMPLOY

Technical Characteristics:

- Stability
- Capacity
- Durability
- Adjustable height
- Accuracy
- Size
- Weight
- Timeliness
- Range
- Operational conditions
- Simple
- Durability
- Simplicity in training
- Interoperability
- Life expectancy
- Power source

WN19 – Indirect Fires

Possible Measures:

RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
SIGNATURE
EFFECTIVENESS
EMPLOYMENT TIME
ACCURACY
TOT (time on target)
COLLATERAL DAMAGE

Technical Characteristics:

- Arming distance
- Is there a requirement for a more precision small mortar?
  - Controllable CEP?
  - Mortar not the weapon of choice?
- Not going to engage out in the open
- Do we need a different smoke? (tie to N14 improved obscurants)
- Type of munition
- Aiming devices (stakes)
- Variable fuzing (time delay)
- Detonation control
- Penetration capability
- Mask and overhead cover
- Engagement time (from start to end)
- Adjustable, scalable
- Stability (base plate)
- Ability to determine range
- Max effect range
- Target exposure time
- Fire and forget
- Arming distance
- Standoff
- Scalable/selectable effects
- Accuracy
- Weight
- Timeliness
- Range
- Operational conditions
- Multispectral smoke (compatibility N14)
- Day/Night
- Comp ability with all sighting system
- Size
- Weight
- Simple
- Durability
- Simplicity in training
- Interoperability
- International Coalition capable
- Operational security
- Signature
- Life expectancy
- Battery power
- Control measure
- On demand
- Close proximity
- Multiple targets
- Maintain universal zero
- Maintain location (grenade)
- Training
- Elevation
- Depression
- Ability to fire in confined spaces
- Munitions effectiveness
- Maintain zero

WN20 – Identify Non-Combatants

Possible Measures:

ACCURACY
INDENTIFY NONCOMBATANTS
RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RESPONSIVENESS

Technical Characteristics:

- Accuracy
- Size
- Weight
- False negatives/accuracy
- Timeliness
- False positives
- Range
- Operational conditions
- Weight
- Simple
- Not take sights off
- Durability
- Simplicity in training
- Longevity
- Not be an additional piece of equipment
- Individual to individual
- Interoperability
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- Situational awareness tool
- Control measure
- On demand
- Close proximity
- Not MOUT specific

WN21 – Improved MOUT Obscurant

Possible Measures:

RANGE
OPERATIONAL CONDITIONS
PORTABILITY
VOLUME
DENSITY
DURATION
RAPIDITY
MULTI-SPECTRAL
NON-TOXIC

Technical Characteristics:

- Individually employable
- Non-burning
- Accuracy
- Timeliness
- Range
- Operational conditions
- Size
- Weight
- Simple
- Durability
- Simplicity in training
- Interoperability
- Life expectancy
- Control measure
- MOUT specific

WN22 – Casualty Treatment

Possible Measures:

DIED OF WOUNDS RATE
SPEED OF TREATMENT
LEVEL OF TREATMENT
TIME TO RETURN TO DUTY
MOUT SPECIFIC WOUNDS
REDUCTION IN COMBAT FORCE
TIME OF AWARENESS

Technical Characteristics:

- Burns
- Psychological casualties
- Eye injury
- Lacerations
- Crushings
- Joint injuries
- Overpressure injuries
- Amputations
- Smoke inhalations
- SA of injury
- Organization training
- Make to medical community
- Triage
- System of treatment
- Training for medics and training for individuals
- Look at possibilities for more equipment (first aid kit and contents) at individual level

WN23 – Neutralize Explosives/Explosive Devices

Possible Measures:

NEUTRALIZE ALL TYPES OF DEVICES
REMOTE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
EFFECTIVENESS

Technical Characteristics:

- Link to N26
- Reusability/Expendable
- Standoff capability
- Size
- Weight
- Timeliness
- Range
- Operational conditions
- Weight
- Simple
- Durability
- Simplicity in training
- Longevity
- Not be an additional piece of equipment
- Interoperability
- Operational security
- Signature
- Life expectancy
- Battery power
- Dual function
- On demand
- Close proximity
- MOUT specific

WN24 – Vehicular Survivability

Possible Measures:

THREATS DEFEATED
NUMBER OF FRIENDLY VEHICLES DESTROYED (also disabled)
CASUALTIES (CREW AND OTHER)
PORTABILITY
SPEED TO EMPLOY
IMPACT ON COMBAT EFFECTIVENESS

Technical Characteristics:

- Impact of visibility (part of force effectiveness)
- Primary first line of defense
- Employ while moving
- Designed to defeat the following threats:
  -Molotov cocktail
  -RPGs
  -grenades
- Survivability (sustain multiple hits)
  -especially from top attacks
- Surfaces protected
- Scalable (same device can be used on as many vehicles as possible)
- Dimensions (on all vehicles)
- Loss of mobility
- Modularity
- Size
- Weight
- Camouflage
- Fire resistant
- Does it require vehicle modification (mounting kit?)
- Ease of removal (may not always want on the vehicle)

WN25 – MOUT Logistics

Possible Measures:

PORTABILITY
TIME TO RESUPPLY
    -getting there
    -how long it takes to re-supply
ABILITY TO MAINTAIN MOMENTUM OF ATTACK
SURVIVABILITY (OF TRANSPORTERS AND GEAR)
KNOWING WHAT AND WHEN TO RESUPPLY (tie to N21 Comms at all levels)
    -question of redistribution
FORCE REDUCTION
PRECISION OF DELIVERY (by whatever means)

Technical Characteristics:

- Urban foraging (water, electricity, other infrastructure)
- Digital resupply request (similar to comms note)
- Payload, capacity
- How to hand off things like ladders (although not really re-supply)
- How well does the item bring forward the MOUT package?
- Level of distribution (the lower the level the better)
- Redistribution
- Surface vs. air delivery
- Question of MSRs?
- Link to N19 (Cas-evac)
- Quantity of goods resupplied
- Vertical resupply
- Method of transportation
- Resupply in position (in the foxhole?) vs. out of position
- Shelf life
- Ready-to-use
- Disposable magazine?
- Break into usable pieces-packaging that makes more sense (camelback water example)

WN26 – Power Source Efficiency

Possible Measures:

INTEROPERABILITY
DURATION
MULTIFUNCTIONALITY
SELF SUSTAINING
RENEWABLE
UNIVERSALLY RECHARGABLE
PORTABILITY
OPERATIONAL CONDITIONS

Technical Characteristics:

- Variable output
- Modularity
- Size
- Weight
- Environmentally friendly
- Simplicity
- Rate of charge
- Power source
- Rate of output
- Consistence
- Charge retention

WN27 – Soldier/Marine Individual Operational Effectiveness (temperature?)

Possible Measures:

ABILITY TO CONTINUE SUSTAINED OPERATIONS
REDUCED CASUALTIES FROM CONDITIONS
- Not just heat casualties
- thermal extremes
- dysentery

SPEED and ACCURACY with which a person could complete a given task

Technical Characteristics:

- Study found decrease in heat casualties because of camelbacks
  -Is there something better to fill it with? Might reduce need for MREs
- Ability to monitor
- Hydration
- Gel neck packs, camel backs
- Equipping, sustaining, training
- Cognitive readiness
- Physical fitness
- Related FM?
- Discipline
- Sanitary precautions?
- Training
- Sustenance
- Environmental range
- Genetic engineering
- Gore-tex

WN28 – Non-violent Crowd Dispersal

Possible Measures:

SPEED OF DISPERSAL
NON-COMBATANT CASUALTIES
PUBLIC OPINION (CNN factor) – a subjective measure
SIZE OF CROWD YOU CAN CONTROL
OPERATIONAL CONDITIONS
COUNTER-MEASURE EXISTS?

Technical Characteristics:

- Cultural influences, impact
- Crowds hate to have photos taken
- Method of delivery
- Number of people it takes to deliver it
- Stand-off
- User safety
- Link with N17 (intel), N5 (marking), N3 (ID non-combatants)
- Did they come back?
- Ability to contain
- Psy Ops
- Using water in the crowd, sticky foam, super slick stuff with clean up problems, malodorants, directed E problems
- Barrier or container system
- How do you know it's non-violent?
  -Some members in the crowd violent but rest of the crowd non-violent
  -Would like to know what weapons are in the crowd

WN29 – Rapid Counter-Mobility

Possible Measures:

DEPLOYMENT TIME
REUSABILITY
PORTABILITY
DURABILITY
EFFECTIVE AGAINST ALL WHEEL VEHICLES

Technical Characteristics:

- Limit collateral damage
- Simplicity
- Size
- Weight
- Minimum maintenance

WN30 – Oxygen-Depleted Environment

Possible Measures:

OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
DURATION
EMPLOYMENT TIME
OPERATIONAL EFFECTIVENESS

Technical Characteristics:

- Operational and training capable
- Comfort
- Interoperability
- Field of view
- Size
- Weight
- Simple
- Durability
- Simplicity in training
- Life expectancy
- Power source
- Dual function
- MOUT specific

WN31 – Deny Use of Electrical Equipment

Possible Measures:

RANGE
OPERATIONAL CONDITIONS
SIMPLICITY
PORTABILITY
OPERATIONAL SECURITY
SIGNATURE
RESPONSIVENESS (TIME TO DEFEAT)
INTEROPERABILITY
EFFECTIVENESS (PERCENTAGE OF INTENDED EQUIPMENT DEFEATED)
(DURATION) (REVERSIBILITY)

Technical Characteristics:

- Link to N17
- Exploit
- Manipulate the enemy electronics/infrastructure
- Method of employment
- Selectivity
- Scalability
- Size of area affected
- Accuracy
- Size
- Weight
- Timeliness
- Range
- Operational conditions
- Simple
- Durability
- Simplicity in training
- Operational security
- Signature
- Life expectancy
- Power source
- On demand
- Close proximity
- MOUT capable
- Safety
- Training capability

APPENDIX C

Warfighter SME Brainstorming of Recommendations for MOUT Training

APPENDIX C

Warfighter SME Brainstorming of Recommendations for MOUT Training

Notes:

- Every new piece of technology developed should have the capability of having its effects replicated in training
- Look for solutions that you can train on as well. Will not accept surrogate training item. Want something that functions in the training environment, the same as in operations (except for things like grenades, etc.).
- Little confidence in casualty numbers from training, because we can't represent a number of types of weapons (like M203, SAW) in training (laser tagging systems, simunitions?)
- Training can account for 70 percent of casualties?
- Weapons effects video (different types of weapons against various building materials)
  - classification problems?
  - film while making data tables
- The training environment should represent the weapons effects as well as possible. The weapons effects video should give an appreciation for what the effects really are.
- Should there be a training program overall to create a baseline?
- Training piece for new items like through-wall sensors, etc. The new equipment is only useful if people know how to use it.
- By running vignettes and conducting proper AARs and then rerunning the mission, we can cut the training time to master that task by 40 percent using instrumentation. But not above the platoon level?
- Change field manuals to include operations in urban terrain (not just included in specialized manuals). We concentrate too much on the open fights, but cannot forget about those either.
- Need for training improvements is as important as any of the needs on our list.
- Tech folks should think about training items as well. Doesn't really fit in this process.
- Inside some/all of the needs we listed are associated training needs (like breach trainer, more weapons in MILES, video of weapons effects).
- We're losing a free product if we don't deal with the training issues now.
- Training improvements have a more immediate effect than new systems. Should be included in the rank ordered list, not just a recommendation.

- Training technology needs to enhance the warfighter's understanding of self and unit's overall capabilities and limitations when operating in MOUT.
- Can you get into and out of a Bradley with all of the equipment you're wearing?
- Problem with OPTEMPO with tanks.

APPENDIX D

Incubator Needs for the Follow-on to the MOUT ACTD: MOOs/MOEs/MOPs

(as initially brainstormed during Workshop I and II Support Work, 12 January – 23 March 2001)

APPENDIX D

Incubator Needs for the Follow-on to the MOUT ACTD: MOOs/MOEs/MOPs

(as initially brainstormed during Workshop I and II Support Work, 12 January – 23 March 2001)

Warfighter Need #	Category	Title	Need Definition	MOOs	JCATS— MOEs/MOPs	Non-JCATS— MOEs/MOPs
WN01	**H**	**Urban Surveillance and Detection**	To provide remote surveillance and detection of activity in the urban area.	Engagement	• Red Losses • Red Suppressed • Loss Exchange Ratio • Force Exchange Ratio • Ammunition Exchange Expenditure • Average Engagement Ranges	
				Force Protection	• Blue Losses-Fratricide • Blue Losses (by Red) • Noncombatant Losses • Blue Targets Acquired by Red	
				C4I	• Number of Red Targets (Inside) Acquired by Blue • Percentage of Red Targets (Inside) Acquired by Blue • Number of Red Targets (Outside) Acquired by Blue • Percentage of Red Targets (Outside) Acquired by Blue • Number of Noncombatants Detected • Percentage of Noncombatants Detected • Critical Activities (minefields, crowds, roadblocks, etc.) Detected • Total Surveillance Coverage	• Surveillance Efficiency • Operational Risk (exploitability, countermeasures, signature) • Sensor Coverage
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	

WN02	**I**	**Identify Friendlies**	To identify friendly combatants during all conditions.	Force Protection	• Blue Losses-Fratricide • Blue Losses (by Red)	
				C4I		• Identification Range • Operational Risk (exploitability, countermeasures, false positives)
WN03	**I**	**Communica-tion All Levels**	To communicate across all levels below combined arms task force.	C4I		• Capable of Distribution to All Individuals • Communication Range • Across Arms Communication • Frequency Range Compatibility with Urban Area • Hands-Free • Indoor/Outdoor System • Joint Communications • Non-Line-of-Sight • Operational Risk • Type of Communication
WN04	**H/I**	**Near Real-time, Scaleable Map Information for Production and Dissemination**	To produce near real-time, scaleable map information for dissemination to individual soldiers and Marines.	C4I		• Update Speed • Dissemination Speed • Accuracy • Operational Risk • Scaleability (yes/no) • Degree of Scaleability • Resolution

WN05	**I**	**Sniper Detection**	To detect sniper location under all conditions and situations proactively (and reactively).	Engagement	• Red Sniper Losses • Non-Sniper Red Losses • Loss Exchange Ratio • Force Exchange Ratio • Ammunition Expenditure	
				Force Protection	• Blue Losses by Red Snipers • Blue Losses by Non-Sniper Red • Noncombatant Losses	
				C4I	• Red Snipers Acquired by Blue	• Sniper Position/ Location Accuracy • Operational Risk Detection Range
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	
WN06	**H/I**	**Position Location in Complex and Restrictive Terrain**	To provide platoon leader with position location for his squads in complex and restrictive terrain.	C4I		• Accuracy • Display Quality • Dissemination Range • Environmental Conditions • Individuals Tracked • Information Display • Operational Environment • Operational Risk • Update Rates

WN07	**I**	**Identify Enemy**	To identify enemy combatants during all conditions.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio • Average Engagement Ranges	
				Force Protection	• Blue Losses-Fratricide • Blue Losses (by Red) • Noncombatant Losses	
				C4I		• Identification Range • Operational Risk (exploitability, countermeasures, signature, false negatives)
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	
WN08	**I**	**Improved Target Designation**	To enable target designation and/or hand-off targeting data to off-site shooters, across all arms and services.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio • Ammunition Expenditure	• Designation Range • Engagement Range of Off-site Weapon
				Force Protection	• Blue Losses • Noncombatant Losses	• Collateral Damage
				C4I		• Operational Risk (exploitability, countermeasures, signature)
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-unit to Move between Critical Nodes	

WN09	**S**	**Improved Precision Direct Fire**	To improve precision direct fire.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio • Ammunition Expenditure	• Operational Risk (exploitability, countermeasures, signature) • Engagement Range • Engagement Time
				Force Protection	• Blue Losses-Fratricide • Blue Losses (by Red) • Noncombatant Losses	• Collateral Damage
WN10	**S**	**Enhanced Casualty Evacuation**	To provide means for enhanced casualty evacuation.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio	
				Force Protection	• Blue Losses	• Effect on Wounded Individual
				Mobility	• Time to Accomplish Unit Mission • Time to Evacuate Casualty (from location through evacuation to CCP)	
WN11	**I**	**See While Inside Buildings/ Structures**	To be able to see while inside buildings/ structures at all times.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio • Ammunition Expenditure	
				Force Protection	• Blue Losses-Fratricide • Blue Losses (by Red) • Noncombatant Losses	
				C4I		• Operational Risk (exploitability, countermeasures, signature)
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	

WN12	**I**	**Improved Designation of Persons/Items**	To reversibly designate persons or items of interest to friendly forces under all conditions, on-site or remotely.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio	• Designation Range
				Force Protection	• Blue Losses • Noncombatant Losses	
				C4I		• Operational Risk (exploitability, countermeasures, signature) • Mark Detection Range • Duration of Designation • Reversibility
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	
WN13	**I**	**Improved Forcible Entry**	To improve forcible entry capability (specifically obstacle reduction, interior and exterior building and structure entries; includes need for mechanical breaching kit, remote breaching device, breach trainer).	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio • Ammunition Expenditure	• Item's Range
				Force Protection	• Blue Losses	
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	

WN14	**I**	**Defeat Armored Vehicles, Bunkers, Reinforced Structures**	To enable individual soldiers/ Marines to defeat armored vehicles, neutralize bunkers, and penetrate reinforced structures/ walls/ bunkers from a confined space.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio • Average Engagement Ranges • Ammunition Expenditures	• Operational Risk (exploitability, countermeasures, signature) • Item's Range
				Force Protection	• Blue Losses	
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	
WN15	**S**	**Knowledge of Other Side of Wall**	To know what is on the other side of an opaque wall.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio • Ammunition Expenditure	
				Force Protection	• Blue Losses-Fratricide • Blue Losses (by Red) • Noncombatant Losses • Blue Targets Detected/ Acquired by Red	
				C4I	• Red Targets Acquired by Blue • Noncombatants Detected • Critical Items/ Activities Detected	• Operational Risk (exploitability, countermeasures, signature, false positives) • Item's Range • Type/ Amount of Information • Wall Material Dependent
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	

WN16	**I**	**Improved Personal Protection**	To improve personal protection system (specifically improvement in head, torso, hands, eyes, ears protection against flame, cuts/ puncture, overpressure, ballistic, laser environmental) usable in both training and operation.	Force Protection		• Blue Kills • Blue Wounded – Evacuated • Blue Wounded – Returned to Duty
				C4I		• Degradation of Individual's Communications • Degradation of Individual's Situation Awareness
				Mobility		• Degradation in Individual Mobility
WN17	**S**	**Detect Explosives/ Explosive Devices**	To detect explosives/ explosive devices/ mines inside buildings or in/ around built up areas.	Force Protection	• Blue Losses • Noncombatant Losses	
				C4I	• Explosives Detected	• Type of Explosives Detected • Item's Range • Operational Risk
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	
WN18	**I**	**Get on Top of Buildings**	To be able to put/get soldiers and Marines on top of buildings.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio	
				Force Protection	• Blue Losses	
				Mobility	• Time to Accomplish Unit Mission	• Time to Employ (put together and ascend) • Height Reachable

WN19	**H**	**Enhanced Indirect Fires**	To enhance indirect fires.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio • Average Engagement Ranges • Ammunition Expenditure	• Employment Time • Time of Flight • Item's Range
				Force Protection	• Blue Losses • Noncombatant Losses	• Collateral Damage
				Mobility	• Time to Accomplish Unit Mission	
WN20	**I**	**Identify Non-Combatants**	To identify non-combatants under all conditions.	Force Protection	• Blue Losses-Fratricide • Blue Losses (by Red) • Noncombatant Losses	
				C4I		• Identification Range • Operational Risk (exploitability, countermeasures, signature, false positives)
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	
WN21	**I**	**Improved MOUT Obscurants**	To improve MOUT obscurants at individual soldier/ Marine level.	Force Protection	• Blue Losses • Noncombatant Losses	• Area Concealed • Speed of Employment • Duration of Concealment • Density
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	

WN22	**S**	**Enhanced Casualty Treatment**	To provide means for enhanced casualty treatment.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio	
				Force Protection	• Blue Losses	• Blue Wounded – Returned to Duty • Effect on Individual Casualty (level, speed, and result of treatment) • Time to Return to Duty
				Mobility	• Time to Accomplish Unit Mission	
WN23	**S**	**Improved Neutraliza-tion of Explosives/ Explosive Devices**	To improve neutralization of explosives/ explosive devices/ mines inside buildings or in/ around built up areas.	Force Protection	• Blue Losses • Noncombatant Losses	• Item's Range • Types of Devices • Collateral Damage
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	
WN24	**H**	**Enhanced Urban Vehicular Survivability**	To enhance vehicular survivability during an urban operation.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio	• Operational Risk (exploitability, countermeasures)
				Force Protection	• Blue Losses-Fratricide due to Protective Device • Blue Losses (by Red) • Blue Vehicle Losses • Noncombatant Losses due to Protective System	• Collateral Damage • Improvement in Survivability • Potential Lethality to Friendlies • Time to Install
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	

WN25	**H**	**Improved MOUT Logistics**	To improve logistics capability (Fuel, Fix, Replace, Move, Arm, and Feed) in the urban environment.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio	
				Force Protection	• Blue Losses • Rate of Ammunition Resupply • Rate of Fuel Resupply • Percent of Force Operational • Blue Logistics Vehicle Losses • Blue Vehicles Repaired • Rate of Resupply of Other Supply Classes	
				C4I		• Knowledge of Logistics Needs (what, when and where)
				Mobility	• Time to Accomplish Unit Mission • Time for Sub-units to Move between Critical Nodes	
WN26	**I**	**Improved Power Source Efficiency**	To improve efficiency of battlefield power sources.	Other	*Not modeling oriented*	• Interoperability • Duration • Multifunctionality • Self-sustaining • Renewable • Universally Rechargeable

WN27	**I**	**Improved Soldier/ Marine Individual Operational Effectiveness**	To provide improved approach to individual soldier/ Marine operational effectiveness.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio	
				Force Protection	• Blue Losses	
				C4I		• Effect on Individual's Cognitive Skills • Effect on Individual's Physical Skills
				Mobility	• Time to Accomplish Unit Mission	• Effect on Individual Mobility
WN28	**S**	**Non-Violent Crowd Dispersal (?? Control)**	To provide non-violent means to disperse (control??) a crowd.	Engagement		• Area Covered • Degree of Incapacitation • Maximum Lethality Range • Operational Risk • Target Sensitivity
				Force Protection		• Collateral Damage
WN29	**S**	**Rapid Counter-Mobility**	To provide rapid counter-mobility.	Engagement	• Red Losses • Loss Exchange Ratio • Force Exchange Ratio	• Types of Vehicles • Operational Risk (countermeasures, etc.) • Duration of Effect • Deployment Time • Number of Vehicles Affected • Reversibility
				Force Protection	• Blue Losses • Time for Red to Move between Critical Nodes	• Collateral Damage

WN30	**I**	**Oxygen Depleted Environment**	To operate in oxygen-depleted and NBC contaminated environments.	Engagement	• Force Exchange Ratio • Loss Exchange Ratio • Red Losses	
				Force Protection	• Blue Losses	• Time Able to Operate in Environment • Time to Employ
				C4I		• Degradation of Individual's Communications • Degradation of Individual's Situation Awareness
				Mobility	• Time to Accomplish Unit Mission	• Reduction to Individual Mobility
WN31	**H**	**Control Use of Electrical Equipment**	To selectively control electrical equipment in the urban environment.	Engagement	• Red Losses • Force Exchange Ratio • Loss Exchange Ratio	• Item's Range • Operational Risk • Type of Effect • Types of Equipment Effected • Weapon Coverage
				Force Protection	• Blue Losses	
				Mobility	• Time to Accomplish Unit Mission	

Category Key:
I = Individual Soldier
S = Squad or Individual Soldier Level
H = Higher Echelon

APPENDIX E

Preliminary MOEs/MOPs, Scales, and Logical Decisions Goals Hierarchies for Each Warfighter Need

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Preliminary MOEs/MOPs, Scales, and Logical Decisions Goals Hierarchies for Each Warfighter Need

WN01 - Urban Surveillance and Detection

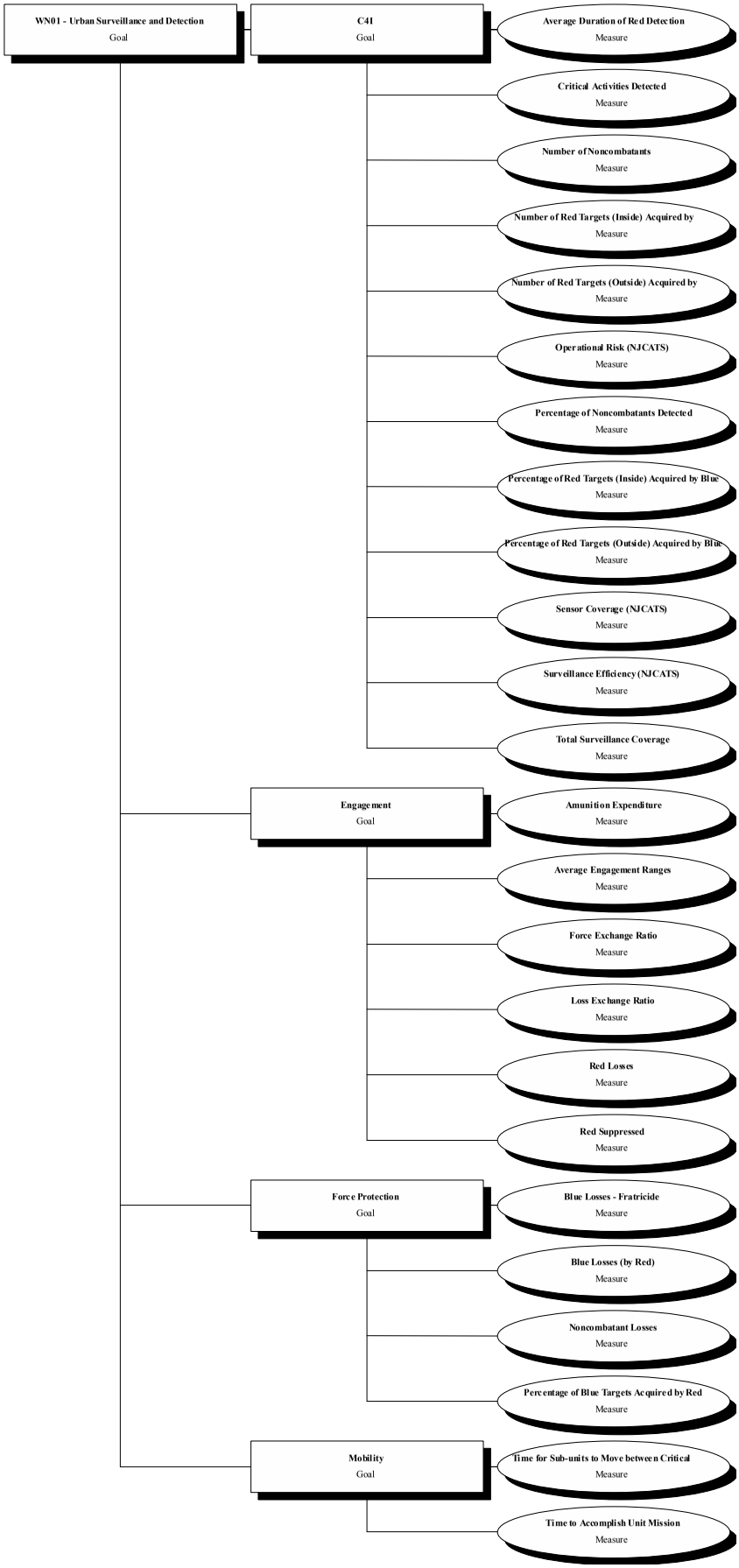
Definition: To provide remote surveillance and detection of activity in the urban area.

MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Average Duration of Red Detection	JO	minutes	*999999*	0		
	Critical Activities Detected	JO	percentage	100	0		Measure refers to number of critical events detected/total number of critical events
	Number of Noncombatants Detected	JO	non-combatants	*999999*	0		
	Number of Red Targets (Inside) Acquired by Blue	JO	red targets	*999999*	0		
	Number of Red Targets (Outside) Acquired by Blue	JO	red targets	*999999*	0		
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
	Percentage of Noncombatants Detected	JO	percentage	100	0		
	Percentage of Red Targets (Inside) Acquired by Blue	JO	percentage	100	0		
	Percentage of Red Targets (Outside) Acquired by Blue	JO	percentage	100	0		
	Sensor Coverage	NJO	meters squared	100000	1		Measure refers to just the sensor, not the platform
	Surveillance Efficiency	NJO	NA			High/Medium/Low	Measure refers to number of critical events distinguishable/monitoring time
	Total Surveillance Coverage	JO	meters squared	100000	1		

WN01 - Urban Surveillance and Detection (cont.)

Definition: To provide remote surveillance and detection of activity in the urban area.

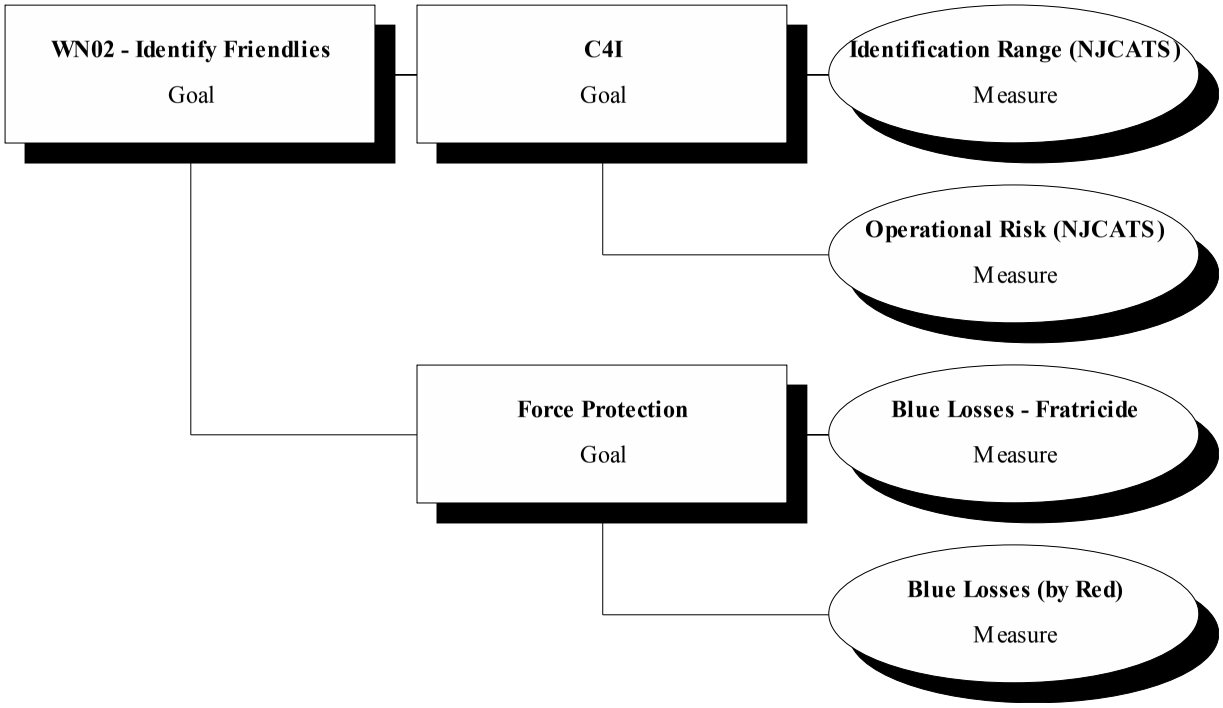
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Ammunition Expenditure	JO	shots	1	*99999*		
	Average Engagement Ranges	JO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
	Red Suppressed	JO	percentage	100	0		
Force Protection:	Blue Losses - Fratricide	JO	percentage	0	*100*		
	Blue Losses (by Red)	JO	percentage	0	*100*		
	Percentage of Blue Targets Acquired by Red	JO	percentage	0	100		
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN01 - Urban Surveillance and Detection
Goal
C4I
Goal
Average Duration of Red Detection
Measure
Critical Activities Detected
Measure
Number of Noncombatants
Measure
Number of Red Targets (Inside) Acquired by
Measure
Number of Red Targets (Outside) Acquired by
Measure
Operational Risk (NJCATS)
Measure
Percentage of Noncombatants Detected
Measure
Percentage of Red Targets (Inside) Acquired by Blue
Measure
Percentage of Red Targets (Outside) Acquired by Blue
Measure
Sensor Coverage (NJCATS)
Measure
Surveillance Efficiency (NJCATS)
Measure
Total Surveillance Coverage
Measure
Engagement
Goal
Amunition Expenditure
Measure
Average Engagement Ranges
Measure
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Red Suppressed
Measure
Force Protection
Goal
Blue Losses - Fratricide
Measure
Blue Losses (by Red)
Measure
Noncombatant Losses
Measure
Percentage of Blue Targets Acquired by Red
Measure
Mobility
Goal
Time for Sub-units to Move between Critical
Measure
Time to Accomplish Unit Mission
Measure

WN02 - Identify Friendlies

Definition: To identify friendly combatants during all conditions.

