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COMBAT IDENTIFICATION: A SUMMARY OF THE LITERATURE, FUNCTION FLOW ANALYSIS AND DECISION REQUIREMENTS ANALYSIS

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Abstract

This report synthesizes and summarizes the findings of four previous contract reports related to modelling the Combat Identification (CID) task as performed by individual mounted or dismounted soldiers in a Land Force context. The four previous reports include:

- Combat ID Literature Review (Vilhena, Zobarich, & Lamoureux, 2007);
- Models of Information Aggregation Pertaining to Combat Identification: A Review of the Literature (Famewo, Matthews, & Lamoureux, 2007);
- Function Flow Analysis for the Combat Identification Process (Bruyn Martin, Famewo, Zobarich, & Lamoureux, 2007); and,
- Decision Requirements Analysis for the Combat Identification Process (Famewo, Bruyn Martin, Zobarich, & Lamoureux, 2007).

Overall this work fulfils a need for documentation of the CID process and analysis of literature that addresses the human information processing aspects of CID. We have identified four main CID functions (prepare for the mission, perform mounted/dismounted functions, take action and evaluate action) that have been decomposed down to the task level. For each of the main CID functions specific decisions were identified and analyzed. With respect to CID decision making tasks, we concluded that the nature of CID tasks require that soldiers take advantage of methods by which decision making can be accelerated, such as heuristics and recognition-primed decision making.

Résumé

Le présent rapport résume les conclusions de quatre rapports contractuels précédents liés à la modélisation de la tâche d'identification au combat (ID cbt) telle qu'elle est accomplie par des soldats embarqués ou débarqués dans un contexte de force terrestre. Les quatre rapports antérieurs sont les suivants :

- Combat ID Literature Review (Vilhena, Zobarich et Lamoureux, 2007);
- Models of Information Aggregation Pertaining to Combat Identification: A Review of the Literature (Famewo, Matthews et Lamoureux, 2007);
- Function Flow Analysis for the Combat Identification Process (Bruyn Martin, Famewo, Zobarich et Lamoureux, 2007); and,
- Decision Requirements Analysis for the Combat Identification Process (Famewo, Bruyn Martin, Zobarich et Lamoureux, 2007).

Dans l'ensemble, ces ouvrages satisfont à un besoin d'avoir de la documentation sur le processus d'ID cbt et une analyse de la documentation qui se penche sur les aspects de l'ID cbt liés au traitement cognitif de l'information. Nous avons relevé quatre fonctions principales de l'ID cbt (se préparer pour la mission, exercer les fonctions embarquées/débarquées, prendre des mesures et évaluer les mesures) qui ont été décomposées au niveau de la tâche. Pour chacune des fonctions principales de l'ID cbt, nous avons cerné et analysé des décisions précises. En ce qui touche les tâches de prise de décisions relativement à l'ID cbt, nous avons conclu que la nature des tâches d'ID cbt nécessite que les soldats profitent des méthodes qui permettent d'accélérer la prise de décisions, telles que les connaissances heuristiques et la prise de décision axée sur la reconnaissance.

Executive Summary

This report synthesizes and summarizes the findings of four previous contract reports related to modelling the Combat Identification (CID) task as performed by individual mounted or dismounted soldiers in a Land Force context. The four previous reports include:

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- Function Flow Analysis for the Combat Identification Process (Bruyn Martin, Famewo, Zobarich, & Lamoureux, 2007); and,
- Decision Requirements Analysis for the Combat Identification Process (Famewo, Bruyn Martin, Zobarich, & Lamoureux, 2007).

This work has allowed us to draw a number of conclusions about the CID process and the state of the associated literature. Overall, it is clear that current literature related to CID does not fully address the human information processing aspects of CID. The outcomes of the four reports listed above address this knowledge gap. This work enabled us to develop an Excitation-Activation Threshold model as a framework for understanding the contribution of various inputs to the CID decision process. This model assists in illustrating the effect of the specific functions and decisions identified in the function flow and decision requirements analyses. The four primary CID functions discussed include:

- Function 1: Prepare for the mission;
- Function 2: Perform mounted/dismounted functions;
- Function 3: Take action; and
- Function 4: Evaluate action taken.

For each of the main CID functions specific decisions were identified and described in terms of information requirements, constraints, decision outcomes, DCRIA (Detect, Classify, Recognise, Identify, Action) stage (Dean, Vincent, Mistry, Hynd & Syms, 2005; Self, 2005), decision complexity, cognitive workload, decision criticality and time to make decision. With respect to CID decision making tasks, we concluded that the nature of CID tasks require that soldiers take advantage of methods by which decision making can be accelerated, such as heuristics and recognition-primed decision making.

This summary indicates the main concepts learned about the CID decision process in addition to suggesting areas requiring future research.

Sommaire

Le présent rapport résume les conclusions de quatre rapports contractuels précédents liés à la modélisation de la tâche d'identification au combat (ID cbt) telle qu'elle est accomplie par des soldats embarqués ou débarqués dans un contexte de force terrestre. Les quatre rapports antérieurs sont les suivants :

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- Function Flow Analysis for the Combat Identification Process (Bruyn Martin, Famewo, Zobarich et Lamoureux, 2007); and,
- Decision Requirements Analysis for the Combat Identification Process (Famewo, Bruyn Martin, Zobarich et Lamoureux, 2007).

Les présents travaux nous ont permis de tirer un certain nombre de conclusions à propos du processus d'ID cbt et de l'état de la documentation connexe. Dans l'ensemble, il est clair que la documentation actuelle liée à l'ID cbt n'aborde pas en détail les aspects liés au traitement cognitif de l'information. Les résultats des quatre rapports susmentionnés comblent cette lacune. Les travaux nous ont permis d'élaborer un modèle du seuil d'excitation-activation comme cadre pour comprendre la contribution de divers apports au processus de prise de décision relatif à l'ID cbt. Ce modèle aide à illustrer l'effet des fonctions et des décisions précises cernées dans l'analyse des processus d'exécution des tâches et l'analyse des exigences en matière de décision. Les quatre fonctions principales de l'ID cbt sont les suivantes :

- Fonction 1 : Se préparer pour la mission;
- Fonction 2 : Accomplir des fonctions embarquées/débarquées;
- Fonction 3 : Prendre des mesures;
- Fonction 4 : Évaluer les mesures.

Pour chacune des fonctions principales de l'ID cbt, des décisions précises ont été recensées et décrites en fonction des besoins en information, des limites, des résultats de décisions, de l'étape DCRIA (Détecter, classer, reconnaître, identifier, agir) (Dean, Vincent, Mistry, Hynd et Syms, 2005; Autopublication, 2005), de la complexité de la décision, de la charge de travail cognitive, de la criticité de la décision et du temps pour prendre la décision. En ce qui touche les tâches de prise de décisions relativement à l'ID cbt, nous avons conclu que la nature des tâches d'ID cbt nécessite que les soldats profitent des méthodes qui permettent d'accélérer la prise de décisions, telles que les connaissances heuristiques et la prise de décision axée sur la reconnaissance.

Le présent sommaire indique les principaux concepts que l'on a appris à propos du processus de décisions liées à l'ID cbt, en plus de proposer des domaines qui nécessiteront de la recherche.

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1 Introduction

1.1 Background

When soldiers stationed in Afghanistan encounter (i.e., detect) contacts in the battlespace, such as a person walking along a roadway outside of Kandahar, a vehicle parked in front of a parliament building, or a crowd buying and selling in a busy marketplace, they must rapidly decide whether any of the contacts pose a threat. This task is termed combat identification (CID), and is formally defined as the *"process of combining situation awareness, target identification, specific tactics, techniques and procedures to increase operational effectiveness of weapons systems and reduce the incidence of casualties caused by friendly fire"* (JWP 0-01.1). The implication of this definition is that CID attempts to ensure that when a weapon is fired, it is fired at an appropriate target. Therefore, CID involves rapidly and accurately identifying the allegiance (e.g., friend, enemy, neutral) of contacts detected in the battlespace to optimally employ weapons and forces while minimizing the risk of fratricide (identifying a friend as hostile), neutricide[1] (identifying a neutral contact as hostile) and injury or death to oneself caused by identifying an enemy contact as not hostile[2]. CID is made especially difficult for soldiers in environments such as Afghanistan by the asymmetric nature of that conflict, characterized by a difficulty in knowing who one's enemy is, where they are, and how and when they will attack.

1.2 Scope and Objective

CID is a continuous decision process. Individual dismounted soldiers and Light Armoured Vehicle (LAV) crewmembers at the close tactical level are required to be constantly building, maintaining and verifying awareness of all contacts in their environment, for the duration of their time 'outside the wire' (i.e. any time potentially in contact with a foe). The CID decision is important because it must be made frequently (i.e., each time a contact is detected) and under time pressure, and the consequences of errors are severe. Despite equipment and technological advancements to assist the CID decision-maker (e.g., improved visibility through night vision, blue-force tracking and Identification Friend or Foe (IFF) sensors), it is ultimately the responsibility of the individual soldier to make and act upon the decision. This report summarizes and synthesizes what we have learned about the CID process through the results of the following four previous contract components aimed at modelling human performance as it applies to the individual soldier's CID decision:

- Combat ID Literature Review (Vilhena, Zobarich, & Lamoureux, 2007);
- Models of Information Aggregation Pertaining to Combat Identification: A Review of the Literature (Famewo, Matthews, & Lamoureux, 2007);
- Function Flow Analysis for the Combat Identification Process (Bruyn Martin, Famewo, Zobarich, & Lamoureux, 2007); and,

[1] Neutricide is the term used by Dean et al. (2005) to describe incidents when civilians and civilian infrastructure are accidentally targeted or misidentified and deliberately targeted.

[2] Referred to as a mistake akin to 'suicide' on the battlefield by Karsh, Walrath, Swoboda and Pillalamarri (1995).

- Decision Requirements Analysis for the Combat Identification Process (Famewo, Bruyn Martin, Zobarich, & Lamoureux, 2007).

This work fills a gap in the CID research literature by assessing the CID task from a Human Factors (HF) perspective and provides insight into the subtle cues used by individuals to make 'friend or foe' identification decisions.

Although the specific objective of this report, as defined in the Statement of Work is to *"prepare a final report summarizing the results of the literature review [i.e., Combat ID Literature Review], function flow analysis and decision requirements analysis"*, we will also incorporate findings from the review related to models of information aggregation and cue-based decision making in order to more fully describe the decision making processes performed during CID. This report will be used in future work to frame experimental investigations into human CID performance.

1.3 Contract and Scientific Authority

This work is under Contract W7711-067996/001/TOR for DRDC Toronto. The scientific authority for this work is Dr. David J. Bryant. This report represents a contract milestone.

1.4 Outline of Report

This report begins by describing the Excitation-Activation Threshold model developed as part of the CID literature review (see Vilhena et al., 2007). This model elaborates on the CID decision process described in the literature and provides a framework for understanding this complex task (Section 2). Section 3 expands on the framework by discussing some of the specifics learned through the function flow and decision requirements analyses. When possible, decision making theory and models of information aggregation (see Famewo et al., 2007) are applied to the results of these analyses. The report concludes in Section 4 with a brief discussion of the implications of this work and offers several recommendations for future research.

2 Excitation-Activation Threshold Model of Combat Identification

Based on a review of the CID literature, we developed and proposed the Excitation-Activation Threshold Model (see Vilhena et al., 2007 for details) to provide a framework for understanding the CID decision process. This model (Figure 1) displays the complex relationship between a soldier's cue acquisition following the detection of a contact in the battlespace and the likelihood of him/her choosing to exercise his/her Rules of Engagement (ROEs). The model demonstrates the applicability of intuition to the CID decision process as well as shows the additive and subtractive nature of information aggregation (the topic of focus in Famewo et al., 2007). In addition, the model shows how situational factors and individual differences affect the CID decision. We will briefly describe the model here, followed by a more detailed discussion of the functions and decisions performed by the CID decision maker, as determined by the function flow and decision requirements analyses (Section 3).

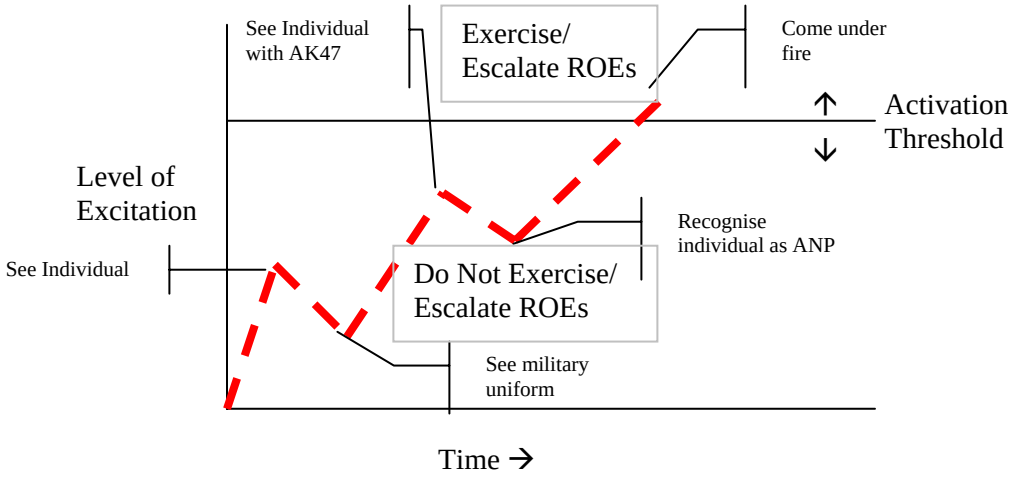

Figure 1: Excitation-Activation Threshold Model. The relation of threshold of action to cue acquisition.

