THE EFFECTS OF TEXT, GRAPHIC, AND IMAGERY PLACEMENT ON UNDERSTANDING AND RETENTION IN PATROL REPORTING

L'IMPACT DU PLACEMENT DU TEXTE, DES GRAPHIQUES ET DES IMAGES DANS LA COMPRÉHENSION ET LA RÉTENTION DES RAPPORTS DE PATROUILLE

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by

Michael Andrew MacKillop, MMV, CD, BA
Captain

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ii

The research involving human subjects that is reported in this thesis was conducted with the approval of the Royal Military College of Canada General Research Ethics Board.

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ABSTRACT

THE EFFECTS OF TEXT, GRAPHIC, AND IMAGERY PLACEMENT ON UNDERSTANDING
AND RETENTION IN PATROL REPORTING

By

MacKillop, Michael Andrew

Master of Public Administration Thesis
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Supervised by

Drs. William Hurley and Robert St. John

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The manipulation and organization of text, graphics, and imagery have substantial effects on a reader's ability to comprehend and retain information. Current military field reporting formats are overwhelmingly text based, with limited consideration as to where an image should be placed, limited use of transferable graphics, and with limited attempts to effectively synchronize these elements. This project has taken lessons from the disciplines of cognitive and educational psychology and used these to develop new templates.

Experimentation between the Canadian Army's current format and the recommended alternative saw an overall percentage improvement of 19.7% and a t-Test score of 3.78. This improvement was echoed by a survey that saw the alternative format rated at 8.3 / 10 in terms of overall utility, compared to optimum forms of the current format that only scored 5.4.

This thesis recommends that such results and the structural techniques used to achieve them be considered when designing future interfaces and reporting templates, a program for future evaluation in this area, and a sample design for an automated format that builds on the work conducted thus far.

RÉSUMÉ

LES EFFETS DU TEXTE , DES GRAPHIQUES , ET DES IMAGES SUR LA COMPRÉHENSION
ET LA RÉTENTION DES RAPPORTS DE PATROUILLES

par

MacKillop, Michael Andrew

Maîtrise en administration publique
Collège militaire royal du Canada

Supervisé par

Dr William Hurley et Robert St. John

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La manipulation et l'organisation du texte, des graphiques et des images ont des effets importants sur la capacité d'un lecteur à comprendre et à retenir l'information. Les formats actuels des rapports opérationnels militaires sont majoritairement basé sur du texte avec peu de considération pour l'endroit où une image doit être placée, pour utilisation limitée des graphiques et pour le peu d'efforts de synchronisation efficace de ces éléments. Ce projet a pris des leçons dans les disciplines de la psychologie cognitive et éducative et utilisé ces leçons pour développer de nouveaux gabarits.

L'expérimentation entre le format actuel de l'Armée canadienne et l'alternative recommandée a vu un pourcentage d'amélioration globale de 19,7% et un résultat t - test de 3,78. Cette amélioration a été observée de nouveau dans un sondage qui a vu le format alternatif évalué à 8,3 / 10 en termes d'utilité générale, par rapport à des formes optimales de la formule actuelle qui a obtenu seulement 5,4.

Cette thèse recommande que de tels résultats et les techniques de constructions utilisées pour les atteindre, un programme pour l'évaluation future dans ce domaine et un plan d'échantillonnage automatisé qui s'appuie sur les travaux réalisés à ce jour soient considérés lors de la conception d'interfaces futures et des modèles de rapports.

MOTS-CLÉS

Patrouille
Rapport de patrouille
Modèles de rapport
Rétention de l'information
Compréhension
Conception des interfaces

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AMS	Applied Military Science Department – Location of the Canadian Army Technical Staff Program and Army Technical Warrant Officer Program
ATWO	Army Technical Warrant Officer Program
BG	Battle Group
CATLM	Cognitive-Affective Theory of Learning with Media
CATSP	Canadian Army Technical Staff Program, formerly the Land Forces Technical Staff Program
CBRN	Chemical, Biological, Radiological, and Nuclear
CIED	Counter-Improvised Explosive Device Team
Coy	Company
C/S	Call Sign
Det	Detachment
GPS	Global Positioning System
GR	Grid Reference
IED	Improvised Explosive Device
IPB	Intelligence Preparation of the Battlefield
DLR	Directorate of Land Requirements
LFTSP	Land Forces Technical Staff Program, now the Canadian Army Technical Staff Program
LSL	Louis St. Laurent Building (Gatineau, QC) – Location of the Directorate of Land Requirements
OP	Observation Post
ORV	Objective Rendez-vous Location
PB	Patrol Base
Pl	Platoon
PT	Physical Training
Recce	Reconnaissance
Sect	Section
SOPs	Standard Operating Procedures
TF	Task Force
TMST	Theatre-Mission Specific Training
TTPs	Tactics, Techniques, and Procedures
2IC	Second-in-Command

CHAPTER 1: INTRODUCTION

Patrolling is a fundamental military activity. It is a tool of paramount value for gathering information, disruption, and gaining and maintaining the initiative in all phases of war and peace support operations. It is challenging but invigorating. Some patrols seek to gain a better appreciation for the lay of the land, some to engage with and learn about the population, some to find an enemy (ISTAR, 2004). Some patrols have a specific goal; the purpose of others is more general (Directorate of Army Doctrine, Infantry Insert, 2000). Some are covert; some are deployed forward explicitly to pick a fight. A patrol may be dispatched by combat engineers, consist of reconnaissance patrolman, of general infantry soldiers, may be done by forward parties of the artillery, or a combination of these and other forces.