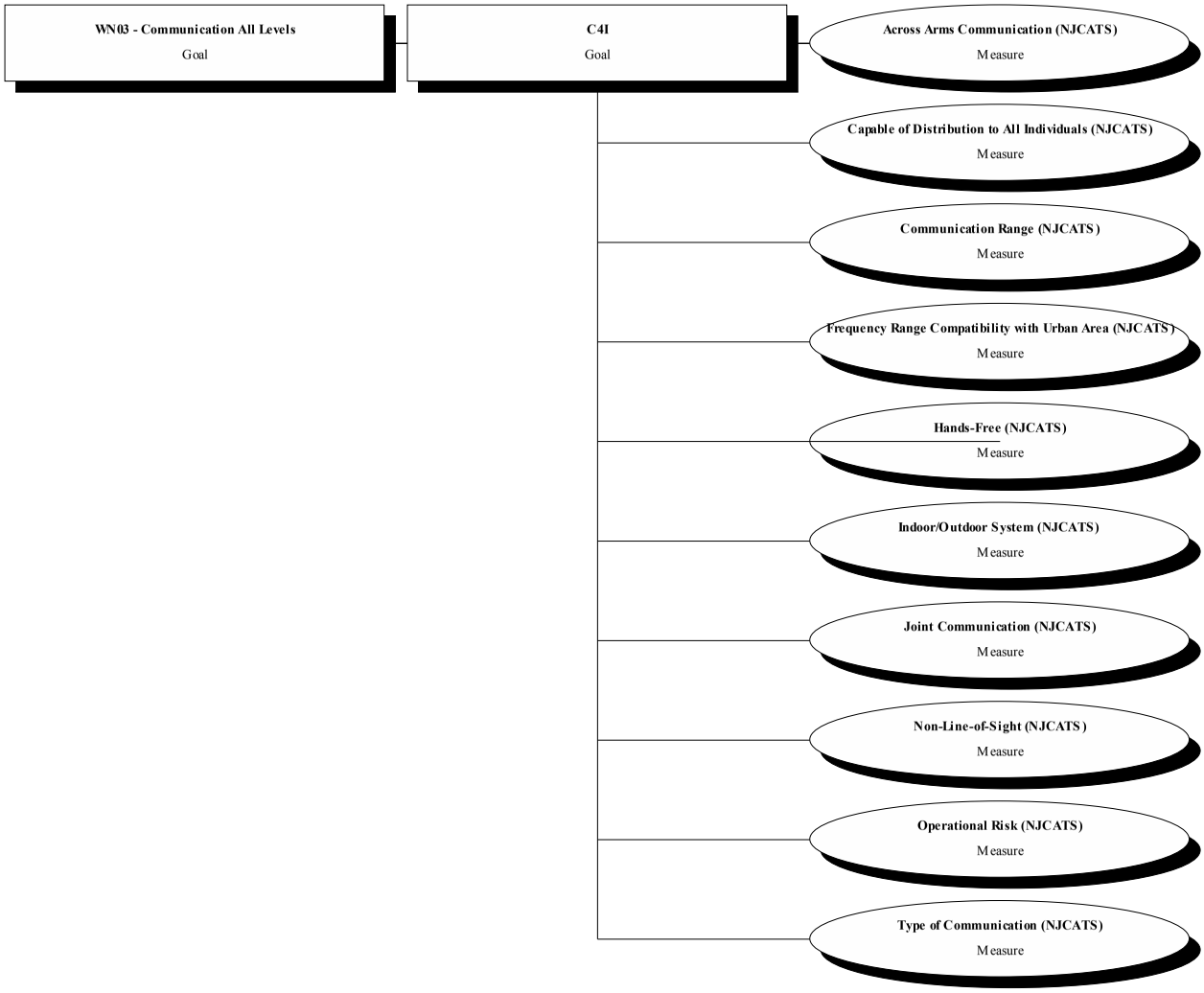
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Identification Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature, false positives
Force Protection:	Blue Losses - Fratricide	JO	percentage	0	*100*		
	Blue Losses (by Red)	JO	percentage	0	*100*		


WN02 - Identify Friendlies
Goal
C4I
Goal
Identification Range (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Force Protection
Goal
Blue Losses - Fratricide
Measure
Blue Losses (by Red)
Measure

WN03 - Communication All Levels

Definition: To communicate across all levels below combined arms task force.

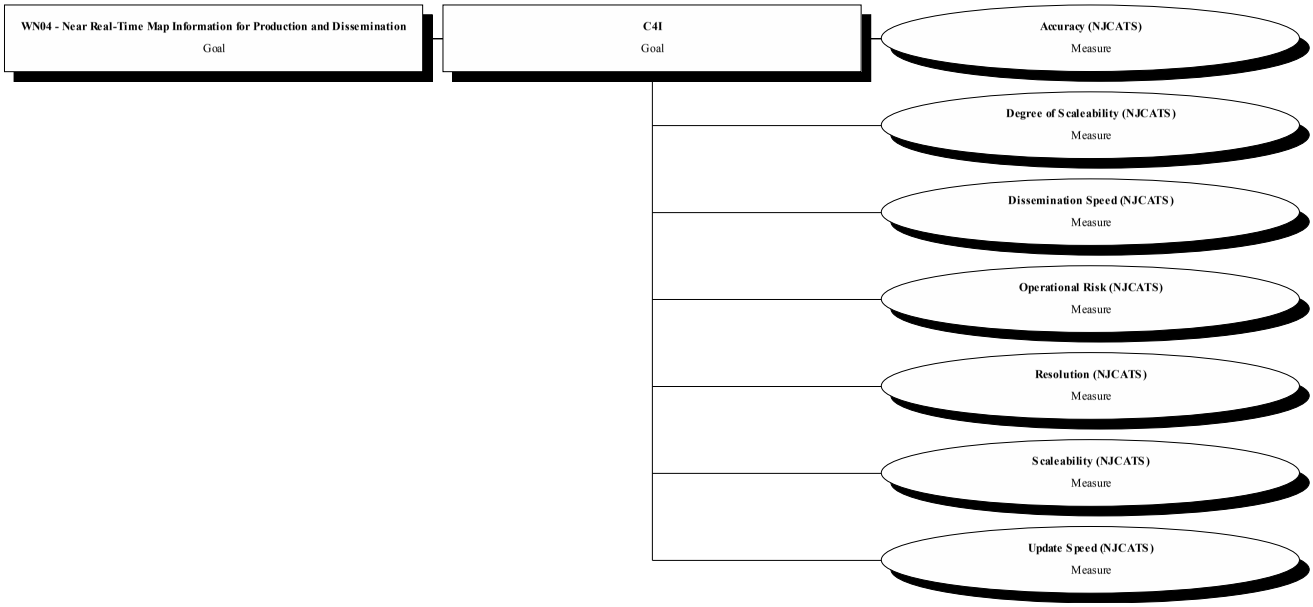
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Capable of Distribution to All Individuals	NJO	NA			Yes/No	
	Communication Range	NJO	meters	100,000	100		
	Across Arms Communication	NJO	NA			Across All/Across Some/Infantry Only	
	Frequency Range Compatibility with Urban Areas	NJO	NA			Excellent/Good/Poor	
	Hands-Free	NJO	NA			Yes/No	
	Indoor/Outdoor System	NJO	NA			Both/Indoors/Outdoors	
	Joint Communication	NJO	service	4	1		
	Non-Line-of-Sight	NJO	NA			Yes/No	
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
	Type of Communication	NJO	NA			Both/Voice or Data	


WN03 - Communication All Levels
Goal
C4I
Goal
Across Arms Communication (NJCATS)
Measure
Capable of Distribution to All Individuals (NJCATS)
Measure
Communication Range (NJCATS)
Measure
Frequency Range Compatibility with Urban Area (NJCATS)
Measure
Hands-Free (NJCATS)
Measure
Indoor/Outdoor System (NJCATS)
Measure
Joint Communication (NJCATS)
Measure
Non-Line-of-Sight (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Type of Communication (NJCATS)
Measure

WN04 - Near Real-time, Scaleable Map Information for Production and Dissemination

Definition: To produce near real-time, scaleable map information for dissemination to individual soldiers and Marines.

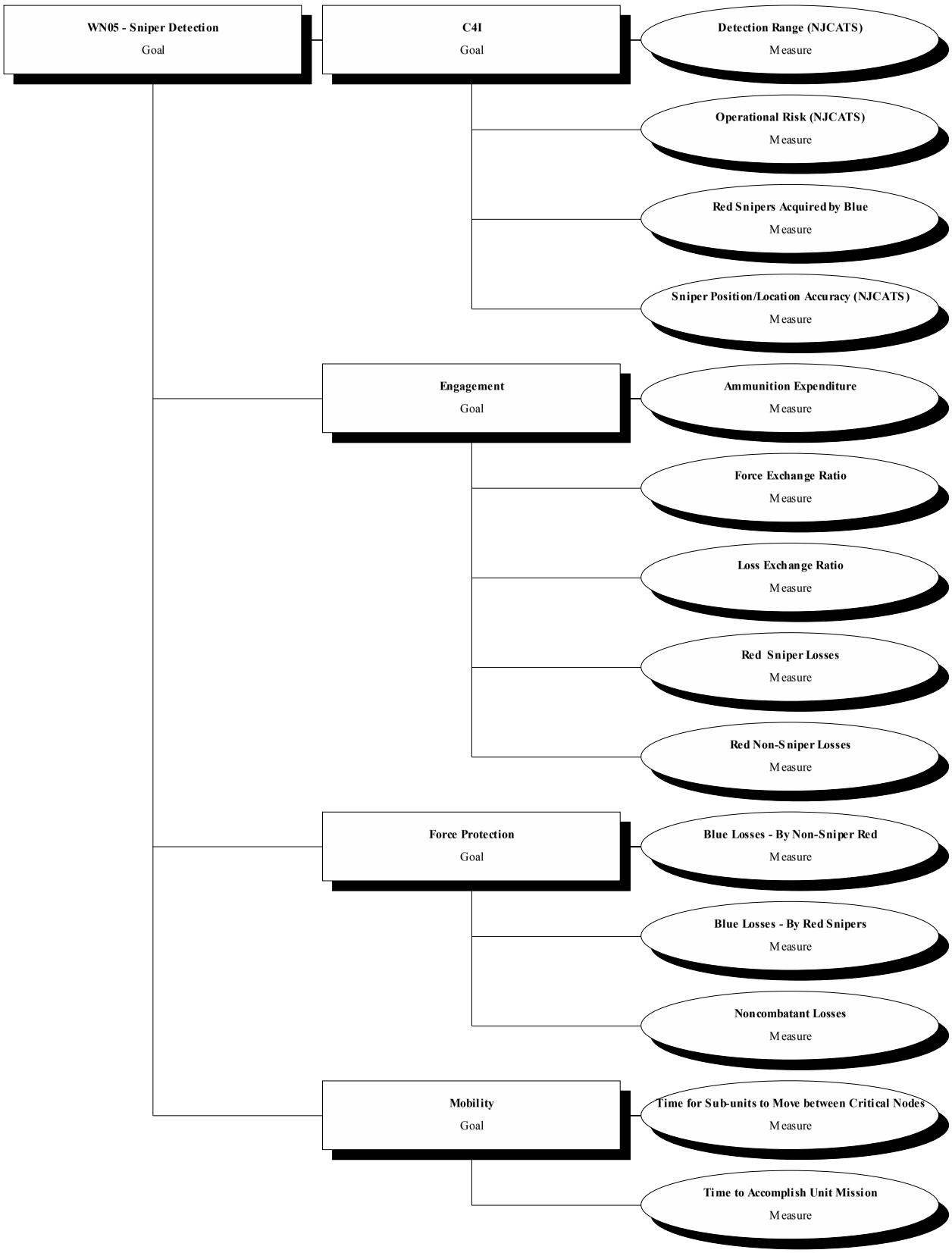
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Accuracy	NJO	meters	0.2	1000		
	Degree of Scaleability	NJO	NA			Room/Building/Block	
	Dissemination Speed	NJO	NA			Fast/Medium/Slow	
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature, false positives
	Resolution	NJO	meters	0.5	1000		
	Scaleability	NJO	NA			Yes/No	
	Update Speed	NJO	NA			Fast/Medium/Slow	


WN04 - Near Real-Time Map Information for Production and Dissemination
Goal
C4I
Goal
Accuracy (NJCATS)
Measure
Degree of Scaleability (NJCATS)
Measure
Dissemination Speed (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Resolution (NJCATS)
Measure
Scaleability (NJCATS)
Measure
Update Speed (NJCATS)
Measure

WN05 - Sniper Detection

Definition: To detect sniper location under all conditions and situations proactively (and reactively).

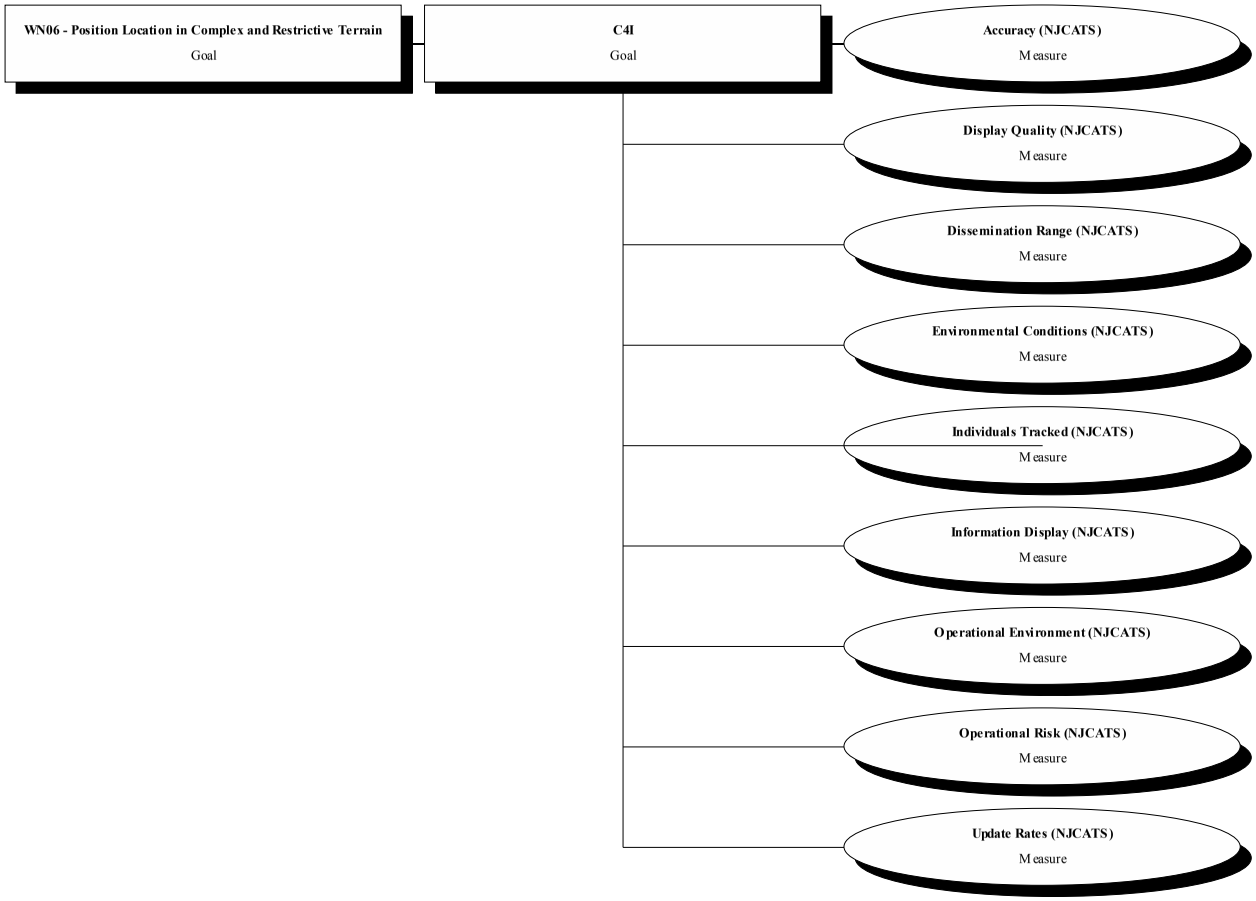
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Detection Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Operational Risk	NJO	NA			Low/Medium/High	
	Red Snipers Acquired by Blue	JO	percentage	100	0		
	Sniper Position/ Location Accuracy	NJO	NA			Window/Room/Floor/Building	
Engagement:	Ammunition Expenditure	JO	shots	1	*999999*		
	Force Exchange Ratio	JO	NA	0	999999		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	999999	0		
	Red Sniper Losses	JO	percentage	100	0		
	Red Non-Sniper Losses	JO	percentage	100	0		
Force Protection:	Blue Losses - By Non-Sniper Red	JO	percentage	0	100		
	Blue Losses - By Red Snipers	JO	percentage	0	100		
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN05 - Sniper Detection
Goal
C4I
Goal
Detection Range (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Red Snipers Acquired by Blue
Measure
Sniper Position/Location Accuracy (NJCATS)
Measure
Engagement
Goal
Ammunition Expenditure
Measure
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Sniper Losses
Measure
Red Non-Sniper Losses
Measure
Force Protection
Goal
Blue Losses - By Non-Sniper Red
Measure
Blue Losses - By Red Snipers
Measure
Noncombatant Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN06 - Position Location in Complex and Restrictive Terrain

***Definition*: To provide platoon leader with position location for his squads in complex and restrictive terrain.**

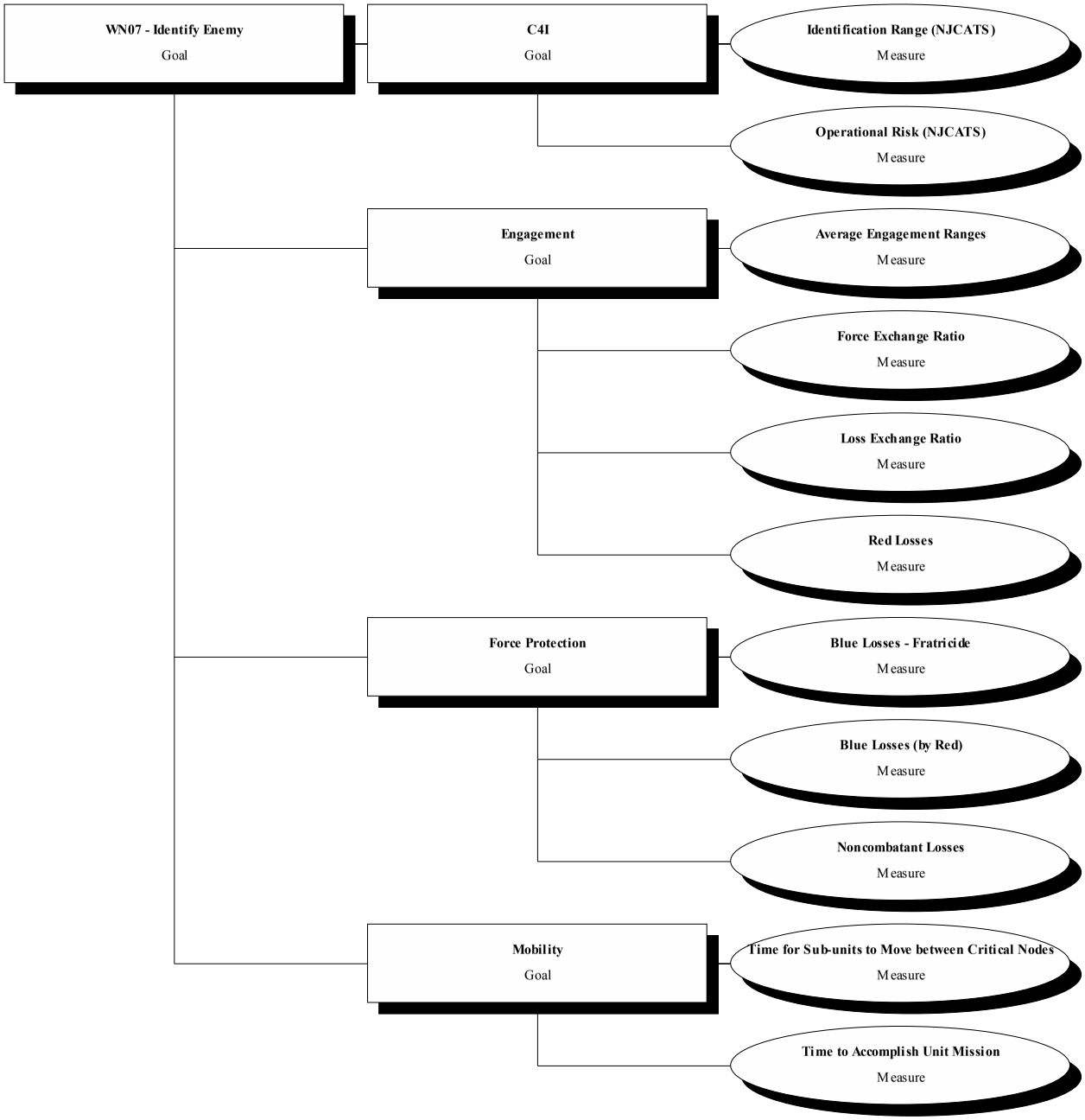
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Accuracy	NJO	meters	0.2	1000		
	Display Quality	NJO	NA			Excellent/Good/Poor	Measure refers to ability to convert z coordinate to building floor, scaleability, clarity of information, ease of use, etc.
	Dissemination Range	NJO	meters	5000	0		Measure refers to the distance the platoon leader can be from the squad
	Environmental Conditions	NJO	NA			All/Some/One	Measure refers to, for example, weather, fog, etc.
	Individuals Tracked	NJO	NA			All Individuals/ Fireteam Leaders/ Squad Leaders	
	Information Display	NJO	NA			Individual and Platoon Leader/ Platoon Leader	Measure refers to self-awareness
	Operational Environment	NJO	NA			All of Below/Four of Below/Three of Below/Two of Below/ Inside underground structure/Inside building/ Outside, but covered/ Outside, but up against building/Open Areas	Measure refers to where it will work
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
	Update Rates	NJO	seconds	1	7200		


WN06 - Position Location in Complex and Restrictive Terrain
Goal
C4I
Goal
Accuracy (NJCATS)
Measure
Display Quality (NJCATS)
Measure
Dissemination Range (NJCATS)
Measure
Environmental Conditions (NJCATS)
Measure
Individuals Tracked (NJCATS)
Measure
Information Display (NJCATS)
Measure
Operational Environment (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Update Rates (NJCATS)
Measure

WN07 - Identify Enemy

Definition: To identify enemy combatants during all conditions.

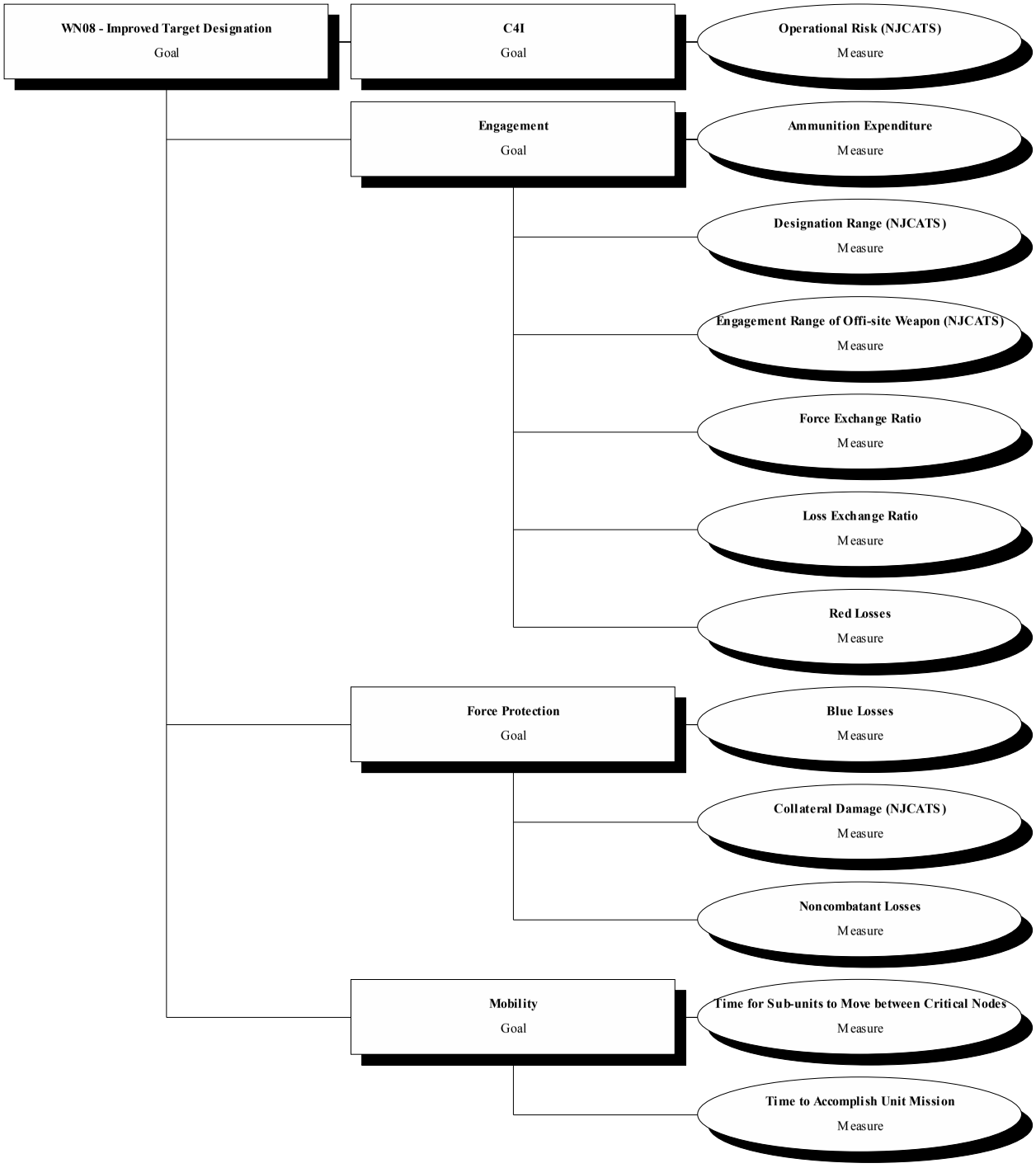
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Identification Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Operational Risk	NJO	NA			Low/Medium/High	
Engagement:	Average Engagement Ranges	JO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses - Fratricide	JO	percentage	0	*100*		
	Blue Losses (by Red)	JO	percentage	0	*100*		
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN07 - Identify Enemy
Goal
C4I
Goal
Identification Range (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Engagement
Goal
Average Engagement Ranges
Measure
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses - Fratricide
Measure
Blue Losses (by Red)
Measure
Noncombatant Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN08 - Improved Target Designation

Definition: To enable target designation and/or hand-off data to off-site shooters, across all arms and services.

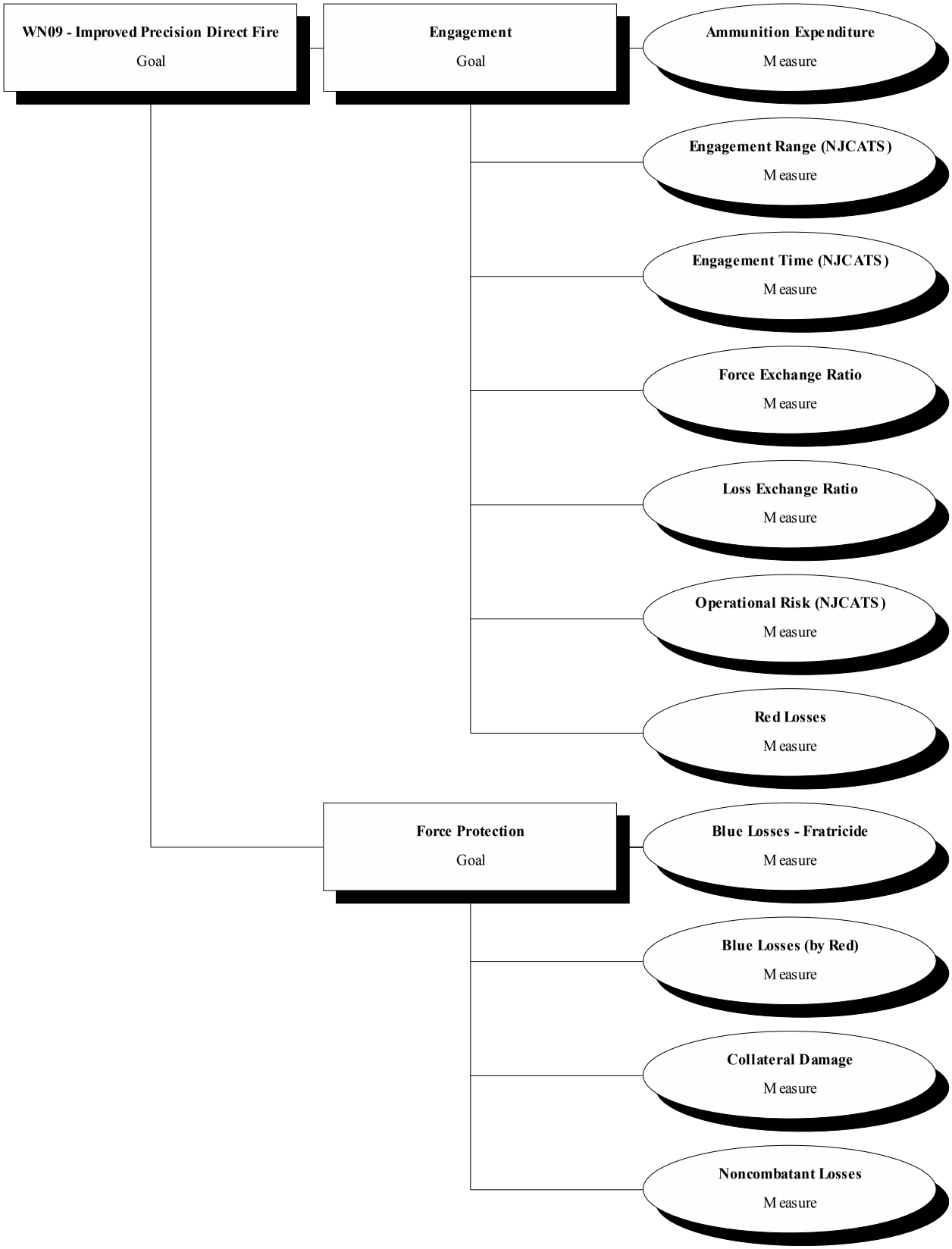
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
Engagement:	Ammunition Expenditure	JO	shots	1	*999999*		
	Designation Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Engagement Range of Off-site Weapon	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
	Collateral Damage	NJO	NA			None/Low/Medium/High	
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN08 - Improved Target Designation
Goal
C4I
Goal
Operational Risk (NJCATS)
Measure
Engagement
Goal
Ammunition Expenditure
Measure
Designation Range (NJCATS)
Measure
Engagement Range of Offi-site Weapon (NJCATS)
Measure
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses
Measure
Collateral Damage (NJCATS)
Measure
Noncombatant Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN09 - Improved Precision Direct Fire

Definition: To improve precision direct fire.

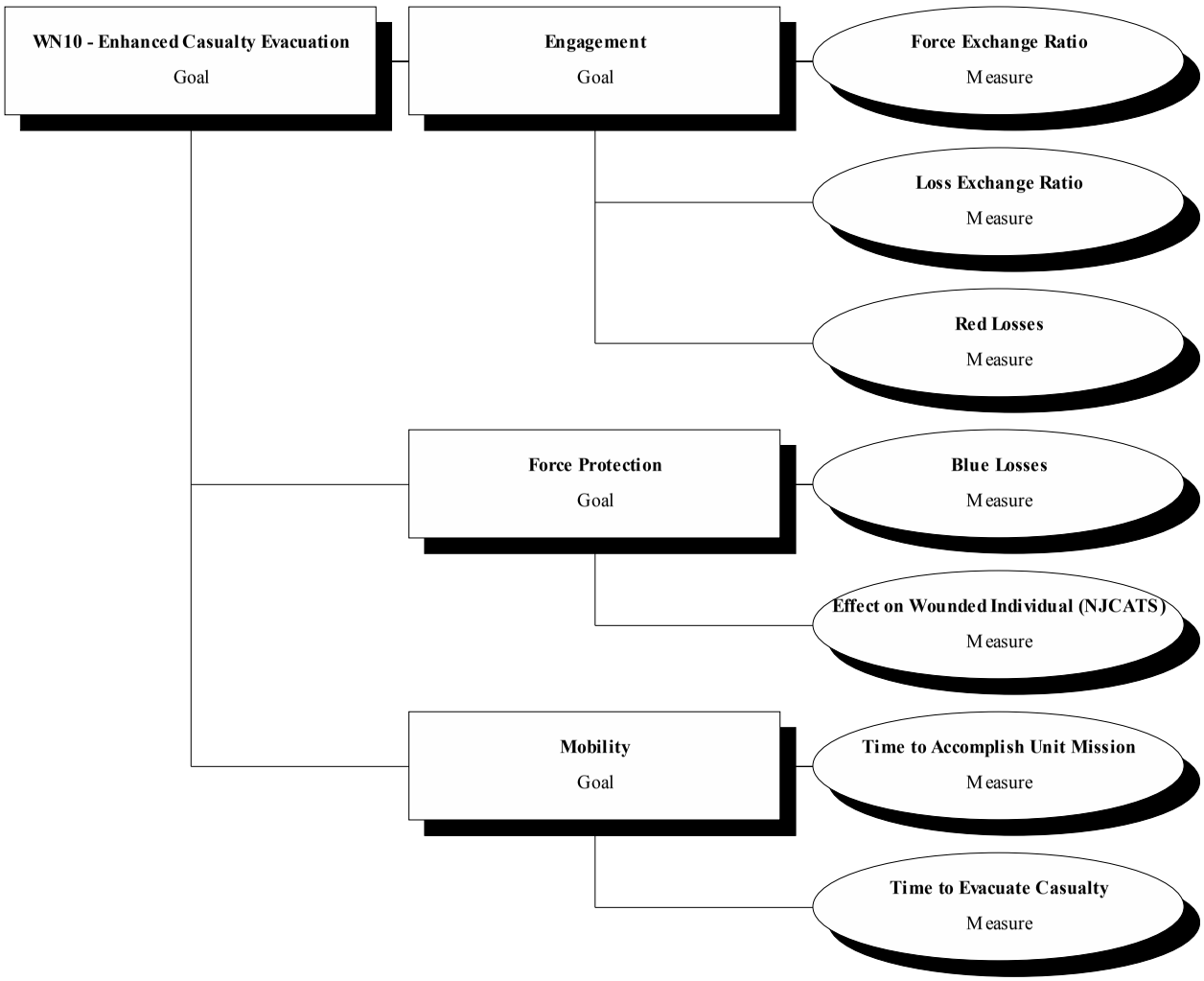
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Ammunition Expenditure	JO	shots	1	*999999*		
	Engagement Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Engagement Time	NJO	seconds	1	3600		
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Operational Risk	NJO	NA			Low/Medium/High	
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses - Fratricide	JO	percentage	0	*100*		
	Blue Losses (by Red)	JO	percentage	0	*100*		
	Collateral Damage	NJO	NA			None/Low/Medium/High	
	Noncombatant Losses	JO	percentage	0	100		


WN09 - Improved Precision Direct Fire
Goal
Engagement
Goal
Ammunition Expenditure
Measure
Engagement Range (NJCATS)
Measure
Engagement Time (NJCATS)
Measure
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Operational Risk (NJCATS)
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses - Fratricide
Measure
Blue Losses (by Red)
Measure
Collateral Damage
Measure
Noncombatant Losses
Measure

WN10 - Enhanced Casualty Evacuation

Definition: To provide means for enhanced casualty evacuation.