The Excitation-Activation Threshold model consists of an activation threshold and an excitation level, each of which is affected differently by the situation and the decision maker (refer to Annex A for details related to the factors affecting CID).

The soldier's activation threshold is the level of excitation that must be exceeded for the soldier to exercise his/her ROEs (therefore deciding that a contact poses a threat). Individual factors, such as the experience and training received by the soldier (e.g., previous experience with a particular location; beliefs about one's degree of accuracy on past decisions) and psychophysiological factors (e.g., fatigue, fear) affect the level of the activation threshold, making it either easier or more difficult to reach the point where one views the situation as requiring an action. For example, when in a fearful state, a soldier's activation threshold may be lowered relative to the threashold the

soldier possesses when calm. Situational or environmental factors such as the time of day, weather and field of view also affect the activation threshold. For example, the activation threshold may be higher during night-time missions than that of daylight missions because of the greater uncertainty in detecting and assessing contacts in the dark. It is not, however, readily apparent what a soldier's threshold might be in a given situation. Consider, for example, that stimuli encountered at night may hold a greater excitatory potential, thus easily exceeding the activation threshold, because of a soldier's expectations regarding who he/she will meet at night. Therefore, the activation threshold level can vary reasonably frequently as the situation changes or the soldier moves from environment to environment. Careful consideration of the specific factors in play is also needed. The degree to which the activation threshold is exceeded determines whether the soldier will try to use non-physical (e.g., gestured warning) or physical (possibly deadly) means to eliminate the threat.

The soldier's level of excitation represents how close he/she is to the activation threshold based on the information accumulated about the detected contact(s) in his/her area of interest. CID decision makers acquire information about a detected contact through visual and auditory cues, technology, intelligence briefings, etc. Different cues carry varying weights or strengths (i.e., size of increase or decrease in excitation) based on the certainty the decision maker perceives about the information, and the meaningfulness of the cue. Refer to Famewo et al. (2007) for details on the factors affecting the weighing of information. The cues are then aggregated with other information (e.g., cues already assessed and previous knowledge), in an additive or subtractive fashion depending on whether it raises or lowers the soldier's level of excitation. Once sufficient information is integrated to reach the activation threshold, a satisfactorily-confident identification of threat is made and ROEs are exercised.

Depending on what information is received, as well as other factors such as the battle environment, the activation threshold may be exceeded slowly, or very quickly. For example, coming under fire will immediately elevate the level of excitation significantly above the activation threshold such that the highest level of ROEs will be exercised (i.e. lethal force). In contrast, uncertainty regarding various cues may lead to the assessment of many pieces of information before resolving the need for an action (a result of the Reduction strategy of the Reducing, Assumption, Weighing, Forestalling, and Suppressing (RAWFS) heuristic discussed in Famewo et al., 2007 as an intuitive method for dealing with uncertainty). Another way that the activation threshold will be exceeded more rapidly is when it is 'set' at a low level. For example, if a soldier has a recent encounter with an enemy contact, he/she will be primed for the presence of another enemy and will therefore have a lowered activation threshold. As discussed in Famewo et al. (2007), when a person makes an assumption regarding the likelihood of something occurring based on the availability of instances that can be brought to mind, he/she is employing the availability heuristic in order to accelerate his/her decision making process. The soldier would then require few or weak additive excitation cues to reach the point of action.

The use of intuition in forming the CID decision is particularly important given the speed-accuracy trade-off necessary during this decision. It is generally impossible to assess all information about a contact (in current conflicts due to the volume of information and its ambiguity) and therefore soldiers must rely on 'feeling' the situation. This strategy is part of Naturalistic Decision Making (NDM) and is discussed in depth in Famewo et al. (2007). The Excitation-Activation Threshold model is able to capture the intuitive nature of the task through the interaction between the excitation level and the activation threshold. When the soldier's excitation approaches the

activation threshold, his/her 'spidey sense'[3] will start to tingle. The sensitivity of the 'spidey sense' increases according to how low the activation threshold is set (i.e., less or weaker information will be required to suspect that an action may be required).

Although CID decision makers use intuition when forming their identification decision, they must still perform a variety of functions and associated decisions to reach the point of exceeding the activation threshold and exercising their ROEs. These details are summarized in the following section.

[3] 'Spidey sense' is an implicit belief that something bad is about to happen and is named based on the Spiderman character of the comics, cartoons and movies.

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3 Modelling the Specific Functions and Decisions Involved in the CID Task

The function flow and decision requirements analyses conducted under this contract have revealed the specifics of the cognitive aspects of human performance during the CID task. Although not all details will be reiterated here, the function flow hierarchy outlines from the function flow analysis are provided in Annex B, and the decision requirements tables from the decision requirements analysis are presented in Annex C (full methodologies and analyses are available in Bruyn Martin, Famewo, Zobarich, & Lamoureux, 2007, and Famewo, Bruyn Martin, Zobarich, & Lamoureux, 2007; PDFs of the function flow diagrams are also available as a supplement to Bruyn Martin et al., 2007).

3.1 Four Primary Functions

The function flow analysis revealed four primary functions performed during Land Force Operations related to CID processes, including:

- Function 1: Prepare for the mission;
- Function 2: Perform mounted/dismounted functions;
- Function 3: Take action; and
- Function 4: Evaluate action taken.

Each of these functions is decomposed to at least three levels of component tasks performed by the mounted or dismounted soldier showing the hierarchical relationship between the tasks. In addition, the decision requirements analysis assessed each component task for the presence of a decision and its associated description, including such features as information requirements and complexity. Below we summarize the main findings from these analyses, interpreting them in terms of the Excitation-Activation Threshold, and providing insight into areas requiring support or further research.

3.1.1 Function 1: Prepare For the Mission

The first set of functions and tasks soldiers perform are related to mission preparation. During this stage, soldiers build their mental models[4] which 1) support development of situation awareness (SA)[5], that in turn affects the interpretation of cues detected during the mission, and, 2) form expectations that affects how high or low the activation threshold is set.

A soldier's mental model is formed by learning about potential enemy, friendly, and neutral forces, and specific individuals of interest that are relevant to the mission, by examining tasking/briefing/intelligence information, maps, photos, reports from informants, or through seeing

[4] Mental models are formed and stored in long term memory.

[5] SA includes perceiving cues from the environment [Level 1 SA], comprehending the current situation through integrating and interpreting the perceived information [Level 2 SA], and projecting understanding of the current situation into the near future [Level 3 SA] (Endsley, 1988).

the environment (e.g., terrain). Many decisions are involved in this process, such as choosing which information to examine, deciding when the information has been sufficiently learned (i.e., metacognition) and planning the route. It is expected that given sufficient time, these decisions would be processed in an analytic manner. Analytic Decision Theory (ADT) is a rational form of decision making that focuses on selection of the optimal course of action (COA) from all possible alternatives as derived from all available information. ADT, therefore, is a cognitively demanding process, needing both time and effort to assess and integrate as many cues as possible (decision theory is discussed in depth in the literature review by Famewo et al., 2007). We acknowledge, however, that given the types of environments in which CID decisions are made, the majority of decisions involved in the CID process will require the use of recognition-primed or heuristic (i.e. non-analytic) decision making strategies (see Section 3.1.2 for further discussion).

The involvement of the mission preparation stage of CID in setting the activation threshold and building SA suggests that the information used during this stage needs to be highly accurate and/or include a stated level of certainty. The presence of inaccurate information may cause the soldier to have a higher-than-required activation threshold negating the impact of cues which may otherwise clearly indicate hostile intent. This insensitivity may slow the soldier in taking action therefore potentially endangering his/her and others' safety. In addition to information accuracy, it is also important that soldiers have access to the information they decide is necessary. Security issues sometimes prevent access to information, which limits SA. In other situations, soldiers may have access to too much information, resulting in cognitive overload if they are unable to effectively discriminate relevant from irrelevant cues. As discussed in Famewo et al. (2007) too much information can cause people to arbitrarily assign weights to information or treat every cue as equal, therefore biasing their assessment of the situation.

Overall, the analyses of Function 1 conclude that during the mission preparation stage soldiers need to be able to access the right information, know the accuracy of the information and be able to determine when the information has been learned such that it will be retained and recalled when needed. For the latter requirement, information should be communicated in its most learnable form (e.g., visualization, mnemonics, point form) to the decision maker. Determining the most effective mode of communication that will form a lasting representation (i.e., mental model) in the soldier's long term memory will require further investigation – especially if the knowledge is to last through psychophysiological stressors common in the battlefield (e.g., stress, fatigue). Investigations should also be made into the amount of knowledge soldiers require about a mission in order to effectively determine which details should be included in briefings so as not to cause cognitive overload.

3.1.2 Function 2: Perform Mounted/Dismounted Functions

Function 2 represents the core of the CID task and includes all of the functions and decisions performed to detect, classify, recognize and identify (DCRI) an unknown contact (refer to Vilhena et al., 2007 and Famewo et al., 2007 for descriptions of these terms). Essentially, this function consists of acquiring and aggregating information about the detected contact (e.g., presence of a weapon) and the environment (e.g., amount of activity) to adjust the soldier's excitation level towards or away from the activation threshold. This function terminates with the decision maker determining whether to exercise the ROEs or to gather more information about the contact (therefore repeating Function 2 but with assessment of different cues).

The decisions associated with this function are generally the ones targeted for technological support, specifically allowing for better visualization of contacts (e.g., blue force tracking

technology to assist in knowing the location of friendly forces, infra-red (IR) reflective tape, thermal vehicle marking, IR strobes). In addition to an enemy's active attempts at deception, visibility and visual resolution are the main constraints affecting this function due to the need to clearly observe a variety of cues (e.g., clothing details, actions, camouflage or concealment). Experience is the other critical constraint because it leads to the development of situation expectations, which are stored in mental models in long-term memory, and are utilized to guide visual search. These expectations are used to decide how particular cues will affect the level of excitation (i.e., towards or away from the activation threshold, with a strong or weak effect).

Function 2 consists of the most decisions out of the four functions analyzed because of the presence of binary and discrimination decisions related to each cue potentially available to the soldier (e.g., is the contact wearing boots, running shoes or sandals?). However, it is not likely that in any given encounter all decisions would be required, or even possible given the limited time available to reach a conclusion. Instead of assessing and therefore deciding on every piece of available information, CID decision makers use intuitive decision strategies, which seek to use the most relevant, available or salient cues. These strategies focus on forming an adequate (i.e., satisficing), rather than optimal decision. As reviewed in Famewo et al., (2007), intuitive decision making is divided into Behavioural Decision Theory (BDT) and Naturalistic Decision Making (NDM). In high stress, time-pressured environments, decision makers, particularly those experienced in their domain, rely on intuitive strategies, using the heuristics and cognitive biases of BDT, and/or the recognition-primed decision (RPD) model or lens model of NDM. For example, soldiers would use pattern matching, an aspect of the RPD model, to associate observed cues with those present during previous experiences to determine the necessary action. Therefore, amongst the decisions identified within Function 2, only a subset of them would likely be performed during the CID task.

One noteworthy decision included as part of Function 2 is the crucial "sanity check" in which the soldier must try to determine whether anything may have negatively affected their identification decision, such as uncertainty or past experiences. This decision is a self-assessment of the level to which the activation threshold has been set and is crucial in hopes of avoiding errors. Once a threat (i.e. foe/enemy/hostile) identification has been made with a certain level of confidence, the process of taking action commences (Function 3).

In summary, the cues used by CID decision makers will differ based on their past experiences. Cues that match those observed to have significant meaning in the past are expected to be those to which soldiers would most quickly attend. Further research is necessary to assess this hypothesis. It is also likely that the most commonly used cues would vary depending upon the context, and would continue to change across missions as enemy contacts seek more diverse concealment and camouflage options due to the nature of asymmetric warfare. However, if patterns of commonly used cues could be determined through experimentation or interview methods, training methods could be developed to assist inexperienced soldiers in knowing what to look for. Specialized training simulations may be effective methods for training this knowledge.

3.1.3 Function 3: Take Action

The tasks and decisions of Function 3 take place after the activation threshold has been exceeded. This stage is generally excluded from the CID literature, which often stops at the point of identification. However, by analysing this process, we can see that decisions about a contact's threat level do not end upon identification. Instead, the threat level is continuously reviewed while exercising or escalating the ROEs to eliminate the threat. Actions may include using non-deadly or

deadly force depending upon the severity of the threat and the actions of the contact(s) in response to the engagement. The decisions involved in this function, therefore, are related to choosing a COA based on the information acquired and aggregated during Functions 1 and 2. Experience and a thorough understanding of the ROEs are necessary to ensure appropriate use of force during this task. It is important, therefore, that the ROEs are learned sufficiently during the mission preparation stage.