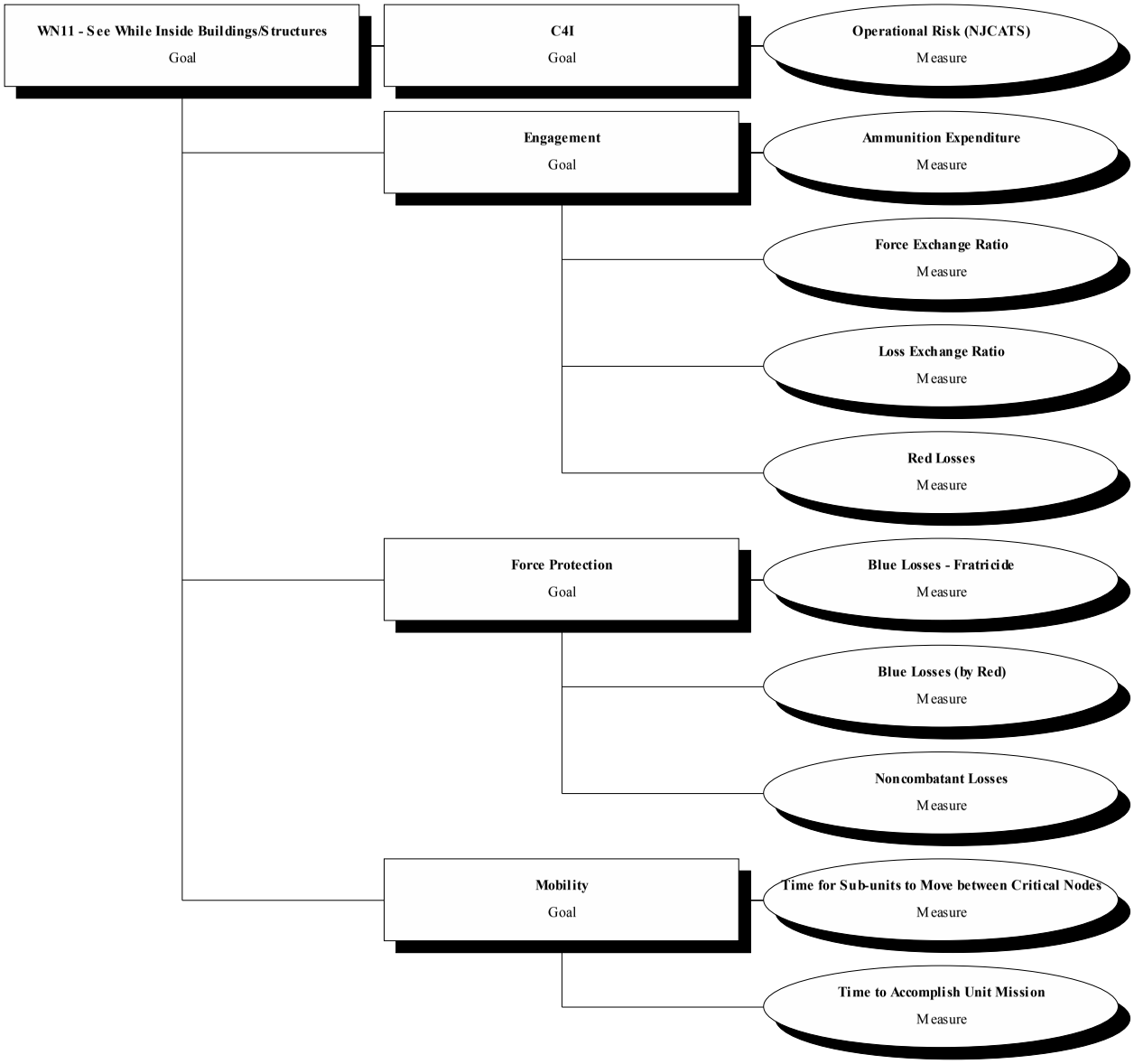
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
	Effect on Wounded Individual	NJO	NA			None/Some/Severe	
Mobility:	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		
	Time to Evacuate Casualty	JO	minutes	1	120		


WN10 - Enhanced Casualty Evacuation
Goal
Engagement
Goal
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses
Measure
Effect on Wounded Individual (NJCATS)
Measure
Mobility
Goal
Time to Accomplish Unit Mission
Measure
Time to Evacuate Casualty
Measure

WN11 - See While Inside Buildings/Structures

Definition: To be able to see while inside buildings/structures at all times.

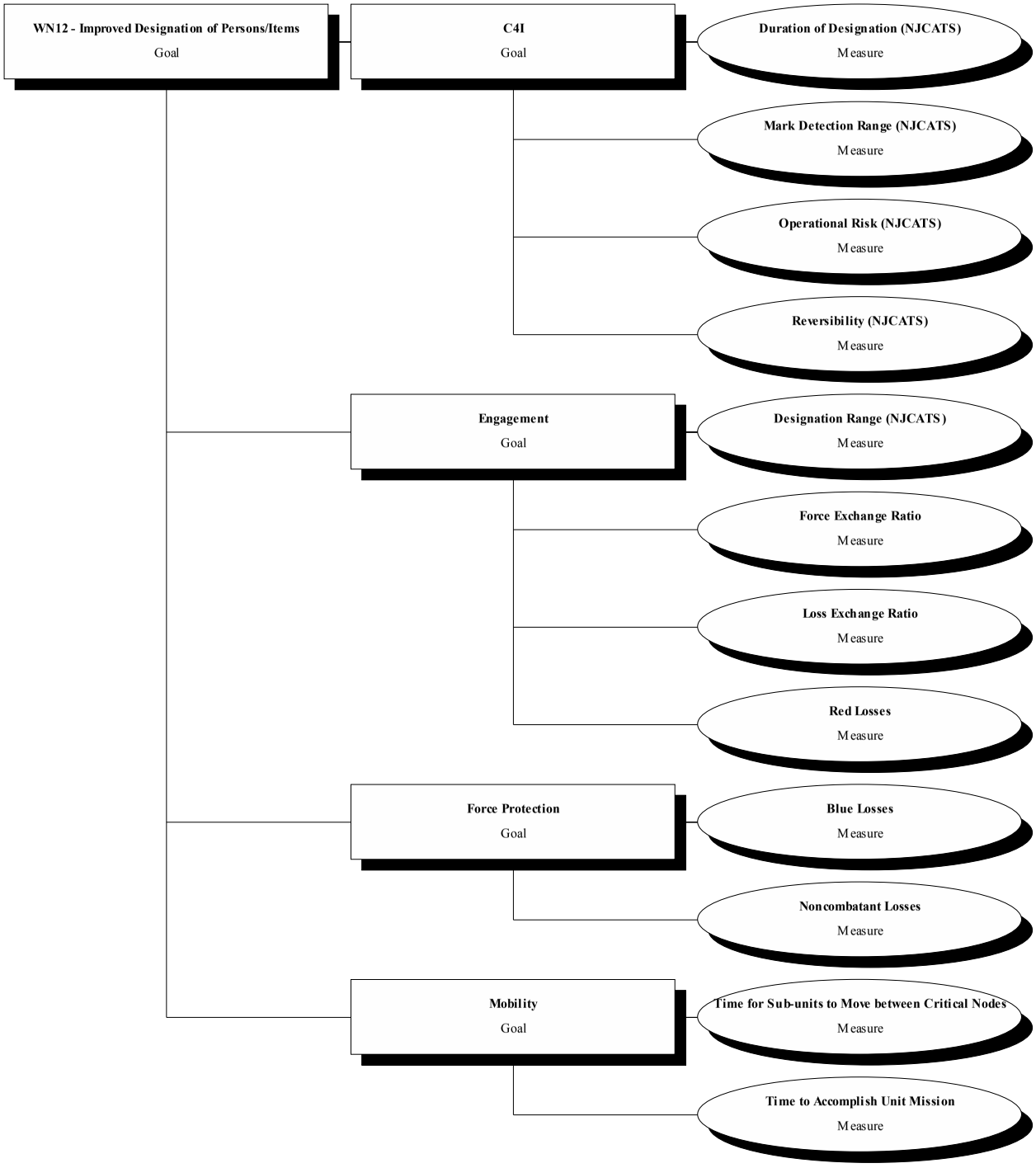
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
Engagement:	Ammunition Expenditure	JO	shots	1	*999999*		
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses - Fratricide	JO	percentage	0	*100*		
	Blue Losses (by Red)	JO	percentage	0	*100*		
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN11 - See While Inside Buildings/Structures
Goal
C4I
Goal
Operational Risk (NJCATS)
Measure
Engagement
Goal
Ammunition Expenditure
Measure
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses - Fratricide
Measure
Blue Losses (by Red)
Measure
Noncombatant Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN12 - Improved Designation of Persons/Items

Definition: To reversibly designate persons or items of interest to friendly forces under all conditions, on-site or remotely.

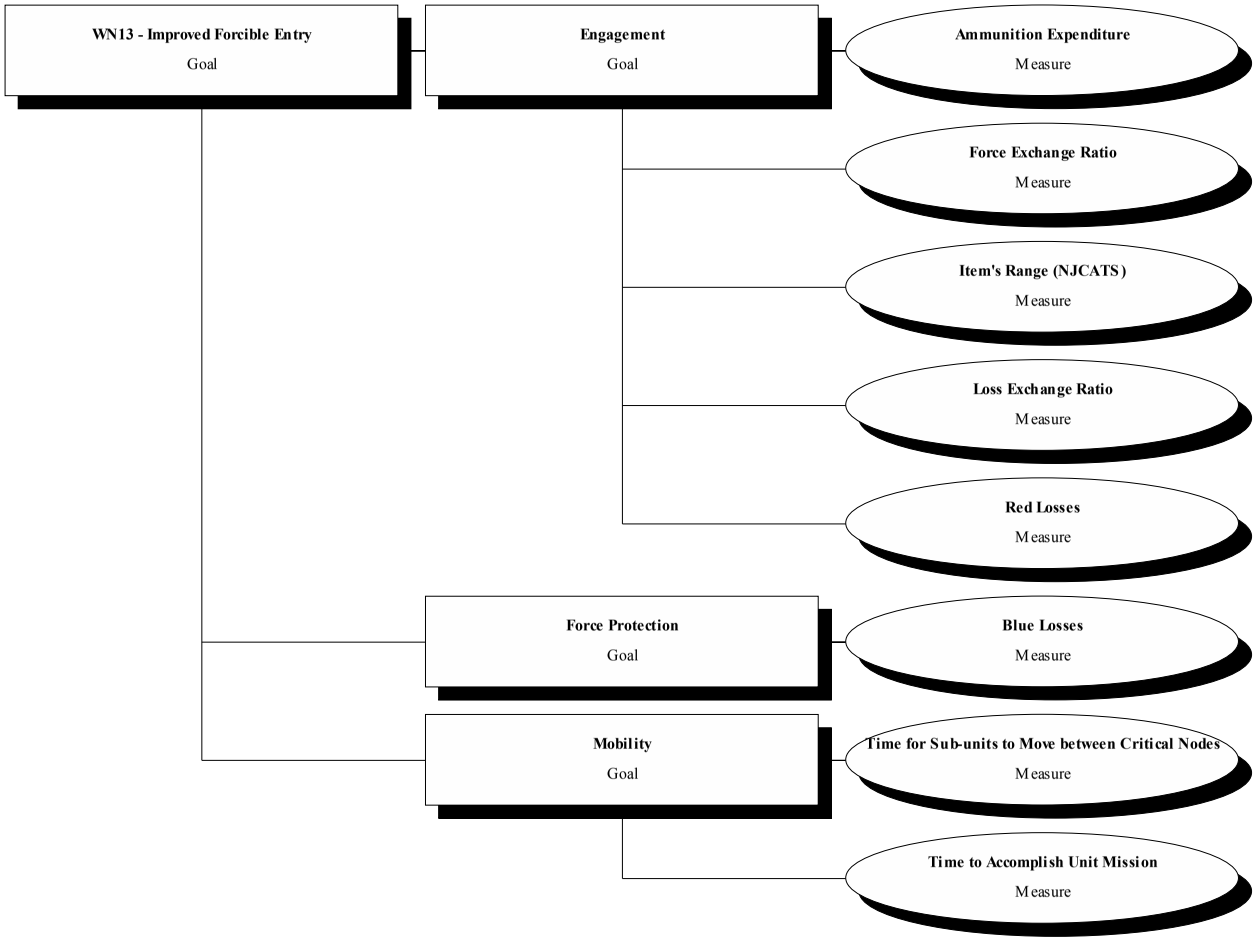
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Duration of Designation	NJO	minutes	*999999*	1		
	Mark Detection Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
	Reversibility	NJO	NA			Yes/No	
Engagement:	Designation Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN12 - Improved Designation of Persons/Items
Goal
C4I
Goal
Duration of Designation (NJCATS)
Measure
Mark Detection Range (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Reversibility (NJCATS)
Measure
Engagement
Goal
Designation Range (NJCATS)
Measure
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses
Measure
Noncombatant Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN13 - Improved Forcible Entry

***Definition*: To improve forcible entry capability (specifically obstacle reduction, interior and exterior building and structure entries; includes need for mechanical breaching kit, remote breaching device, breach trainer).**

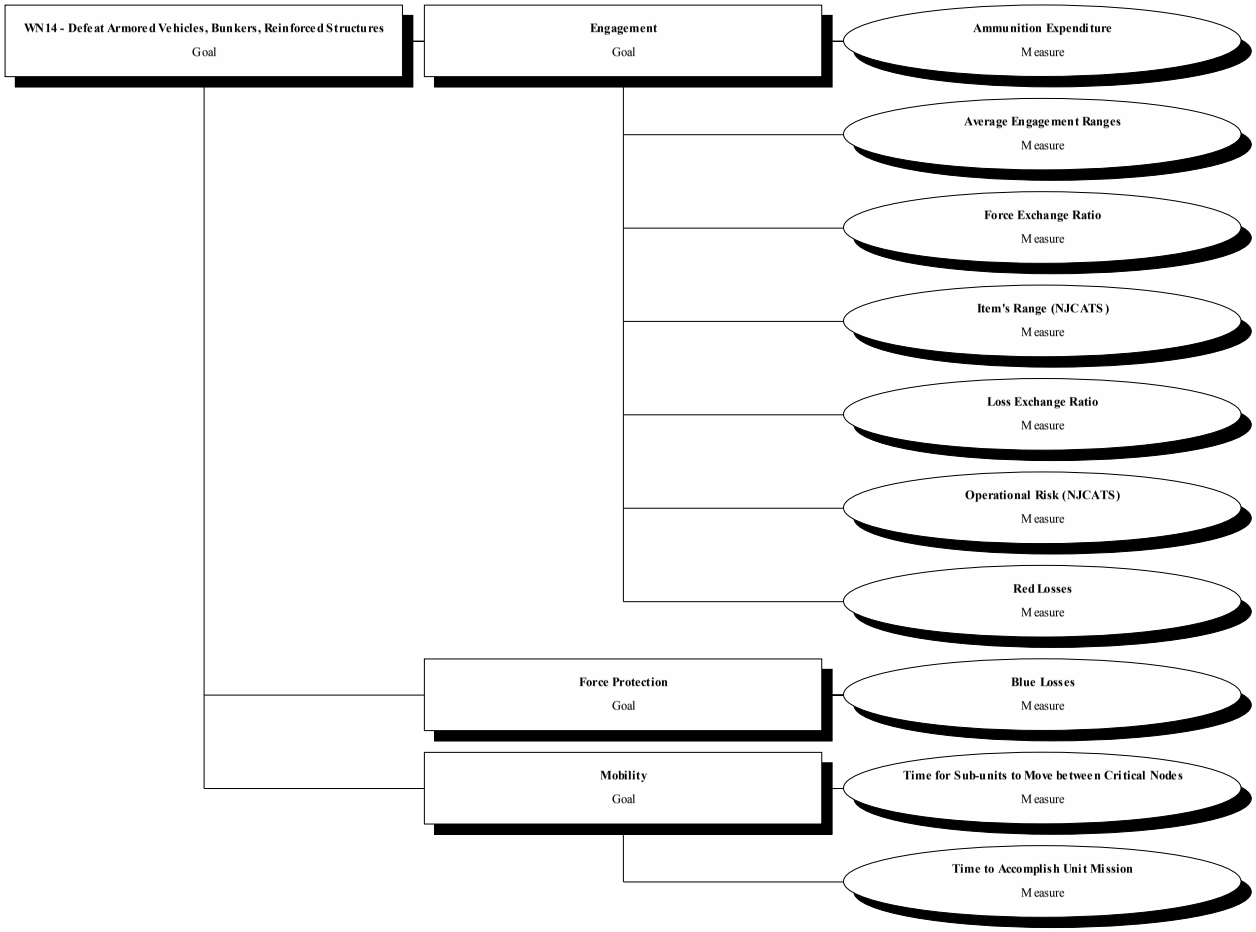
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Ammunition Expenditure	JO	shots	1	*999999*		
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Item's Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN13 - Improved Forcible Entry
Goal
Engagement
Goal
Ammunition Expenditure
Measure
Force Exchange Ratio
Measure
Item's Range (NJCATS)
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN14 - Defeat Armored Vehicles, Bunkers, Reinforced Structures

Definition: To enable individual soldiers/Marines to defeat armored vehicles, neutralize bunkers, and penetrate reinforced structures/walls/bunkers from a confined space.

MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Ammunition Expenditure	JO	shots	1	*999999*		
	Average Engagement Ranges	JO	meters	50000	0		Measure refers to average engagement ranges overall; Most preferred range reflects distance for very long range fires.
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Item's Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN14 - Defeat Armored Vehicles, Bunkers, Reinforced Structures
Goal
Engagement
Goal
Ammunition Expenditure
Measure
Average Engagement Ranges
Measure
Force Exchange Ratio
Measure
Item's Range (NJCATS)
Measure
Loss Exchange Ratio
Measure
Operational Risk (NJCATS)
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN15 - Knowledge of Other Side of Wall

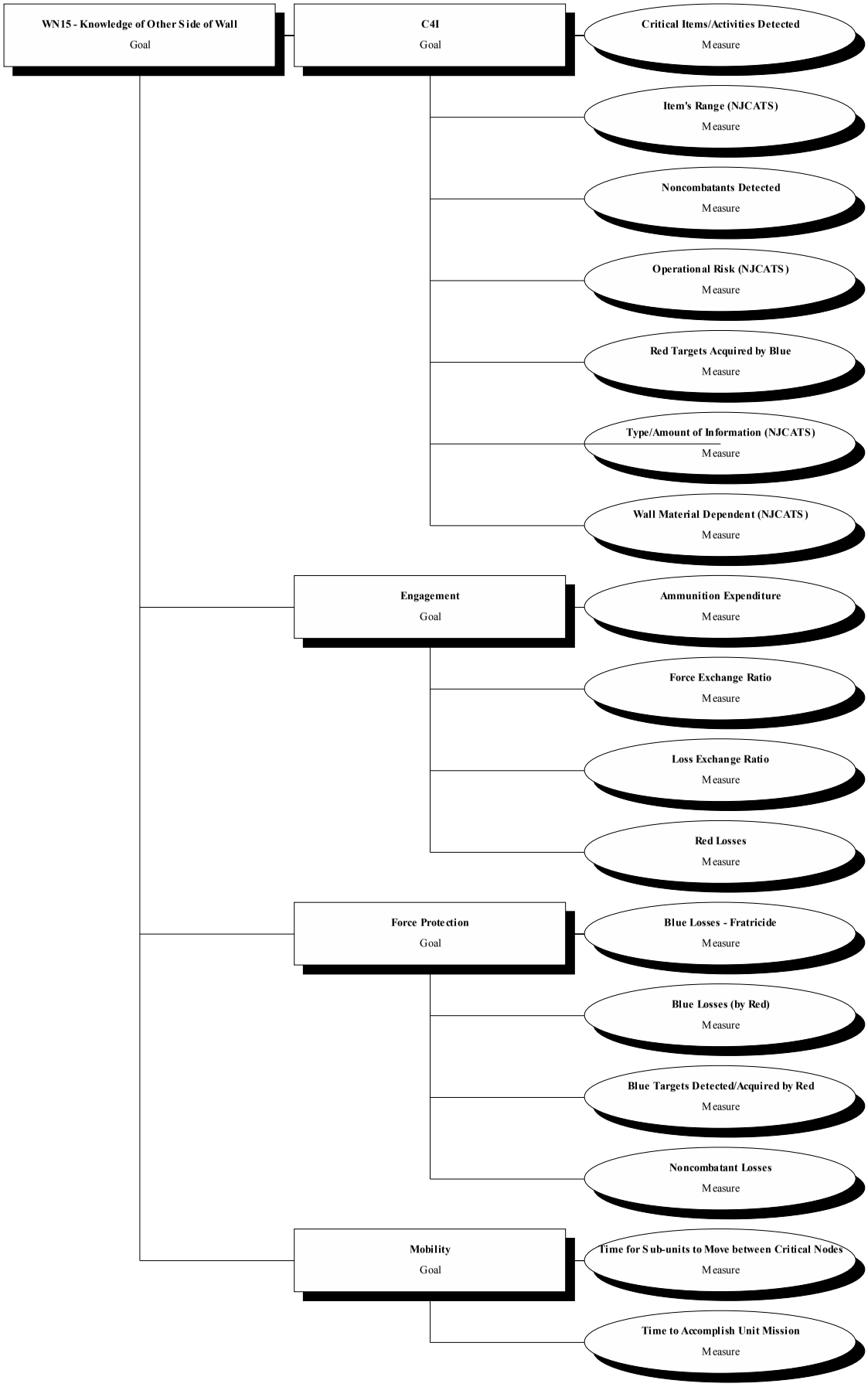
***Definition*: To know what is on the other side of an opaque wall.**

MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Critical Items/Activities Detected	JO	percentage	100	0		Measure refers to number of critical events detected/total number of critical events
	Item's Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Noncombatants Detected	JO	percentage	100	0		
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature, false positives
	Red Targets Acquired by Blue	JO	percentage	100	0		
	Type/Amount of Information	NJO	NA			All from Below/4 from Below/3 from Below/2 from Below/ Armed/ Side/ Location/ Number/ Occupied	
	Wall Material Dependent	NJO	NA			No/Yes	
Engagement:	Ammunition Expenditure	JO	shots	1	*999999*		
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		

WN15 - Knowledge of Other Side of Wall (cont.)

Definition: To know what is on the other side of an opaque wall.

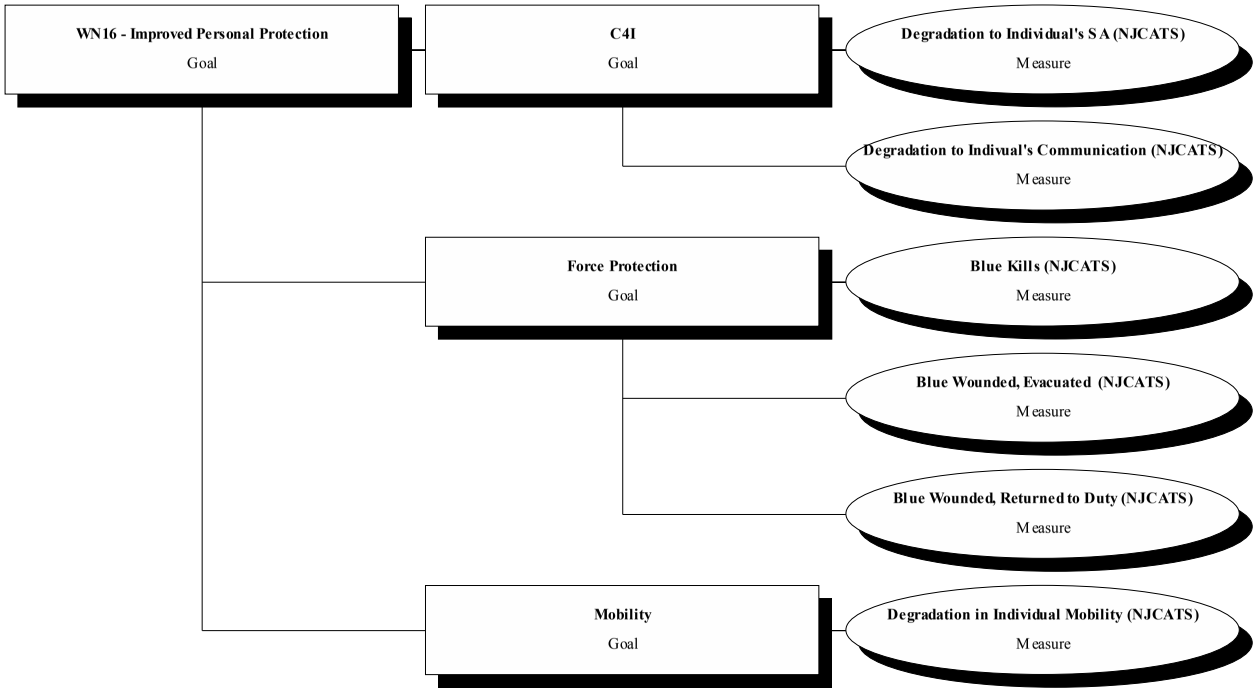
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Force Protection:	Blue Losses - Fratricide	JO	percentage	0	*100*		
	Blue Losses (by Red)	JO	percentage	0	*100*		
	Blue Targets Detected/Acquired by Red	JO	NA			No/Yes	
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN15 - Knowledge of Other Side of Wall
Goal
C4I
Goal
Critical Items/Activities Detected
Measure
Item's Range (NJCATS)
Measure
Noncombatants Detected
Measure
Operational Risk (NJCATS)
Measure
Red Targets Acquired by Blue
Measure
Type/Amount of Information (NJCATS)
Measure
Wall Material Dependent (NJCATS)
Measure
Engagement
Goal
Ammunition Expenditure
Measure
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses - Fratricide
Measure
Blue Losses (by Red)
Measure
Blue Targets Detected/Acquired by Red
Measure
Noncombatant Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN16 - Improved Personal Protection

Definition: To improve personal protection system (specifically improvement in head, torso, hands, eyes, ears protection against flame, cuts/puncture, overpressure, ballistic, laser, environmental) usable in both training and operation.

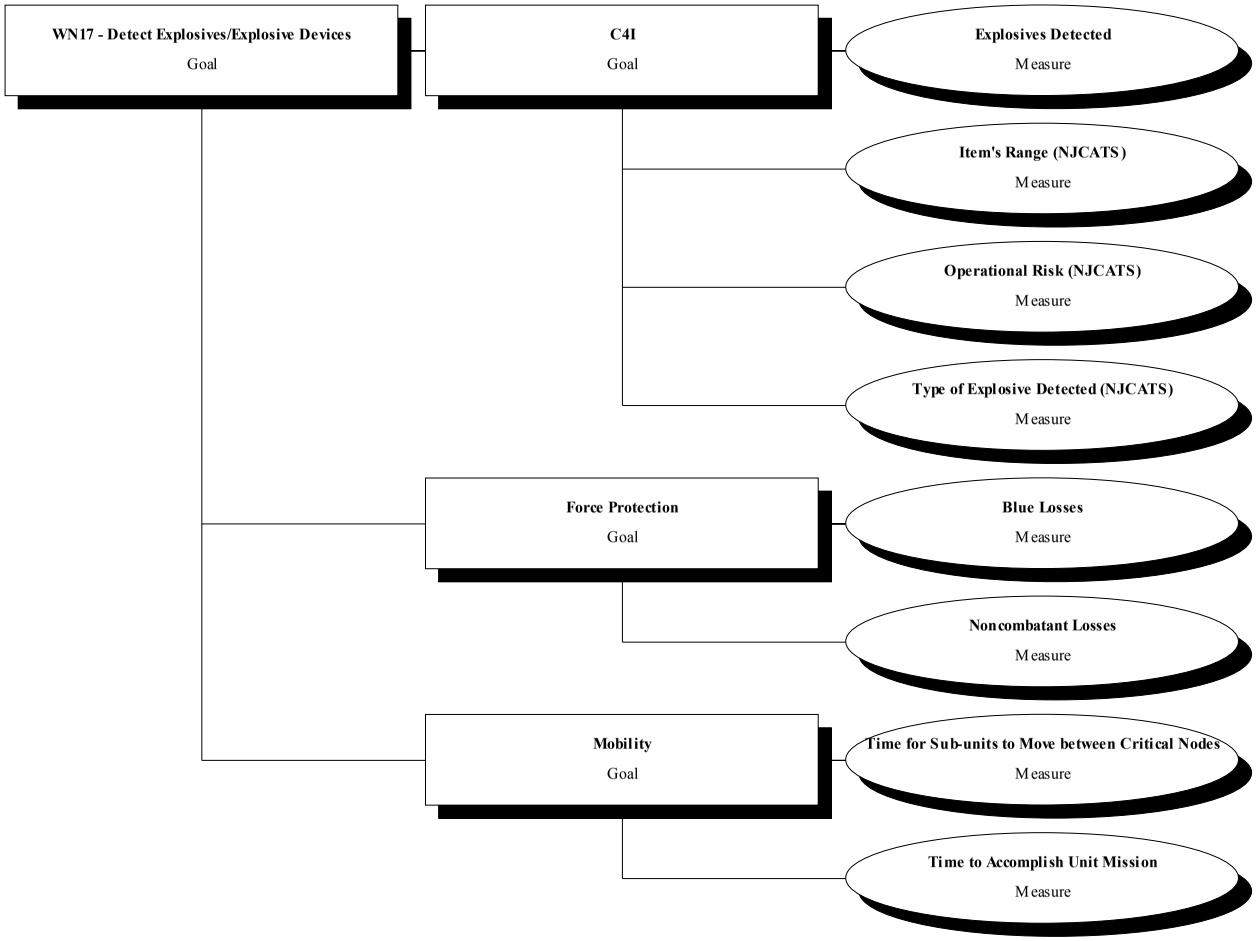
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Degradation of Individual's SA	NJO	NA			None/Low/Medium/High	
	Degradation of Individual's Communications	NJO	NA			None/Low/Medium/High	
Force Protection:	Blue Kills	NJO	percentage	0	*100*		
	Blue Wounded, Evacuated	NJO	percentage	0	*100*		
	Blue Wounded, Returned to Duty	NJO	percentage	0	*100*		
Mobility:	Degradation in Individual Mobility	NJO	NA			None/Low/Medium/High	


WN16 - Improved Personal Protection
Goal
C4I
Goal
Degradation to Individual's SA (NJCATS)
Measure
Degradation to Indivual's Communication (NJCATS)
Measure
Force Protection
Goal
Blue Kills (NJCATS)
Measure
Blue Wounded, Evacuated (NJCATS)
Measure
Blue Wounded, Returned to Duty (NJCATS)
Measure
Mobility
Goal
Degradation in Individual Mobility (NJCATS)
Measure

WN17 - Detect Explosives/Explosive Devices

Definition: To detect explosives/explosive devices/mines inside buildings and in/around built up areas.

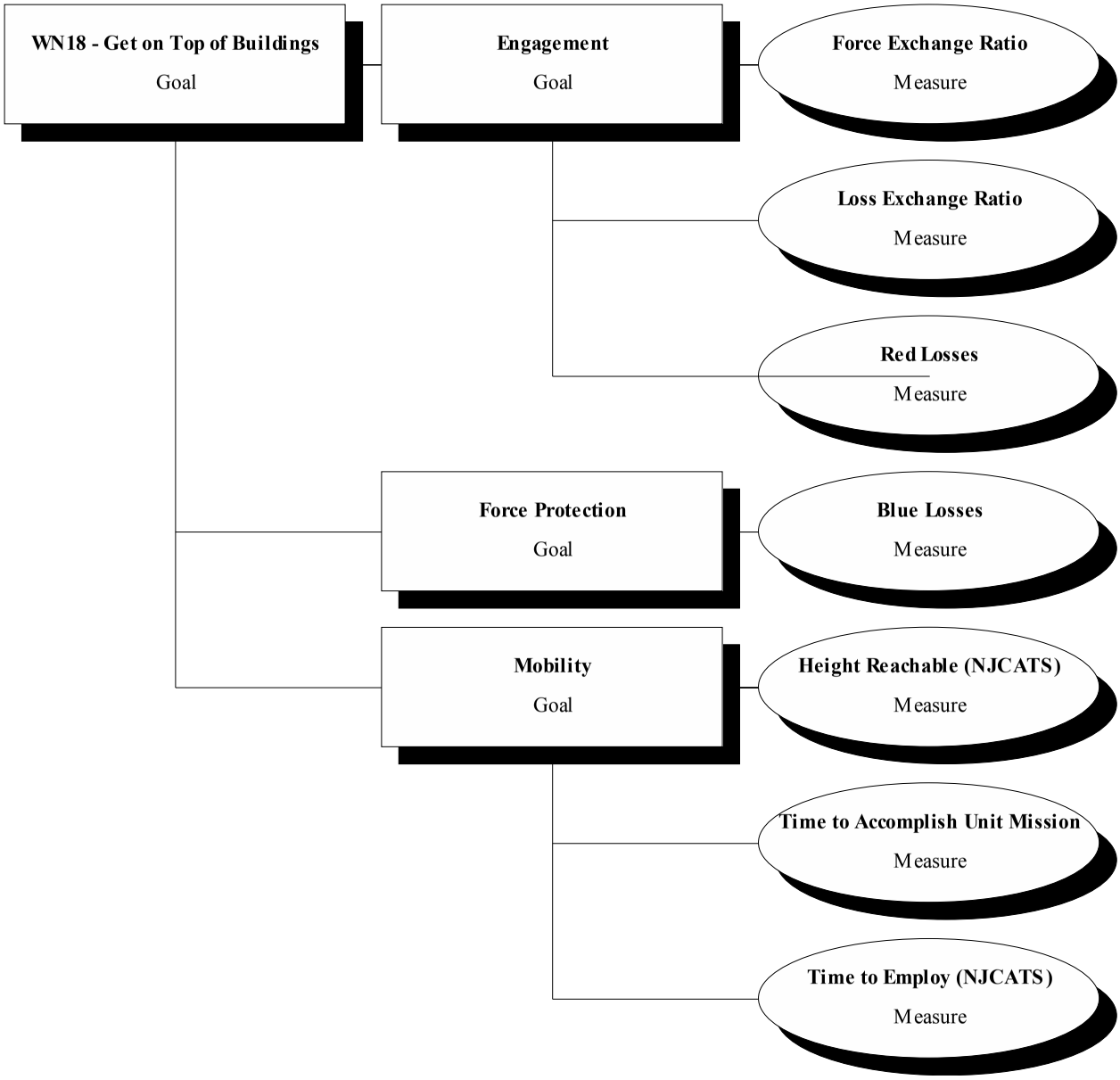
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Explosives Detected	JO	percentage	100	0		
	Item's Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
	Type of Explosive Detected	NJO	NA			All/Some/One	
Force Protection:	Blue Losses	JO	percentage	0	*100*		
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN17 - Detect Explosives/Explosive Devices
Goal
C4I
Goal
Explosives Detected
Measure
Item's Range (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Type of Explosive Detected (NJCATS)
Measure
Force Protection
Goal
Blue Losses
Measure
Noncombatant Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN18 - Get on Top of Buildings

Definition: To be able to put/get soldiers and Marines on top of buildings.