3.1.4 Function 4: Evaluate Action Taken

Function 4, like Function 3, is outside the general area of study for CID. However, similarly, the decisions involved in this function have important implications for the CID decision maker. Feedback acquired upon evaluating one's actions can be used to recalibrate the soldier's SA and mental models related to the situation. This function, therefore, can affect the activation threshold which is influenced by experience and expectations. Despite the benefits of this stage, it is often not possible due to strict time constraints caused by the presence of other contacts in the area of interest. In order to fully evaluate the information that may have been overlooked during intuitive information acquisition and aggregation processes, time-consuming ADT strategies would need to be employed, which are generally only practical in situations with relatively low cognitive demands.

4 Conclusions and Recommendations

The four contract components synthesized and summarized in this report have provided insight into the workings of the human CID decision process not previously available in the literature. The HF perspective taken in this project has resulted in the development of the Excitation-Activation Threshold model, which attempts to portray the moment-to-moment changes made in the mind of the CID decision maker as information is accumulated about the contact of interest. In addition, the function flow and decision requirements analyses have provided the detailed functions and decisions associated with the CID process. This information has implications for the development of training exercises and decision support systems, and has revealed several recommendations for future research that will benefit the individual soldier in the battlefield.

The intuitive nature of the CID decision making process (specifically Function 2) has suggested that experience is critical to making effective CIDs. Therefore, it is expected that the development of training simulations highly specialized to a mission would benefit the inexperienced soldier in learning the appropriate cues to which to attend. However, due to the ever-changing characteristics of asymmetric warfare and the associated need for CID training to be immersive, such specialized training could prove costly given their need for continual updating. It remains to be determined the degree to which generalized simulations would enhance inexperienced soldier's CID decisions. It is proposed that simulations of varying levels of specificity be assessed in terms of the quality of experience it provides and how beneficial it will be in improving the soldier's CID skills.

Two recommendations can also be proposed with respect to the specific cues used during the DCRI phase (Function 2: Perform Mounted and Dismounted Functions). First, it is recommended that future research continue to involve development of vision and SA enhancement technologies that will assist in detecting and assessing the cues. This is particularly important given that visibility and comprehension are the main constraints affecting the soldier's ability to accumulate information that will change his/her excitation level. Second, research is needed into a number of cues that were beyond the scope of the function flow and decision requirements analyses. As discussed in Famewo et al., (2007), there may be situations where soldiers not only aggregate information personally observed in the environment, but they may also incorporate the opinions of other soldiers in the vicinity. It is necessary to evaluate how opinions are aggregated in the high stress environment of the battlefield and determine whether technology can be used to facilitate the sharing of opinions in an effective way.

An important realization from this project that is recommended for use in future research is the inclusion of the analysis of decisions and functions performed both before (Function 1: Mission Preparation) and after (Function 3: Take Action; Function 4: Evaluate Action Taken) the DCRI phase (Function 2: Perform Mounted and Dismounted Functions). This is important because of the role of these functions in setting and altering the soldier's activation threshold. When these functions are not considered with respect to the CID process, a number of critical decisions relating to CID are disregarded.

The inclusion of Functions 1, 3 and 4 has allowed for identification of areas requiring decision support that are often neglected in the literature. For example, the necessity for accurate and appropriate information during mission preparation suggests the need for research into the methods of presenting accuracy or reliability levels, and into the types of information that would most benefit the soldier. Research is also needed into methods of information presentation that will

assist the soldier in learning, retaining and recalling relevant information acquired during mission preparation for use during Function 2 and 3. Due to the important role of function 4 in calibrating SA and mental models, it is also recommended that feedback acquisition methods be developed to assist the soldier in honing his/her competence in CID.

Overall, this project has detailed the CID decision making process, allowing for insight into the mind of the soldier during this complex task. Through the use of HF methodologies (i.e., function flow analysis, decision requirements analysis), areas of future research have been proposed that will ultimately result in methods to assist the soldier in making more effective and timely identification decisions.

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6 Acronyms

ADT	Analytic Decision Theory
BDT	Behavioural Decision Theory
CID	Combat Identification
COA	Course of Action
DCRI	Detect, Classify, Recognize, Identify
DRDC	Defence Research & Development Canada
HF	Human Factors
ID	Identification
IFF	Identification Friend or Foe
LAV	Light Armoured Vehicle
NDM	Naturalistic Decision Making
ROEs	Rules of Engagement
RPD	Recognition Primed Decision
SA	Situation Awareness

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Annex A – Factors Influencing Combat Identification

Affective (Personal) Factors

Factor	Description	Effect on Activation Threshold	Effect on Excitation
Trust	If a soldier trusts the information provided by systems and colleagues it can raise or lower the activation threshold, but will make that activation threshold consistent across different individuals. If s/he incorrectly trusts this information, the threshold could be raised or lowered incorrectly.	↑/↓	Nil
Confidence	If the soldier has high confidence in their experience or decision making abilities, the activation threshold may not raise or lower; it is more likely to stay static. However, if they do not have confidence in their abilities, it could act with fear to lower the threshold, or with decision making to raise the threshold.	Unlikely to move or ↑/↓	Nil
Fear	Fear of the situation is likely to lower the activation threshold as the soldier is more likely to act defensively. Lack of fear would lead to more decision making and would raise the threshold. Fear of the consequences of action may move the threshold oppositely.	↑/↓	Nil
Fatigue	Fatigue is likely to reduce the likelihood of perceiving relevant stimuli, and is also likely to lower the activation threshold.	↓	↓
Stress	Stress can include psychological stress, physical stress or physiological stress. The presence of stress will lower the activation threshold.	↓	Nil

Perceptual Factors

Factor	Description	Effect on Activation Threshold	Effect on Excitation
Discrete			
Location	Where is the stimulus? If it is near a convoy, or high up, of in the middle of the road, it is likely to increase excitation.	Nil	↑
Time of Day	During daylight there is likely to be no effect, but finding a contact after darkness will raise excitation.	Nil	↑
Activity	What is the contact doing? If they are doing market things, it will not affect excitation, but if they are digging up a road, or seeming to observe, or running away, excitation will raise.	Nil	↑
Direction of Movement	If moving toward a military convoy or patrol, excitation will raise.	Nil	↑

Factor	Description	Effect on Activation Threshold	Effect on Excitation
Hands	If the contact is not showing one or both hands, this will raise excitation.	Nil	↑
Weapons	Presence of weapons (or something that looks like it might be a weapon) will raise excitation and lower the activation threshold. If, on further investigation, the weapon turns out to not be an AK-47, the excitation level will likely fall.	↓	↑/↓
Receiving fire	Coming under fire (either seeing or hearing shots or explosions) will immediately raise the excitation level to exceed the activation threshold and will lower the activation threshold.	↓	↑
Clothing	Local clothing will not add anything to the CID task, but the presence of a military uniform will lower excitation.	Nil	↓
Beard	Presence of a beard will not add anything to the CID task, but the absence of a beard on an old-enough individual may cause the soldier to investigate further by raising the excitation level.	Nil	↑
Helmet	Presence of a helmet will lower the excitation level, because only foreign military and Afghan National Army have helmets	Nil	↓
Footwear	Military boots will lower the excitation level.	Nil	↓
Appearance	If the individual looks like someone who has been identified as a target, excitation level increases.	Nil	↑
Behavioural			
Noise	Ambient noise in the vicinity will provide an important cue to CID. If the noise level or composition changes, activation threshold will lower and excitation level will rise.	↓	↑
Activity	If the pattern of activity in the local area changes, activation threshold will fall and excitation level will rise.	↓	↑
Mix of people	If the mix of men, women and children in the local area changes to one of predominantly men, activation threshold will lower and excitation will rise.	↓	↑
Interactions with others	If individuals start to act suspiciously, holding furtive conversations with each other, looking, pointing, etc. toward soldiers, activation threshold will fall and excitation will rise.	↓	↑
Interactions with soldiers	If individuals engage with soldiers, generally by acknowledging their presence and indicating compliance, excitation will fall.	Nil	↓
Associates	If an individual is associating with a known suspect, excitation will rise.	Nil	↑

Training/Briefing Factors

Factor	Description	Effect on Activation Threshold	Effect on Excitation
Situation Awareness	SA, although a product of all the below, will enable the soldier to make better decisions more quickly. As such, there is no direct effect on activation threshold or excitation level, but SA will determine the magnitude of the effect of all other factors on activation threshold and excitation.	Nil	Nil
Tactics	Effective tactics will raise or lower the activation threshold appropriately according to the situation.	↑/↓	Nil
Techniques	Effective techniques will raise or lower the activation threshold appropriately according to the situation.	↑/↓	Nil
Procedures	Effective procedures will raise or lower the activation threshold appropriately according to the situation.	↑/↓	Nil
Style of Conflict	Given the asymmetric nature of the conflict in Afghanistan, the activation threshold falls.	↓	Nil
Social/ Cultural Factors	A good understanding of the social/cultural factors that will influence the local population's dealings with, and responses to, the soldiers, will raise the activation threshold.	↑	Nil
Crew size/ role	A confidence and trust in the size of a soldier's own force and the adequacy of their defined roles will lead to an appropriate rise or fall in the activation threshold.	↑/↓	Nil
Expectations/ bias	A soldier's expectations/bias will influence their interpretation of what they are seeing. If they expect something bad, the activation threshold and excitation level will fall; if they expect something benign, the activation threshold and excitation level will rise.	↑/↓	↑/↓
SA systems/ technology	Provision of good SA information via automated means (including radio) will appropriately raise or lower the activation threshold.	↑/↓	Nil
Experience/ learning/ feedback	A soldier's experience, learning and feedback will inform their expectations and calibrate their mental model. This can help to appropriately raise or lower the activation threshold.	↑/↓	Nil
Detection range	A belief that the soldier is able to detect an enemy before the enemy can detect the soldier will lead to a rise in the activation threshold. This situation is most likely to be true during night time or outside of cities, towns or villages. During the daytime, and in a population centre, the soldier is unlikely to believe this, so the activation threshold will fall.	↑/↓	Nil
Weapons range	In most situations the soldier will believe that his/her weapon system can engage the enemy before the enemy's weapons system can effectively engage the soldier. This will lead to a rise in the activation threshold.	↑	Nil
Protection	The soldier's belief that the protection afforded by armour and fragmentation vests is sufficient to protect against most attacks will lead to a rise in the activation threshold.	↑	Nil
ROEs	ROEs can also be considered part of the procedures. The degree of	↓	nil

Factor	Description	Effect on Activation Threshold	Effect on Excitation
	freedom that the soldier has to exercise his/her ROEs will lead to an appropriate increase or decrease in the activation threshold. In Afghanistan, soldiers have freedom to exercise their ROEs, leading to a fall in the activation threshold.		
Daily Rhythm	A soldier's understanding of the daily rhythm in the community will assist in interpreting stimuli. This can lead to an appropriate rise or fall in the activation threshold.	↑/↓	Nil
The Plan	The plan handed down from the higher command can be considered part of the tactics. The soldier's understanding of the plan and the expectations that the plan provides will lead the activation threshold to rise or fall in accordance with those expectations.	↑/↓	Nil
Skill	The soldier's skill at the CID task will lead to an appropriate rise or fall in both the activation level and the excitation level, according to the specific situational variables that exist at the time.	↑/↓	↑/↓
Familiarity (with physical area)	The degree to which the soldier knows the local area and understands all the options for attack, retreat, ambush, concealment and observation will serve to appropriately raise or lower the activation threshold.	↑/↓	Nil

Environmental Factors

Factor	Description	Effect on Activation Threshold	Effect on Excitation
Darkness	Darkness acts to obscure cues that a soldier prefers to see. However, darkness also makes it easier to detect thermal signatures in an otherwise-blank scene. Although darkness might act to put the soldier on a more defensive posture and thus lower the activation threshold, anecdotal evidence suggests that the superior night time sensor capabilities, combined with an increase in uncertainty with respect to the identification of a contact, lead to a rise in the activation threshold. This will also reduce the soldier's ability to detect stimuli in the environment, effectively reducing excitation.	↑	↓
Visibility	Poor visibility, such as fog or dense rain, acts in a similar fashion to darkness. However, sensors are affected by the visibility, and do not provide such a detection superiority. However, poor visibility increases the uncertainty of the identification of a contact. Thus, the net result is to raise the activation threshold. This will also reduce the soldier's ability to detect stimuli in the environment, effectively reducing excitation.	↑	↓
Temperature	The extreme temperatures experienced in Afghanistan act as a stressor on the soldier and reduce the effectiveness of the various sensor systems, increasing uncertainty. However, the impact on the soldier as a cognitive processor is likely to lower the activation threshold as the discomfort puts the soldier in an inattentive mode and makes him/her more defensive.	↓	↓