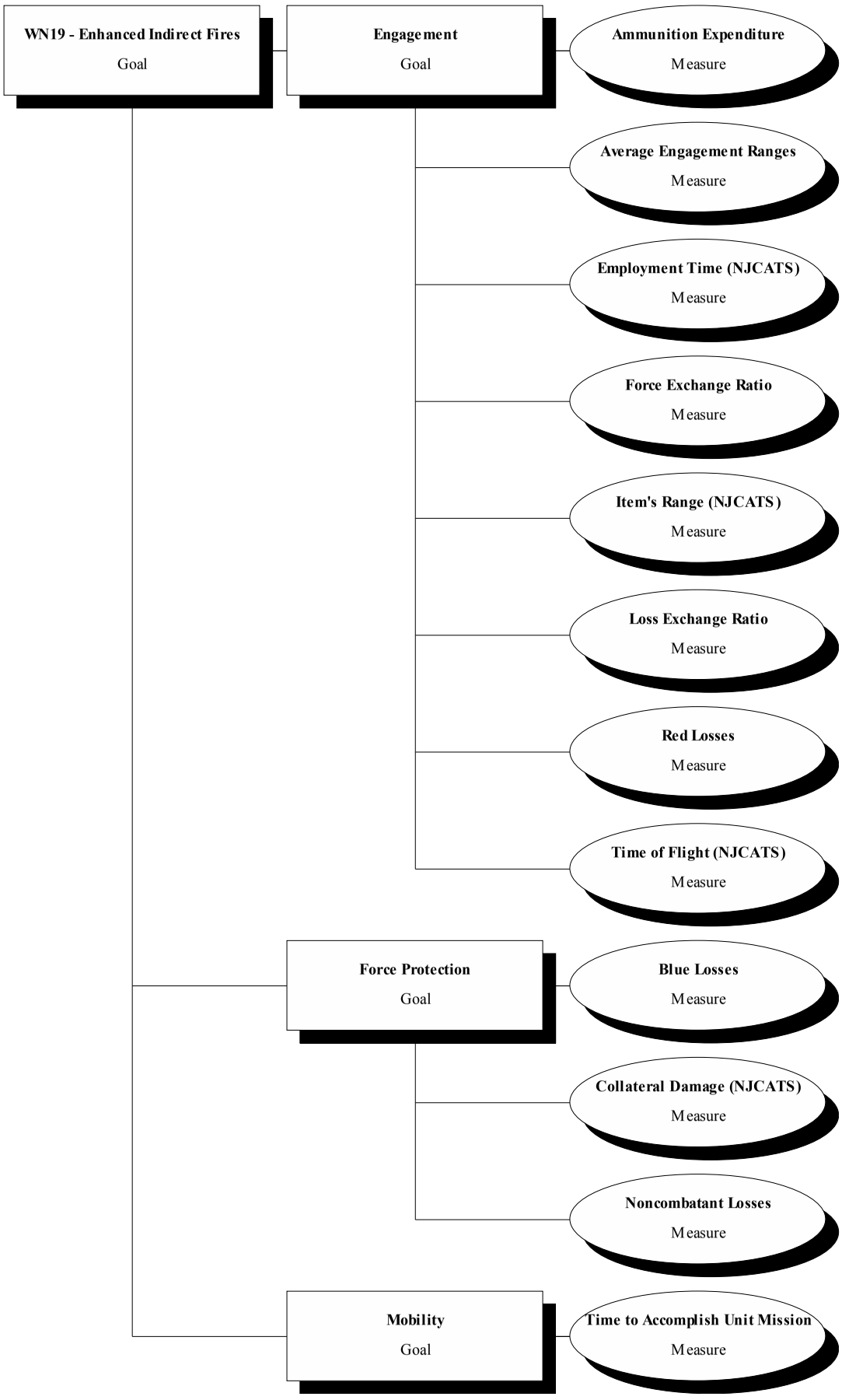
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
Mobility:	Height Reachable	NJO	NA			Unlimited stories, More than 5 stories, 4-5 stories, 3 stories, Less than 3 stories	
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		
	Time to Employ	NJO	seconds	1	3600		


WN18 - Get on Top of Buildings
Goal
Engagement
Goal
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses
Measure
Mobility
Goal
Height Reachable (NJCATS)
Measure
Time to Accomplish Unit Mission
Measure
Time to Employ (NJCATS)
Measure

WN19 - Enhanced Indirect Fires

Definition: To enhance indirect fires.

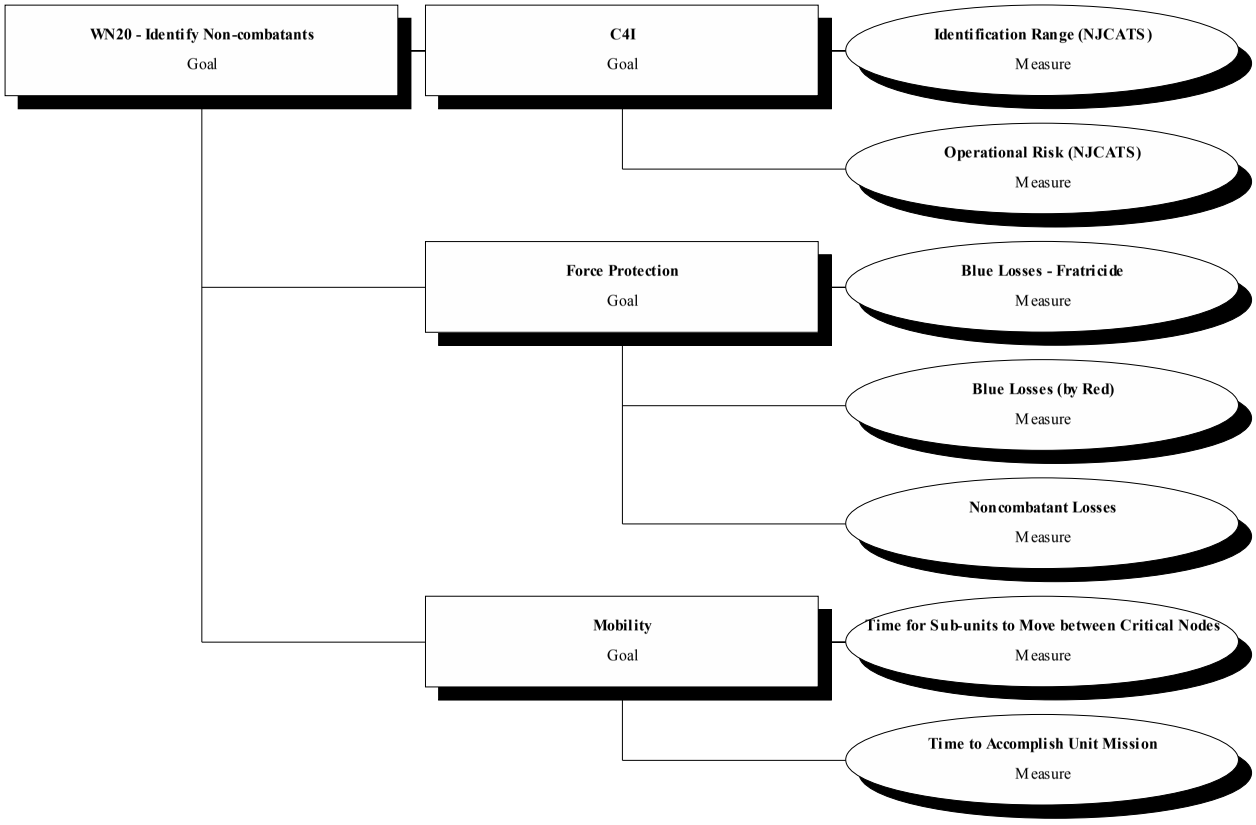
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Ammunition Expenditure	JO	shots	1	*999999*		
	Average Engagement Ranges	JO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Employment Time	NJO	seconds	1	*999999*		
	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Item's Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Loss Exchange Ratio	JO	NA	999999	0		
	Red Losses	JO	percentage	100	0		
	Time of Flight	NJO	seconds	1	*999999*		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
	Collateral Damage	NJO	NA			None/Low/Medium/High	
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN19 - Enhanced Indirect Fires
Goal
Engagement
Goal
Ammunition Expenditure
Measure
Average Engagement Ranges
Measure
Employment Time (NJCATS)
Measure
Force Exchange Ratio
Measure
Item's Range (NJCATS)
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Time of Flight (NJCATS)
Measure
Force Protection
Goal
Blue Losses
Measure
Collateral Damage (NJCATS)
Measure
Noncombatant Losses
Measure
Mobility
Goal
Time to Accomplish Unit Mission
Measure

WN20 - Identify Non-Combatants

Definition: To identify non-combatants under all conditions.

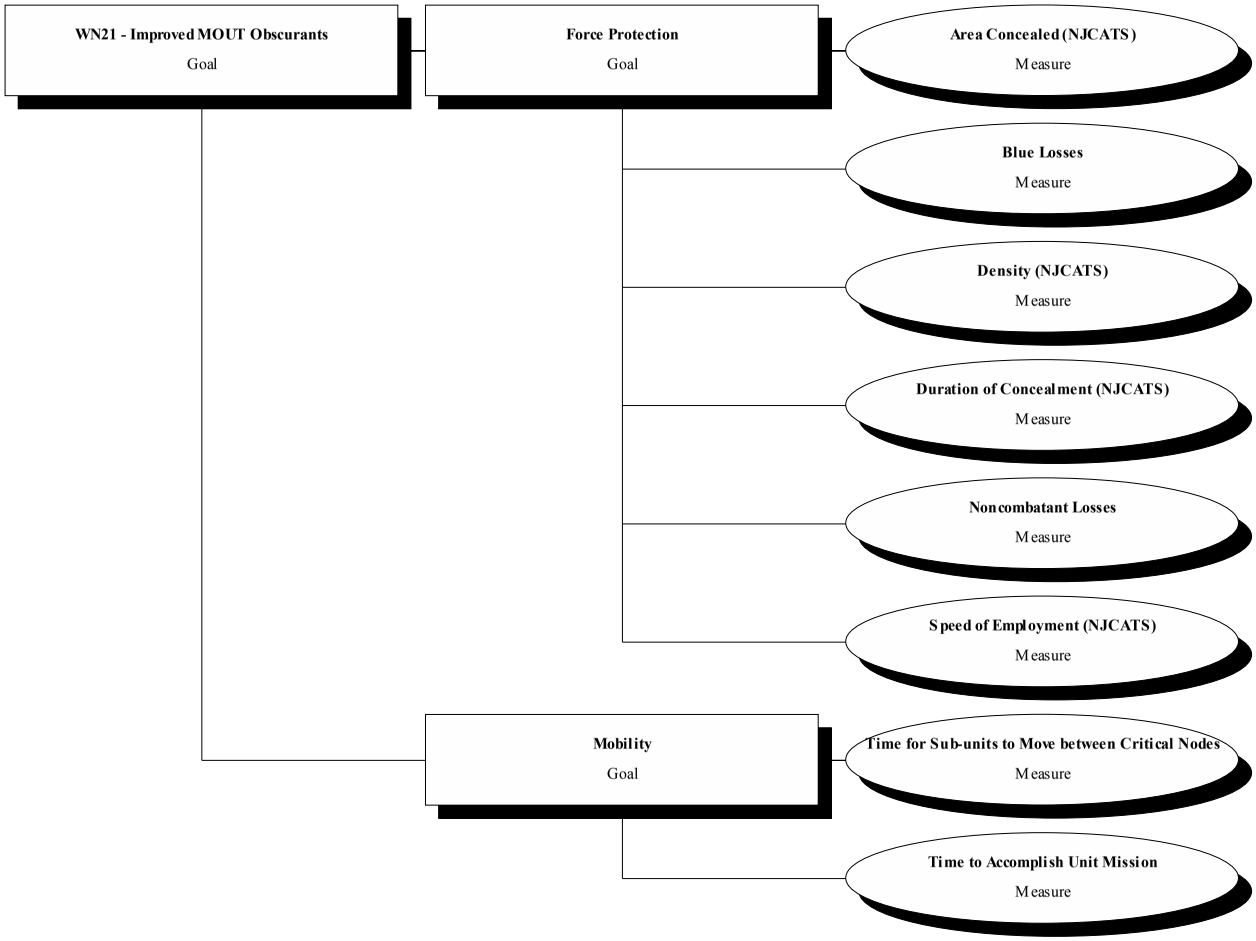
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Identification Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature, false positives
Force Protection:	Blue Losses - Fratricide	JO	percentage	0	*100*		
	Blue Losses (by Red)	JO	percentage	0	*100*		
	Noncombatant Losses	JO	percentage	0	100		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN20 - Identify Non-combatants
Goal
C4I
Goal
Identification Range (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Force Protection
Goal
Blue Losses - Fratricide
Measure
Blue Losses (by Red)
Measure
Noncombatant Losses
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN21 - Improved MOUT Obscurants

Definition: To improve MOUT obscurants at individual soldier/Marine level.

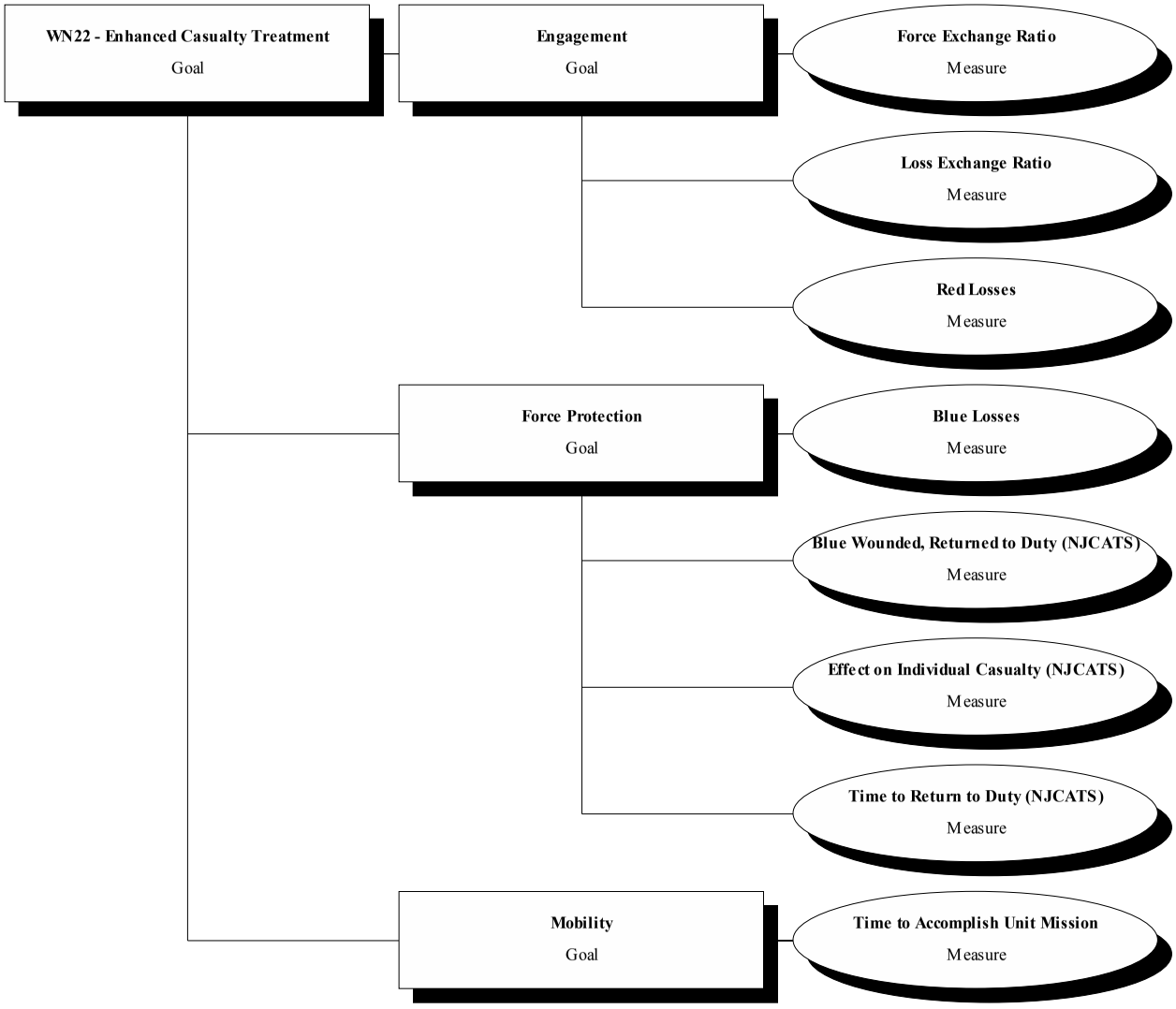
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Force Protection:	Area Concealed	NJO	meters squared	300	0		
	Blue Losses	JO	percentage	0	*100*		
	Density	NJO	particles per cubic centimeter	*999999*	1		
	Duration of Concealment	NJO	minutes	120	0		
	Noncombatant Losses	JO	percentage	0	100		
	Speed of Employment	NJO	seconds	0	7200		
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN21 - Improved MOUT Obscurants
Goal
Force Protection
Goal
Area Concealed (NJCATS)
Measure
Blue Losses
Measure
Density (NJCATS)
Measure
Duration of Concealment (NJCATS)
Measure
Noncombatant Losses
Measure
Speed of Employment (NJCATS)
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN22 - Enhanced Casualty Treatment

Definition: To provide means for enhanced casualty treatment.

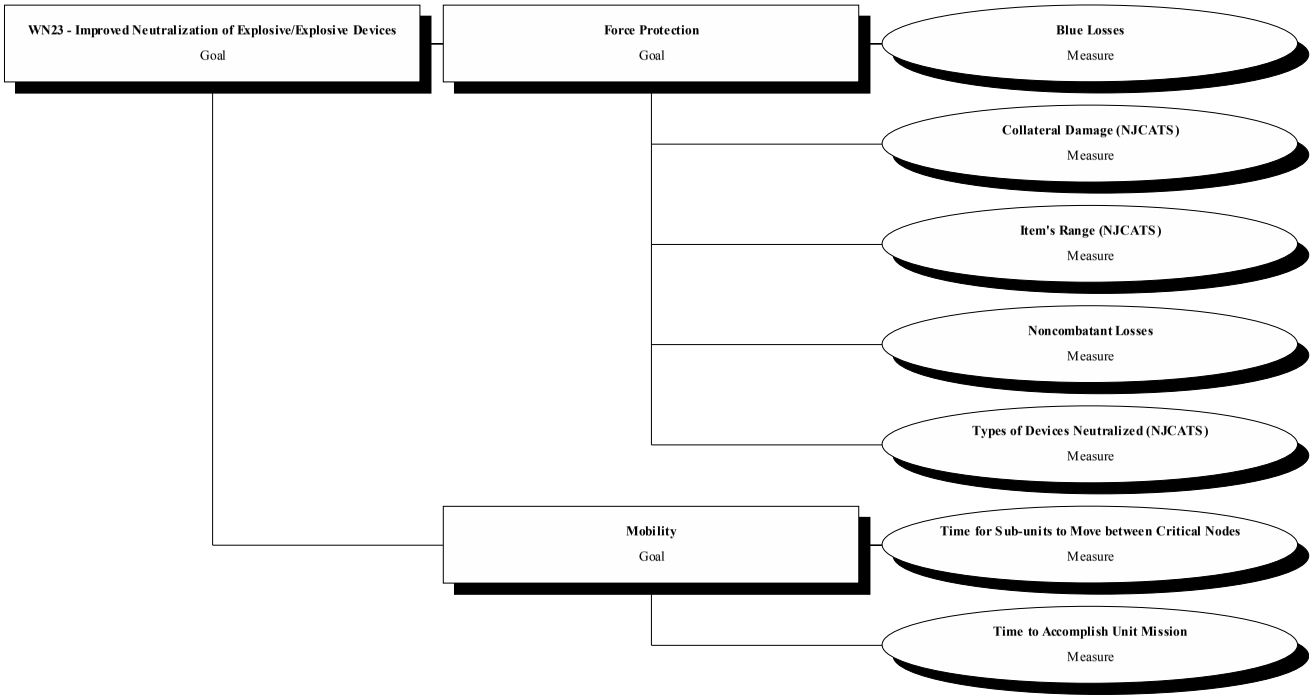
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
	Blue Wounded, Returned to Duty	NJO	percentage	100	0		
	Effect on Individual Casualty	NJO	NA			Great improvement over current system/ Little improvement over current system/ No improvement over current system	Measure reflects level, speed, result of treatment
	Time to Return to Duty	NJO	hours	0.5	720		
Mobility:	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN22 - Enhanced Casualty Treatment
Goal
Engagement
Goal
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses
Measure
Blue Wounded, Returned to Duty (NJCATS)
Measure
Effect on Individual Casualty (NJCATS)
Measure
Time to Return to Duty (NJCATS)
Measure
Mobility
Goal
Time to Accomplish Unit Mission
Measure

WN23 - Improved Neutralization of Explosives/Explosive Devices

Definition: To improve neutralization of explosives/explosive devices/mines inside buildings or in/around built up areas.

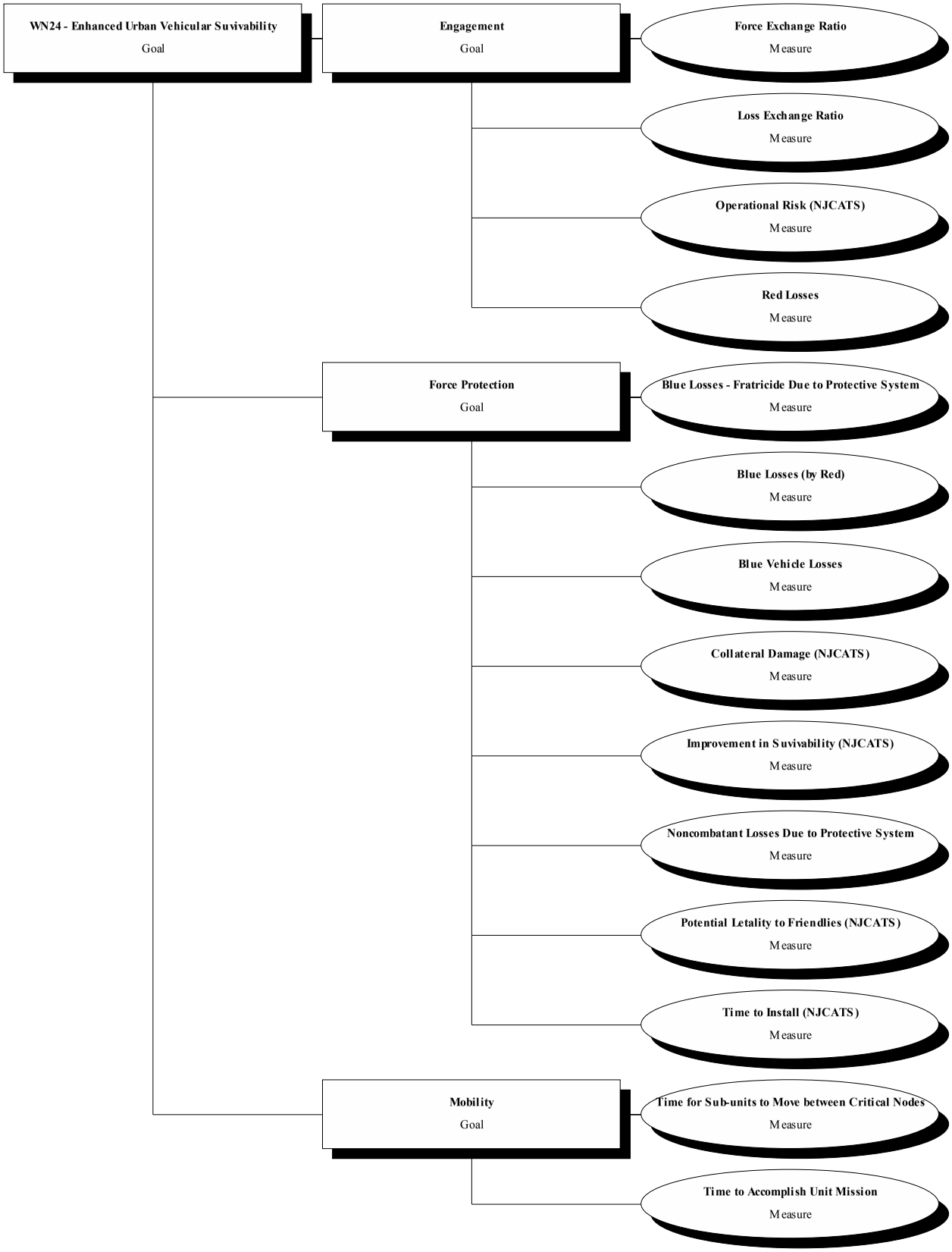
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Force Protection:	Blue Losses	JO	percentage	0	*100*		
	Collateral Damage	NJO	NA			None/Low/Medium/High	
	Item's Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires
	Noncombatant Losses	JO	percentage	0	100		
	Types of Devices Neutralized	NJO	NA			All/Some/One	
Mobility:	Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN23 - Improved Neutralization of Explosive/Explosive Devices
Goal
Force Protection
Goal
Blue Losses
Measure
Collateral Damage (NJCATS)
Measure
Item's Range (NJCATS)
Measure
Noncombatant Losses
Measure
Types of Devices Neutralized (NJCATS)
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN24 - Enhanced Urban Vehicular Survivability

Definition: To enhance vehicular survivability during an urban operation.

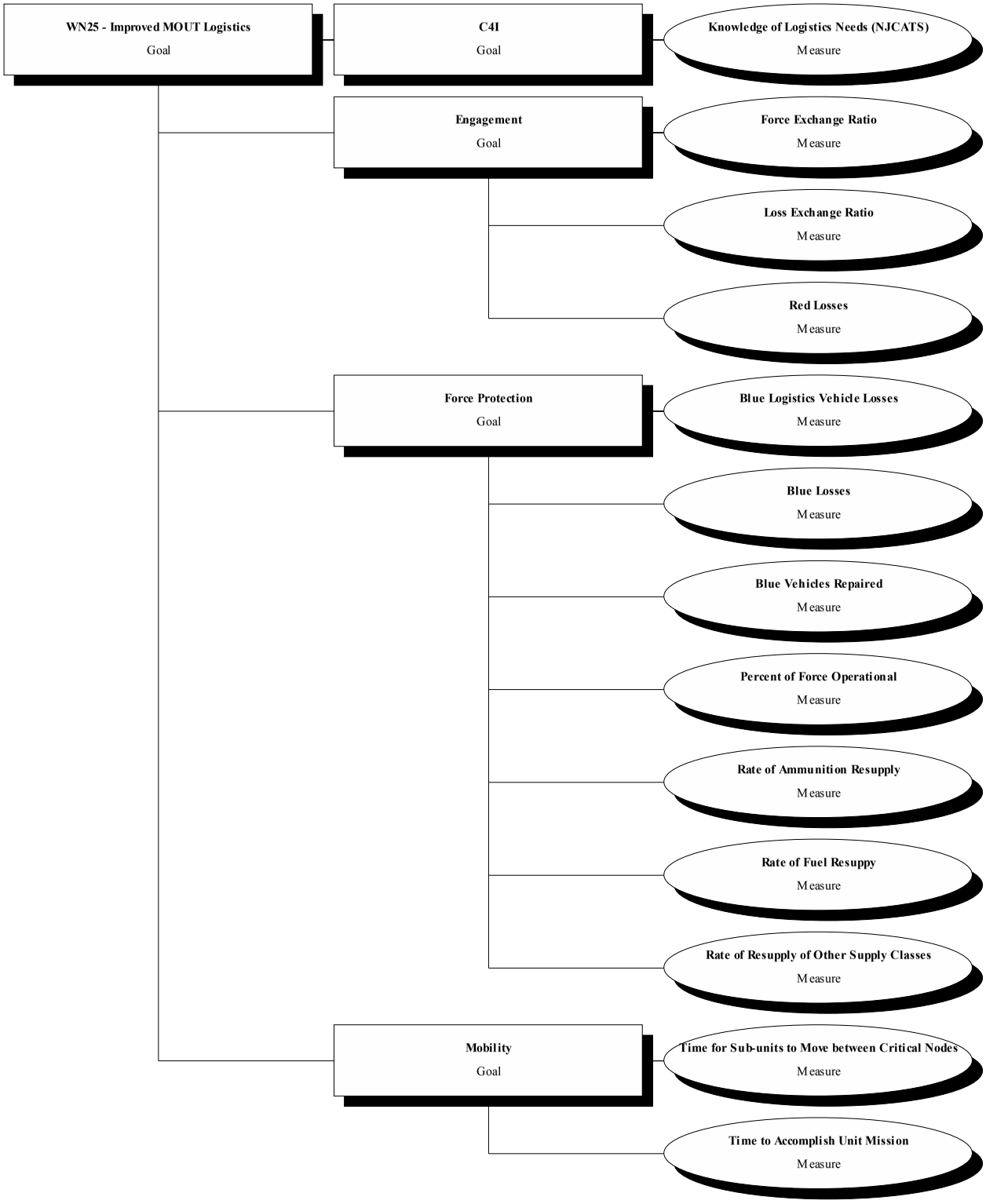
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Operational Risk	NJO	NA			Low/Medium/High	
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses - Fratricide due to Protective System	JO	percentage	0	*100*		
	Blue Losses (by Red)	JO	percentage	0	*100*		
	Blue Vehicle Losses	JO	NA			No Loss/Mobility Loss/Fire Power Loss/Mobility Loss and Fire Power Loss/Catastrophic Loss	
	Collateral Damage	NJO	NA			None/Low/Medium/High	
	Improvement in Survivability	NJO	percentage	*999999*	0		
	Noncombatant Losses due to Protective System	JO	percentage	0	100		
	Potential Lethality to Friendlies	NJO	percentage	100	0		Measure refers to pk range for this based on area of band in the immediate vicinity of the vehicle.
	Time to Install	NJO	seconds	0	7200		
Mobility:	Time for Sub-units to Move between Critical Needs	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN24 - Enhanced Urban Vehicular Suvivability
Goal
Engagement
Goal
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Operational Risk (NJCATS)
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses - Fratricide Due to Protective System
Measure
Blue Losses (by Red)
Measure
Blue Vehicle Losses
Measure
Collateral Damage (NJCATS)
Measure
Improvement in Suvivability (NJCATS)
Measure
Noncombatant Losses Due to Protective System
Measure
Potential Letality to Friendlies (NJCATS)
Measure
Time to Install (NJCATS)
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN25 - Improved MOUT Logistics

Definition: To improve logistics capability (Fuel, Fix, Replace, Move, Arm, and Feed) in the urban environment.

MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Knowledge of Logistics Needs	NJO	NA			Greatly improved over current system/ Somewhat improved over current system/ Same as current system	Measure refers to what, when, where
Engagement:	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Logistics Vehicle Losses	JO	percentage	0	*100*		
	Blue Losses	JO	percentage	0	*100*		
	Blue Vehicles Repaired	JO	percentage	100	0		
	Percent of Force Operational	JO	percentage	100	0		
	Rate of Ammunition Resupply	JO	rounds per hour	*999999*	0		
	Rate of Fuel Resupply	JO	gallons per hour	*999999*	0		
	Rate of Resupply of Other Supply Classes	JO	units per hour	*999999*	0		Measure includes water, food, etc.
Mobility:	Time for Sub-unit to Move between Critical Nodes	JO	minutes	0	*999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		

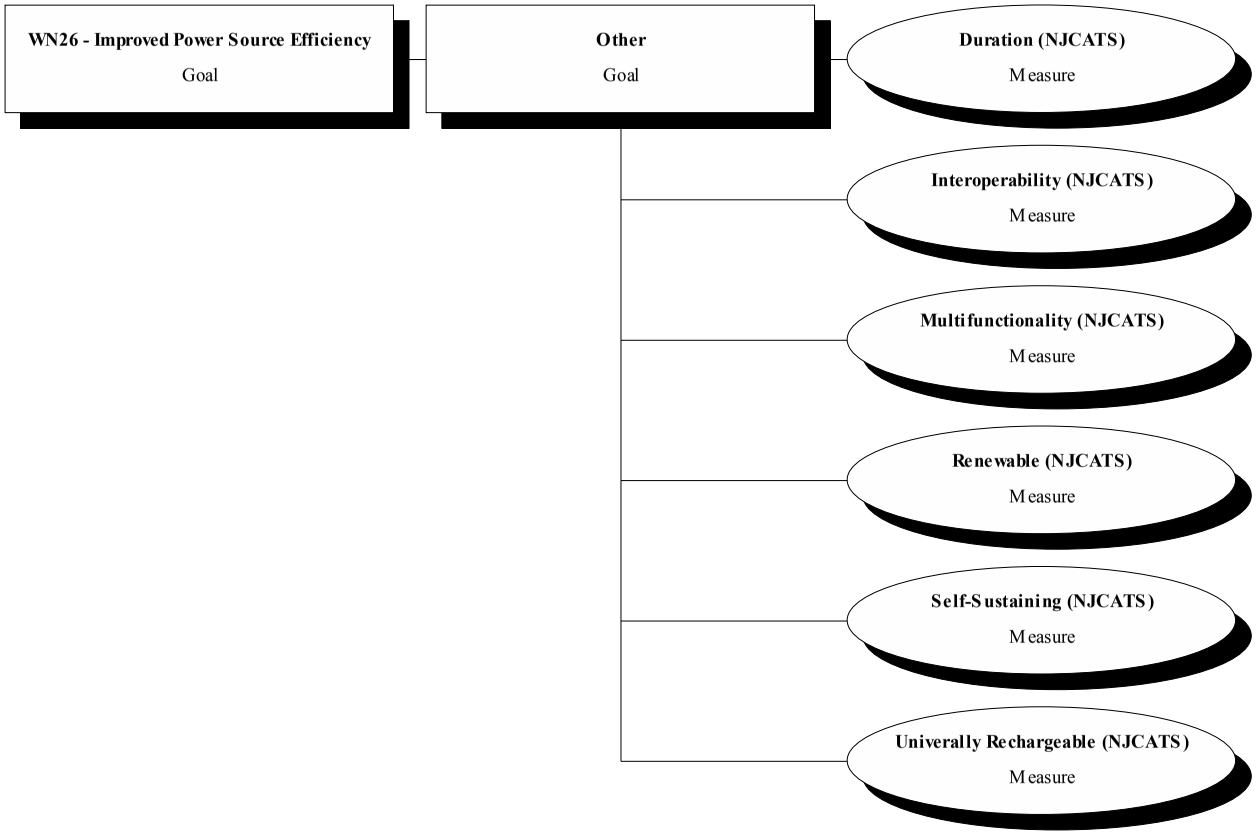

WN25 - Improved MOUT Logistics
Goal
C4I
Goal
Knowledge of Logistics Needs (NJCATS)
Measure
Engagement
Goal
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Logistics Vehicle Losses
Measure
Blue Losses
Measure
Blue Vehicles Repaired
Measure
Percent of Force Operational
Measure
Rate of Ammunition Resupply
Measure
Rate of Fuel Resuppy
Measure
Rate of Resupply of Other Supply Classes
Measure
Mobility
Goal
Time for Sub-units to Move between Critical Nodes
Measure
Time to Accomplish Unit Mission
Measure

WN26 - Improved Power Source Efficiency

Definition: To improve efficiency of battlefield power sources.