Factor	Description	Effect on Activation Threshold	Effect on Excitation
Humidity	Humidity makes the soldier uncomfortable and adversely affects his/her vigilance, leading to an inability to detect relevant cues in the environment and a reduction in the activation threshold.	↓	↓
Number/ density of stimuli	If the soldier is confronted with a great deal of stimuli that present in a rapid and ever-changing manner the soldier may become confused and nervous. Thus, the effect will be to lower the activation threshold and increase excitation (by virtue of the number of stimuli being processed).	↓	↑
Vibration	This will reduce the soldier's ability to detect stimuli in the environment, effectively reducing excitation.	Nil	↓
Tempo	If events are occurring in rapid succession, the soldier may become more nervous while also detecting more cues in the environment, thus lowering the activation threshold and increasing the excitation level.	↓	↑
Field of View	When observing a scene with the unaided eye, the soldier enjoys a large field of view and can consider it holistically, looking for movement or things that are out of place. A reduction in the field of view will reduce the soldier's ability to detect cues, thereby reducing excitation.	Nil	↓
Resolution	The ability of the soldier to discriminate the detail required to confidently make an identification will lower excitation.	Nil	↓
Colour	Evidence exists to suggest that colour aids in the identification process. Thus, when using vision systems in poor visibility, the likelihood is that monochrome displays will be used, reducing the soldier's ability to extract data from the scene, and reducing the excitation level.	Nil	↓
Magnification/ Distance	Increased magnification, similar to being close to the contact and enjoying high resolution, allows the soldier to discriminate the detail required to make an identification. Without the magnification, or at a significant distance, the soldier cannot obtain that detail, reducing the excitation level.	Nil	↓

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Annex B – Outline View of Combat ID Function Analysis

1. Prepare for mission

1.1 Familiarise with ROEs

1.2 Review tasking/briefing/intelligence information

1.2.1 Examine potential enemy forces

1.2.1.1 Estimate enemy strength

1.2.1.2 Estimate enemy assets

1.2.1.3 Estimate enemy locations

1.2.2 Examine friendly forces

1.2.2.1 Examine locations of friendly forces

1.2.2.2 Examine synchronisation of friendly forces

1.2.3 Examine neutral forces

1.2.3.1 Examine local police forces

1.2.3.1.1 Know who the chief of police is

1.2.3.1.2 Know how many officers are in the force

1.2.3.1.3 Know where they might be stationed/patrolling

1.2.3.2 Know key civilian buildings (e.g. hospitals)

1.2.4 Examine maps/photos/other intel

1.2.4.1 Examine all information on terrain

1.2.4.1.1 Examine high ground (OP locations)

1.2.4.1.2 Examine dead ground

1.2.4.1.3 Examine points of access

1.2.4.1.4 Examine cover

1.2.4.1.5 Examine retrieval points

1.2.4.1.6 Examine insertion points

1.2.4.2 Examine potential threat areas

1.2.4.2.1 Understand how an attack might occur in different places

1.2.5 Examine information on specific individuals of interest (Intelligence)

1.2.5.1 Examine photos

1.2.5.2 Consider location

1.2.5.3 Consider informants

1.2.5.4 Consider likely associates/protection/lookouts

1.2.6 Plot route

2. Perform Mounted/Dismounted Functions

2.1 Monitor arcs

2.1.1 During daytime, use eyes and ears (unaided) to gather information

2.1.2 If necessary, use binoculars, thermal sight, camera (LAV), or image intensifier to gather information

2.1.3 During nighttime, use thermal sight or image intensifier to gather information

2.1.4 Detect (living) contact of interest

2.1.4.1 Detect movement

2.1.4.2 Detect human shapes

2.1.4.3 Detect thermal signature

2.2 Monitor systems

2.2.1 Monitor radio/comms equipment to gather information

2.2.2 Monitor other equipment to gather information (e.g. Blue Force Tracking)

2.3 Come under fire

2.3.1 See bullet hits around own forces

2.3.2 See own forces (local) hit

2.3.3 Feel a round hit you

2.3.4 See ricochet

2.3.5 Hear shot/bullet

2.3.6 Feel artillery rounds overhead

2.4 Consider every living contact in vicinity

2.4.1 Look for perceptual cues

2.4.1.1 Identify fast movement

2.4.1.1.1 See women and children leaving area

2.4.1.1.2 See vicinity suddenly become chaotic

2.4.1.1.3 See individual(s) running towards own forces

2.4.1.1.4 See individual(s) run between own forces

2.4.1.1.5 See individual(s) run away from own forces

2.4.1.2 Perceive the presence of something that looks like a weapon

2.4.1.3 Perceive the presence/absence of hands

2.4.1.4 Perceive the presence/absence of a military uniform

2.4.1.5 Perceive the presence/absence of a helmet

2.4.2 Look for behavioural cues

2.4.2.1 See things that contradict expectations

2.4.2.1.1 Hear less noise than expected

2.4.2.1.2 See less women and children than expected

2.4.2.1.3 See more men than expected

2.4.2.1.4 See less activity than expected

2.4.2.1.5 See more activity than expected

2.4.2.1.6 Smell suspicious smell

2.4.2.1.7 Perceive uncharacteristic activity

2.4.2.2 Identify coordinated movement

2.4.2.2.1 See extended line of individuals moving on high ground (ambush)

2.4.2.2.2 See individuals advancing to contact

2.4.2.2.3 See individuals perform contact drills

2.5 Escalate the threat of the situation accordingly

2.5.1 Go to 3.0 take action

2.5.2 Go to 2.6 investigate potential threat

2.6 Investigate potential threat

2.6.1 Stop

2.6.2 Consider if there is time to look more closely

2.6.3 Consider if there is opportunity to look more closely safely

2.6.4 Look for additional cues to disambiguate potential threat

2.6.4.1 Look for additional perceptual cues

2.6.4.1.1 Examine head for head dress, camouflage/concealment, face

2.6.4.1.1.1 Identify head dress

2.6.4.1.1.1.1 See helmet

2.6.4.1.1.1.2 See turban

2.6.4.1.1.1.3 See beret

2.6.4.1.1.1.4 See hair

2.6.4.1.1.1.5 See absence of hair

2.6.4.1.1.2 Identify camouflage/concealment

2.6.4.1.1.2.1 See camouflage

2.6.4.1.1.2.2 See shrubbery

2.6.4.1.1.2.3 See face mask

2.6.4.1.1.2.4 See face paint

2.6.4.1.1.3 Identify face

2.6.4.1.1.3.1 Determine ethnicity

2.6.4.1.1.3.2 Determine emotional state

2.6.4.1.1.3.3 See half-hearted smiles AND lack of small muscles around the eye

2.6.4.1.1.3.4 See excessive blinking

2.6.4.1.1.3.5 See nervous or tense individuals

2.6.4.1.1.3.6 See micro facial expressions, i.e. small tell tale expressions that are just barely noticeable

2.6.4.1.1.3.7 Look for individual(s) look up and to the right when answering questions

2.6.4.1.2 Examine hands for the presence/absence of object(s)

2.6.4.1.3 Identify object(s) carried

2.6.4.1.3.1 Examine entire body for objects carried

2.6.4.1.3.2 See Improvised Explosive Devices

2.6.4.1.3.3 See large tube, e.g. anti-tank/RPG

2.6.4.1.3.4 See Pistol

2.6.4.1.3.5 See Machine Gun

2.6.4.1.3.5.1 See AK-47

2.6.4.1.3.5.2 See C6

2.6.4.1.3.5.3 See C9

2.6.4.1.3.5.4 See M16

2.6.4.1.3.6 See Rifle

2.6.4.1.3.7 See Machetes

2.6.4.1.3.8 See Knives

2.6.4.1.3.9 See Equipment

2.6.4.1.4 Examine torso for weapons, clothing, and camouflage/concealment

2.6.4.1.4.1 See suspicious load on Torso (bulge, wires, etc…)

2.6.4.1.4.2 Identify clothing

2.6.4.1.4.2.1 Look for local garb/civilian clothing

2.6.4.1.4.2.2 Look for other style of clothing

2.6.4.1.5 Examine footwear

2.6.4.1.5.1 See combat boots

2.6.4.1.5.2 See civilian footwear

2.6.4.1.5.3 See sandals

2.6.4.1.5.4 See running shoes

2.6.4.1.5.5 See other footwear

2.6.4.1.6 Identify presence/absence of equipment

2.6.4.1.6.1 Look for communications equipment

2.6.4.1.6.2 Look for visual aids

2.6.4.1.6.3 Look for aural aids

2.6.4.1.6.4 Look for other equipment

2.6.4.2 Look for additional behavioural cues

2.6.4.2.1 Identify slow movement

2.6.4.2.1.1 See individual(s) walking towards own forces

2.6.4.2.1.2 See individual(s) with hands in the air

2.6.4.2.2 Identify suspicious movements

2.6.4.2.2.1 Look for suspicious hand movements

2.6.4.2.2.2 See individual(s) look at soldier and make eye contact

2.6.4.2.2.3 See individual(s) go to and immediately talk to someone else.

2.6.4.2.2.4 See individual(s) point at soldiers

2.6.4.2.2.5 Consider tense posture or posture shifts

2.6.4.2.2.6 Consider fidgeting

2.6.4.2.2.7 Look for attempts to evade own forces

2.6.4.2.2.8 Look for attempts to deceive own forces

2.6.4.2.2.9 Look for attempts to conceal weapons

2.6.4.2.3 Identify individuals occupying key locations

2.6.4.2.3.1 See individual(s) in front of own forces

2.6.4.2.3.2 See individual(s) occupy high ground

2.6.4.2.3.3 See individual(s)/things occupying cut-off points

2.6.4.2.3.4 See individual(s)/things blocking escape routes

2.6.4.2.4 Identify attempts to conceal things from observation

2.6.4.2.4.1 Consider individual(s) proximity to potential hiding places (for weapons)

2.6.4.2.4.2 See individuals digging in the middle of the road at night

2.6.4.2.5 Identify suspicious communication

2.6.4.2.5.1 Listen to suspicious communication

2.6.4.2.5.2 Correlate with movements out of the ordinary

2.6.5 Consider whether any conditions exist that would reduce your confidence in your own judgement of friend/foe

2.6.5.1 Consider expected location of friendly forces

2.6.5.1.1 Consult maps

2.6.5.1.2 Radio for further information

2.6.5.1.3 Coordinate identification response from units believed to be in vicinity

2.6.5.1.4 Consider whether Afghan police are known to be in the area

2.6.5.2 Consider personal experience

2.6.5.2.1 Consider pattern of previous engagements

2.6.5.2.2 Consider accuracy of previous decision making

2.6.5.2.3 Consider known or suspected associates of individual(s) under observation

2.6.5.2.3.1 Decide whether individual is Afghan National Police (ANP)

2.6.5.2.3.2 Decide whether individual is Taliban/insurgent

2.6.5.2.3.3 Decide whether individual is unknown

2.6.5.3 Consider uncertainty of situation

2.6.5.3.1 Consider what you think you saw

2.6.5.3.2 Consider what you think you heard

2.6.5.3.3 Consider what you think you know

2.6.5.3.4 Consider impact of fatigue and other psychophysiological factors

3. Take Action

3.1 Locate origin of fire

3.2 Dismount

3.3 Exercise ROEs

3.3.1 Use non-deadly force

3.3.1.1 Maintain physical presence of disciplined and professional personnel

3.3.1.2 Challenge and warn

3.3.1.2.1 Repeat verbal/visual warnings/repeat challenges until it is clear that you were seen or heard

3.3.1.3 Use empty hand control

3.3.1.4 Use intermediate weapons

3.3.1.5 Use mechanical constraints

3.3.2 Use deadly force

3.3.2.1 Brandish weapons (load, take direct aim, etc.)

3.3.2.2 Fire warning shots

3.3.2.3 Shoot to kill

3.3.2.3.1 Pre-emptive shot

3.3.2.3.2 Return fire

3.4 Assume contact is benign

4. Assess Action Taken

4.1 Consider whether right decision was made

4.1.1 Consider feedback from perceptual cues

4.1.1.1 Come under fire

4.1.1.2 Firing stops

4.1.2 Consider feedback from behavioural cues

4.1.1 People run to assistance of stricken person

4.1.2 Vicinity goes quiet

4.1.3 Vicinity becomes chaotic

4.1.4 Make assessment

4.1.4.1 Take shot - incorrect

4.1.4.2 Take shot - correct

4.1.4.3 Don’t take shot – incorrect

4.1.4.4 Don’t take shot – correct

Annex C: Decision Requirements Tables

Column Legend

- **Information Requirements.** This column includes the cues/information used to make the decision.
- **Specific Constraints.** This column lists any constraints expected to specifically affect the ease of making the associated decision.
- **Decision Outcome**. This column includes the general outcome of the decision.
- **DCRIA Stage.** This column shows whether the decision falls under the Detect, Classify, Recognize, Identify or Action process of CID. These processes include the following decisions (Self, 2005):
    - *Detect.* Is the entity really a target? A vehicle, person or structure of possible military interest is noticed. The military observer takes action to search for further information.
    - *Classify*. What class of target is it? The object is distinguished by class, such as wheeled or tracked vehicle, animal or human.
    - *Recognize*. What type of target is it? The object is distinguished by category, such as tank or personnel carrier in the tracked vehicle class. If the object is human, elements of the person, such as lack or presence of equipment, head-gear, or posture are used to determine if the person is of military interest.
    - *Identify*. Is the target friendly, neutral or hostile? The object is distinguished by model (e.g., 4 door sedan if a vehicle) and the force allegiance (friend, foe, etc) is determined (but not confirmed). If the object is human, elements of the person, such as clothing, equipment, posture and/or gender are used to determine if the person is armed or potentially combatant.
    - *Action.* Is it necessary to move closer to the target to get more information to make an identification, or can an action be taken based on the identity determined? When an identification is made, action options include, but are not limited to destroy, report or avoid.
- **Decision Complexity.** This column includes a rating of the complexity of the decision on a three-point scale described below:
    - 1 – Simple decisions involving detection or discrimination with yes/no options (e.g., do I see a helmet?);
    - 2 – Decisions involving judgement (e.g., is the amount of activity in the market normal or not?); and,
    - 3 – Decisions involving several factors to trade off (e.g., do I exercise my ROE's?).

- **Cognitive Workload.** This column contains a rating on a three-point scale regarding the cognitive workload associated with the decision (in addition to the general workload caused by the situation). Although decision complexity certainly contributes to cognitive workload, factors such as ambiguity and modality of information can also directly affect the decision maker's level of mental effort. Hence, this rating is based on consideration of the presence of conscious/mental effort (i.e. working memory demands, attentional resource demands), uncertainty and the amount and type of information to be aggregated.
    - 1 – Low cognitive workload. Minimal mental effort required, low level of uncertainty, little information required, information available in same sensory modality;
    - 2 – Moderate cognitive workload. Mixture of low and high requirements (mental effort, uncertainty, amount and type of information); and,
    - 3 – High cognitive workload. High mental effort required, high level of uncertainty, many pieces of information required, some of which may be from different sensory modalities.
- **Decision Criticality.** This column contains a rating of the criticality of the decision on a three point-scale, based on the likelihood that the decision will increase the level of excitation of the soldier towards the activation threshold:
    - 1 – Low criticality. Decision unlikely to increase the level of excitation of the soldier towards activation threshold;
    - 2 – Moderate. Decision may increase the level of excitation of the soldier towards activation threshold (i.e. whether or not to exercise ROEs);
    - 3 – High criticality. Decision is likely to increase the level of excitation of the soldier towards activation threshold (i.e. whether or not to exercise ROEs).
- **Time Required to Make Decision.** This column was completed at the end of the decision collection process and includes a rating of 1 to 3 to show the time requirements to make the decision relative to other decisions. The time required is a function of the amount of information that needs to be acquired and integrated and hence, cognitive workload. This dimension does not necessarily reflect the time available to make decisions. We assume that, in practice, decisions related to Function 2 and 3 would have the least available time whereas Functions 1 and 4 would have more available time.
    - 1 – Low amount of time required
    - 2 – Moderate amount of time required
    - 3 – High amount of time required

Function 1: Prepare for Mission

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide to what extent to prepare for the mission	1.0 Prepare for mission 1.1 Familiarize with ROEs 1.2 Review tasking/briefing/ intelligence information	Knowledge of the mission plan Level of familiarity with similar missions Urgency of undertaking the mission Anticipated risk involved in the mission Crew size and roles Information available (e.g., maps, photos, other) about friendly, neutral and enemy forces, and specific individuals of interest ROEs	Experience (i.e., with similar missions, culture) Time available for preparation Availability of information (e.g., plan handed down from higher command, maps, photos) Confidence in own abilities and understanding	The required breadth and depth of mission preparation is determined	pre-DCRIA	3	2	1	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide how familiar one should be with the ROEs and when this level of familiarity is achieved	1.1 Familiarize with ROEs	ROEs/card Knowledge of mission plan and requirements Meta-cognition (knowing when something has been learned to an appropriate level)	Time available to familiarize self with ROEs Number and length of ROEs Novelty of ROEs (e.g. ROEs may have changed and are unfamiliar) Accuracy in metacognition (knowing when something has been learned to an appropriate level)	The soldier becomes familiar with the ROEs so that if/when contacts are encountered he/she will be prepared with knowledge of when and to what extent engagement is appropriate	pre-DCRIA	2	2	1	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide which tasking/briefing/ intelligence information is relevant and when one has assessed enough of this information for the mission	1.2 Review tasking/briefing/ intelligence information 1.2.1 Examine potential enemy forces 1.2.2 Examine friendly forces 1.2.3 Examine neutral forces 1.2.4 Examine maps, photos, other intelligence 1.2.5 Examine specific individuals of interest	Photos, maps and reports that provide information about potential enemy forces, friendly forces, neutral forces, and specific individuals of interest Information provided in taskings and briefings Knowledge of mission plan and requirements Meta-cognition (knowing when something has been learned to an appropriate level)	Experience and training Availability, accessibility and accuracy of relevant information pertaining to the situation Time available to review the information Tempo Mission plan Crew size, skill and role Working memory overload caused by too much information, irrelevant information, or information in different sensory modalities (e.g., auditory information needing translation into visuo-spatial information) Accuracy in metacognition (knowing when something has been learned to an appropriate level)	Determination of tasking, briefing, and intelligence information with respect to potential enemy forces, friendly forces, neutral forces, and specific individuals of interest relevant to the current mission. Supports building levels 2 and 3 SA which affects expectations and both the activation threshold level and the base excitation level	pre-DCRIA	3	3	1	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide what information to consider regarding potential enemy forces, and when one has assessed enough of this information for the mission	1.2.1 Examine potential enemy forces 1.2.1.1 Estimate enemy strength 1.2.1.2 Estimate enemy assets 1.2.1.3 Estimate enemy locations	Information about enemy strength, assets, locations, combat power, number of units, centre of gravity, line of operations, etc. Knowledge of mission plan and requirements Meta-cognition (knowing when something has been learned to an appropriate level)	Experience and training Availability, accessibility and accuracy of information Accuracy in metacognition (knowing when something has been learned to an appropriate level)	Determination of information about potential enemy forces, such as strength, assets and locations relevant to the current mission Supports building levels 2 and 3 SA Influences expectations about the risk of the mission and both the activation threshold level and the base excitation level	pre-DCRIA	3	3	1	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide what information to consider regarding friendly forces and when one has assessed enough of this information for the mission	1.2.2 Examine friendly forces 1.2.2.1 Examine locations of friendly forces 1.2.2.2 Examine synchronisation of friendly forces	Information regarding friendly forces such as locations (e.g., observation points, high ground, low ground, dead ground) and synchronization Knowledge of mission plan and requirements Meta-cognition (knowing when something has been learned to an appropriate level)	Experience and training Availability, accessibility and accuracy of information Accuracy in metacognition (knowing when something has been learned to an appropriate level)	Determination of information about friendly forces, such as location and synchronization, relevant to the current mission Supports building levels 2 and 3 SA Influences expectations about the mission, and alters the activation threshold level and the base excitation level	pre-DCRIA	3	3	1	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide what information to consider regarding neutral forces and when one has assessed enough of this information for the mission	1.2.3 Examine neutral forces 1.2.3.1 Examine local police forces 1.2.3.1.1 Know who the chief of police is 1.2.3.1.2 Know how many officers are in the force 1.2.3.1.3 Know where they might be 1.2.3.2 Know key civilian buildings (e.g. hospitals)	Information about the locations and capabilities of police forces, including details such as who the chief of police is and how many officers are in the force Information about locations, usage, and significance of key civilian buildings Knowledge of mission plan (e.g., locations involved) Meta-cognition (knowing when something has been learned to an appropriate level)	Experience and training Deception caused by enemy forces seeking to appear neutral Availability, accessibility and accuracy of information Accuracy in metacognition (knowing when something has been learned to an appropriate level)	Determination of information about neutral forces, such as locations and capabilities of local police forces and locations, usage and significance of key civilian buildings relevant to the current mission. Supports building levels 2 and 3 SA Influences expectations about the mission, and alters the activation threshold level and the base excitation level	pre-DCRIA	3	3	1	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide which maps, photos, and other intelligence to examine for the mission	1.2.4 Examine maps, photos, other intelligence; 1.2.4.1 Examine all information on terrain; 1.2.4.2 Examine potential threat areas;	Assortment of maps, photos, intelligence sources (reports, communication, technology) Knowledge of the mission plan and requirements Reliability of the different information sources Knowledge of the type of information needed for the mission	Availability, accessibility and accuracy of information Ability to selectively attend to relevant information Time available to examine information	Determination of relevant sources to use to acquire the information needed about enemy, friendly and neutral forces Supports building levels 1,2 and 3 SA	pre-DCRIA	2	2	1	3
Decide which information gained from examining the terrain will assist in preparing for the mission	1.2.4.1 Examine all information on terrain; 1.2.4.1.1 Examine High ground (OP locations); 1.2.4.1.2 Examine dead ground; 1.2.4.1.3 Examine points of access; 1.2.4.1.4 Examine cover; 1.2.4.1.5 Examine retrieval points; 1.2.4.1.6 Examine insertion points;	Information from observing the terrain such as: high ground, dead ground (barriers, mountains), points of access (open area), cover (shelter, trenches), retrieval points, insertion points, infrastructure (roadways). Knowledge of mission plan and requirements	Visibility of terrain features Ability to selectively attend to relevant information Availability and accessibility of information	Supports building of levels 1,2 and 3 SA in order to gain an understanding of such places as OP locations, dead ground, points of access, cover, retrieval points and insertion points, which are relevant to the mission plan	pre-DCRIA	2	2	1	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide where potential threat areas (geographical) exist	1.2.4.2 Examine potential threat areas; 1.2.4.2.1 Understand how attack might occur in different places;	Locations, capabilities and synchronization of own and enemy forces across time (i.e. in relation to H-hour) Knowledge of previous enemy activities Characteristics of terrain	Availability and accessibility of information Experience and training	The soldier has an understanding of the location of threat areas based on knowledge of previous enemy activities, locations and capabilities of enemy forces Supports building level 3 SA Influences expectations about the risk of the mission and both the activation threshold level and the base excitation level	pre-DCRIA	2	3	1	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide what information/ characteristics to collect about specific individuals of interest and determine how this information may affect the mission	1.2.5 Examine specific individuals of interest 1.2.5.1 Examine photos 1.2.5.2 Consider location 1.2.5.3 Consider informants 1.2.5.4 Consider likely associates/protection/ lookouts	Information about specific individuals of interests, such as: identity and location, role in the community (power, influence), social network, routine, salient physical characteristics, level of protection Knowledge of the mission plan and requirements Knowledge of existing informants and/or individuals of interest	Availability and accessibility of information Reliability of informants Time available to adequately study individuals Experience and training	Determination of how particular individuals may affect the mission based on information such as location, associates, routine and status. Supports building levels 2 and 3 SA Influences expectations about the mission and both the activation threshold level and the base level of excitation Acquiring the characteristics about individuals will build intelligence and provide a potential basis for effects-based operations Development of a network of individuals of interest and informants.	pre-DCRIA	2	3	1	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Based on knowledge of mission, ROEs, enemy, friendly and neutral forces, terrain, and specific individuals of interest, decide how the patrol route should be plotted	1.2.6 Plot Route	See information requirements for all other decisions under Function 1.0	Terrain Threat areas Weather Time of day Time available Supply points Accuracy and completeness of levels 2 and 3 SA	Patrol route is outlined Soldier is ready to begin mounted and dismounted functions	pre-DCRIA	3	3	1	3