Not Modeling Oriented

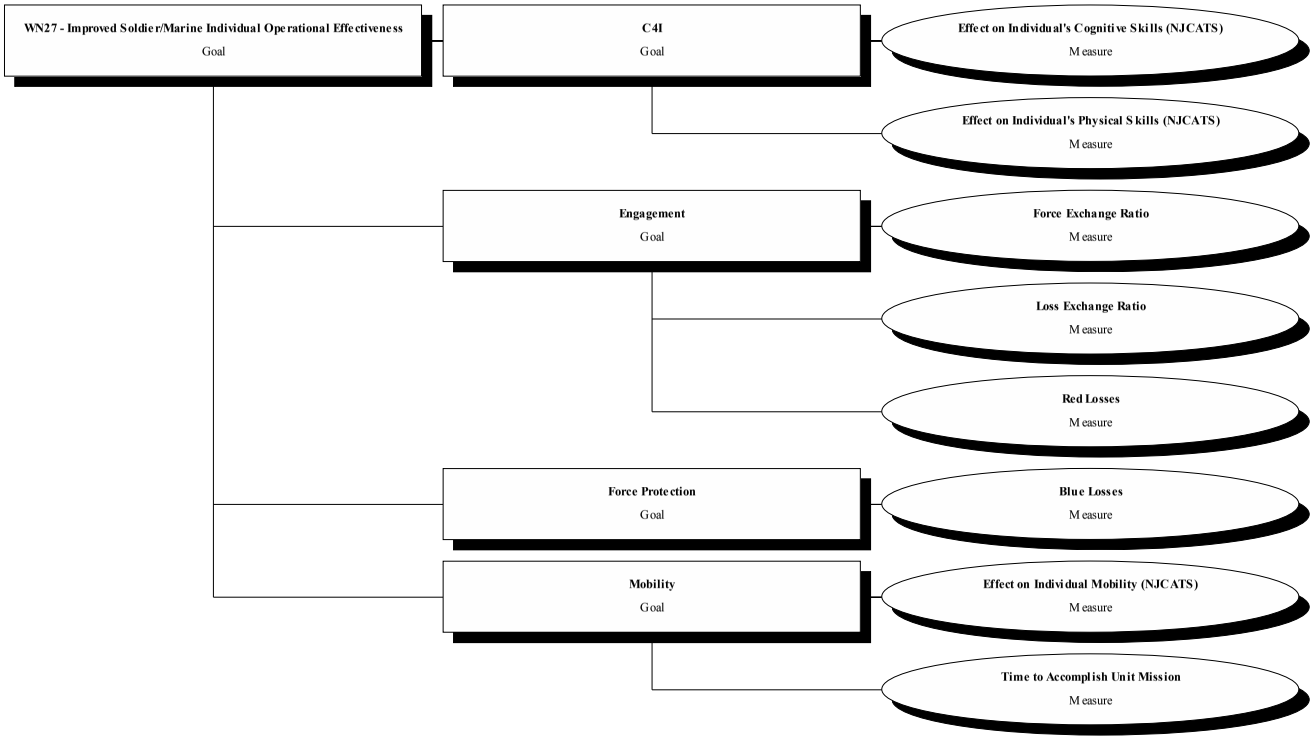
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Other:	Duration	NJO	hours	999999	0.5		
	Interoperability	NJO	NA			All/Some/None	refers to compatibility with all arms, services, and coalition members
	Multifunctionality	NJO	NA			All/Some/None	refers to compatibility with different devices
	Renewable	NJO	NA			Yes/No	
	Self-Sustaining	NJO	NA			Yes/No	
	Universally Rechargeable	NJO	NA			Yes/No	


WN26 - Improved Power Source Efficiency
Goal
Other
Goal
Duration (NJCATS)
Measure
Interoperability (NJCATS)
Measure
Multifunctionality (NJCATS)
Measure
Renewable (NJCATS)
Measure
Self-Sustaining (NJCATS)
Measure
Univerally Rechargeable (NJCATS)
Measure

WN27 - Improved Soldier/Marine Individual Operational Effectiveness

Definition: To provide improved approach to individual soldier/Marine operational effectiveness.

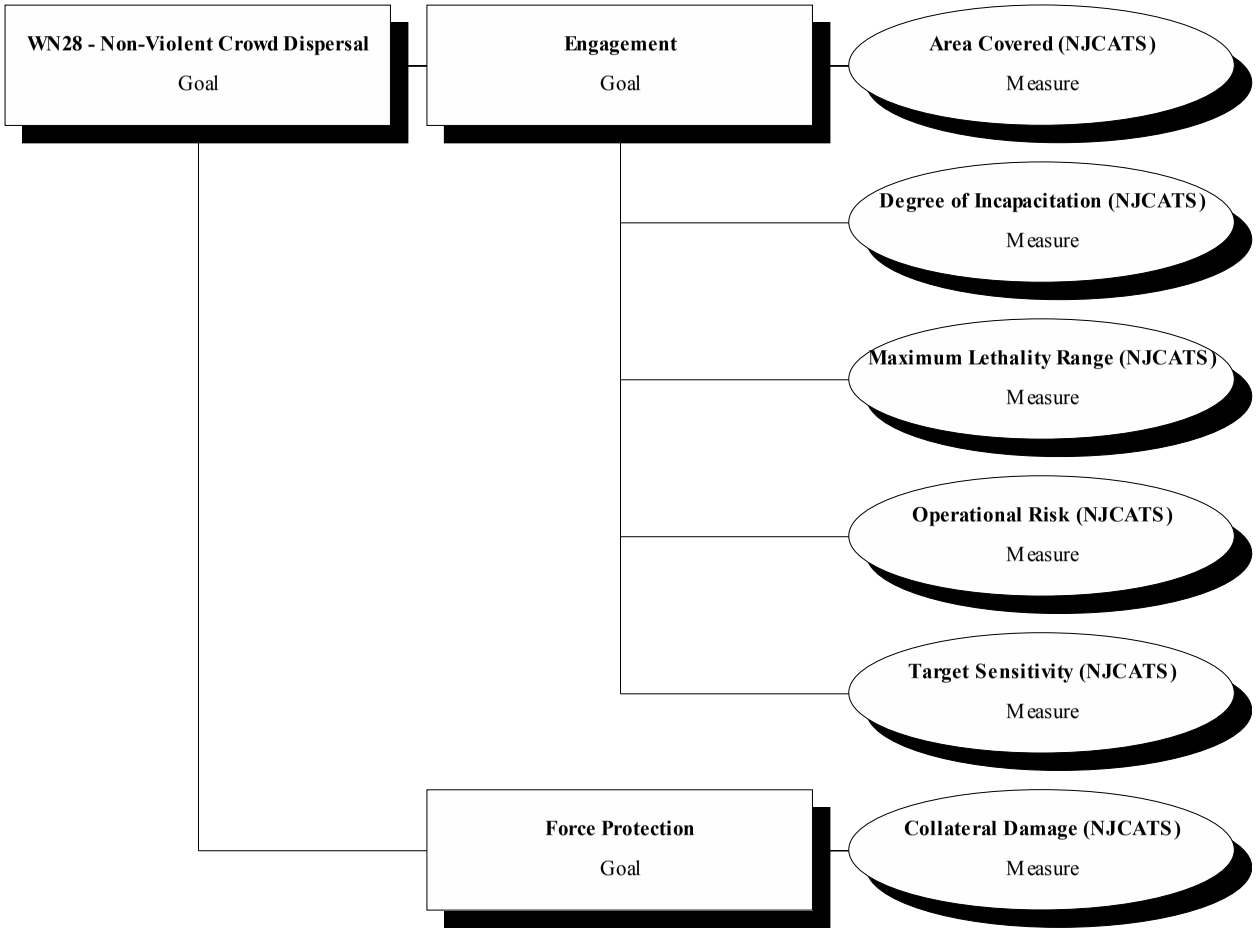
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Effect on Individual's Cognitive Skills	NJO	percentage	*999999*	*-999999*		
	Effect on Individual's Physical Skills	NJO	percentage	*999999*	*-999999*		
Engagement:	Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
Mobility:	Effect on Individual Mobility	NJO	percentage	999999	*-999999*		
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN27 - Improved Soldier/Marine Individual Operational Effectiveness
Goal
C4I
Goal
Effect on Individual's Cognitive Skills (NJCATS)
Measure
Effect on Individual's Physical Skills (NJCATS)
Measure
Engagement
Goal
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses
Measure
Mobility
Goal
Effect on Individual Mobility (NJCATS)
Measure
Time to Accomplish Unit Mission
Measure

WN28 - Non-Violent Crowd Dispersal

Definition: To provide non-violent means to disperse a crowd.

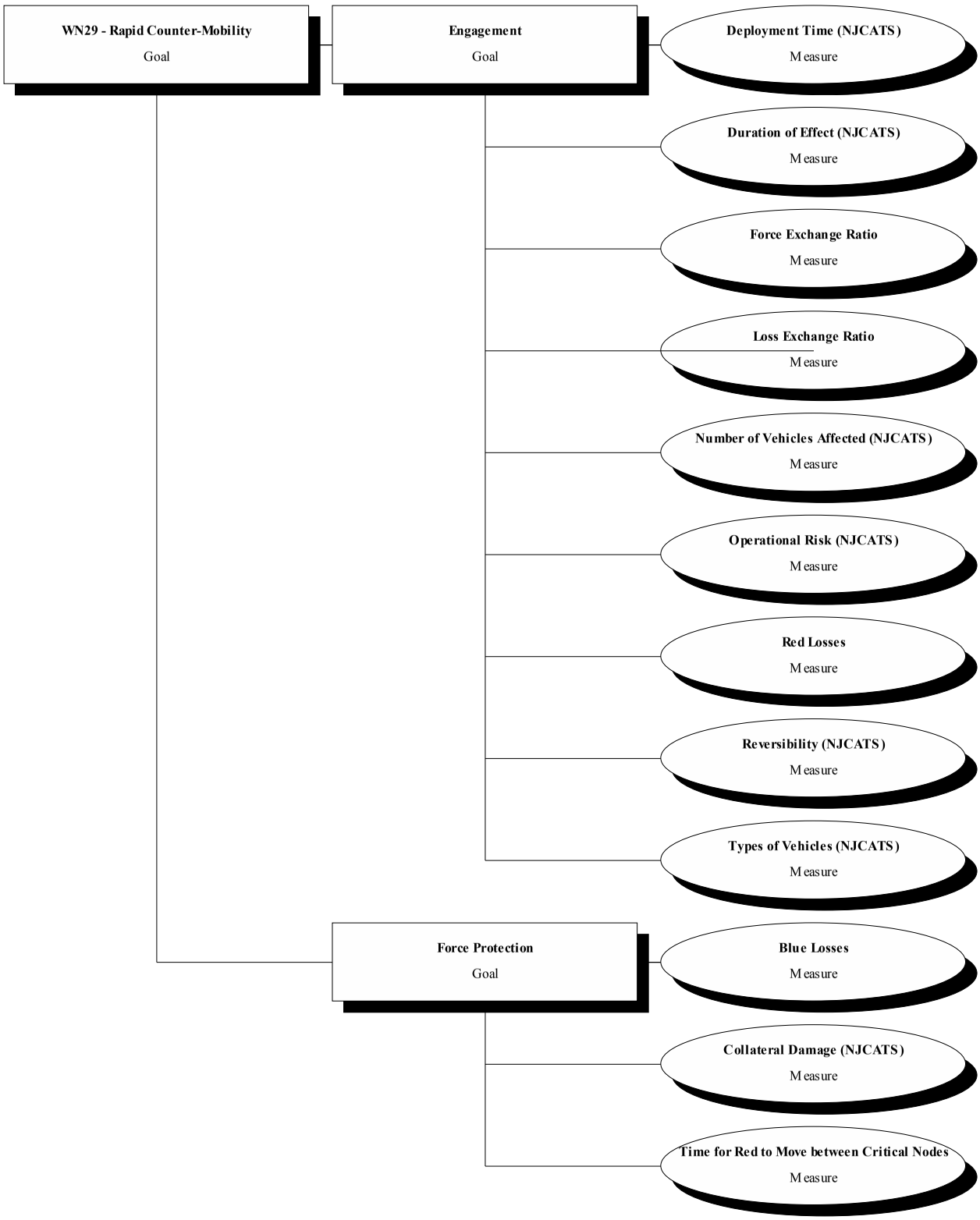
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Area Covered	NJO	meters squared	1000	1		
	Degree of Incapacitation	NJO	NA			None/Some/Complete	
	Maximum Lethality Range	NJO	NA			Close/Near/Far	
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
	Target Sensitivity	NJO	NA			No/Somewhat/Very	Measure refers to at any and every range, sensitivity of capability given the target (I.e., man, woman, child). No sensitivity means that the result would not be dependent on the target, while very sensitive would indicate that the capability's results are highly dependent on the target.
Force Protection:	Collateral Damage	NJO	NA			None/Low/Medium/High	


WN28 - Non-Violent Crowd Dispersal
Goal
Engagement
Goal
Area Covered (NJCATS)
Measure
Degree of Incapacitation (NJCATS)
Measure
Maximum Lethality Range (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Target Sensitivity (NJCATS)
Measure
Force Protection
Goal
Collateral Damage (NJCATS)
Measure

WN29 - Rapid Counter-Mobility

Definition: To provide rapid counter-mobility.

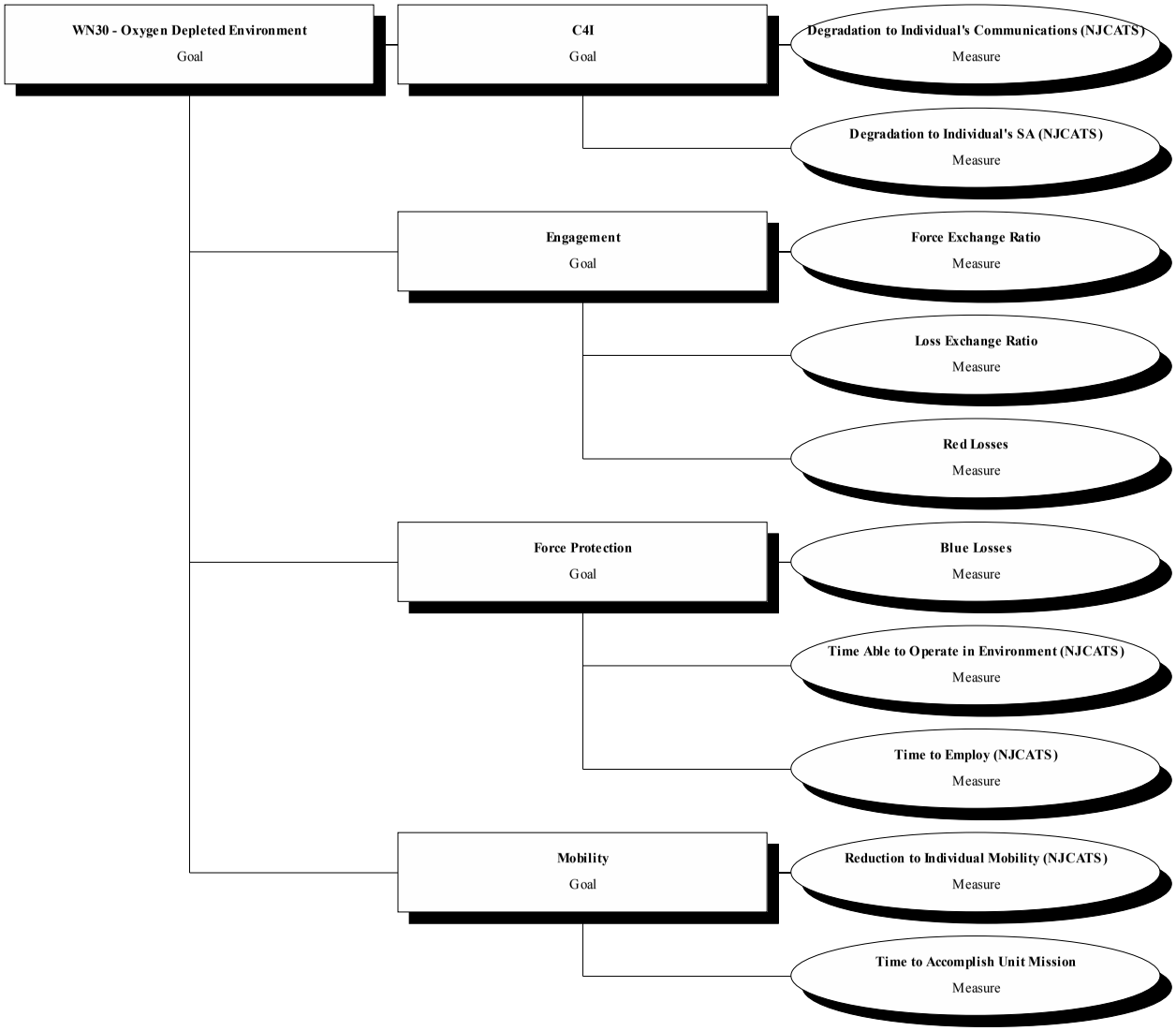
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Deployment Time	NJO	minutes	0	*999999*		
	Duration of Effect	NJO	minutes	*999999*	0		
	Force Exchange Ratio	JO	NA	0	*999999*		
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Number of Vehicles Affected	NJO	NA			Selectable/Not selectable	
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
	Red Losses	JO	percentage	100	0		
	Reversibility	NJO	NA			Yes/No	
	Types of Vehicles	NJO	NA			All vehicles/Up to medium vehicles/Small vehicles	
Force Protection:	Blue Losses	JO	percentage	0	*100*		
	Collateral Damage	NJO	NA			None/Low/Medium/High	
	Time for Red to Move between Critical Nodes	JO	minutes	*999999*	0		


WN29 - Rapid Counter-Mobility
Goal
Engagement
Goal
Deployment Time (NJCATS)
Measure
Duration of Effect (NJCATS)
Measure
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Number of Vehicles Affected (NJCATS)
Measure
Operational Risk (NJCATS)
Measure
Red Losses
Measure
Reversibility (NJCATS)
Measure
Types of Vehicles (NJCATS)
Measure
Force Protection
Goal
Blue Losses
Measure
Collateral Damage (NJCATS)
Measure
Time for Red to Move between Critical Nodes
Measure

WN30 - Operation in Oxygen Depleted Environment

Definition: To operate in oxygen-depleted and NBC contaminated environments.

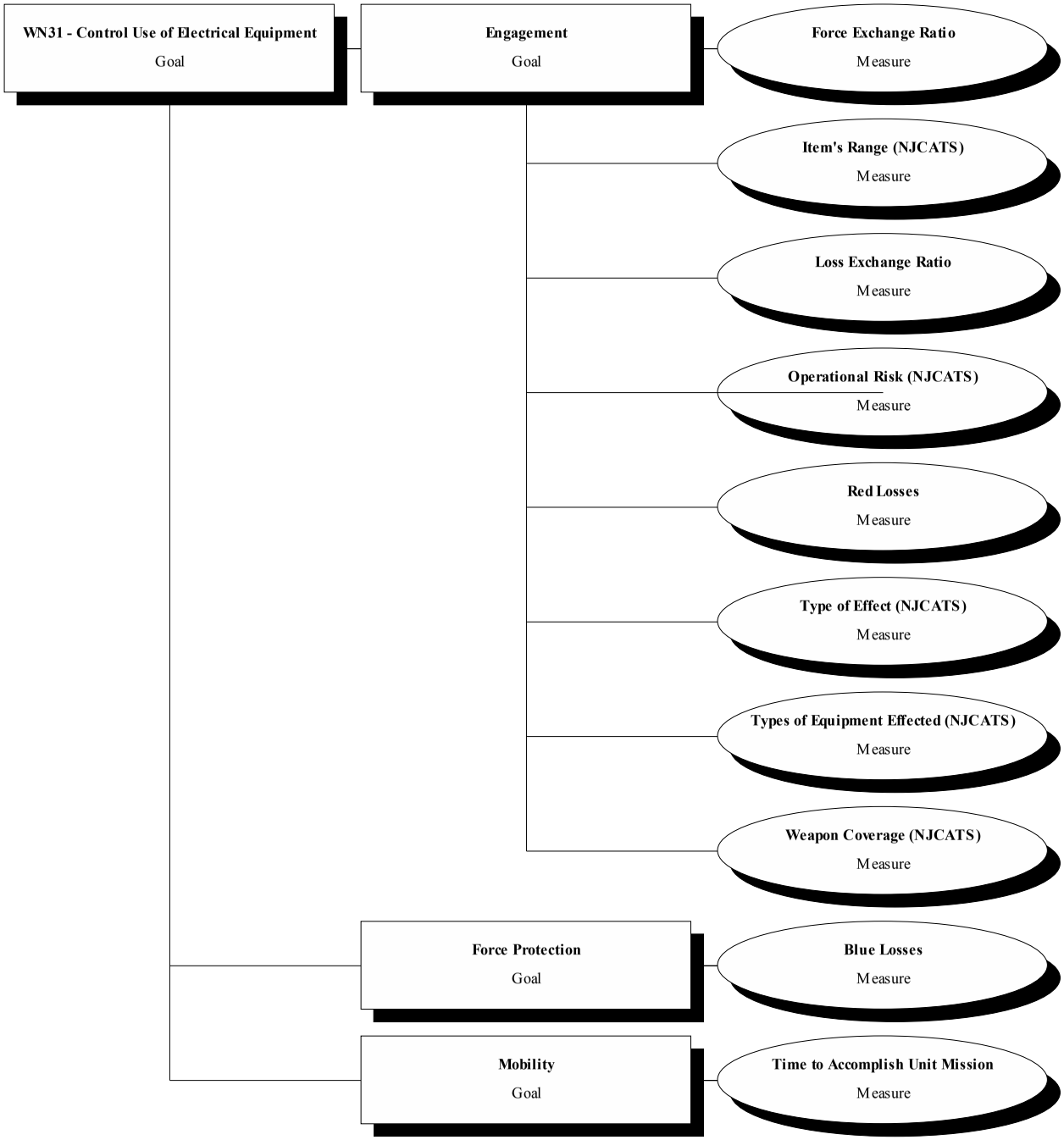
MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
C4I:	Degradation of Individual's Communications	NJO	NA			None/Low/Medium/High	
	Degradation of Individual's SA	NJO	NA			None/Low/Medium/High	
Engagement:	Force Exchange Ratio	JO	NA	0	999999		Measure equals % Red Remaining/% Blue Remaining
	Loss Exchange Ratio	JO	NA	999999	0		
	Red Losses	JO	percentage	100	0		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
	Time Able to Operate in Environment	NJO	hours	*999999*	0.1		
	Time to Employ	NJO	seconds	0	7200		
Mobility:	Reduction to Individual Mobility	NJO	percentage	0	100		Measure refers to percentage reduction in mobility
	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN30 - Oxygen Depleted Environment
Goal
C4I
Goal
Degradation to Individual's Communications (NJCATS)
Measure
Degradation to Individual's SA (NJCATS)
Measure
Engagement
Goal
Force Exchange Ratio
Measure
Loss Exchange Ratio
Measure
Red Losses
Measure
Force Protection
Goal
Blue Losses
Measure
Time Able to Operate in Environment (NJCATS)
Measure
Time to Employ (NJCATS)
Measure
Mobility
Goal
Reduction to Individual Mobility (NJCATS)
Measure
Time to Accomplish Unit Mission
Measure

WN31 - Control Use of Electrical Equipment

Definition: To selectively control electrical equipment in the urban environment.

MOOs	MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes
Engagement:	Force Exchange Ratio	JO	NA	0	*999999*		Measures refers to % Red Remaining/%Blue Remaining
	Item's Range	NJO	meters	50000	0		Most preferred range reflects distance of very long range fires
	Loss Exchange Ratio	JO	NA	*999999*	0		
	Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature
	Red Losses	JO	percentage	100	0		
	Type of Effect	NJO	NA			Control (Deny and Use)/ Deny/ Degrade	
	Types of Equipment Effected	NJO	NA			All/Some/Few	
	Weapons Coverage	NJO	meters squared	*999999*	1		
Force Protection:	Blue Losses	JO	percentage	0	*100*		
Mobility:	Time to Accomplish Unit Mission	JO	minutes	0	*999999*		


WN31 - Control Use of Electrical Equipment
Goal
Engagement
Goal
Force Exchange Ratio
Measure
Item's Range (NJCATS)
Measure
Loss Exchange Ratio
Measure
Operational Risk (NJCATS)
Measure
Red Losses
Measure
Type of Effect (NJCATS)
Measure
Types of Equipment Effected (NJCATS)
Measure
Weapon Coverage (NJCATS)
Measure
Force Protection
Goal
Blue Losses
Measure
Mobility
Goal
Time to Accomplish Unit Mission
Measure

APPENDIX F

All MOEs/MOPs and Corresponding Scales by MOO for the Needs of the Follow-on to the MOUT ACTD

APPENDIX F

All MOEs/MOPs and Corresponding Scales by MOO for the Needs of the Follow-on to the MOUT ACTD

Table F-1. All C4I MOEs/MOPs and Corresponding Scales for the Needs of the Follow-on Program

MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes	Needs Applied
Across Arms Communication	NJO	NA			Across All/Across Some/Infantry Only		WN03
Accuracy	NJO	meters	0.2	1000			WN04, WN06
Average Duration of Red Detection	JO	minutes	*999999*	0			WN01
Capable of Distribution to All Individuals	NJO	NA			Yes/No		WN03
Communication Range	NJO	meters	100,000	100			WN03
Critical Activities Detected	JO	percentage	100	0		Measure refers to number of critical events detected/total number of critical events	WN01
Critical Items/Activities Detected	JO	percentage	100	0		Measure refers to number of critical events detected/total number of critical events	WN15
Degradation of Individual's Communications	NJO	NA			None/Low/Medium/High		WN16, WN30
Degradation of Individual's SA	NJO	NA			None/Low/Medium/High		WN16, WN30
Degree of Scaleability	NJO	NA			Room/Building/Block		WN04
Detection Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires	WN05

Display Quality	NJO	NA			Excellent/Good/Poor	Measure refers to ability to convert z coordinate to building floor, scaleability, clarity of information, ease of use, etc.	WN06
Dissemination Range	NJO	meters	5000	0		Measure refers to the distance the platoon leader can be from the squad	WN06
Dissemination Speed	NJO	NA			Fast/Medium/Slow		WN04
Duration of Designation	NJO	minutes	*999999*	1			WN12
Effect on Individual's Cognitive Skills	NJO	percentage	*999999*	*-999999*			WN27
Effect on Individual's Physical Skills	NJO	percentage	*999999*	*-999999*			WN27
Environmental Conditions	NJO	NA			All/Some/One	Measure refers to, for example, weather, fog, etc.	WN06
Explosives Detected	JO	percentage	100	0			WN17
Frequency Range Compatibility with Urban Area	NJO	NA			Excellent/Good/Poor		WN03
Hands-Free	NJO	NA			Yes/No		WN03
Identification Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires	WN02, WN07, WN20
Individuals Tracked	NJO	NA			All Individuals/ Fireteam Leaders/ Squad Leaders		WN06
Indoor/Outdoor System	NJO	NA			Both/Indoors/Outdoors		WN03
Information Display	NJO	NA			Individual and Platoon Leader/ Platoon Leader	Measure refersto self-awareness	WN06

Item's Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires	WN15, WN17
Joint Communication	NJO	service	4	1			WN03
Knowledge of Logistics Needs	NJO	NA			Greatly improved over current system/ Somewhat improved over current system/ Same as current system	Measure refers to what, when, where	WN25
Mark Detection Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires	WN12
Noncombatants Detected	JO	percentage	100	0			WN15
Non-Line-of-Sight	NJO	NA			Yes/No		WN03
Number of Noncombatants Detected	JO	non-combatatants	*999999*	0			WN01
Number of Red Targets (Inside) Acquired by Blue	JO	red targets	*999999*	0			WN01
Number of Red Targets (Outside) Acquired by Blue	JO	red targets	*999999*	0			WN01
Operational Environment	NJO	NA			All of Below/Four of Below/Three of Below/Two of Below/ Inside underground structure/Inside building/ Outside, but covered/ Outside, but up against building/Open Areas	Measure refers to where it will work	WN06

Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature, false positives	WN01, WN02, WN03, WN04, WN05, WN06, WN07, WN08, WN11, WN12, WN15, WN17, WN20
Percentage of Noncombatants Detected	JO	percentage	100	0			WN01
Percentage of Red Targets (Inside) Acquired by Blue	JO	percentage	100	0			WN01
Percentage of Red Targets (Outside) Acquired by Blue	JO	percentage	100	0			WN01
Red Snipers Acquired by Blue	JO	percentage	100	0			WN05
Red Targets Acquired by Blue	JO	percentage	100	0			WN15
Resolution	NJO	meters	0.5	1000			WN04
Reversibility	NJO	NA			Yes/No		WN12
Scaleability	NJO	NA			Yes/No		WN04
Sensor Coverage	NJO	meters squared	100000	1		Measure refers to just the sensor, not the platform	WN01
Sniper Position/ Location Accuracy	NJO	NA			Window/Room/Floor/ Building		WN05
Surveillance Efficiency	NJO	NA			High/Medium/Low	Measure refers to number of critical events distinguishable/monitoring time	WN01
Total Surveillance Coverage	JO	meters squared	100000	1			WN01
Type of Communication	NJO	NA			Both/Voice or Data		WN03

Type of Explosive Detected	NJO	NA			All/Some/One		WN17
Type/Amount of Information	NJO	NA			All from Below/4 from Below/3 from Below/2 from Below/ Armed/ Side/ Location/ Number/ Occupied		WN15
Update Rates	NJO	seconds	1	7200			WN06
Update Speed	NJO	NA			Fast/Medium/Slow		WN04
Wall Material Dependent	NJO	NA			No/Yes		WN15

Table F-2. All Engagement MOEs/MOPs and Corresponding Scales for the Needs of the Follow-on Program

MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes	Needs Applied
Ammunition Expenditure	JO	shots	1	*999999*			WN01, WN05, WN08, WN09, WN11,WN13, WN14, WN15, WN19
Area Covered	NJO	meters squared	1000	1			WN28
Average Engagement Ranges	JO	meters	50000	0		Measure refers to average engagement ranges overall; Most preferred range reflects distance for very long range fires.	WN01, WN07, WN14, WN19
Degree of Incapacitation	NJO	NA			None/Some/Complete		WN28
Deployment Time	NJO	minutes	0	*999999*			WN29
Designation Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires	WN08, WN12
Duration of Effect	NJO	minutes	*999999*	0			WN29
Employment Time	NJO	seconds	1	*999999*			WN19
Engagement Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires	WN09
Engagement Range of Off-site Weapon	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires	WN08
Engagement Time	NJO	seconds	1	3600			WN09

Force Exchange Ratio	JO	NA	0	*999999*		Measure equals % Red Remaining/%Blue Remaining	WN01, WN05, WN07, WN08, WN09, WN10, WN11, WN12, WN13, WN14, WN15, WN18, WN19, WN22, WN24, WN25, WN27, WN29, WN30, WN31
Item's Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires	WN13, WN14, WN19, WN31
Loss Exchange Ratio	JO	NA	*999999*	0			WN01, WN05, WN07, WN08, WN09, WN10, WN11, WN12, WN13, WN14, WN15, WN18, WN19, WN22, WN24, WN25, WN27, WN29, WN30, WN31
Maximum Lethality Range	NJO	NA			Close/Near/Far		WN28
Number of Vehicles Affected	NJO	NA			Selectable/Not selectable		WN29
Operational Risk	NJO	NA			Low/Medium/High	Measure refers to, for example, exploitability, countermeasures, signature	WN09, WN14, WN24, WN28, WN29, WN31

Red Losses	JO	percentage	100	0			WN01, WN07, WN08, WN09, WN10, WN11, WN12, WN13, WN14, WN15, WN18, WN19, WN22, WN24, WN25, WN27, WN29, WN30, WN31
Red Non-Sniper Losses	JO	percentage	100	0			WN05
Red Sniper Losses	JO	percentage	100	0			WN05
Red Suppressed	JO	percentage	100	0			WN01
Reversibility	NJO	NA			Yes/No		WN29
Target Sensitivity	NJO	NA			No/Somewhat/Very	Measure refers to at any and every range, sensitivity of capability given the target (I.e., man, woman, child). No sensitivity means that the result would not be dependent on the target, while very sensi-tive would indicate that the capability's results are highly dependent on the target.	WN28
Time of Flight	NJO	seconds	1	*999999*			WN19
Type of Effect	NJO	NA			Control (Deny and Use)/ Deny/ Degrade		WN31
Types of Equipment Effected	NJO	NA			All/Some/Few		WN31
Types of Vehicles	NJO	NA			All vehicles/Up to medium vehicles/Small vehicles		WN29
Weapon Coverage	NJO	meters squared	*999999*	1			WN31

Table F-3. All Force Protection MOEs/MOPs and Corresponding Scales for the Needs of the Follow-on Program

MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes	Needs Applied
Area Concealed	NJO	meters squared	300	0			WN21
Blue Kills	NJO	percentage	0	*100*			WN16
Blue Logistics Losses	JO	percentage	0	*100*			WN25
Blue Losses	JO	percentage	0	*100*			WN08, WN10, WN12, WN13, WN14, WN17, WN18, WN19, WN21, WN22, WN23, WN25, WN27, WN29, WN30, WN31
Blue Losses (by Red)	JO	percentage	0	*100*			WN01, WN02, WN07, WN09, WN11, WN15, WN20, WN24
Blue Losses - By Non-Sniper Red	JO	percentage	0	*100*			WN05
Blue Losses - By Red Snipers	JO	percentage	0	*100*			WN05
Blue Losses - Fratricide	JO	percentage	0	*100*			WN01, WN02, WN07, WN09, WN11, WN15, WN20
Blue Losses - Fratricide due to Protective System	JO	percentage	0	*100*			WN24
Blue Targets Detected/Acquired by Red	JO	NA			No/Yes		WN15

Blue Vehicle Losses	JO	NA			No Loss/ Mobility Loss/Fire Power Loss/Mobility Loss and Fire Power Loss/ Catastrophic Loss		WN24
Blue Vehicles Repaired	JO	percentage	100	0			WN25
Blue Wounded, Evacuated	NJO	percentage	0	*100*			WN16
Blue Wounded, Returned to Duty	NJO	percentage	100	0			WN16, WN22
Collateral Damage	NJO	NA			None/Low/Medium/High		WN08, WN09, WN19, WN23,WN24, WN28, WN29
Density	NJO	particles per cubic centimeter	*999999*	1			WN21
Duration of Concealment	NJO	minutes	120	0			WN21
Effect on Individual Casualty	NJO	NA			Great improvement over current system/ Little improvement over current system/ No improvement over current system	Measure reflects level, speed, result of treatment	WN22
Effect on Wounded Individual	NJO	NA			None/Some/Severe		WN10
Improvement in Survivability	NJO	percentage	*999999*	0			WN24
Item's Range	NJO	meters	50000	0		Most Preferred range reflects distance for very long range fires	WN23

Noncombatant Losses	JO	percentage	0	100			WN01, WN05, WN07, WN08, WN09, WN11, WN12, WN15, WN17, WN19, WN20, WN21, WN23
Noncombatant Losses due to Protective System	JO	percentage	0	100			WN24
Percentage of Blue Targets Acquired by Red	JO	percentage	0	100			WN01
Percent of Force Operational	JO	percentage	100	0			WN25
Potential Lethality to Friendlies	NJO	percentage	100	0		Measure refers to pk range for this based on area of band in immedi-ate vicinity of vehicle.	WN24
Rate of Ammunition Resupply	JO	rounds per hour	*999999*	0			WN25
Rate of Fuel Resupply	JO	gallons per hour	*999999*	0			WN25
Rate of Resupply of Other Supply Classes	JO	units per hour	*999999*	0		Measure includes water, food, etc.	WN25
Speed of Employment	NJO	seconds	0	7200			WN21
Time Able to Operate in Environment	NJO	hours	*999999*	0.1			WN30
Time for Red to Move between Critical Nodes	JO	minutes	*999999*	0			WN29
Time to Employ	NJO	seconds	0	7200			WN30
Time to Install	NJO	seconds	0	7200			WN24
Time to Return to Duty	NJO	hours	0.5	720			WN22
Types of Devices Neutralized	NJO	NA			All/Some/One		WN23

Table F-4. All Mobility MOEs/MOPs and Corresponding Scales for the Needs of the Follow-on Program

MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes	Needs Applied
Degradation in Individual Mobility	NJO	NA			None/Low/Medium/High		WN16
Effect on Individual Mobility	NJO	percentage	999999	*-999999*			WN27
Height Reachable	NJO	NA			Unlimited stories, More than 5 stories, 4-5 stories, 3 stories, Less than 3 stories		WN18
Reduction to Individual Mobility	NJO	percentage	0	100		Measure refers to percentage reduction in mobility	WN30
Time for Sub-units to Move between Critical Nodes	JO	minutes	0	*999999*			WN01, WN05, WN07, WN08, WN11, WN12, WN13, WN14, WN15, WN17, WN20, WN21, WN23, WN24, WN25

Time to Accomplish Unit Mission	JO	minutes	0	*999999*			WN01, WN05, WN07, WN08, WN10, WN11, WN12, WN13, WN14, WN15, WN17, WN18, WN19, WN20, WN21, WN22, WN23, WN24, WN25, WN27, WN30, WN31
Time to Employ	NJO	seconds	1	3600			WN18
Time to Evacuate Casualty	JO	minutes	1	120			WN10

Table F-5. All Other MOEs/MOPs and Corresponding Scales for the Needs of the Follow-on Program

MOEs/MOPs	JO/ NJO	Scale units	Most Preferred	Least Preferred	Labels (most preferred to least preferred)	Notes	Needs Applied
Duration	NJO	hours	999999	0.5			WN26
Interoperability	NJO	NA			All/Some/None	Measure refers to compatibility with all arms, services, and coalition members	WN26
Multifunctionality	NJO	NA			All/Some/None	Measure refers to compatibility with different devices	WN26
Renewable	NJO	NA			Yes/No		WN26
Self-Sustaining	NJO	NA			Yes/No		WN26
Universally Rechargeable	NJO	NA			Yes/No		WN26
Update Rates	NJO	seconds	1	7200			WN06

APPENDIX G

Capabilities Brainstorming for Each Need

APPENDIX G

Capabilities Brainstorming for Each Need

WN01 Urban Surveillance and Detection

Need Number	Need Title	Need Definition	Capabilities
WN01	**Urban Surveillance and Detection**	To provide remote surveillance and detection of activity in the urban area.	
		NOTE: Both inside and outside of structures	thermal sensor package
			day camera sensor package
			acoustic sensor package
			RF
			radar
			motion detection
			magnetic anomaly detection
			HUMINT
			seismic
			chemical sensors
			SIGINT
		Technology Characteristics:	
		mobile	
		static	
		airborne	
		ground	
		amphibious	
		space	

Notes:

- Sensor packages to include visual, acoustic, thermal, basic visual camera, VHF, UHF, RF.
- By platform: mobile, static, airborne, ground, space-based, amphibious (more of a technology?).
- Need capabilities to sense what's going on inside buildings (we've got ways of detecting what's outside). Seems a little different from the need as stated. This could lead to a different set of capabilities than those used to provide surveillance of outdoor activities. Not talking about through-wall sensors inside buildings, but surveillance inside.
- Want to tell whether people are armed or unarmed (use metal detection?); related to identify friend, enemy, non-combatant (these are other needs).
- Equipment detection?