Function 2: Perform Mounted/Dismounted Functions

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide how the environment should be viewed (e.g., eyes, binoculars, thermal sight, camera, image intensifier)	2.1.1 During daytime, use eyes and ears (unaided) to gather information 2.1.2 If necessary, use binoculars, thermal sight, camera (LAV), or image intensifier to gather information 2.1.3 During nighttime, use thermal sight or image intensifier to gather information	Time of day Weather (temperature, humidity) Distance to be viewed Resolution and field of view required Knowledge of equipment capabilities (distance, resolution, field of view)	Availability of equipment Human and equipment limitations in visual acuity Training	Detection of the environment Supports building levels 1 and 2 SA	Pre-DCRIA	1	1	1	1
Decide whether a living contact is detected	2.1.4 Detect (living) contact of interest	Presence of movement Human shape(s) Thermal Signature	Proper method of visualizing the environment is chosen Salience of contact compared to background clutter (signal-to-noise ratio)	Soldier detects a living contact of potential interest Threat/excitation level is adjusted accordingly	D	1	2	2	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide to consider every living contact in the vicinity unless firing is detected	2.3 Come Under Fire 2.3.1 See bullet hits around own forces 2.3.2 See own forces (local) hit 2.3.3 Feel a round hit you 2.3.4 See ricochet 2.3.5 Hear shot/bullet 2.3.6 Feel artillery rounds overhead 2.4 Consider Every Living Contact in Vicinity	Presence of living contacts (based on presence of movement, human shape, thermal signature) to consider Detect presence of firing based on the following cues: see bullet hits around own forces, see own local forces hit, feel a round hit you, see ricochet, hear shot/bullet, feel artillery rounds overhead	Visual, auditory, tactical senses alert to sensations (i.e. not blocked by helmet or armour)	Detect whether one has come under fire. If firing is not occurring, each living contact is considered for threat potential	D	1	1	3	1
If one is considering each living contact, decide what perceptual cues are relevant to look at to assist with identification	2.4.1 Look for perceptual cues	Knowledge about what is a relevant perceptual cue (e.g., weapon, equipment, fast movement, clothing, head dress) Proximity of living contacts to decision-maker	Experience and training Visual resolution (to observe the contact's details)	Decision is made to allocate resources to relevant cues that will assist in identifying the threat of the contact Supports building levels 1 and 2 SA	C,R	2	2	2	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
If one is considering each living contact, decide what behavioural cues are relevant to look at to assist with identification	2.4.2 Look for behavioural cues	Knowledge about what is a relevant behavioural cue (e.g., coordinated movement, activity) Proximity of living contacts to decision-maker	Experience and training Visibility of the contact (to view movement)	Decision is made to allocate resources to relevant cues that will assist in identifying the threat of the contact Supports building levels 1 and 2 SA	C,R	2	2	2	1
Decide whether the contacts are moving rapidly and whether this suggests suspicious behaviour	2.4.1.1 Identify fast movement 2.4.1.1.1 See women and children leaving area 2.4.1.1.2 See vicinity suddenly become chaotic 2.4.1.1.3 See individual(s) running towards own forces 2.4.1.1.4 See individual(s) running between own forces 2.4.1.1.5 See individual(s) running away from own forces	Knowledge of the normal amount and type of movement in the given location Activity of contacts (e.g., women and children leave the area, vicinity suddenly becomes chaotic, individual(s) run towards, between or away from own forces) Levels 2 and 3 SA Proximity of contacts to the decision-maker	Experience Visibility of contacts	Decision of whether contacts should be considered suspicious based on fast movements Supports building levels 1, 2 and 3 SA	R	2	2	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the contact is carrying something that looks like a weapon	2.4.1.2 Perceive presence of something that looks like a weapon	Knowledge of what a weapon looks like Perceptual cues that suggest the contact is carrying something (e.g., bulky/bumpy clothing, shiny/metallic object, wires) View of the object held or worn by the contact	Visual Resolution Experience and training	Decision of whether contact is armed Threat/excitation level is adjusted accordingly Supports building levels 1 and 2 SA	R, I	1	2	2	1
If the contact is perceived as carrying something that looks like a weapon, decide whether it poses an immediate threat	2.4.1.2 Perceive presence of something that looks like a weapon	Method by which the weapon is being carried (e.g., in hands, strapped over arm, in pocket) Activity of the contact (e.g., pointing the weapon)	Visual Resolution Experience and training	Determine whether the contact should be considered a threat Threat/excitation level is adjusted accordingly	I	1	2	3	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the contact's hands are visible and what this means in terms of being a potential threat	2.4.1.3. Perceive presence/absence of hands	Activity of hands Knowledge of culture-specific hand signals Presence of objects carried by hands Activity of the contact in general (particularly if hands are not visible) Appearance of the contact (particularly if hands are not visible)	Cultural experience and training Visual resolution (to see hands)	Decision whether the contact's hands are used in a threatening manner Threat/excitation level is adjusted accordingly Supports building levels 1 and 2 SA	R	2	2	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the contact is wearing a military uniform	2.4.1.4 Perceive presence/absence of military uniform	Knowledge of what military uniforms look like Appearance of the clothing (e.g., colour, pattern, presence and location of insignia, type of material, presence of reflective tape)	Visual Resolution (to see clothing details) Experience and training	Determination of whether the contact is wearing a military uniform If the contact is wearing a military uniform, he/she is recognized as being of military interest (allegiance not necessarily known) Threat/excitation level is adjusted accordingly Supports building levels 1 and 2 SA	R	1	1	2	1
If the contact is wearing a military uniform, decide whether the allegiance of the contact can be confidently determined	2.4.1.4 Perceive presence/absence of military uniform	Identifying features of the military uniform (e.g., flag, shape, colour, reflective tape) Activity of the contact Expectations about the location of friendly/enemy forces	Accuracy in expectations of the location of friendly/enemy forces Possibility of deception by enemy forces	Determination of whether the contact's allegiance can be identified based on the type of uniform worn If an identification is made, action may be taken (e.g., shoot, ignore, avoid)	I	2	2	2	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the contact is wearing a helmet	2.4.1.5 Perceive presence/absence of helmet	Knowledge of what a helmet looks like Perceptual cues indicating the contact is wearing some form of head dress Appearance of the head dress (e.g., shape, material, colour, pattern)	Visual Resolution (to see head dress details) Experience and training	Determination of whether the contact is wearing a helmet If the contact is wearing a helmet, he/she is recognized as being of military interest (allegiance not necessarily known) Threat/excitation level is adjusted accordingly Supports building levels 1 and 2 SA	R	1	1	2	1
If the contact is wearing a helmet, decide whether the allegiance of the contact can be confidently determined	2.4.1.5 Perceive presence/absence of helmet	Identifying features of the helmet (e.g., flag, shape, colour) Activity of the contact that may suggest allegiance Other identifying features such as the presence of a military uniform Expectations about the location of friendly/enemy forces	Accuracy in expectations of the location of friendly/enemy forces Possibility of deception by enemy forces	Determination of whether the contact's allegiance can be identified based on the presence of a helmet If an identification is made, action may be taken (e.g., shoot, ignore, avoid)	I	2	2	2	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the behaviour of the contact(s) is different from what is expected	2.4.2.1 Sense things that contradict expectations 2.4.2.1.1 Hear less noise than expected 2.4.2.1.2 See less women and children than expected 2.4.2.1.3 See more men than expected 2.4.2.1.4 See less activity than expected 2.4.2.1.5 See more activity than expected 2.4.2.1.6 Smell suspicious smell 2.4.2.1.7 Perceive uncharacteristic activity	Expectations based on experience regarding noise levels, gender of people in area, type of activity, and activity level of people in the area Current noise levels Gender of contacts present (e.g., less women and children than expected, more men) Current activity level of contacts Type of activity being performed by the contacts Presence of suspicious odour (e.g., explosives)	Previous experience Time since experience (long-term memory effects) Salience of contact compared to background clutter (signal-to-noise ratio) Accuracy of intuition (spidey-sense)	Behaviours are recognized as normal or not normal based on expectations Threat/excitation level is adjusted accordingly Supports building levels 1 and 2 SA	R	2	3	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether observed movements are coordinated activity	2.4.2.2 Identify coordinated movement 2.4.2.2.1 See extended line of individuals moving on high ground (ambush) 2.4.2.2.2 See individuals advancing to contact 2.4.2.2.3 See individuals perform contact drills	Positioning of contacts relative to each other Movement and activity of contacts (e.g., an extended line of individuals moving on high ground as if preparing for an ambush, individuals advancing to contact, or individuals performing contact drills)	Experience and training (e.g., TTPs)	Behaviours are recognized as either coordinated activity or not Threat/excitation level is adjusted accordingly Supports building levels 1, 2 and 3 SA	R	2	2	2	1
Decide whether the threat level of the situation should be escalated based on consideration of the perceptual and behavioural cues associated with the contacts	2.5 Escalate Threat of Situation Accordingly	Information requirements for all decisions under Function 2.4	Constraints affecting all decisions under Function 2.4 Working memory limitations to hold and integrate all relevant information	Threat/excitation level is adjusted accordingly based on the integration of the observed perceptual and behavioural cues	R,I,A	3	3	3	2
Decide to take action based on the threat level or to investigate the potential threat further	2.5.1 Go to 3.0 Take action 2.5.2 Go to 2.6 Investigate threat potential	Height of excitation level relative to activation threshold based on information already acquired about the contact, and the urgency of the situation Levels 2 and 3 SA	Time constraints Opportunities to examine the potential threat further Flexibility of ROEs	The contact's allegiance is identified and action is taken, or the contact is investigated further by acquiring more information	I and A, or R	3	3	3	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
If action is not deemed necessary yet based on the threat level, stop and decide whether there is time and an opportunity available to safely look more closely, or whether an action really should be taken	2.6.1 Stop 2.6.2 Consider if there is time to look more closely 2.6.3 Consider if there is an opportunity to look more closely safely 2.6.4. Look for additional cues to disambiguate potential threat	Time available Mission plans and objectives Risk based on knowledge of the location and previous experience ROEs Levels 2 and 3 SA	Experience and training Time constraints, tempo Opportunities to examine the potential threat further Flexibility of ROEs	A decision is made whether additional cues can be assessed safely based on time available and risk, or whether an action should be taken	R or I and A	3	3	3	2
If it is determined that more information can be assessed, decide what are relevant perceptual cues that will assist in disambiguating the potential threat	2.6.4.1 under Look for additional perceptual cues	Knowledge about what perceptual cues are relevant (head dress, camouflage, concealment, face, hands) Proximity of contact to decision-maker Recollection of cues already assessed	Experience and training Visual resolution (to observe the contact's details)	Decision is made to allocate resources to relevant cues that will assist in identifying the threat of the contact	C,R	2	2	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
If it is determined that more information can be assessed, decide what are relevant behavioural cues that will assist in disambiguating the potential threat	2.6.4.2 Look for additional behavioural cues	Knowledge about what behavioural cues are relevant (movement, communication) Proximity of contacts to decision-maker Recollection of previously assessed cues	Experience and training Visibility of the contact (to view movement)	Decision is made to allocate resources to relevant cues that will assist in identifying the threat of the contact	C,R	2	2	2	2
Decide the type of head dress worn by the contact (e.g., helmet, beret, hair, absence of hair)	2.6.4.1.1.1 Identify head dress 2.6.4.1.1.1.1 See helmet 2.6.4.1.1.1.3 See beret 2.6.4.1.1.1.4 See hair 2.6.4.1.1.1.5 See absence of hair	Knowledge about different kinds of head dress and their significance (military, cultural) Perceptual cues, such as shape, colour, pattern, material, indicating the presence of head dress and the type	Visual resolution (to see head dress details) Sufficient experience in determining importance of different types of head dress	Recognize type of head dress Threat/excitation level is adjusted accordingly Supports building levels 1 and 2 SA	R	1	1	2	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether camouflage or concealment is being used	2.6.4.1.1.2 Identify camouflage/concealment 2.6.4.1.1.2.1 See camouflage 2.6.4.1.1.2.2 See shrubbery 2.6.4.1.1.2.3 See face mask 2.6.4.1.1.2.4 See face paint	Knowledge of different kinds of camouflage and concealment (e.g., shrubbery, face mask, face paint) Perceptual cues suggesting camouflage or concealment (e.g., colour, texture, shape, movement)	Visual resolution (to see details suggesting camouflage or concealment) Sufficient experience in discriminating camouflage from background clutter Signal-to-noise ratio	Recognize presence of camouflage or concealment Threat/excitation level is adjusted accordingly Supports building levels 1 and 2 SA	R	1	2	2	2
Decide whether the contact's face provides information (e.g., ethnicity, emotional state, nervousness, lying) about the identity of the contact	2.6.4.1.1.3 Identify face 2.6.4.1.1.3.1 Determine ethnicity 2.6.4.1.1.3.2 Determine emotional state 2.6.4.1.1.3.3 See half-hearted smiles AND lack of small muscles around eye 2.6.4.1.1.3.4 See excessive blinking 2.6.4.1.1.3.5 See nervous or tense individuals 2.6.4.1.1.3.6 See micro facial expressions (e.g., tell-tale expressions that are just barely noticeable) 2.6.4.1.1.3.7 Look for individual(s) looking up and to the right when answering questions	Ethnicity Emotional cues (including half-hearted smiles and lack of small muscles around the eye) Excessive blinking Cues suggesting nervousness or tension Micro-facial expressions Eye movements (up and to right when answering questions)	Visual resolution (to see details of the contact's face) Experience related to reading a person's face	Facial cues are used to recognize presence/absence of threat Threat/excitation level adjusted accordingly Supports building levels 1 and 2 SA	R	2	2	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the contact is carrying an object in his/her hands	2.6.4.1.2 Examine hands for presence/absence of object(s)	Visibility of contact's hands Knowledge of different objects that might be carried for different tasks	Visibility of objects that may be carried by the contact	Determine whether the contact is carrying something Supports building level 1 SA	R	1	2	2	1
If the contact does have an object, decide what it is (e.g., IEDs, large tube such as anti-tank/RPG, pistol, machine gun, rifle, machete, knives, equipment) and whether it poses a threat	2.6.4.1.3 Identify object(s) carried 2.6.4.1.3.1 Examine entire body for objects carried 2.6.4.1.3.2 See improvised explosive decides 2.6.4.1.3.3 See large tybe (e.g., anti-tank/RPG) 2.6.4.1.3.4 See pistol 2.6.4.1.3.5 See machine gun 2.6.4.1.3.6 See rifle 2.6.4.1.3.7 See machetes 2.6.4.1.3.8 See knives 2.6.4.1.3.9 See equipment	Knowledge of what different kinds of objects are (i.e., weapons, equipment) Perceptual cues indicating the type of object (e.g. shape, material, size)	Visual Resolution (to see object details) Experience and training	Determine the kind of object(s) carried by the contact and increase the threat level accordingly Supports building levels 1 and 2 SA	R	2	2	2	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
If the object carried by the contact is a machine gun, decide what kind it is (e.g., AK-47, C6, C9, M16)	2.6.4.1.3.5 See machine gun 2.6.4.1.3.5.1 See AK-47 2.6.4.1.3.5.2 See C6 2.6.4.1.3.5.3 See C9 2.6.4.1.3.5.4 See M16	Knowledge of appearance of different kinds of weapons Perceptual cues indicating different kinds of guns (e.g., size, shape)	Visual Resolution (to see object details) Experience and training	Determine the kind of machine gun being carried Threat/excitation level is adjusted accordingly Supports building levels 1 and 2 SA	R	1	2	2	1
Decide whether anything on the torso of the contact including weapons, clothing and camouflage/concealment (e.g., a suspicious load on the torso such as a bulge or wires) indicate the presence of a threat.	2.6.4.1.4 Examine torso for weapons, clothing and camouflage/concealment 2.6.4.1.4.1 See suspicious load on torso (e.g., bulge, wires, etc) 2.6.4.1.4.2. Identify clothing	Knowledge about the fit of clothing around the torso when no objects are present (cultural familiarity may be required) Perceptual cues from the torso of the contact such as the type of clothing, fit of the clothing, visibility of objects in pockets or belted around the waist	Concealment Signal-to-noise ratio Visual resolution (to see the contact's torso) Experience and training Accuracy of intuition (spidey-sense)	The torso is examined for weapons, clothing features and the presence of camouflage or concealment Threat/excitation level is adjusted accordingly Supports building levels 1 and 2 SA	R	2	3	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide what kind of footwear the contact is wearing (e.g., combat boots, civilian footwear, sandals, running shoes, other), and whether it suggest a potential threat	2.6.4.1.5 Examine footwear 2.6.4.1.5.1 See combat boots 2.6.4.1.5.2 See civilian footwear 2.6.4.1.5.3 See sandals 2.6.4.1.5.4 See running shoes 2.6.4.1.5.5 See other footwear	Visibility of contact's feet Perceptual cues discriminating different kinds of footwear (e.g., material, colour, shape, pattern) Knowledge of different kinds of footwear (combat boots, civilian footwear, sandals, running shoes, other) and what they mean with regards to threat level	Visibility (to see the contact's feet) Visual Resolution (to see the details of the footwear) Experience and training	Determine the type of footwear worn by the contact Threat/excitation level is adjusted accordingly Supports building level 1and 2 SA	R	2	2	2	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the contact has equipment, and if so, what kind (e.g., communications equipment, visual aids, aural aids, other), and whether it poses a threat	2.6.4.1.6 Identify presence/absence of equipment 2.6.4.1.6.1 Look for communication equipment 2.6.4.1.6.2 Look for visual aids 2.6.4.1.6.3 Look for aural aids 2.6.4.1.6.4 Look for other equipment	Perceptual cues indicating the presence of equipment (worn, carried) Perceptual cues indicating the type of equipment (e.g., features, shape, size, wires, location worn such as eyes or ears) Knowledge of what different equipment looks like Knowledge of who uses different kinds of equipment and why (culture, vocations) Cues indicating whether the equipment is being used or only carried	Visual Resolution (to see details of the equipment) Experience and training	Determine whether the contact has equipment and if so, what kind Threat/excitation level adjusted accordingly Supports building level 1 and 2 SA	R	2	2	2	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether slow movements suggest suspicious behaviour	2.6.4.2.1 Identify slow movement 2.6.4.2.1.1 See individual(s) walking towards own forces 2.6.4.2.1.2 See individual(s) walking with hands in the air	Proximity of contacts to the decision-maker Direction of movement (e.g. contacts walking towards own forces) Non-verbal behaviour (e.g. contacts walking with hands in the air). Insight from levels 2 and 3 SA	Visibility of movement Target rich environment (signal-to-noise ratio) Experience	Decision of whether contacts should be considered suspicious based on slow movements. Threat/excitation level adjusted accordingly Supports building level 1 and 2 SA	R	2	2	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the contact is moving suspiciously	2.6.4.2.2 Identify suspicious movements 2.6.4.2.2.1 Look for suspicious hand movements 2.6.4.2.2.2 See individual(s) look at soldiers make eye contact 2.6.4.2.2.3 See individual(s) immediately go and talk to someone else 2.6.4.2.2.4 See individual(s) point at soldiers 2.6.4.2.2.5 Consider tense posture or posture shifts 2.6.4.2.2.6 Consider fidgeting 2.6.4.2.2.7 Look for attempts to evade own forces 2.6.4.2.2.8 Look for attempts to deceive own forces 2.6.4.2.2.9 Look for attempts to conceal weapons	Body language (e.g., hand movements, contact points at a soldier, contact makes eye contact with soldier and then immediately talks to someone, tense posture, posture shifts, fidgeting) Evasion attempts Deception attempts	Experience reading body language (cultural understanding may be required) Accuracy of intuition (spidey-sense) Visibility (to see contact(s) movement)	Decision whether contact is moving suspiciously Threat/excitation level is adjusted accordingly Supports building levels 1, 2 and 3 SA	R	2	3	2	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether individuals occupy key locations.	2.6.4.2.3 Identify individuals occupying key locations 2.6.4.2.3.1 See individual(s) in front of own forces 2.6.4.2.3.2 See individual(s) occupy high ground 2.6.4.2.3.3 See individual(s)/things occupying cut-off points 2.6.4.2.3.4 See individual(s)/things blocking escape routes	Knowledge of key locations (e.g., high ground, cut-off points, escape routes) Presence of contacts in key locations (e.g., contacts are in front of own forces, occupying high ground, cut-off points, blocking escape routes).	Visibility of terrain and the presence of contact(s) Availability and accessibility of information about key locations Experience and training	Determine whether individuals occupy key locations Threat/excitation level is adjusted accordingly Support of building levels 2 and 3 SA	R	1	1	2	1
Decide whether the contact is attempting to conceal things from observation	2.6.4.2.4 Identify attempts to conceal things from observation 2.6.4.2.4.1 Consider individual(s) proximity to potential hiding places (for weapons) 2.6.4.2.4.2 See individual(s) digging in the middle of the road at night	Knowledge of methods of concealment (e.g., underground or amongst vegetation) Location of contact (e.g. contact is close to places that could be used for hiding weapons) Actions of contact (e.g. contact is observed digging in the middle of the road at night, as if to place an IED).	Visibility (to see movements) Experience and training	Determine whether attempts are being made to conceal things from observation Threat/excitation level is adjusted accordingly Supports building levels 2 and 3 SA	R,I	2	3	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the contact is communicating suspiciously	2.6.4.2.5 Identify suspicious communication 2.6.4.2.5.1 Listen to suspicious communication 2.6.4.2.5.2 Correlate with movements out of the ordinary	Content of communication (e.g., hear communication related to enemy plans) Communication interactions (e.g., contact speaks with contacts of known military-interest) Body language during communication (e.g., eye gaze suggesting the topic of discussion) Cues suggesting communication that is out of the ordinary based on the situation (e.g., louder or quieter than expected) Tone of communication (e.g. yelling, rapid speaking) suggesting emotion (e.g., angry, peaceful)	Expectations about communication in specific contexts based on experience and training Ability to hear conversations of specific contacts Visual or auditory information is distinguishable from background clutter or noise (signal-to-noise ratio) Visual resolution (to determine eye gaze) Accuracy of intuition (spidey-sense)	Determine whether suspicious communication is occurring Threat/excitation level is adjusted accordingly Supports building levels 1,2 and 3 SA	R,I	2	3	2	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether any conditions exist that should reduce the confidence in one's identification of the contact (friend/foe)	2.6.5 Consider whether any conditions exist that would reduce your confidence in your own judgement of friend/foe. 2.6.5.1 Consider expected location of friendly forces 2.6.5.2 Consider personal experience 2.6.5.3 Consider uncertainty of situation	Expectations about the contact based on knowledge about the expected location of friendly forces from tasking/briefing/intelligence information Personal expectations based on previous experience (e.g., familiarity with the physical area, daily rhythm of the citizens) Expected level of uncertainty in the situation given the possibility of deception and the complexity of the environment Perceptual cues suggesting information that conflicts with the expectations Metacognition (knowing the confidence one has in the identification)	Experience Stress (may affect ability to detect cues conflicting with expectations) Level of uncertainty (i.e. too much uncertainty will make it difficult to have any confidence in the decision)	Confidence in the identification, as achieved through integration of perceptual and behavioural cues, is reduced if it is determined that conditions exist that may have biased the initial identification Action may be taken based on the identification if the level of confidence is adequate, or further information may be gathered	I, A	3	3	3	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the location of friendly forces should alter the confidence in identification of the contact	2.6.5.1 Consider expected location of friendly forces 2.6.5.1.1 Consult maps 2.6.5.1.2 Radio for further information 2.6.5.1.3 Coordinate identification response from units believed to be in vicinity	Location of friendly forces relative to the location of the contact(s)-of-interest as indicated on maps, SA technology and provided by others Coordinated communication of contact identification by other units believed to be in the vicinity Perceptual and behavioural cues as listed under Functions 2.4 and 2.6 (e.g., head dress, clothing, weaponry, movement, footwear, activity level) Metacognition (knowing the confidence one has in the identification)	Availability, accessibility and reliability of information Ability to communicate with other units in a coordinated fashion ROEs Experience and training Stress	Determination of whether the confidence level in the identification decision should be changed based on expectations about the location of friendly forces (e.g., a contact appears like a friend, but there are no friendly forces supposed to be in the location, therefore confidence in a 'friend' ID is reduced) The decision process proceeds to the action phase or further information is sought	I, A	3	3	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether personal experiences (e.g., pattern of previous engagements, previous accuracy in decision making, knowledge of social networks related to contact) affect confidence in the identification of the contact	2.6.5.2 Consider personal experience 2.6.5.2.1 Consider pattern of previous engagements 2.6.5.2.2 Consider accuracy of previous decision making 2.6.5.2.3 Consider known or suspected associates of individual(s) under observation	Personal experience with previous engagements Knowledge about the accuracy of previous decision making (therefore, feedback has been received on previous occasions) Knowledge of the social network (known and suspected associates) of the contact-of-interest Metacognition (knowing the confidence one has in the identification)	Experience and training Ability to rapidly apply relevant experience to the current situation Improper use of cognitive biases or heuristics (availability, representativeness, story building based on few cues) based on extensive experience which may lead to erroneous conclusions Amount of time spent in the area in order to develop adequate knowledge about the contact's social network Availability of feedback regarding decision-making in previous situations	Determination of whether personal experiences relevant to the current situation might affect the confidence level in the identification (e.g., a soldier has made an identification, but due to being incorrect on previous decisions, his confidence in the identification is reduced) The decision process proceeds to the action phase or further information is sought	I,A	2	2	2	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the uncertainty of the situation (i.e., uncertainty in what you thought you heard, saw or know) and the impact of fatigue or other psychophysiological factors affects confidence in the identification of the contact	2.6.5.3 Consider uncertainty of situation 2.6.5.3.1 Consider what you think you saw 2.6.5.3.2 Consider what you think you heard 2.6.5.3.3 Consider what you think you know 2.6.5.3.4 Consider impact of fatigue and other psychophysiological factors	Metacognition: knowing the confidence one has in the identification, and insight into own understanding of the situation (e.g., what you think you saw, what you think you heard, what you think you know) Presence/absence of an opportunity to assess the situation again to confirm understanding Knowledge that fatigue and other psychophysiological factors can affect perception and cognition Amount of time available to consider the influence of psychophysiological factors on one's thinking process	Presence of time available to consider the influence of psychophysiological factors on one's thinking process Experience and training to recognize the effect of fatigue and other psychophysiological factors Uncertainty introduced by poor visibility, signal-to-noise ratios Ability to effectively manage stress and fatigue to avoid additional uncertainty Ability to accurately recall and integrate cues	Determination as to whether uncertainty in the situation (including that caused by psychophysiological factors like stress and fatigue) may have affected the identification decision The decision process proceeds to the action phase or further information is sought	I,A	3	3	3	3