- Raytheon has a magnetic anomaly detection system (short battery life was a problem).
- Suggest we add things like wire tapping, acoustic sensors—means for indoor/underground surveillance.
- Seismic detection? Movement of heavy vehicles, etc.
- Robotics? Don't want to specify types of robotics because that would be at the technology level.
- Distinguish between mobile and stationary sensors? Again, will this fall out in the technology search—don't want to be constrained by having to look for sensors that are mobile or stationary. Could have airborne platform for all varieties of sensors—don't want to include platform as a capability.
- Include as a capability some kind of invisible sensing station? No, again this is a platform question.
- Phone-tapping would be included under RF.

WN02 Identify Friendlies

Need Number	Need Title	Need Definition	Capabilities
WN02	**Identify Friendlies**	To identify friendly combatants during all conditions.	
		NOTE: real-time, may be linked to position-location	visual
			thermal
			acoustic
			RF
			chemical sensor
			magnetometer
			HUMINT
			SIGINT
	Technology Characteristics:		
	active interrogation		
	passive measures		

Notes:

- What's been looked at in the past: active optical solutions (R11), audible marking, IR, visual, thermal, acoustic, RF.
- Put some kind of scent on them?
- Need to interrogate a potential target before firing—active interrogation.
- Land Warrior has an ability to stop fratricide using their common operating picture.
- Position location could be part of the solution? No, want interrogation—need to know now, in real time. Position location is something different (and covered under a different need).
- People are only going to feel comfortable with visual capabilities. People are probably not going to feel comfortable with acoustic or thermal—they're going to want to "see".
- View active and passive as methods (for identifying friendlies) of employment.
- Laser reflector, visual ID are technologies.
- From warfighter perspective, doesn't matter whether the system is active or passive.
- Need to stick with either active and passive as the two capabilities, or else the sensor types (visual, thermal, acoustic, RF). Shouldn't keep all the capabilities; they're not the same things.
- Co-managers are concerned with return on investment. They will compare the investment on acoustic sensor (plus database development) vs. RF capabilities.
- Maybe break into active-thermal, passive-thermal, active-visual, etc? Combinations of the active/passive and sensor types.

- Want to create new category called “Technology Characteristics” in addition to the capabilities. Sensor types are capabilities, and active/passive are technical characteristics.
- Marine Corps won’t consider active systems.
- What about identifying friendly vehicles? This is considered because some warfighters are mounted on vehicles.
- By platform: mobile, static, airborne, ground, space-based, amphibious (not limiting factors, but keywords). Captured these on capability sheet as “Technology characteristics.”

WN03 Urban Communication All Levels

Need Number	Need Title	Need Definition	Capabilities
WN03	**Urban Communication All Levels**	To communicate across all levels below combined arms task force in urban/complex terrain.	
	changed need title and definition	NOTE: communication with all platforms in the battalion task force	RF
	Technology Characteristics:		
	NLOS, but don't want to eliminate consideration of LOS		
	real-time		
	relay function		
	voice and data focused		
	tactical level, combined arms force		
	focus on comms between infantry and armor at the individual level		
	security		
	identify what we have at the moment that could be used at this lower level		
	mobile, adaptable networking		
	nodal networking		

Notes:

- An audible communication device. Also need to include others like images, data. Separate the different types of data from each other.
- Audible: UHF, VHF.
- Visible: hand-signals.
- What about difference between seeing a picture vs. a text message? Not different capabilities, but characteristics of the solution.
- NLOS.
- What are the core means of communications? Talking, hand-signals.

- Want a relay function to get greater range, share with vehicle. Packet relay.
- How do data get sent?
- Basis for this need is the combined arms, tactical-level fight — how to communicate with one another. Voice, real-time, during the battle. Were not really thinking about data for this need. Should we just limit to voice? May need to focus the problem—too broadly defined right now. We may only be able to find a solution to part of this huge need.
- NLOS, hands-free comms as a capability?
- What about finding partial solutions to this huge need? Like the need discussed about allowing a soldier inside the tank to talk to another outside the tank.
- Redefine need to not include data? Voice communications are the problem area although data are included in the types of comms at the level we're looking at.
- NLOS-voice and NLOS-data as two distinct capabilities? What if there are good capabilities that are LOS? We just want to make sure it works in built-up areas. Shouldn't limit to NLOS.
- Security, a characteristic.
- Want to be able to communicate between all platforms within the battalion task-force (LAV, AAV, helicopter, tanks).
- Communicate data to data, data to voice, voice to data? Cover all depending on the situation.
- Voice and data as types of communications instead of ways to communicate (talk to a person, use a radio, bank teller container, hammering on outside of tank).
- Everyone else has radios and we need to communicate with them.
- Are LOS and NLOS significantly different? Should they be included as separate capabilities? From one company to another, we do not necessarily need the other.
- Tethered balloon up above a city as a capability?
- Capability gap at the low level. Don't miss solving the problems at the lower levels. Make sure to understand what we've already got.
- Include mobile or adaptable networks.
- Changed title and definition of Need to include "urban".

WN04 Near Real-time, Scaleable Map Information for Production and Dissemination

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN04	**Near Real-time, Scaleable Map Information for Production and Dissemination**	To produce near real-time, scaleable map information for dissemination to individual soldiers and Marines.		
		a) produce	digital/picto-mapping	download data (e.g. NIMA)
			imagery	Photos, lidar, UAV, sketching, radar
		b) disseminate	paper	
			electronic	
	Technology Characteristics:			
	hand held viewers			
	software to display			
	overlays			
	getting the attention of the commander (but a different issue)			
	local map production (for produce part of need)			
	scaleability (for disseminate part of need)			
	warfighter interface (e.g. heads-up display)			

Notes:

- This refers to providing a soldier or a Marine with a map, something that can be put in their hands.
- Two parts to the need: 1) produce a map and 2) disseminate it.
- Part of production is also the ability to update, rather than just the initial generation.
- Should be able to reflect real-time information.
- There is both local production and leveraging other sources, i.e., national assets.

- May want to consider separating the two parts of this need because there are different capabilities that could apply to each; Consider making WN4a – Production, WN4b – Updating, and WN4c – Dissemination.
- Important to be able to update maps to reflect changes occurring since first issue.
- Different ways of map generation may require different ways of getting updates.
- Want to be able to produce an update map now of the area of interest, then the individual will update as necessary given his situation/information; may not need continual updating.
- What is going to interest a battalion commander is important, but different from that of the soldier/Marine at individual level; may be two different issues.
- Decide to approach brainstorming capabilities by the sub-needs of the need – production, updating, and dissemination.
- Decide not to add update and just stay with produce and disseminate.
- Scaleability needs to be captured as a technology characteristic.
- Heads-up display would speak to the visualization aspect of this.
- Should there be a separate part of this need that specifically refers to the visualization piece of the map? There may be different technology opportunities for viewing a map.
- If you can disseminate the data associated with a map, then you should be able to produce it (provide a visual representation) either by paper or electronically. For example, if you had an electronic map, how it was displayed would be part of that technology.

WN05 Sniper Detection

Need Number	Need Title	Need Definition	Capabilities
WN05	**Sniper Detection**	To detect sniper location under all conditions and situations proactively (and reactively).	
		NOTE: determine location of sniper that you cannot see	visual/optical
		NOTE: may depend on our definition of sniper	thermal
			acoustic
			RF
			radar
			magnetometer
			chemical sensor
			SIGINT
			HUMINT
	Technology Characteristics:		
	detect before shot is taken		
	speed of detection		

Notes:

- Slightly different need between detecting sniper and identifying friend/foe/non-combatants, because you will not see the sniper until he has fired.
- Radar could be used to identify movement, so if you use it to identify movement alone on high ground, you might be able to use to deduce sniper location.
- May want to consider what is meant by sniper; trained sniper, military rifleman trained as a marksman, and an untrained civilian type.
- In the end, may not care what type of sniper you are dealing with; all you care is that you are taking casualties.
- There is nothing within the definition of the need, the capabilities listed, and the technologies that are available (present and near future) that will allow us to do anything about the sniper prior to the shot being fired.
- The ability to sight before a shot is taken would be a technical characteristic.
- Include speed of detection? Depends more on whether or not you can detect before shot is taken.

WN06 Position Location in Complex and Restrictive Terrain

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN06	**Position Location in Complex and Restrictive Terrain**	To provide platoon/squad leader with position location for his squads/fire team leaders in complex and restrictive terrain.		
	modified definition	a) locate	RF	
			GPS	
			inertial guidance	dead reckoning
		b) disseminate	RF	
			display	electronic
			locomotion	
			marking	smoke signals
	Technology Characteristics:			
	platoon should be able to cross-talk with squads in other platoons			
	real-time			
	stealth			

Notes:

- LW will be able to provide down to the individual level, but that is not what we were talking about when this need was generated.
- Seems as if there are two parts to this need: 1) location of squads and fire teams and then 2) disseminating that information.
- The platoon leader should have the ability to cross-talk to other platoon leaders both within and outside of his company; should be scaleable within one's area of concern.
- RF is probably the only way to get at the real-time aspect.
- Smoke would probably be under marking, rather than display; Something that friendlies can see, but not the enemy.
- Stealth is something that should be considered as a technology characteristics
- Dead reckoning would fall under inertial.

WN07 Identify Enemy

Need Number	Need Title	Need Definition	Capabilities
WN07	**Identify Enemy**	To identify enemy combatants during all conditions.	
			visual
			thermal
			acoustic
			RF
			chemical sensor
			magnetometer
			HUMINT
			SIGINT
	Technology Characteristics:		
	means of dissemination		

Notes:

- If you can't identify someone as friendly, then you know they are enemy or non-combatants.
- There might be a distribution aspect to this; captures a means for dissemination. Need to share information with others.

WN08 Improved Target Designation

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN08	**Improved Target Designation**	To enable target designation and/or hand-off targeting data to off-site shooters, across all arms and services.		
		a) designate	laser designate	
			visual marking	Paintball, tracer round (mark target electronically)
			electronic marking	Beacon, tracer round (mark target electronically)
			transmit target through electronic map	
			acoustic	sonar
			radar	
			guided munition (no hand-off)	
		b) hand off	RF	
	Technology Characteristics:			
	detectability of laser (or other means of designation)			
	position-location			
	common map display			
	compatible with other comms			

Notes:

- The key of need is to identify targets, particularly to aircraft, etc., which they presently cannot do.
- Focus on two aspects of the need: 1) designate and 2) hand-off.
- There may be other ways to mark a target other than laser designation (i.e., visually or electronic).
- Passive designation and active designation may be capability?
- The detectability of the laser or other means of designation is an issue to be considered as a technical characteristic.
- Capable of super accurate grid coordinates; position-location.
- Hand-off has to be compatible with whatever comms system is used by the system that is going to be doing the firing.
- When you are talking about a laser designation, then there really isn't an issue of hand-off.
- There are two potential laser applications: 1) you lase the target and the weapon hones in on that laser signature; 2) you can use a laser to ping something to determine position-location of something and then transmit/disseminate that information.
- Will be constrained in the hands-off portion, because you aren't going to be able to change the communications systems of existing vehicles/systems.
- May have been originally thinking the ability to mark a target (for example, a tracer round).

WN09 Improved Precision Direct Fire

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN09	**Improved Precision Direct Fire**	To improve precision direct fire.		
	NOTE: unique to the MOUT environment		aiming	self guided round, laser aiming device
			emplacement	non-rolling grenade
			enhanced munitions specific to urban	controlled penetration munition, door breaching, wall breaching round, self guided breaching round, breaching round for the tank, thermobaric
	Technology Characteristics:			
	small signature on weapon system			
	controllable/variable fusing			
	rapid zero/boresight			

Notes:

- When we came up with this need, this captured talk about NLOS weapons (including talk of non-rolling grenade).
- This was also specifically meant to be unique to the MOUT environment.
- At one point, also discussed being able to enter a room, fire, and not have the rounds leave the room (frangible munition).
- How much of this requirement is linked to having a better weapon-sight?
- Technologies to support training is also important to this need.
- This refers to ANY direct fire weapon.
- This may also encompass the development of rounds that have different levels of penetration into city, building, wall, etc.
- The issue of fusing.
- Another capability would be thermobarics.
- A better retention system for aiming devices; zeros automatically.
- Also, would like to not have to re-zero after changing sights.
- Using PAC2 or PAC4 on different types of weapons can be a problem.
- Is this unique to the MOUT environment? Yes, because of the different lighting conditions.

- Maybe a rapid verification of zero? A boresight problem rather than a zeroing problem? Boresight verification?
- Boresighting gets you close enough to shoot in the battlefield, but zeroing is needed for sniping, fine targeting. For the average rifleman (300m or less), boresighting is enough.
- Aiming devices with rapid zero.
- Interpret this need as the delivery and packaging, not the actual explosive.
- Junior guys do not find optics helpful and are intimidated by them. Not everyone needs them. A training issue and an employment issue.
- A tracer you can see in IR?

WN10 Enhanced Casualty Evacuation

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN10	**Enhanced Casualty Evacuation**	To provide means for enhanced casualty evacuation.		
			manual	
			mechanical	mule
	Technology Characteristics:			
active	powered			
passive	unpowered			
	manportable			
	autonomous			
	protect evacuator			
	minimize people out of the fight			
	minimize time required			
	all terrain			
	multifunctional			
	compatible with further evacuation methods (e.g. stretcher into ambulance)			

Notes:

- Two capabilities are manual and mechanical.
- The other types of items brainstormed are more along the lines of technology characteristics (i.e., powered, unpowered, manportable, etc.).
- When does Cas Evac become a TTP issue?

WN11 See While Inside Buildings/ Structures

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN11	**See While Inside Buildings/ Structures**	To be able to see while inside buildings/structures at all times.		
		NOTE: includes needing both a visible light and non-visible light solution (refers to the tech search; idea is to combine)	sensors	Thermal, I2, sensor Fusion, sonar
			illumination	white light
			transition	
	Technology Characteristics:			
	multifunctional			
	link to ability to designate targets			
	multispectral			
	compatibility with masks			
	ideally would like you to be able to see, but enemy still in dark			
	ultimate solution likely a combined solution			
	not to disrupt op tempo			
	light to dark and dark to light			
	also limited visibility conditions (i.e., smoke)			

Notes:

- Want soldiers to be able to see through smoke, in darkness, when entering buildings. Solve problem of moving from light to dark, and moving from dark to light.
- Thermal, I2, white light.
- Want to get away from having to carry another piece of equipment. Maybe in conjunction with mask. Don't want to add another rail to the weapon. Want to continue the tempo.
- Sensor fusion, needs to be linked to the ability to designate targets.
- Can't designate in thermal, need to make sure we can designate with other types of sensors as we move forward.
- Basic torch system, something on the weapon system. Enemy can't make use of the advantage (enemy can see white light).
- Sometimes want to use white light, and other times, want to use other types of sensors. Not an either/or situation. Need both a visible light capability and a non-visible capability. Combine those capabilities somewhere down the line.
- There may be some ways to control the physiology of your eyes (rapid gradient lenses?) when moving from light to dark/dark to light.
- Include "transition capability," sunglasses? May need to check with medical community.
- AF developed some kind of eye shield to maintain a constant level of light, even protect against a nuclear blast.
- Sonar could help you get around when you can't see.

WN12 Improved Designation of Persons/Items

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN12	**Improved Designation of Persons/Items**	To reversibly designate persons or items of interest to friendly forces under all conditions, on-site or remotely.		
			physical marking	naked eye, infrared
			electronic marking	
			chemical marking	
			biological marking	
			olfactory marking	
	Technology Characteristics:			
	non-reproducible by enemy			
	specified period of time for mark			
	reversibility from stand-off position			

Notes:

- Started with requirement to mark a building that's been cleared; addresses problem of enemy reoccupying the building; includes marking leaders in crowds.
- Secure so that enemy cannot use it against you.
- Non-reproducible by enemy, and secure.
- Maybe set on a timer so that it would wear off after a certain period of time. Is this being used to cover reversible requirement? Not really the same thing. Still want to reverse mark from a stand-off position.

WN13 Improved Forcible Entry

Need Number	Need Title	Need Definition	Capabilities
WN13	**Improved Forcible Entry**	To improve forcible entry capability (specifically obstacle reduction, interior and exterior building and structure entries; includes need for mechanical breaching kit, remote breaching device, breach trainer).	
		NOTE: includes everyone within the combined arms task force having a breach and counter-breach capability	
		NOTE: want vehicles to be able to move as seamlessly as infantry	
		Divide Need into 3 sub-needs:	
		a) infantry forcible entry into buildings	explosive
			kinetic energy
			mechanical
			directed energy
			chemical
		b) vehicle breach of walls	explosive
			kinetic energy
			mechanical
			directed energy
			chemical
		c) vehicle ability to clear/reduce obstacles	explosive
			kinetic energy
			mechanical
			directed energy
			chemical
	Technology Characteristics:		
	stand-off		
	well concealed		
	need flexible tool kit		

Notes:

- Developed from need for stand-off breach capability – doors, ceilings, obstacle reduction.
- Gain access to structure with limited exposure.
- Expand need definition to include wheeled and tracked vehicles to clear obstacles. In Grozny, Russians had systems to remove vehicle obstacles, barriers from streets.
- Everyone in task force needs a breaching capability. Multiple shots to take out a brick wall and still need to deal with rebar. Solution could be a tank round.
- Want armored vehicles to move as seamlessly as possible through an urban environment. Question of whether or not this can be an issue for the follow-on program. Infantry clear way for armored vehicles? Probably need to work with other programs like FCS. Tie into other programs.
- Mechanical plow?
- In third world, construction is quite heavy. Those who can afford to build, build a fort.
- Have three needs here: 1) forcible entry into buildings; 2) vehicle rounds to breach walls; 3) ability of vehicles to clear obstacles. For purposes of modeling, it is easier to develop measures for the three separate areas.
- The amount of explosives needed to breach really weighs down a person and only provides one shot. Would rather have a vehicle do this. But a vehicle-mounted breach capability is not useful if you can't get the vehicle to the building.

WN14 Defeat Armored Vehicles, Bunkers, Reinforced Structures

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN14	**Defeat Armored Vehicles, Bunkers, Reinforced Structures**	To enable individual soldiers/Marines to defeat armored vehicles, neutralize bunkers, and penetrate reinforced structures/walls/ bunkers from a confined space.		
		a) defeat of lightly armored and wheeled vehicles	combined effects	thermobaric
			overpressure	fuel air explosives
			kinetic	
			directed energy	
		b) defeat of reinforce structures/bunkers, etc.	combined effects	thermobaric
			overpressure	fuel air explosives
			kinetic	
			directed energy	
	Technology Characteristics:			
	cold launch			
	stand-off			
	soft launch			
	range (measure?)			
	close range or minimum range kill of armored vehicle			
	ideally would like a single solution to address both sub-needs			
	may require multiple solutions to meet different aspects within this need			
	mobility kill			
	catastrophic kill			
	manportable			
	manpackable			

Notes:

- Capability to fire a weapon from inside a building that will defeat an armored vehicle.
- Lots of wargaming and modeling of thermobarics in the UK. Results show that whichever force has those weapons always wins.
- Thermobaric weapons provide more than overpressure effects. Negative and positive blast. Can't pigeonhole the effects. Provides combined effects.
- Have overpressure problem now when breaching. The effects of overpressure are cumulative.
- Cold launch weapons have no blast. Designed for town fights so that it wouldn't destroy the houses. Easy to train on because there is no noise to distract the gunner.
- The need to defeat an armored vehicle and to neutralize a bunker are very different things.
- Power lines in a city create problems for wire-launched munitions. Our current weapons were designed to defeat the Russians, not work in cities.
- Ideally, would like solution that would defeat both vehicles and bunkers, but would accept a solution that does one or the other. Definitely don't throw out munitions because they can't defeat both vehicles and bunkers.
- Asking for a man-packed round to defeat a vehicle (and what does defeat mean? KK, Mob?) may be asking too much. But let tech people look for it.
- Need to ask the warhead to do more if armor is reactive. Should qualify armor in this need to be "lightly armored."

WN15 Knowledge of Other Side of Wall

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN15	**Knowledge of Other Side of Wall**	To know what is on the other side of an opaque wall.		
			thru-wall sensing	radar
			robotics	UAV, UGV, biobots
			physical penetration	fiber optics, kinetic round
	Technology Characteristics:			
	stealth			
	covertness			
	impact on op tempo			
	reliability of detection			
	resolution of detection information			
	means of detection			
	time to achieve detection			

Notes:

- What about idea of knowing remotely what's on the other side of the wall?
- Levels of detection, means of detection.
- Ways of smelling adrenaline? Picking up a faster heart rate?

WN16 Improved Personal Protection

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN16	**Improved Personal Protection**	To improve personal protection system (improvement in head, torso, hands, eyes, ears protection against flame, cuts/puncture, overpressure, ballistic, laser, environmental) usable in both training &operation.		
		NOTE: spirit of this need is to address the urban-specific protection needs (with OFW to address full spectrum individual protection overall)		
		a) ballistic protection	shield/barrier	
		b) respiratory protection against toxic fumes (should capture present WN30)	closed loop	Rebreather, catalytic
			open loop	
		c) eye protection	shield/barrier	Visor, goggle, UVA block, UVB Block, laser Filter, Photo-elec.
		d) cut/puncture protection	shield/barrier	
		e) flash/flame protection	shield/barrier	
		f) ear protection	shield/barrier	
			noise cancellation	
		g) impact protection	shield/barrier	soft sole boots, Joint protection
		h) signature reduction	acoustic	soft sole boots, urban patterned camouflage
			IR - near and far	
			visual	
			olfactory	
			electromagnetic	
			higher frequencies	
	Technology Characteristics:			
	light weight			
	area of coverage			
	improved mobility while still protected			
	stand-off/remote vs. level of protection			
	comfort			
	Can wick away sweat			
	stealth			
	signature			
	interoperability with other systems			

Notes:

- Lightweight; do not want any 73lb shields.
- Similar need in OFW, which is divided into sub-needs. OFW is looking at all environments. Maybe for the follow-on program we should focus on urban-specific protection needs? Special camouflage, hearing protection, protection from urban-toxic fumes
- On the ballistic side, the predominate places of casualties are upper chest area, throat, arms (data to support this at ProMet using MILES and Simunitions). Can we protect those?
- There may be a legitimate need to vary coverage of body armor based on different people's missions. Need to look at most important areas of coverage. Johns Hopkins did a study on this four years ago. DARPA's exoskeleton project is based on that premise. Need to tap into that study.
- But, majority of casualties taken are out in the open, people aren't dying inside the buildings. Need to focus on casualties incurred outside, more than inside.
- Trying to improve mobility (reduce weight carried) and protect. Not necessarily protection against small arms. If you are more mobile, how much less protected can you be? If invisible, don't need protection.
- Need to tie this to OFW. OFW should leverage for the follow-on program.
- Toxic fumes more likely in an urban environment. Although, is this covered in WN30 Oxygen Depleted Environment?
- Risk to the eyes, splatter protection, Kevlar sleeve (have seen many casualties here).
- Cappeline shirt to wear under body armor would be great. Something to wick moisture. It is commercially available.
- Soft-soled boot. Boots are really loud right now, would like to absorb sound. Could also impact protection for your feet. Natick developed some boots and did a good job with them. Problem of continuous wear.
- Ballistic protection: area of coverage as a characteristic.
- Respiratory protection:
  - Catalytic filter (included under rebreather).
  - Closed loop vs. open loop as capabilities for respiratory protection (instead of powered/unpowered).
- Eye protection: Goggle, visor, passive shield, photovoltaic or photoelectric(?), UAV/UVB.
- Ear protection: white noise, noise cancellation.
- Signature reduction:
  - Electromagnetic includes visual, IR (near and far)
  - Hide signatures at wavelengths so that dogs cannot detect you
  - List mask, camouflage, cancel as capabilities instead of listing the types of signatures to be dealt with?

WN17 Detect Explosives/Explosive Devices

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN17	**Detect Explosives/Explosive Devices**	To detect explosives/explosive devices/mines inside buildings or in/around built up areas.		
		NOTE: link to WN23	chemical sniffers	dogs
			electronics detectors	
			metal detectors	
			visual detection	improved lighting, silly string
	Technology Characteristics:			
	programmable detection			
	manportable			
	detection time			
	does not detonate device			

Notes:

- This need was sparked by the issue of booby traps.
- Having really good lighting or somehow enhancing visibility might be a way to detect these types of issues.
- Some capabilities might address being able to locate the trigger mechanism, rather than just the explosive; an example might be silly string; probably also falls under visual detection, since it allows these things to be visible.
- Sniffers usually will not work in a MOUT environment.
- The detection capability should not detonate what you are looking for in the first place.

WN18 Get on Top of Buildings

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN18	**Get on Top of Buildings**	To be able to put/get soldiers and Marines on top of buildings.		
			mechanical	Catapult, crampons Pogo stick, ladder, Robot, suction cups
			propulsion	jet pack
			explosive	
			aerial	Parafoil, fast rope
	Technology Characteristics:			
	reduce vulnerability			
	time to employ			
	usable both inside and outside buildings			
	manportable			
	light weight			
	allow more than one man at a time (with combat load) (e.g. cargo net)			
	requires little if any effort			

Notes:

- Discussion at last workshop was that not only might you want to get to the top of the building to clear it downward, but that current or traditional methods (ladders, ropes, etc.) to get people to upper floors require one to be exposed for a certain amount of time.
- This need reflects the ability to get on top of buildings, both inside and outside.
- Should make sure that lightweight and manportable are both captured wherever one has already been identified under the technology characteristics.
- Issue raised about current ladders where only one person is on the ladder at once with the others lined up at the bottom, which may translate into vulnerability.
- Ideally, whatever method is identified would require less effort than the current one to ascend the building.

WN19 Enhanced Indirect Fires

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN19	**Enhanced Indirect Fires**	To enhance indirect fires.		
	NOTE: clarification of need--means to control effects of indirect fire		improvements to existing mortar	improved/adapted mortar base plate
			accuracy	guidance
			variable effects	fuzed explosive, dial-a-yield
	Technology Characteristics:			
	variable effects from fusing and payload			
	man-deliverable			
	improved stability of mortars			
	delayed effects			
	precision			

Notes:

- Believe that this need was referring to indirect mortars; the idea of being able to go through to, say, the second floor.
- A reduced charge so that you have a reduced effect; reduces the overall damage and also can be used closer to friendly forces (linked to fusing and payload issues).
- Not really trying to talk about precision-guided weapons for indirect fire, but trying to take what we do have now and use better in an urban environment.
- Precision may be important if you think you'll be using these things in close proximity.
- May be worth redefining this need; maybe talking about precision or minimizing/ reducing collateral; really talking about having greater control over the effects of indirect fire.
- Is there any way to control the yield of a regular weapon in the way that this can be done with a nuclear weapon? The idea of dial-a-yield.
- Believe that time would be better spent in developing/improving the mortar base plate than to spend time on trying to be able to guide a mortar; although you do want to be concerned with accuracy.
- Would the capability be a fused explosive, and then an improved mortar baseplate would be a capability.
- Concern that the capabilities listed presently (i.e., improvements to existing mortar, improve accuracy/guidance, and improvements to the round) are really just further definition of the need.
- Fusing is a technology for achieving variable effects.

WN20 Identify Non-Combatants

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN20	**Identify Non-Combatants**	To identify non-combatants under all conditions.		
			marking	
			aggressive body language detection	
			training	
			thermal	
			acoustic	
			RF	
			chemical sensor	
			magnetometer	
			HUMINT	
			SIGINT	remote listening devices
	Technology Characteristics:			
	ID friends and enemy, non-combatants are the rest			

Notes:

- This need came out of an original need to identify friend and foe; first started talking about being able to identify enemy in a crowd of civilians, so ultimately you also get at the need to also identify non-combatants; this will be difficult.
- If you can identify friend or foe, then you have given the soldier/Marine something great.
- Possibly mirrors WN07 – Identify Enemy?; yes to some extent, but there may be some technology solutions that are able to identify those with weapons. This does not mean that they are automatically enemy.
- Are there any out-of-the-box indicators of non-combatants? Secret Service has technique that allows them to survey a crowd and look for certain types of body language, which they mark, and then they can move in to remove those potentially threatening individuals.
- There might be some specific training that the infantryman could go through relevant to crowd behavior/surveillance techniques.
- The ultimate solution to this need is probably very synergistic.

WN21 Concealment

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN21	**Concealment**	To conceal movement, activity and/or position		
		NOTE: changed need title and definition	chemical process	smoke
			diversionary concealment	tactics
			directed energy	dazzlers
			cloaking	Mud, block thermal signature
	Technology Characteristics:			
	time to conceal (prefer instantaneous)			
	persistence			
	toxicity			
	block enemy's multispectral sensors, but not ours			
	prevent enemy observation			
	instantaneous			
	ease of employment			
	remote			
	smoke for different times of day			

Notes:

- This was based on the soldier/Marine being able to put down instantaneous obscurant that can be used to conceal movement/activity/position.
- At present, operationally have a system that works (i.e., smoke), but it takes time to employ; would like something that could be employed/conceal more quickly.
- Ideally it would block multi-spectral on the enemy, but would still allow friendly to see through.
- There might be some difference between visual and diversionary concealment.
- Seem to be focusing on passive capabilities, but there may also be more active capabilities (i.e., directed energy).
- Is there a need for night-time concealment (i.e., so that you cannot be detected by the enemy's Night Vision Devices); may also consider being able to bloom out the enemy's NVD, but must be sure that light flash does not bloom own NVD.
- Suggestion to change need to encompass concealment rather than just obscurants.
- Key to this need is instantaneous.

WN22 Enhanced Casualty Treatment

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN22	**Enhanced Casualty Treatment**	To provide means for enhanced casualty treatment.		
	NOTE: link to position-location need	a) ways of administering aid	telemedicine	
			self-aid	isolate and reduce pain locally
			casualty alert	Personal Status Monitor
			organizational change	move medics forward
		b) types of aid	prolong tolerance to injury	Adrenaline, isolate and Reduce pain locally
			stop bleeding	Cauterization, clotting, Pressure bandage
			prevent shock	
			training and techniques	self-aid
			fluid replacement	drinkable IV
	Technology Characteristics:			
	improve soldier's first aid kit			
	prepackaged medical supplies			
	self-aid			
	"extend golden hour"			

Notes:

- This was about trying to extend the "golden hour" and the life of a casualty.
- Also talked about a way that data about the injury could be transmitted to doctors/medics elsewhere, so that when someone reaches him, they have an idea of what they are dealing with.
- Also we only have a compression bandage period at the present; should also look at improving the first aid kit given to the soldier/Marine.
- Could possibly have a capability related to prolonging the tolerance to injury (for example, adrenaline, clotting, etc.).
- Can probably solve a lot of this with training and techniques.

- This would be linked to position-location, because you still have to locate the injured to get to him to provide further casualty treatment and/or evacuate.
- Need some sort of alert that an injury has just taken place and where that individual is located.
- The ability to be able to provide self-aid is a lot more important and difficult that you might realize (for example, being able to put in one's own IV); if you give the individual the ability to provide more self-aid, you extend the "golden hour" and have more time to get the individual off the battlefield.
- Want to be able to take pain medication, etc., but maintain operational effectiveness (remain in the fight).
- One of the reasons that people keep going once wounded is that the adrenaline is flowing.
- May want to consider separating into two categories of needs – 1) ways of administering aid; 2) types of aid. Actually better to just have the ways of administering the aid.
- Might not want to think of telemedicine here in the traditional sense, in that some private is being talked through some sort of complicated surgery; but there would be benefit for someone to be able to contact a doctor and explain what the wound looks like and get information on what the problem might be and how to initially treat it.
- Should probably think of this as concentrating on improving base level medicine/first aid to sustain an individual without "professional" medical personnel.

WN23 Improved Neutralization of Explosives/Explosive Devices

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN23	**Improved Neutralization of Explosives/Explosive Devices**	To improve neutralization of explosives/explosive devices/mines inside buildings or in/around built up areas.		
		NOTE: not necessarily deployed by infantry but within battalion task force; closely linked to position location/ marking	minimize/mitigate effects on troops	Sandbags, sticky foam, blanket
		NOTE: need does not include non-explosive devices	render device ineffective	high pressure water stream, freeze
			decision aids	
			training about how to work safely around devices (once Identified)	
	Technology Characteristics:			
	ease of employment			
	maximum applicability across hazardous devices			
	manportable			
	minimize toxicity			

Notes:

- This is linked to the ability to detect explosives and explosive devices, so that the commander can decide what he wants to do (i.e., neutralize it or by-pass); the detection piece is really critical for the urban environment.
- Are we looking for an organic capability that the infantryman can do without engineers?; may not want to completely rule out engineer involvement and if so, maybe should note this relevant to the need.
- Also linked to marking and position-location needs.
- Might there be a need for a capability that provided decision aid that would offer different approaches to neutralizing the type of explosive/explosive devices detected; could be linked to training about types of devices, how to approach them.
- Disabling means that you have to get more involved (probably an EOD expert) with the device than neutralization, which is stopping the effects of whatever that explosive/device is.
- Is the nature of this need to ignore non-explosive booby traps? They could require very different types of capabilities; feel that at the time that the needs were defined, the warfighters did not consider non-explosive booby traps to be that big of a problem in MOUT. They may be encountered, but then they become an obstacle.

WN24 Enhanced Urban Vehicular Survivability

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN24	**Enhanced Urban Vehicular Survivability**	To enhance vehicular survivability during an urban operation.		
			barriers	Nets, shields, Chicken wire, Reactive armor
			maintain mobility	keep tracks on armored vehicles
			extinguish fire outside vehicle	
	Technology Characteristics:			
	protection from top attack			
	protection from bottom attack (e.g. from manhole)			

Notes:

- Original discussion during the generation of this need was based on having nets/chicken wire, etc. that could be used to deflect.
- Tank is relatively well protected, but other vehicles are less well protected.
- Need a way to get tracks and wheels on armored vehicles when they encounter explosives; related to ability to maintain mobility of the vehicle.
- You need same type of fire protection material/capability on the inside as the outside, so that if you encounter Molotov cocktail, fire can be extinguished.
- This was focused on the close-in attack.

WN25 Improved MOUT Logistics

Need Number	Need Title	Need Definition	Capabilities	Technical Solutions
WN25	**Improved MOUT Logistics**	To improve logistics capability (Fuel, Fix, Replace, Move, Arm, and Feed) in the urban environment.		
			mechanical devices	mules
			combat pre-packaged items	
			precision delivery	
			just-in-time resupply	
			planning tool	
	Technology Characteristics:			
	push vs. pull system			
	autonomy			
	disposability			
	link to position location			
	link to casualty evacuation			
	reliability			

Notes:

- Need came from the concept of prepackaged logistics support, rapidly refueling vehicles.
- Just-in-time supply to minimize the things you need to carry.
- Push or pull? Push logistics forward, but capability for pull if needed.
- Combat pre-packaging – provide bullets in the magazines, not in a case.
- Disposable magazines. Biodegradable?
- Know when a team or squad is short of supplies. They don't even know their supply-levels until the levels are low.
- Tools to aid in planning.
- Should be tied to position location and casualty evacuation. Those people moving casualties should be bringing up supplies.

WN26 Improved Power Source Efficiency

Need Number	Need Title	Need Definition
WN26	**Improved Power Source Efficiency**	To improve efficiency of battlefield power sources.
		NOTE: should consider this need as an overarching imperative to be applied to capabilities in other needs; Refers to two areas: 1) power management and 2) system efficiencies
	Technology Characteristics:	

Notes:

- There is an area of OFW covering power usage. In OFW, looking at ways to store and generate power; rechargeable batteries.
- This need came from prolonging life of battery, recharging batteries, reducing usage of power from radios and other systems, recharging from the vehicles.
- Are there MOUT-specific power source needs? If not, perhaps should defer this need to OFW? The MOUT kit may require more power than other combinations of equipment.
- CECOM already has many programs dealing with this.
- Have several modes for through-wall devices. In the mode that we need for urban operations, there are energy-saving means to allow device to last for several days.
- Becomes an overarching imperative of power efficiency.

WN27 Enhanced Individual and Collective Urban Training

Need Number	Need Title	Need Definition	Capabilities
WN27	**Enhanced Individual and Collective Urban Tactical Training**	To provide enhanced individual and collective urban tactical training	
changing this need; remove from numbering scheme as a stand-alone, more of an imperative; remember to renumber rest of needs			facilities
			training doctrine
			programs of instruction
			training impact analyses
			TTP development
			training devices
	Characteristics:		
	urban specific		
	frequency of training		
	perishability of skills		
	intuitiveness of technical solution		
	importance of training cycle time within experimentation		
	realism		

Notes:

- Becomes an overarching imperative.
- Came from need for training to accompany all of these technologies? Micro-climate, water, sustenance.
- Microclimate cooling is not an urban-unique problem. OFW is covering this.
- WN32 covered realism in training, which no longer is a separate need.
- Not a need, but a desired effect from synergy of training, equipment, doctrine.
- Urban-specific need: high fidelity training.
- Collective effect of organization, not individual effectiveness.

- STRICOM's range activities are not looking at the individual, squad level effectiveness. JRTC does not meet the individual training needs. Need McKenna, Lejuene type training facilities.
- Could address primary-level training needs with WN27. Perhaps cannot pay for it, but can at least identify need and share with others.
- Range upgrades, building of new ranges (even just a bunch of windows). Although we probably won't be doing this through the follow-on program.
- If the follow-on program recommends training in certain areas, people will listen.
- Pull out as a stand-alone item, approach: would not compete with other needs. Avoid problem of having to re-rank needs because this one changed.
- It's one thing to train on a weapon, and something different to train on that same weapon with a special sight.
- OPFOR at JRTC are already listening to the new radios using scanners they bought at Radio Shack. That's because the radios are not being used properly – a training problem
- Tech search might want to look at technologies in terms of how easy they are to use. The easier the equipment is to use, the better off we are.
- The ability to conduct effective NET, develop TTP before collecting data at experimentation is very important. Need to build time for this into programs. Need to approximate reality as much as possible in training.

WN28 Non-Violent Crowd Control

Need Number	Need Title	Need Definition	Capabilities
WN28	**Non-Violent Crowd Control**	To provide non-violent means to control a crowd.	
need title and definition changed		NOTE: defer to/leverage other work in this area by Crowd Control CEP	
		NOTE: The follow-on program will track Crowd Control CEP progress and incorporate findings as appropriate	
	Technology Characteristics:		

Notes:

- Covered by programs at non-lethal directorate; leverage that work.
- Plenty of violent means, and non-lethal is still violent; needed because of CNN factor.
- The follow-on program will keep track of what comes out of Crowd Control Concept Exploration Program (CEP) (Picatinny) and be prepared to incorporate findings when and if appropriate.

WN29 Rapid Counter-Mobility

Need Number	Need Title	Need Definition	Capabilities
WN29	**Rapid Counter-Mobility**	To provide rapid counter-mobility.	
		NOTE: leverage ongoing work (non-lethal aspects) by Area Denial to Vehicles CEP (not watercraft) and Area Denial Personnel CEP	
		NOTE: The follow-on program will track Area Denial Vehicles CEP and Area Denial Personnel CEP progress and incorporate findings as appropriate	
	Technology Characteristics:		

Notes:

- Fancy spike strip? FASCAM? Quick road blocks.
- Could be lethal, could be non-lethal.
- There is another program, Area Denial of Vehicles CEP, which is looking at non-lethal means (also Non-lethal Weapons Directorate?). Leverage this program? It addresses everything but watercraft.
- Also a third program, Area Denial of Personnel CEP.
- Leverage and track these programs.

WN30 Oxygen Depleted Environment

Need Number	Need Title	Need Definition	Capabilities
WN30	**Oxygen Depleted Environment**	To operate in oxygen-depleted and NBC contaminated environments.	
Rolls under Personal Protection WN16			
	Technology Characteristics:		

Notes:

- Rolled under WN16 – Improved Personal Protection.

WN31 Control Use of Electrical Equipment

Need Number	Need Title	Need Definition	Capabilities
WN31	**Control Use of Electrical Equipment**	To selectively control electrical equipment in the urban environment.	
			smart jamming
			power denial
			jamming
			electronic viruses
			reachback technical support
	Technology Characteristics:		
	reversible		
	remote		

Notes:

- Selectively deny lights, turn on when needed again. Not necessarily destroy.
- Would like to control lights, telephones, cell phones.
- AF dropped graphite on power grid in Belgrade.
- Need a telemedicine-type capability, a "reach-back" for technical advice so that soldier/Marine knows what to do.
- There are probably people that already know how to do these things, need to talk to them.
- Do we want to limit ourselves to reversible? Do we want to disregard a capability because it's not reversible?

APPENDIX H

M&S Plan for the Incubator Process in Support of the MOUT ACTD Follow-on Program

APPENDIX H

M&S Plan for the Incubator Process in Support of the MOUT ACTD Follow-on Program

The following is a plan for the modeling and simulation in support of the MOUT ACTD follow-on Incubator process. The purpose of this modeling is to compare the different capabilities developed in Workshop IIa to meet each of the needs identified in Workshop I. Not all of the needs and capabilities are suitable for modeling, but this plan addresses how we intend to handle those needs and capabilities that are.

We plan to coordinate the MOUT ACTD follow-on modeling as much as possible with other M&S efforts in which we are currently involved. These include the Validation portion of the MOUT ACTD-sponsored MOUT Verification and Validation (V&V) and the Congressionally mandated through-wall sensor study.

The Incubator scenarios will provide an excellent opportunity for Subject Matter Experts (SMEs) to validate the JCATS model. SMEs at Ft. Benning can review some of the JCATS Incubator scenarios gamed by the Dismounted Battlespace Battle Lab (DBBL) Simulation Center and comment on the model's ability to produce a realistic representation of the urban scenarios. The through-wall sensor study also fits in well with the Incubator modeling since one of the MOUT ACTD follow-on needs (WN15) addresses the problem of needing to know of what's on the other side of the wall.

A. MOUT ACTD FOLLOW-ON NEEDS LIST

The following is a list of the MOUT ACTD follow-on needs. The columns to the right of the needs indicate whether or not the needs are included in Objective Force Warrior (OFW) (an ongoing Army program developing equipment and clothing for the individual warfighter), whether the needs are conducive to modeling, if the needs are intended for gaming by DBBL, and whether they have been identified for use with the MOUT V&V. Needs that are not included in OFW or that are not suitable for M&S using JCATS will not be modeled. Those needs have been grayed out in the table below.

Need Name and Number	OFW	Suitable for M&S using JCATS?	Candidate for gaming by DBBL?	Use for MOUT V&V[1]
WN01: Urban Surveillance and Detection	Yes	Yes		
WN02: Identify Friendlies	Yes	Yes		
WN03: Urban Communication all Levels	Yes	No. JCATS does not represent communications Call for fire study?		
WN04: Near Real-Time, Scaleable Map Information for Production and Dissemination	Yes	No. JCATS will not differentiate between different means of production/ dissemination		
WN05: Sniper Detection	Yes	Yes		
WN06: Position Location in Complex and Restrictive Terrain	Yes	No. JCATS automatically provides pos/loc information to the JCATS operator		
WN07: ID Enemy	Yes	Yes		
WN08: Improved Target Designation	Yes	Yes		
WN09: Improved Precision Direct Fire	Yes	No. Capabilities are too different		
WN10: Enhanced Casualty Evacuation	Yes	Yes		
WN11: See While Inside Buildings and Structures	Yes	No. Light model inside buildings not detailed enough		
WN12: Improved Designation of Persons/Items	Yes	No. Marking individuals is not currently represented in JCATS		

[1] In each scenario, Red will defend building and or street from attack.

Need Name and Number	OFW	Suitable for M&S using JCATS?	Candidate for gaming by DBBL?	Use for MOUT V&V[1]
WN13: Improved Forcible Entry	Yes	Yes	Yes. DBBL has already modeled breaching—leverage for MOUT ACTD follow-on	Yes. Dismounted troops enter building (breach and enter on first floor). Vehicle clear obstacle on street. Secure the street.
WN14: Defeat Armored Vehicles, Bunkers, Reinforced Structures	No	NA		
WN15: Knowledge of Other Side of Wall	Yes	Yes. Leverage Through-wall sensor study	Yes	Yes. Floor clearing operation.
WN16: Improved Personal Protection	Yes	No. JCATS does not have a detailed enough representation of human body But maybe assign probabilities for degrees of wounding?		
WN17: Detect Explosives/Explosive Devices	Yes	Yes	Yes	
WN18: Get on Top of Buildings	Yes	Yes	Yes. DBBL has already modeled ladders—Leverage for MOUT ACTD follow-on	Yes. Secure a building.
WN19: Enhanced Indirect Fires	Yes	Yes	Yes. DBBL has already conducted a PGMM study	Yes. Attack a bunker.
WN20: Identify Non-Combatants	Yes	Yes		
WN21: Concealment	Yes	Yes	Yes. If tactics are included as a capability, otherwise not gamed	

Need Name and Number	OFW	Suitable for M&S using JCATS?	Candidate for gaming by DBBL?	Use for MOUT V&V[1]
WN22: Enhanced Casualty Treatment	Yes	No. JCATS does not have a detailed enough representation of the human body to represent casualty treatment		
WN23: Improved Neutralization of Explosives/Explosive Devices	Yes	Yes		
WN24: Enhanced Urban Vehicular Survivability	No	NA		
WN25: Improved MOUT Logistics	Yes	Yes		
WN26: Improved Power Source Efficiency	Yes	Delete. Imperative		
WN27: Improved Soldier/Marine Individual Operational Effectiveness	Yes	Delete. Imperative		
WN28: Non-violent Crowd Dispersal	Yes	Delete. Covered by Concept Exploration Program (CEP)		
WN29: Rapid Counter-Mobility	Yes	Delete. Covered by CEP		
WN30: Oxygen Depleted Environment (now included under WN 16)	Yes	Absorbed into WN16		
WN31: Control Use of Electrical Equipment	Yes	No. JCATS does not represent power in buildings (e.g. for electricity). It will not be able to distinguish between the different capabilities.		

1. Scenarios

For each of the MOUT ACTD follow-on needs that we plan to address (as shown in table above), a scenario will be developed that depicts that particular need and provides an opportunity to compare different capabilities to fill that need. Where possible, scenarios will be reused. For example, a room-clearing scenario may be appropriate for illustrating several of the MOUT ACTD follow-on needs.

2. Gamed vs. Preplanned Scenarios

All of the scenarios used to model the MOUT ACTD follow-on needs could be gamed, or played interactively by JCATS operators controlling the JCATS entities throughout the scenario. Some of the scenarios are also conducive to modeling using a pre-planned approach, where the scenarios are prepared in advance and run multiple times. Preplanned scenarios are most effective when there are few decisions that will be made to change the course of a scenario, and those decisions that are made can be predicted. Urban scenarios require smaller units of soldiers and more control/decision making at lower levels. This level of decision-making can make urban scenarios more difficult to model using preplanned scenarios because the scenario outcomes depend heavily on the decisions of individuals. For example, loss of a key individual could result in a change in the course of the scenario. By keeping the scenarios simple, we will try to avoid such problems with the preplanned scenarios.

3. Capabilities and Capability Data

The data used to represent the capabilities in JCATS will be based on information that the MOUT ACTD Follow-on Scout team can gather about that capability. In general, JCATS models the effects of capabilities, so even if a capability cannot be explicitly modeled, it may be possible to represent the effects. There may be cases where that information about the capability and/or its affect is limited. In those cases, assumptions will be made based on subject matter expert judgment. Alternatively, we may also choose to parametrically vary the key characteristics (e.g. range and accuracy) to determine what the most desirable data values might be.

Cases may also arise where the capabilities addressing a need cannot be distinguished from one another due to the limitations of JCATS. In these instances, we intend to model the capability and compare it to a baseline.

4. Descriptions of M&S Approach for Each Need

The next section (Section B) describes approaches to modeling capabilities, possible scenarios, required data elements and other information as guidance for modeling the MOUT ACTD Follow-on needs. Specifically, each need sub-section includes the following information.

- *Capabilities* — a list of capabilities identified during Workshop III to address a warfighter need

- *General approach* — a basic description of how JCATS will be used to investigate capabilities for a warfighter need, including any particular strengths that JCATS may possess
- *MOUT V&V Considerations* — additional information for those needs that can be used in the Validation portion of the MOUT ACTD sponsored MOUT V&V
- *Hypothesis* — a statement about how the use of identified capabilities will or will not impact (positively or negatively) force effectiveness
- *Does this need require gaming?* — an assessment of whether a warfighter need must be gamed, rather than modeled through pre-planned scenarios
- *Scenario outline* — a description of the entities, characteristics, and features of a scenario that could be used to compare capabilities for a warfighter need
- *Assumptions* — a record of any assumptions that will be made with respect to the capabilities and/or use of JCATS
- *Measures* — a list of measures that could be used to compare capabilities for a warfighter need
- *Experimental design* — a plan for the number of different cases and runs to be conducted
- *Data requirements* — a list of data requirements needed in order to appropriately represent the capabilities in JCATS
- *Questions* — a record of any additional, outstanding questions that would need to be resolved prior to conducting analysis using JCATS for a warfighter need.

Note that some of the needs include more detailed information than others. For example, needs WN01: Urban Surveillance and Detection, WN05: Sniper Detection, WN08: Improved Target Designation, and WN10: Enhanced Casualty Evacuation include very detailed information about the modeling approach while other needs lack information including Scenario outlines, Assumptions, and Experimental Design. This is because the four needs listed in the previous sentence were modeled as a "proof of principle" to demonstrate the Incubator process. See the main report section, "Implementation Experience," for the results of that modeling.

B. MOUT ACTD FOLLOW-ON INCUBATOR NEEDS

WN01: Urban Surveillance and Detection

Capabilities identified in Workshop IIa:
- Thermal sensor package
- Day camera sensor package
- Acoustic sensor package
- RF
- Radar
- Motion detection
- Magnetic anomaly detection
- HUMINT
- Seismic
- Chemical sensors
- SIGINT

General approach: The capabilities identified for this need are different types of sensors (with the exception of HUMINT and SIGINT, which refer to types of information). None of these capabilities specify platforms or modes of employment, but platform and employment issues will be important considerations. JCATS may be more helpful in investigating these types of parameters rather than the different sensor types alone (especially since JCATS doesn't represent many of the sensors listed above).

Some of the capabilities listed above are likely to be stationary, others are likely to be mobile; thus we recommend modeling these different capabilities to compare their platform and mode of employment rather than comparing the specific sensor types. The first step will be to make assumptions about the platforms and employment configurations for the capabilities above, so that we can group and compare them.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: No.

Scenario outline: Arrange two squads of enemy troops and five enemy vehicles in an area in and around buildings, according to the table below.

Enemy System	Moving/Stationary	Inside/Outside Buildings
1 APC	moving	Outside
1 tank	stationary	Outside
1 truck	stationary	Outside
2 trucks	moving	Outside
1 squad	moving	Outside
1 squad	stationary	Inside

Compare three different capabilities: UGVs, UAV (specifically, Pointer), and fixed ground sensors based on their capabilities to detect the enemy individuals in and around the buildings. In this set of scenarios, we will compare one UAV to three UGVs to 12 fixed ground sensors.

As a base case, two soldiers will watch the site (where the red entities are) through binoculars from a distance. One soldier will be located southwest of the site in a tree line, the other will be positioned northeast of the site, also in a tree line.

In the robots case, each of the three robots will explore a separate section of the site. Two of the robots will be deployed from a position southwest of the site (near the position of the soldier in the base case) and the third from a position northeast of the site (near the other soldier's position in the base case).

In the UAV case, the UAV will take off from a location more than one km from the site. It will fly figure eights over the site and then return to the area it took off from.

Assumptions:

- Each of the three capabilities we identified uses a sensor that is most appropriate to the system. The three capabilities do not use the same sensors (MRT curves).

- The robots and UAVs are mature enough so that they do not require soldiers to control them at very close range, nor do they require LOS to the soldier controlling them.

- According to the MOUT ACTD database, the Pointer UAV can only operate for 20 minutes on a non-rechargeable battery. To include this constraint in the scenarios, each of the 4 capability scenarios will run for 25 minutes. This will give capabilities that do not have such a restrictive time constraint an opportunity to show the time advantage. This assumption would need to change if the operation time of one of the other capabilities is less than 20 minutes.

- There are no data describing the vulnerability of the UAVs, robots, and ground sensors to enemy weapons. Although these surveillance systems are vulnerable to enemy fire, for the purposes of this study we will focus only on the systems' capabilities to detect enemy. If a decision were made to use vulnerability in this

study, in addition to adding the vulnerability information to the sensor systems, appropriate weapons (e.g., a grenade launcher and a light anti-tank weapon) for use against the systems would need to be added to those available to the enemy forces.

- The ground sensors are assumed to be in position. How they actually get there (e.g., dropped from an aircraft) is a very important consideration, but will not be taken into consideration in this scenario.

- UAV is a fixed-wing system[2]

    - Length=1.8m
    - Width=2.7m
    - Height=0.3m
    - Observation height=0.3m
    - Speeds
        - Slow=19.12knots
        - Med=30knots
        - Fast/Max=43.45knots
    - Altitude
        - Low=100m
        - Medium=500m
        - High=914.4m
    - Max turning radius=36.1deg/sec
    - Min take-off/land distance=25m
    - Max climb rate=60,000m/min
    - Max descent rate=60,000m/min
    - Operation time
        - 140 minutes on non-rechargeable battery
        - 20 minutes on a rechargeable battery
    - Range = 8km
    - Sensor
        - UAV Sensor (optical sensor with maximum range of 3000m)
        - Field of Regard (FOR) = 90 degrees

[2] Data for the UAV and the robots was taken from: MOUT ACTD database, NASA website (http://uav.wff.nasa.gov/db/uav_char.html?key=33), Aerovironment (Pointer manufacturer) website (http://www.aerovironment.com/area-aircraft/prod-serv/pointer.html)

- Robots are modified Matilda-Vs from early MOUT ACTD M&S files
    - Length=0.76m
    - Width=0.51m
    - Height=0.3m
    - Observation height=0.2 m
    - Speeds
        - Slow=0.86 km/hr
        - Med=1.71 km/hr
        - Fast/Max=3.12 km/hr
    - Range=100m from operator
    - Sensor
        - Matilda sensor (optical sensor with maximum range of 100m)
        - FOR = 360 degrees

- Ground sensors are the same as Matilda Vs, but stationary
    - Positioned in a grid around buildings in the MOUT site 30 m apart
    - Sensor
        - Matilda sensor (optical sensor with maximum range of 100m)
        - FOR = 360 degrees

Measures: Average duration of Red detection, critical activities detected, number of non-combatants detected, number of Red targets (inside) acquired by Blue, number of Red targets (outside) acquired by Blue, percentage of non-combatants detected, percentage of Red targets (inside) acquired by Blue, percentage of Red targets (outside) acquired by Blue, total surveillance coverage, ammunition expenditure, average engagement ranges, FER, LER, Red losses, Red suppressed, Blue losses (fratricide), Blue losses (by Red), percentage of Blue targets acquired by Red, noncombatant losses, time for sub-units to move between critical nodes, time to accomplish mission

Experimental design:

The following cases will be analyzed:

1. 1 UAV
2. 3 UGVs
3. 12 Fixed sensors
4. Base case

Data requirements: How are the sensors likely to be configured (in terms of the number of sensors, types of platform – specifically mobile vs. stationary), range of the sensors, day/night-capable. See assumptions.

Questions: Would it be acceptable to just use one sensor for this need since we intend to look at the platforms rather than the sensor itself? How would we generate appropriate data for capabilities like magnetic anomaly detection? Instead we could use radar or sonar representations which allow the user to input detection tables for different signatures.

WN02: Identify Friendlies

Capabilities identified in Workshop IIa:

- Visual
- Thermal
- Acoustic
- RF
- Chemical sensor
- Magnetometer
- HUMINT
- SIGINT

General approach: The fratricide model in JCATS will be used to model this need. The fratricide model will allow us to 1) set individuals to "fire on recognition" rather than the normal fire on identification, or 2) set areas where soldiers are more/less likely to fire upon friendlies (if shots are being fired or are impacting nearby). The scenarios used to model this scenario will involve an intense fire-fight with potential for fratricide to occur. In the base case, the friendly forces will be allowed to fire at other friendly forces either by using the JCATS fire on recognition option (rather than identification) or else a JCATS "jumpiness factor" will be assumed. The "jumpiness factor" makes friendly forces more likely to fire at other friendly forces. In the cases where visual, thermal, acoustic, and other capabilities are represented, the likelihood of "jumpiness" will be reduced.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: No

Scenario outline: The McKenna building clearing scenario may be useful for modeling this need. The friendly and enemy forces will not use any automatic weapons; they will only use M16s.

Assumptions:

Measures: Blue losses, Red losses.

Experimental design:

Data requirements: Information about the effect these systems have on the incidence of fratricide. How effective are these systems at detecting friendlies? What are the ranges of these capabilities?

JCATS specific inputs:

- Jumpiness enabled?
- Identification at Recognition?
- Retained shots (number of shots the systems can remember).
- Weight (0=not jumpy, 1=normal jumpiness), distance and time factor (amount of time that the system will remain jumpy) for shot source.
- Weight, distance and time factor for shot impact.
- Weight and distance for intelligence token.

Questions: Are we going to be able to distinguish between one capability and another? How? Increase the jumpiness factor for those systems that are less effective at identifying friendlies? The weight used in JCATS seems arbitrary. How will we incorporate range of the device? Just by range of the sensor that the engaging squad uses?

WN05: Sniper Detection

Capabilities identified in Workshop IIa:

- Visual/Optical
- Thermal
- Acoustic
- RF
- Magnetometer
- Chemical sensor
- HUMINT
- SIGINT

General approach: As in the case of the Urban Surveillance and Detection Need (WN01), we plan to investigate the differences between the sniper detection capabilities according to characteristics of the systems other than just the sensors alone. The capabilities will be modeled according to whether the device works before or after the first shot is fired, the amount of time that passes after the shot is fired before the individual using the capability is made aware of the sniper's location (and returns fires on the sniper), and the range of the device.

The JCATS behaviors model will be used to aid in the representation of the sniper detection system. The individual(s) with the sniper detection device will be assigned a task/behavior that will allow him to plan a direct fire mission on the sniper after a specified time-delay. For example, if a soldier is given the JCATS behavior/task "FireAtSniperWithDelay10," he will return fire on the sniper 10 seconds after the sniper fires at him or at one of his taskforce members. Rather than modeling actual capabilities, we plan to model the capabilities according to the amount of time before the Blue forces return fire on the enemy snipers (10 seconds, 5 seconds, 2 seconds, immediately). Note that the time delays to not represent the time from trigger pull to impact. There is some additional time required to actually use the weapon.

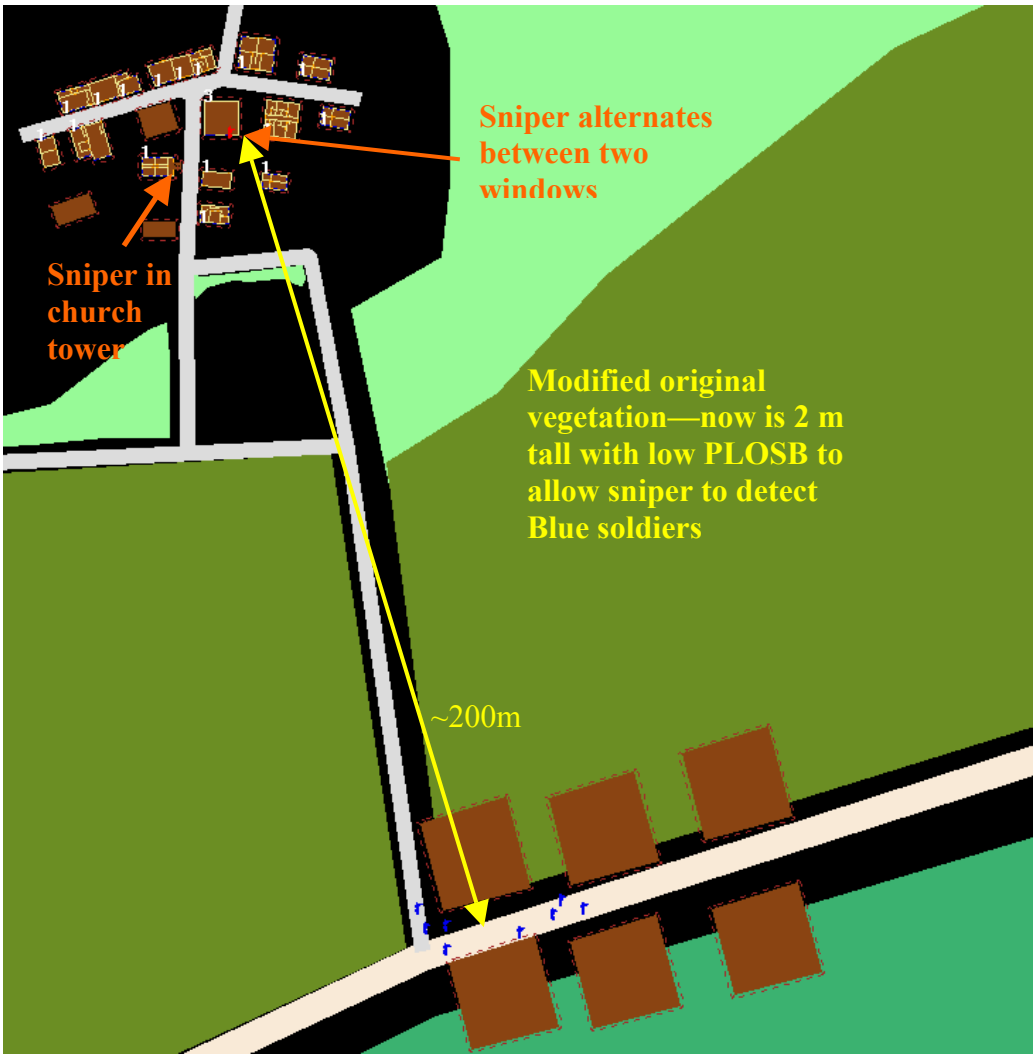
In addition to the time delay, other differences between sniper detection capabilities could be range, accuracy, and even the type of weapon/munition. Modified probability-of-hit tables for the weapon/munition returning fire on the sniper could be used to represent the accuracy of the sniper detection device. If the system is completely accurate, the PH will be close to 1. Using the PH values will also allow the accuracy to vary with range. In these scenarios, however, we do not plan to vary the accuracy of the sniper detection device. Normal M16/5.56mm data will be used.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: No, although other insights could be gained by gaming these scenarios. Some examples:

- When is sniper position information no longer useful?
- How is the accuracy of information about the sniper location (e.g. window, building, or city block) related to the time it takes to get the information (e.g. after 1 shot, after 2 shots, etc). It seems that the longer it takes to get the information, the less important it is that the capability convey detailed location information.

Scenario outline: A squad of friendly forces is scattered around some large buildings (possibly warehouses) about 200 meters southeast of two enemy snipers in the MOUT site. Both enemy snipers are positioned on the third floors of two separate buildings. One sniper fires at the friendly forces in the warehouse area from the church tower in the center of the MOUT site, while the other fires at the friendly forces from a different building nearby the church. The sniper in the church tower will periodically pop-up to engage the friendly forces, while the other sniper alternates between the two windows on the floor where he is located (e.g. shoot, duck down, move to other window in about 30 seconds, repeat). There are nine friendly soldiers around the warehouses and all have the capability to return fire on the snipers if any one of the friendly forces is shot at. All of the friendly forces are armed with M16s, but it would also be interesting to provide some of those friendly forces with OICWs.



After the sniper fires the first shot, all of the friendly troops should go prone. The behaviors model will be used to make the friendly forces perform this action.

As a base case, the friendly forces will use the normal target acquisition algorithm and automatic direct fire to engage the sniper. After an entity fires a weapon in JCATS, the firer's target signature is enlarged for a period of time given in the "Just Fired Time" data element. This makes the base case more realistic.

Assumptions:

- One sniper alternates between two different windows while the other stays at the same window.
- The sniper detection capability provides the friendly soldiers with perfect information about the location of the sniper. Whether or not the sniper is hit or incapacitated depends on the probabilities of hit and kill.
- In the base case, behaviors are assigned to the friendly soldiers so that they do not fire at the sniper until one of them has been fired upon.