Function 3: Take Action

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
If it is determined that one is coming under fire, decide where the firing is coming from (i.e., which contact).	3.1 Locate Origin of Fire	Detection of signs suggesting a specific contacts' weapon has been fired (e.g., unusual movement by a contact, observation of the weapon as it is being fired, observation of the direction the bullet came from, sound localization of shot)	Visual, auditory senses available (e.g., unobstructed by helmet)	Firing contact is targeted in preparation for action	D	1	2	3	2
Decide to dismount vehicle	3.2 Dismount	Detection of firing Determination that firing is not an IED explosion (if it is an IED, soldiers remain in the vehicle)	Training Accuracy of decision that one is coming under fire and where firing is coming from	Dismount vehicle	A	1	1	2	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the contact is benign (non-effective fire, non-threat) or whether ROEs should be exercised (effective fire, threat)	3.3 Exercise ROEs, 3.4 Assume Contact is Benign	Location of contact relative to decision-maker Integration of perceptual and behavioural information requirements under Functions 2.4 and 2.6 within the Perform Mounted/Dismounted Function Meta-cognition (knowledge that one has enough information to make this decision)	Visibility of contact Expectations Experience and training Fear	Contact is assumed benign and the soldier resumes mounted/dismounted functions, or the contact is engaged based on the ROEs	A	3	3	3	3
If ROEs are to be exercised, decide whether there is the need to use lethal force.	3.3.1 Use Non-Deadly Force 3.3.2. Use Deadly Force	ROEs Activity of contact Proximity of contact to decision-maker Weapons' firing range of own weapons and that of the contact	Experience and training Fear ROEs	Determination as to whether lethal force is required	A	3	3	NA (above threshold)	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
If ROEs dictate non-deadly force, decide whether there is time to follow the ordered sequence of applying force (i.e., maintain physical presence of disciplined and professional personnel, challenge and warn, use empty hand control, use intermediate weapons, and then use mechanical restraints)	3.3.1 Use Non-Deadly Force 3.3.1.1 Maintain Physical Presence of Disciplines and Professional Personnel 3.3.1.2 Challenge and Warn 3.3.1.3 Use Empty Hand Control 3.3.1.4 Use Intermediate Weapons 3.3.1.5 Use Mechanized Constraints	Actions of the contact (e.g., direction of movement, position of weapon, hand actions) Cues suggesting imminent death or serious injury will occur if immediate action is not taken Level 3 SA ROEs Amount of time available	Visibility of contact and surroundings Experience and training Fear Accuracy of intuition (spidey-sense)	A decision is made regarding whether the application of force as required by the ROEs is possible given the situation	A	3	3	NA (above threshold)	2
If time does not permit following the sequence of applying non-deadly force, decide the action to take	3.3.1 Use Non-Deadly Force 3.3.1.1 Maintain Physical Presence of Disciplines and Professional Personnel 3.3.1.2 Challenge and Warn 3.3.1.3 Use Empty Hand Control 3.3.1.4 Use Intermediate Weapons 3.3.1.5 Use Mechanized Constraints	Actions of the contact (e.g., direction of movement, position of weapon, hand actions) Cues suggesting imminent death or serious injury will occur if immediate action is not taken Level 3 SA ROEs Amount of time available	Experience and training ROEs Accuracy of intuition (spidey-sense) Amount of time available Availability of equipment (e.g., mechanical constraints)	Determination of the type of force that should be applied given the limited time available	A	3	3	NA (above threshold)	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
After non-deadly force is applied, decide whether the situation is under control or whether the threat has escalated to require deadly force	3.3.1 Use Non-Deadly Force 3.3.1.1 Maintain Physical Presence of Disciplines and Professional Personnel 3.3.1.2 Challenge and Warn 3.3.1.3 Use Empty Hand Control 3.3.1.4 Use Intermediate Weapons 3.3.1.5 Use Mechanized Constraints	Actions of the contact (e.g., direction of movement, position of weapon, hand actions) Actions of surrounding contacts, if any are present ROEs	Visibility of contact and surroundings Experience and training	Determination as to whether or not the situation is under control following non-lethal force, or whether further action is required	A	2	2	NA (above threshold)	1
After challenging and warning the contact, decide whether the warning should be repeated or whether force should be enhanced to using empty hand control.	3.3.1.2 Challenge and Warn 3.3.1.2.1 Repeat verbal/visual warnings or challenges	Actions of the contact indicating whether the warnings were seen and/or heard (e.g., movement stopped, weapon put on ground, hands raised) ROEs	Visibility of contact Experience	The contact is either warned a second time or subsequent non-lethal actions are taken	A	1	2	NA (above threshold)	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
After each use of non-deadly force, decide whether the contact remains a threat, therefore requiring increased force or whether the actions can be stopped and evaluated	3.3.1 Use Non-Deadly Force 3.3.1.1 Maintain Physical Presence of Disciplines and Professional Personnel 3.3.1.2 Challenge and Warn 3.3.1.3 Use Empty Hand Control 3.3.1.4 Use Intermediate Weapons 3.3.1.5 Use Mechanized Constraints 4.0 Evaluate Action Taken	Actions of the contact indicating whether the non-deadly force has successfully stopped the threat (e.g., movement of contact stopped, weapon put on ground, hands raised) versus escalating threat (e.g., continuing to come under fire, movement of contact towards decision-maker) ROEs	Visibility of contact Experience ROEs Fear Accuracy of intuition (spidey-sense)	Determination of whether all levels of non-deadly force are required to end the threat, or whether low-level force is sufficient	A	3	3	NA (above threshold)	1

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
If deadly force is required, decide whether there is time to follow the ordered sequence of force required by the ROEs (i.e., brandish weapons, fire warning shots, shoot to kill)	3.3.2 Use Deadly Force 3.3.2.1 Brandish Weapons 3.3.2.2 Fire Warning Shots 3.3.2.3 Shoot to Kill	Actions of the contact (e.g., direction of movement, position of weapon, hand actions) Cues suggesting imminent death or serious injury will occur if immediate action is not taken Level 3 SA ROEs Amount of time available	Visibility of contact and surroundings Experience Fear	Determination of whether the deadly-force ROEs can be initiated in the sequence of increasing force	A	2	2	NA (above threshold)	2
If time does not permit the ability to follow the sequence of deadly force engagements, decide the action to take (e.g., pre-emptive shot or returning fire)	3.3.2 Use Deadly Force 3.3.2.1 Brandish Weapons 3.3.2.2 Fire Warning Shots 3.3.2.3 Shoot to Kill 3.3.2.3.1 Pre-emptive Shot 3.3.2.3.2 Return Fire	Actions of the contact (e.g., direction of movement, position of weapon, hand actions) Cues suggesting imminent death or serious injury will occur if immediate action is not taken Level 3 SA ROEs	Visibility of contact and surroundings Experience and training ROEs Accuracy of intuition (spidey-sense) Amount of time available Availability of equipment (e.g., weapons and bullets)	Determination of the type of deadly force to take against the contact	A	3	3	NA (above threshold)	2

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
After each use of deadly force, decide whether the contact remains a threat, therefore requiring increased force or whether the actions can be stopped and evaluated	3.3.2 Use Deadly Force 3.3.2.1 Brandish Weapons 3.3.2.2 Fire Warning Shots 3.3.2.3 Shoot to Kill	Actions of the contact indicating whether the deadly force has successfully stopped the threat (e.g., movement of contact stopped, weapon put on ground, hands raised, injury or death of contact) versus escalating threat (e.g., continuing to come under fire, movement of contact towards decision-maker) Actions of surrounding contacts (stopping movement or assisting the wounded/dead versus) ROEs	Visibility of contact and surroundings Experience ROEs Fear Accuracy of intuition (spidey-sense)	Determination of whether all levels of non-deadly force are required to end the threat, or whether low-level force is sufficient	A	3	3	NA (above threshold)	2
When shooting to kill, decide when the situation is such that firing can stop	3.3.2.3 Shoot to Kill	Actions of the contact and surrounding contacts (i.e., threatening or not)	Visibility Experience and training ROEs	A decision is made to stop firing Threat/excitation level has decreased well below the activation threshold	A	2	2	NA (above threshold)	2

Function 4: Evaluate Action Taken

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether the correct action was taken (e.g., took shot, didn't take shot).	4.1 Consider Whether Correct Decision was Made	Feedback from perceptual cues (e.g., type of clothing, weaponry) Feedback from behavioural cues (e.g., actions of contact)	Visibility of the contact and the surroundings Availability of information given that the target may be destroyed and therefore not have any remaining cues Time to consider whether decision was accurate or not	Decision regarding the appropriateness of the action Development of feedback that will be useful in similar future decisions (i.e. Level 2 & 3 SA)	Post-DCRIA	3	3	NA (after the fact)	3
Decide whether perceptual cues suggest that the correct or incorrect action was taken	4.1.1 Consider Feedback from Perceptual Cues 4.1.1.1 Coming Under Fire 4.1.1.2 Firing Stops	Actions of contact (if not destroyed), such as continued firing versus discontinued firing Appearance of the contact (i.e., confirm that you saw what you thought you saw, such as weaponry or enemy clothing)	Visibility of the contact Opportunity and time to consider the cues	Feedback regarding the appropriateness of the action	Post-DCRIA	2	3	NA (after the fact)	3

Decision	Function(s)	Information Requirements	Specific Constraints	Decision Outcome	DCRIA Stage	Decision Complexity	Cognitive Workload	Decision Criticality	Time Req'd to Make Decision
Decide whether behavioural cues suggest that the correct or incorrect action was taken	4.1.2 Consider Feedback from Behavioural Cues 4.1.2.1 People run to assist stricken person 4.1.2.2 Vicinity goes quiet 4.1.2.3 Vicinity becomes chaotic	Actions of those in surroundings (e.g., people run to assist the stricken person, vicinity goes quiet, vicinity becomes chaotic) Actions of the contact (e.g., denial of guilt, refusal to cooperate, cooperation)	Visibility Opportunity and time to consider the cues	Feedback regarding the appropriateness of the action	Post-DCRIA	2	3	NA (after the fact)	3
Decide what to do if the action was incorrect (i.e., shot taken when it shouldn't have been, or failed to take a shot)	4.1.3 Make Assessment 4.1.3.1 Take Shot - Incorrect 4.1.3.2 Take Shot - Correct 4.1.3.3 Don't Take Shot - Incorrect 4.1.3.4 Don't Take Shot - Correct	Levels 2 & 3 SA ROEs, TTPs	Opportunity to perform an additional action (i.e. decision maker is not injured or dead due to failing to identify a foe)	Determination of the necessary action given the first action was incorrect	Post-DCRIA, or A	3	3	NA (after the fact)	3

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(U) This report synthesizes and summarizes the findings of four previous contract reports related to modelling the Combat Identification (CID) task as performed by individual mounted or dismounted soldiers in a Land Force context. The four previous reports include:

• Combat ID Literature Review (Vilhena, Zobarich, & Lamoureux, 2007)

• Models of Information Aggregation Pertaining to Combat Identification: A Review of the Literature (Famewo, Matthews, & Lamoureux, 2007)

• Function Flow Analysis for the Combat Identification Process (Bruyn Martin, Famewo, Zobarich, & Lamoureux, 2007); and,

• Decision Requirements Analysis for the Combat Identification Process (Famewo, Bruyn Martin, Zobarich, & Lamoureux, 2007).

Overall this work fulfils a need for documentation of the CID process and analysis of literature that addresses the human information processing aspects of CID. We have identified four main CID functions (prepare for the mission, perform mounted/dismounted functions, take action and evaluate action) that have been decomposed down to the task level. For each of the main CID functions specific decisions were identified and analyzed. With respect to CID decision making tasks, we concluded that the nature of CID tasks require that soldiers take advantage of methods by which decision making can be accelerated, such as heuristics and recognition−primed decision making.

(U) Le présent rapport résume les conclusions de quatre rapports contractuels précédents liés à la modélisation de la tâche d'identification au combat (ID cbt) telle qu'elle est accomplie par des soldats embarqués ou débarqués dans un contexte de force terrestre. Les quatre rapports antérieurs sont les suivants :

• Combat ID Literature Review (Vilhena, Zobarich et Lamoureux, 2007)

• Models of Information Aggregation Pertaining to Combat Identification: A Review of the Literature (Famewo, Matthews et Lamoureux, 2007)

• Function Flow Analysis for the Combat Identification Process (Bruyn Martin, Famewo, Zobarich et Lamoureux, 2007); and,

• Decision Requirements Analysis for the Combat Identification Process (Famewo, Bruyn Martin, Zobarich et Lamoureux, 2007).

Dans l'ensemble, ces ouvrages satisfont à un besoin d'avoir de la documentation sur le processus d'ID cbt et une analyse de la documentation qui se penche sur les aspects de l'ID cbt liés au traitement cognitif de l'information. Nous avons relevé quatre fonctions principales de l'ID cbt (se préparer pour la mission, exercer les fonctions embarquées/débarquées, prendre des mesures et évaluer les mesures) qui ont été décomposées au niveau de la tâche. Pour chacune des fonctions principales de l'ID cbt, nous avons cerné et analysé des décisions précises. En ce qui touche les tâches de prise de décisions relativement à l'ID cbt, nous avons conclu que la nature des tâches d'ID cbt nécessite que les soldats profitent des méthodes qui permettent d'accélérer la prise de décisions, telles que les connaissances heuristiques et la prise de décision axée sur la reconnaissance.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (Technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

(U) Combat identification, function flow, decision requirements, literature review