- In the different capability cases, the friendly forces use the sniper-detection capability to fire at the sniper—they do not use the normal JCATS acquisition process.
- The friendly soldiers must detect the sniper in order to return fire at him.
- The sniper uses 8X field goggles and an M24 with 7.62MM munitions.
- The friendly soldiers use their unaided eyes and are armed with M16s with 5.56MM munitions.

Measures: Red snipers acquired by Blue, Ammunition Expenditure, FER, LER, Red Sniper Losses, Red Non-Sniper Losses, Blue Losses-by non-sniper Red, Blue losses – by Red snipers, Non-combatant losses, Time for Sub Units to Move Between Critical Nodes, Time to Accomplish Mission.

Experimental design:

The following cases will be analyzed:

1. 10 second delay before shots are returned
2. 5 second delay
3. 2 second delay
4. No delay
5. Base case.

Data requirements:

- Number of shots fired by the sniper before the detection occurs (0, 1, 2, etc.).
- Time after the sniper's first shot before the friendly forces can return fire on the sniper.
- The accuracy of the information provided by the detection system.
- The range at which the system operates.
- Whether or not the system requires LOS.

The following chart might be used to gather data for the different capabilities:

	Option 1	Option 2	Option 3
Range (m)			
Time required			
Accuracy			
Associated weapon/munition			
LOS required?			

JCATS-specific inputs:

Acquisition:

- Just Fired Time (sec)—the amount of time that the target signature is enlarged after firing a weapon.

Behaviors editor:
- Range (m)
- Time before a return shot is fired at the sniper (sec).

Accuracy of information
- PH vs. range (m).

Weapon setup time
- Setup time =0 sec
- Lay time=3.25 sec
- Tear down time=0 sec
- Min cycle time=1 sec
- Sustained cycle time= 3 sec
- Reload time=5 sec.

Questions: What about the case where the sniper is detected before he ever fires?

WN07: Identify Enemy

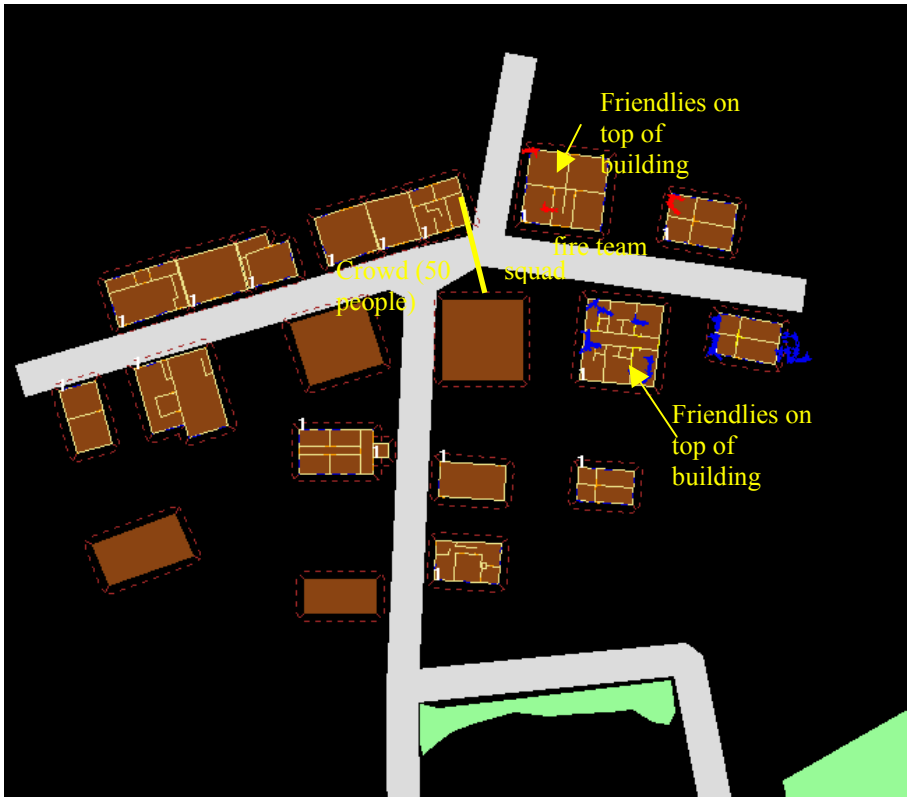
Capabilities identified in Workshop IIa:
- Visual
- Thermal
- Acoustic
- RF
- Chemical sensor
- Magnetometer
- HUMINT
- SIGINT

General approach: To model the capabilities applied to this need, a scenario will be used where a squad of friendly forces is engaging enemy in a crowd of non-combatants. In the base case version, the friendly forces will only engage the enemy after the enemy has fired. The "Hold-fire" attribute in JCATS will ensure that friendly forces shoot at enemy forces only after being shot at. (However, the friendly forces will shoot at any target they acquire, not necessarily the individual that fired at them—the behaviors model may need to be used if we want to target only the individual that shot first). To represent the capability cases, the friendly squad will be allowed to engage the enemy only after they have been identified using the "identify enemy" capability (which will not necessarily be after the enemy has fired first). The capabilities can vary by range, and possibly also by probability of detecting the enemy. For some types of sensors, the JCATS operator can input probability of detection data at levels 1 "detection" and level 4 "identification" by range, rather than using MRT data.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: No.

Scenario outline: Place a fire team of enemy forces in a crowd of 50 non-combatants. The non-combatants will move toward triple-strand concertina wire at the intersection of the roads as shown on the graphic. A squad of friendly forces armed with M16s (no automatic weapons), positioned on the other side of the wire will engage the enemy forces. An additional squad (or fire team) will be positioned further back from the wire. Friendly fire team (or squad) members will be positioned on top of the buildings near the crowd. See graphic.



Assumptions:

Measures: Average engagement ranges, FER, LER, Red losses, Blue losses (fratricide), Blue losses (by Red), Non combatant losses, Time for Sub-Units to Move Between Critical Nodes, Time to Accomplish Unit Mission.

Experimental design:

Data requirements: How effective are these systems at detecting an enemy (in terms of probability of detection)? What are the ranges of these capabilities? Who gets this capability?

JCATS specific data inputs:

Detection
- Range (m) vs. Probability of detection at level 1 "detection" and level 4 "identification."

Questions: Are we going to be able to distinguish between one capability and another? How?

WN08: Improved Target Designation

Capabilities identified in Workshop IIa:
a) Designate
- Laser designate
- Visual marking
- Electronic marking
- Transmit target through electronic map
- Acoustic
- Radar
- Guided munition (no-handoff)

b) Hand-off
- RF

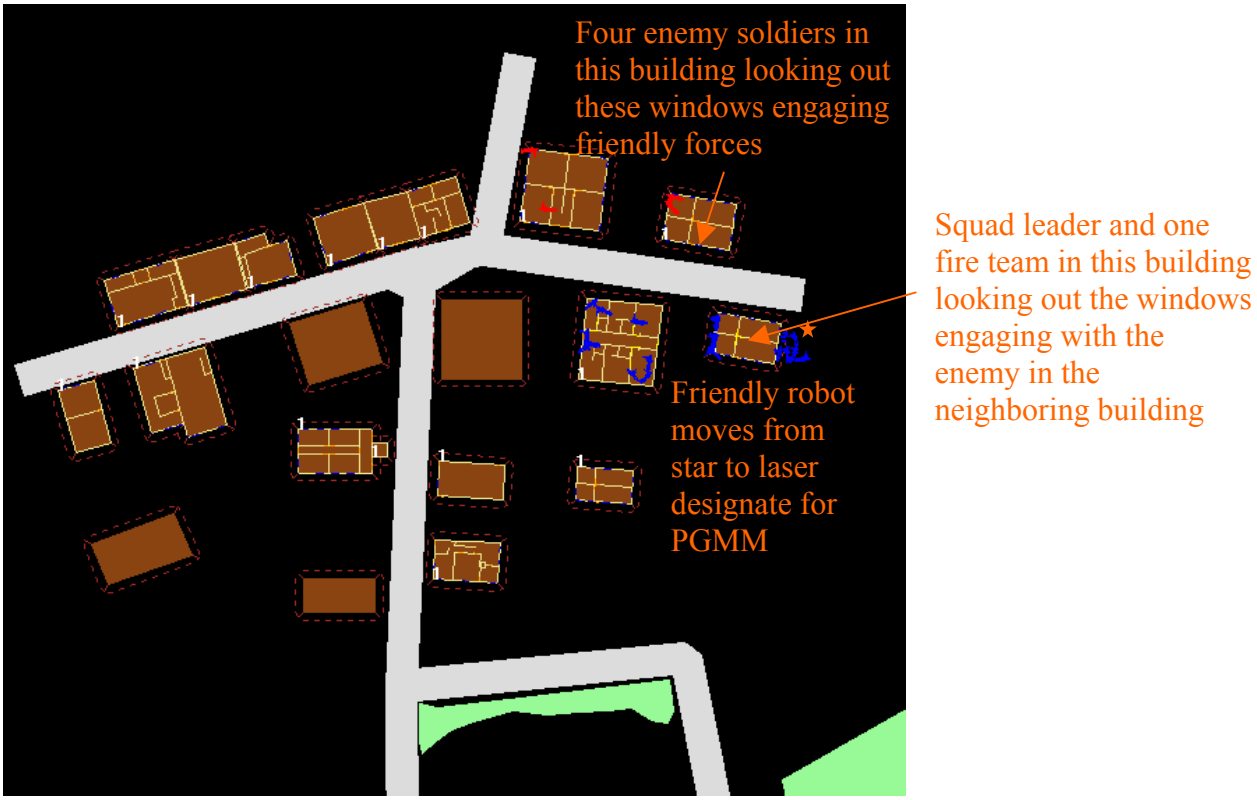
General approach: Although the need for improved target designation was broken into two subneeds (designate and hand-off) in Workshop IIa, for the purposes of comparing the capabilities in JCATS, the capabilities should be considered as the combination of a) designate and b) hand-off. JCATS represents three types of munitions that could be useful for representing target designation: crew-guided (as in TOW II), sensor-guided (Hellfire and Copperhead), and SMART (fire and forget munitions) munitions. The sensor-guided capability (as in Copperhead), rather than the other two types of munitions will be used to represent the guided munitions for this need.

Two different target designation capabilities along with a base case will be modeled. The first capability will allow the squad leader to mark enemy individuals (by some means) to direct the fire team members to fire at that particular target. This will reduce the lay time required for the soldiers to aim and fire their weapons. The behaviors model will be used to represent this capability. The second target designation capability will involve using a robot as the laser designator in conjunction with a PGMM. A base case will also be

modeled where the friendly soldiers do not have the benefit of target designation capabilities.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.
Does this need require gaming: No.

Scenario outline: The basic room-clearing scenario that will be used for some of the other scenarios will be used to represent this need as well. While friendly forces are clearing the building, four enemy positioned in windows of the neighboring building will fire on the friendly soldiers performing the clearing. In another adjacent building, a friendly fire team (2 rifleman, 1 SAW, and 1 grenadier) and a squad leader will fire out of the windows at the enemy forces in the other building. The 120mm gun to fire the PGMM will be positioned 2000m east of the MOUT site.



Assumptions:

- To model PGMM, we will use a Hellfire munition associated with a 120 mm mortar
- The robot being used to laser designate will be a Matilda robot
- To represent the reduced time to acquire and engage targets when the squad leader has designated them for the fire team, the lay times for the M16, M79 and SAW will be reduced to 1 second (from 3.25 seconds)
- In all of the cases, the squad leader will not fire at targets

Measures: Ammunition Expenditure, FER, LER, Red losses, Blue losses, Noncombatant losses, Time for Sub-units to Move Between Critical Nodes, Time to Accomplish Unit Mission

Experimental design:

The following cases will be analyzed:

1. Squad leader designates targets for fire team
2. Robot is used as laser designator with PGMM
3. Base case

Data requirements: These systems will vary by persistence of marking, range, LOS requirement, how many people need to be involved.

JCATS specific inputs:

Laser designator

- Range that munition can be guided (m)
- Time between the call for fire and firing of projectile (sec)
- Cycle time – minimum time (sec) between successive guidance of a laser-guided munition
- Target cone
- Munition.

WN10: Enhanced Casualty Evacuation

Capabilities identified in Workshop IIa:

- Manual
- Mechanical

General approach: It should be straightforward to model and compare manual and mechanical means of casualty evacuation. The casualty evacuation representation in JCATS may be helpful in representing this scenario, but it does not need to be used. Using the casualty evacuation capability, the JCATS operator can assign probabilities to different types of casualties that may occur to an individual, set untreated life expectancies for the different types of casualties, and create depot locations to which the casualties must be brought for treatment. Casualties that do not make it to the depot do

not survive. Rather than using the casualty evacuation representation, a simpler approach would be to assume that the individual to be evacuated is wounded.

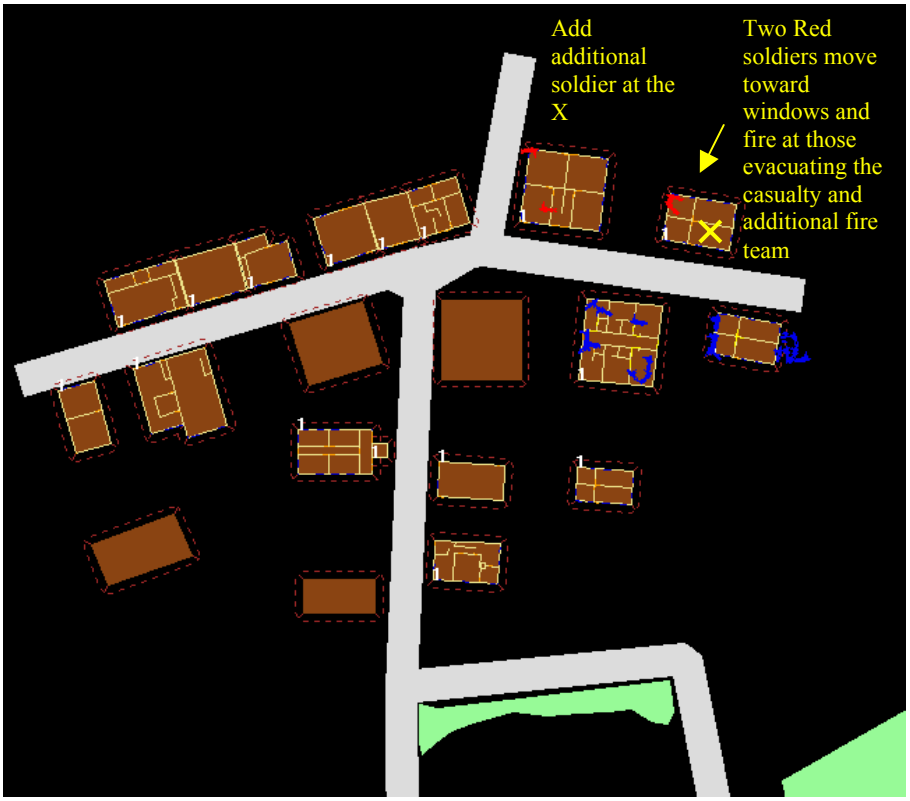
Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: No.

Scenario outline: Use the McKenna room-clearing scenario as the basis for this casualty evacuation scenario. After a member of one of the Blue fire teams is wounded, the Blue forces will extract that casualty using both mechanical and manual capabilities. The manual evacuation capability represents the base case.

More specifically, a friendly soldier is wounded after entering the front door of the building. The casualty evacuation representation in JCATS could be used to ensure that the same soldier is wounded each time, or alternatively, the operator could simply assume that the soldier is wounded. It is important to make sure that the individual to be evacuated does not get catastrophically killed (or KK-killed). In the base case, or manual capability case, two of the soldiers' fire team members will evacuate the casualty once the building is clear. Another fire team will come in afterwards to secure the positions left by the one wounded and two other soldiers evacuating him. While the additional fire team is entering the building and the two soldiers are evacuating the casualty, two enemy soldiers from the neighboring building will fire on them.

In the mechanical capability case, a large robot or "mule" will enter the building and evacuate the wounded soldier. In this case, the additional fire team will not be required to secure the building.



Assumptions: The robot is assumed to be as large as a desk and as vulnerable as a Humvee. The maximum speed of the robot will be about 5 km/hr.

Measures: FER, LER, Red losses, Blue losses, Time to Accomplish Unit Mission, Time to Evacuate Casualty.

Experimental design:

The following cases will be analyzed:

1. Mule is used to extract casualty
2. Armored "Strong mule" is used to extract casualty
3. Base case (two soldiers extract casualty)

Data requirements: Time to evacuate a casualty, number of people required, effect on the wounded individual, dimensions of mechanical system, movement rates

WN13: Improved Forcible Entry

Capabilities identified in Workshop IIa:

a) Infantry forcible entry into buildings
- Explosive
- KE
- Mechanical
- Directed Energy
- Chemical

b) Vehicle breach of walls
- Explosive
- KE
- Mechanical
- Directed Energy
- Chemical

c) Vehicle ability to clear/reduce obstacles
- Explosive
- KE
- Mechanical
- Directed Energy
- Chemical

General approach: The participants in Workshop IIa divided the Improve Forcible Entry need into sub-needs, as they did with other needs like WN08: Improved Target Designation. For the purposes of this study, capabilities will be compared within each sub-need. The sub-needs will not be compared against one another. JCATS representation of both vehicle and infantry breach of walls and obstacles (wire, sandbags, hulks, rubble) will be used to represent the breaching capabilities.

DBBL has already modeled stand-off and conventional forms of breaching in their modeling studies in support of the MOUT ACTD. In one of their MOUT ACTD studies, the modeling of the selected suite of MOUT ACTD requirements, DBBL modeled wall breaching devices, Rifle Launched Entry Munitions (RLEM), and door breaching devices. They modeled RLEM again in an aggregate force effectiveness study, also in support of the MOUT ACTD. We intend to leverage the work that DBBL has already done in this area.

MOUT V&V considerations:
- Use 13a "Infantry forcible entry into buildings" to simulate dismounted troops breaching and entering the first floor of a building.
- Use 13c "Vehicle ability to clear/reduce obstacles" to simulate a vehicle clearing an obstacle in the street and then securing a street. Red will defend the street in this scenario.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: Yes. Since DBBL already has a scenario and has modeled some capabilities, they should continue their work in this area and game the capabilities to fill the sub-needs above.

Scenario outline: This scenario will be determined by DBBL.

Assumptions:

Measures: Ammunition Expenditure, FER, LER, Red losses, Blue losses, Time for Sub Units to Move Between Critical Nodes, Time to Accomplish Mission.

Experimental design:

Data requirements: The different capabilities can be represented according to whether or not the capability is stand-off, the range at which it operates, the time required to breach, the size of the opening created, etc.

JCATS specific inputs:

Walls

- Breach time (sec)
- Breach size (width)

Wire/rubble/mines

- Speed (km/hr) of movement through obstacle
- Size of breach is the width of the vehicle

WN15: Knowledge of Other Side of Wall

Capabilities identified in Workshop IIa:

- Through-wall sensing
- Robotics
- Physical Penetration

General approach: The approach for this need will be to model through-wall sensors, robotics, and physical penetration as alternative ways for individuals to get information about people or activities on the other side of a wall. Robotics include both UAVs and UGVs and we may want to model both. Physical penetration could mean breaching a small hole in the wall, or sliding something beneath the wall/door.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

MOUT V&V considerations: Perform floor-clearing operation using through-wall sensors, robotics, and physical penetration. Red will defend the building.

Does this need require gaming: Yes. The additional modeling for the Congressionally mandated through-wall sensor study (see below) focuses on the value of different types of information and will require gaming.

Scenario outline: This scenario will be determined by DBBL.

Assumptions:

Measures*:* Critical Items/Activities Detected, Non-combatants Detected, Red Targets Acquired by Blue, Ammunition Expenditure, FER, LER, Red Losses, Blue Losses – fratricide, Blue losses (by Red), Blue Target Detected/Acquired by Red, Non-combatant losses, Time for Sub-Units to Move Between Critical Nodes, Time to Accomplish Unit Mission.

Experimental design:

Data requirements: To compare the three capabilities, the modelers will need to know what types of information are provided by each of the "thru-wall" capabilities. Possible information includes: whether the room is occupied or unoccupied, the number of people in the room, whether or not there are weapons in the room, information about where the people are located in the room, a camera-view of the room, and whether or not there are enemy in the room.

- Through-wall sensor: range, the number of walls it can penetrate, whether or not it is man-portable, the time required to achieve detections in the next room, and the type of information provided.

- Robotics (to include UGVs and UAVs): dimensions, types of sensors on the robot, any weapons that the robot may carry, speed of movement, whether or not the robot is tele-operated (and if so, the range at which the robot is tethered to the operator and whether LOS is required), whether or not the robot can breach doors, is tall enough to look into windows, etc. The modelers also need to know what kind of information the robot gathers. Is the robot's camera view shown to the operator, or does the robot have some kind of metal-detecting device mounted on it, etc. Is the robot loud, will it alert the enemy of its presence, or is it silent?

- Physical penetration: time to penetrate (whether that means sliding something under the door, or creating a hole in the door), type of information is gained, how much of a distraction is presented to the enemy?

JCATS specific inputs:

Through-wall sensor
- Min/max range (m)
- FOV (degrees)
- Acquisition scan interval (sec)
- Probability of detection/scan interval
- Whether or not the sensor is electronic
- Maximum concurrent acquisitions (#)
- Reliability (%)
- Detect only moving entities
- Detect only dismounted entities
- Limited by X number of walls (#).

Additional modeling for through-wall sensor study: Some questions that we may want to investigate include analyzing the benefits that the different types of information provide. Is it important to know where the people are in the adjacent room, or just to know that the room is occupied? Scenarios could be gamed where the JCATS operators are provided with different levels of information and are then allowed to script their reactions based on that information.

WN17: Detect Explosives/Explosive Devices

Capabilities identified in Workshop IIa:
- Chemical sniffers
- Electronic detectors
- Metal detectors
- Visual detectors

General approach: These four different capabilities can be modeled according to the detection ranges and types of devices that the capabilities can detect at those ranges. JCATS' representation of obstacles like anti-personnel (AP) mines and munitions associated with sensors will be used to model the explosive devices in this scenario.

JCATS does not represent detection of mines in detail, and is not flexible in the way that booby-traps are detected. To get around these limitations, a work around approach could be used. A system with the detection signature of booby-trap could be collocated with the booby-trap. The chemical sniffer, electronic detector, metal detector, and visual detectors will be represented as sensors with JCATS operator-input probabilities of detection (by range, probabilities of detection at levels 1 "detection" and 4 "identification") for the different types of booby traps.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: Yes.

Scenario outline: This scenario will be determined by DBBL.

Assumptions:

Measures: Explosives detected, Blue losses, Non-combatant losses, Time for Sub Units to Move Between Critical Nodes, Time to Accomplish Unit Mission

Experimental design:

Data requirements: These systems vary by range, time to detect, what can be detected, how often the system identifies the device correctly, who has the capability to use it (BOI).

WN18: Get on Top of Buildings

Capabilities identified in Workshop IIa:

- Mechanical
- Propulsion
- Explosive
- Aerial

General approach: Mechanical, propulsion, explosive and aerial capabilities will all differ by the amount of time required to get a person to the top of a building, the time required to setup time the capability, availability (basis of issue (BOI)/ownership), height reachable, and protection provided to the individual getting moved to the top of the building.

These capabilities could be modeled as a person moving between floors using a "go to floor" node in a clear-walled addition to the building. Alternatively, it may be possible to model the people as small helicopters (or mount the people on person-size helicopters) to ascend the outside of the building.

DBBL has already modeled ladders as a part of the aggregate force effectiveness study in support of the MOUT ACTD. We intend that they leverage their work in this area to represent this need.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: Yes.

Scenario outline: This scenario will be determined by DBBL.

Assumptions:

Measures: FER, LER, Red Losses, Blue Losses, Time to Accomplish Unit Mission.

Experimental design:

Data requirements: Speed of ascent, time to prepare, height achievable, basis of issue/ownership, loudness (so that the enemy can react appropriately).

WN19: Enhanced Indirect Fires

Capabilities identified in Workshop IIa:
- Improvements to existing mortars
- Accuracy
- Variable effects

General approach: The question we want to investigate in this modeling is whether more accurate mortars or more control over the effects of the mortars provides an increase in force effectiveness.

During Workshop IIa, mortar base plate modifications were discussed as possible improvement to existing mortars. This base plate improvement would result in better accuracy for the mortar—the second capability listed above. Improved accuracy could be modeled in JCATS by reducing the error in the munition.

Variable effects could be modeled in JCATS by using three (or some other number) different types of mortar munitions associated with the mortar weapon. The individuals operating JCATS could choose to fire the appropriate one, depending on the circumstances. For this reason, the scenarios for Enhanced Indirect Fires (WN19) will need to be gamed, or played interactively.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

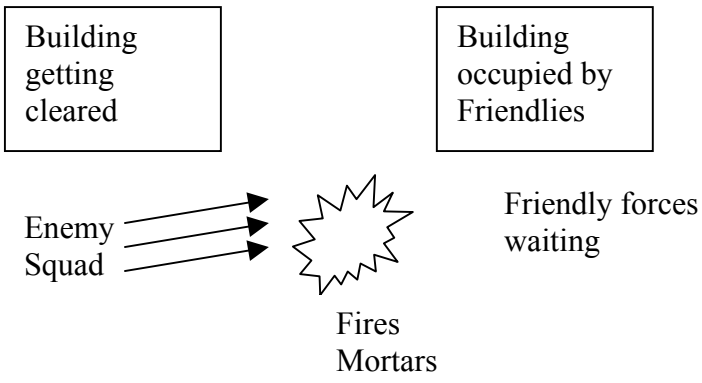
MOUT V&V considerations: For the purposes of the MOUT V&V, the scenario should represent Blue forces attacking a Red bunker. Red will defend against attack.

Does this need require gaming: Yes.

Scenario outline: This scenario will be determined by DBBL.

This scenario could also be built from the McKenna room-clearing scenario. One option would be to place an enemy squad/fire team just south of the building being cleared by the friendly forces. The enemy squad will fire the improved mortars on the friendly forces clearing and waiting beside the building.

One possible scenario:



Assumptions:

Measures: Ammunition expenditure, Average engagement ranges, FER, LER, Red losses, Blue losses, Non-combatant losses, Time to Accomplish Mission.

Experimental design:

Data requirements:

JCATS specific inputs:

Accuracy—

- In range data, change Aiming Error Deflection and Range to values near zero
- In range data, change Ballistic Error Deflection and Range to values near zero

Variable HE effects—

- Burst height (m)
- Lethality angles (at 1/3, 2/3, and max range) (degrees)
- Lethal area.

WN20: Identify Non-combatants

Capabilities identified in Workshop IIa:

- Visual
- Thermal
- Acoustic
- RF
- Chemical sensor
- Magnetometer
- HUMINT
- SIGINT

General approach: To model the capabilities applied to this need, we will use the same basic scenario that was used for Identify Enemy (WN07). In the scenario, a squad of friendly forces will engage enemy soldiers in a crowd of non-combatants.

In the base case version, the friendly forces will only engage the enemy only after the enemy has fired. The "Hold-fire" attribute in JCATS will ensure that engaging friendly forces shoot at enemy forces only after being shot at. (However, the friendly forces will shoot at any target that they've acquired, not necessarily the individual that fired at them; we may need to use the behaviors model if we want to target only the individual that shot first). To represent the capabilities above, the friendly squad will be allowed to engage the enemy only after the enemy has been identified using the "identify non-combatants" capability (which will not necessarily be after the enemy has fired first). The capabilities can vary by ranges at which they operate, and by probability of detection at levels 1 "detection" and 4 "identification."

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: No.

Scenario outline: Use the same general scenario used for Identify Enemy (WN07).

Assumptions:

Measures: Blue losses – fratricide, Blue losses (by Red), Non-combatant losses, Time for Sub Units to Move Between Critical Nodes, Time to Accomplish Unit Mission.

Experimental design:

Data requirements: Information will be required about the effects these systems have on the incidence of fratricide. How effective are these systems at detecting non-combatants? What are the ranges of these capabilities? Who gets this capability?

JCATS specific data inputs:

Detection
- Range (m) vs. Probability of detection at level 1 "detection" and level 4 "identification"

Fratricide
- Jumpiness enabled?
- Identification at Recognition?
- Retained shots (number of shots the systems can remember)
- Weight (0=not jumpy, 1=normal jumpiness), distance and time factor (amount of time that the system will remain jumpy) for shot source
- Weight, distance and time factor for shot impact
- Weight and distance for intelligence token.

Questions: Are we going to be able to distinguish between one capability and another? How?

WN21: Concealment

Capabilities identified in Workshop IIa:
- Chemical process (smoke)
- Diversionary concealment (tactics)
- Directed Energy (dazzlers)
- Cloaking

General approach: Smoke, tactics, and dazzlers will be compared to gain insights about which form of concealment provides the most increase in force effectiveness. Since JCATS does not model smoke inside buildings, these scenarios will be conducted around buildings rather than inside the buildings.

Diversionary concealment will be considered a base case. Tactics are already used for concealment.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: Yes. Concealment would be best modeled using gamed scenarios. Gamers will need to develop the appropriate tactics for the diversionary concealment capability/basecase.

Scenario outline: This scenario will be determined by DBBL.

Assumptions:

Measures: Blue losses, Non-combatant losses, Time for Sub Units to Move Between Critical Nodes, Time to Accomplish Unit Mission.

Experimental design:

Data requirements:

- Smoke – use the smoke capability currently in JCATS
- Tactics – to be developed by the gamers
- Directed Energy – range affected, type of effect (could model this as suppression)
- Cloaking is probably not conducive to modeling.

JCATS specific inputs:

Smoke

- Decay rate is hard-wired at 30%
- HC burn efficiency (%)

Suppression data

- By range, degradations to speed, position preparation, PH, shoot prep-time, acquisition.

WN23: Improved Neutralization of Explosives/Explosive Devices

Capabilities identified in Workshop IIa:

- Minimize/mitigate effects on troops
- Render device ineffective
- Decision aids
- Training about how to work safely around devices (once they are identified)

General approach: By modeling this need, we will examine the question of whether it is better to render an explosive device ineffective, or to try to minimize its effects. Minimizing the effects of the device could mean using an explosive blanket to trigger the device and shield the effects. Rendering the device ineffective may require a more time-consuming, but more effective process of detecting the device.

JCATS does not currently model the neutralization of booby traps at all. Mine clearing and triggering, however, is modeled in JCATS. JCATS also models booby traps – they are represented as an unattended sensor linked to a weapon – but they cannot be neutralized.

The differences between the capabilities that minimize effects vs. mitigate effects will be represented through modifications in the probability of kill tables in JCATS and through the time requirements to use the two capabilities.

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: No.

Scenario outline: This scenario will also be based on the McKenna room-clearing scenario. Explosive devices will be placed in the hallway of the building being cleared by the Blue forces. The room-clearing scenario will need to be altered to represent the devices being neutralized or their effects being mitigated.

The Blue soldiers will attempt to clear the room more quickly than usual, knowing that there are explosive devices in the building. Antipersonnel (AP) mines can be used to represent the explosive device. In the case where the explosive device is rendered ineffective, some of the troops will need to breach it. In the case where the effects of the device are minimized, the soldiers may use a blanket to trigger the device (and reduce the effects). In this case, the minefield will again need to be breached, but this time at a faster speed and with greater probability of casualties.

Assumptions:

Measures: Blue losses, Non-combatant losses, Time for Sub Units to Move Between Critical Nodes, Time to Accomplish Unit Mission.

Experimental design:

Data requirements: These systems will vary by the time to employ the system, and the reduction in the effectiveness (reduced PH/PK or area of effect).

JCATS specific inputs:

Mines

- Plane width (m)
- Chunk size (m)
- Density (mines/square meter)
- Probability of Deliberate Detection (%)
- Breaching M-Kill (0-100%)
- Breaching K-Kill (0-100%)
- Non-breaching M-Kill (0-100%)
- Non-breaching K-Kill (0-100%)
- Breaching Triggering (0-100%)
- Non-breaching Triggering (0-100%)

Clearing Mines (under System tab in Vista)

- Speed of mine clearing (km/hour)

WN25: Improved MOUT Logistics

Capabilities identified in Workshop IIa:

- Mechanical devices
- Combat pre-packaged items
- Precision delivery
- Just-in-time resupply
- Planning tool

General approach: Mechanical devices used for logistics can be currently modeled, but more definition is needed about what combat pre-packaged items, precision delivery, and just-in-time resupply mean before those capabilities can be represented and compared.

One option for modeling this need would be to represent the use of a robotic mule to pick up logistics supplies and compare it to strategically located supply points and just-in-time delivery of supplies (by aerofoil, for example).

Hypothesis: The capabilities listed above provide no improvements in force effectiveness (compared to a base case) to those forces using the capabilities. In addition, all of the capabilities listed above provide the same force effectiveness to the force using the capabilities.

Does this need require gaming: Yes. Reactions from encounters with enemy when the robot or individual is collecting supplies would need to be scripted if these scenarios are not gamed.

Scenario outline: This scenario will be determined by DBBL.

Assumptions:

Measures: FER, LER, Red Losses, Blue Logistics Vehicle Losses, Blue Losses, Percent of Force Operational, Rate of Ammunition Resupply, Rate of Fuel Resupply, Rate of Resupply of Other Supply Classes, Time for Sub-Unit to Move Between Critical Nodes, Time to Accomplish Unit Mission.

Experimental design:

Data requirements:

Mechanical device—
- Dimensions of the robot
- Movement rates
- Whether or not the system is tele-operated
- Tether range
- Whether or not LOS is required

Precision delivery—
- Who delivers (robot vs. soldier)
- How does the system know when to deliver?

Different supply points (not included in the capabilities)
- Where?
- Who picks up the supplies?

Questions: Clarify what combat pre-packaged items, precision delivery, and just-in-time supply mean (and what they provide). Can we add an additional capability: alternative positioning of supply points?

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14. ABSTRACT

This document describes the implementation of the Incubator Process for a proposed follow-on program to the Military Operations in Urban Terrain (MOUT) Advanced Concept Technology Demonstration (ACTD). The Incubator was originally developed as a needs generation and evaluation methodology in conjunction with the planning for this proposed follow-on program to the MOUT ACTD. This document presents a brief description of the proposed follow-on program, introduces the two M&S tools (Logical Decisions and Joint Conflict and Tactical Simulation [JCATS]) selected to support the Incubator Process, describes the implementation of the Incubator Process to date, and specifically elaborates on the JCATS-specific support work performed.

15. SUBJECT TERMS

Incubator Process or Incubator, Military Operations in Urban Terrain (MOUT), Advanced Concept Technology Demonstration (ACTD), Need, Capability, Warfighter, Subject Matter Expert (SME), Methodology, Science and Technology Program, Modeling and Simulation (M&S), Joint Conflict and Tactical Simulation (JCATS), Logical Decisions

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