Patrols vary in size as they vary in purpose. They can be as small as a reconnaissance detachment and as large as an infantry company (Directorate of Army Doctrine, Land Force Information Operations Field Manual, 2001). A successful army is good at patrolling. It must be. A machine sensor – no matter how powerful – is not a substitute for human presence and assessment. Not only does a patrol have all the benefits of human perception across five senses – which are now enhanced through technology such as night vision and ranged optics – but its leadership can determine the significance of what is perceived within the context of their experience and can summarize their finds and make recommendations based on these to higher levels of command. More so, the very presence of human actors changes the dynamic of the area patrolled. True, a population may change its habits over time if it knows it is under occasional aerial surveillance, but an enemy will immediately and dramatically alter their activities when in the vicinity of an armed force, just as they will change their routine if they anticipate covert forces moving against them.

All of this is to say that when this thesis speaks to reporting, it is talking about more than simply correlating route traces, event markers, imagery and samples from recordings for meta-processing or later retrieval. Such activities are certainly important and enabled through emerging technology, but this is not the essence that this research aims at. Instead this paper looks specifically at how the lessons learned in patrolling are shared throughout what should be a learning organization and how the understanding of one commander can be imparted to all of the others who would benefit from his human assessment of a given area at a given time.

This thesis focuses primarily on dismounted patrolling and the tactics primarily employed by the infantry. This said the deductions and recommendations made can be extended to other arms and to mechanized assets. While forms of reporting do differ – an engineer report on the suitability of a crossing site would include more technical details in terms of gap spans, water depths, and soil conditions than an infantry section's presence patrol through a neutrally-aligned village – the kind of improvements observed here speak to the general increases in understanding and retention enabled through the balancing of graphics, images, and text. So while the techniques used in thesis are validated through experimentation with infantry-focused templates, it is likely that the same techniques applied to similar formats would yield comparable results.

The Canadian Army is good at patrolling. It is good at planning patrols, it is good at executing them, but where it falls short is in extrapolating the assessment of the effect of these activities. This became clear over the course of numerous interviews with infantry section and platoon commanders, reconnaissance patrolman and snipers, and intelligence operators that deployed to Afghanistan between 2008 and 2010. During this period – covering five rotations – there was a noted deficiency in the Army's capacity to share assessments between and within sub-units and units, and from rotation to

rotation, resulting in redundant and misguided efforts that were both counter to defeating the insurgency and supporting the local population and likely placed soldiers in unnecessary peril.[1]

This research attempts to mitigate some small part of this deficiency by looking specifically at how patrol commanders' assessments are recorded, to determine if significant gains in the understanding and retention of this information by subsequent readers can be enabled through something as simple as improvements in the design of the report's template.

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[1] Personal correspondence with Captains Matt Despard (Task Force 3-09 Platoon Commander), Mike Hughes (Task Force 3-09 Platoon Commander), Edward Kamps (Task Force 3-09 Information Operations Officer), Bryce Talsma (Task Force 3-09 Platoon Commander), Tyler Wentzell (Task Force 1-08 Mentor), summer and fall 2010.

CHAPTER 2: LITERATURE REVIEW

Section 2.1: Problem Space

Significant intelligence is collected at the section and platoon level. This contribution increases during peace support operations and counter-insurgency operations, where a detailed understanding of the local situation and especially the population is necessary to enable strategic effects.   Since the collapse of the Soviet Union and the United States' definitive victory over Iraqi forces in Kuwait during the First Gulf War, most of the conflicts involving Canada and its allies have been counter-insurgency and peace support operations. For the Canadian Army our operations over the last two decades have included multiple operations in Haiti; single rotations through conflict zones such as Rwanda, Somalia and Ethiopia / Eretria; our extended presence in the former Yugoslavia; and most recently in Afghanistan. In the coming years, "the Army is most likely to be engaged over time in a wide variety of complex operations in fragile regions or states in the developing world involving a broad array of actors in a multidimensional context" (Directorate of Land Concepts and Designs, Designing Canada's Army of Tomorrow, 2011). The United States does not anticipate that any other country will be able to develop a near-peer enemy until at least 2020 (United States Army Field Manual 7-100.2, Opposing Force Doctrine, 2004) and their invasions of Afghanistan and Iraq have demonstrated that defeating a substantially less capable force can be achieved relatively quick and effectively as compared to the long and complex counter-insurgencies that followed these military victories. In violent conflicts with intensities below that of total war, the Canadian Army "will operate in increasingly complex, interdependent environment in [it] must plan to operations will influence the physical and cognitive aspects of the terrain, threats and hazards, the local populace and other systems, actors, and entities" (Directorate of Army Doctrine, Land Operations, 2008). Much of the information required to conduct such operations will come in the form of patrol reporting as section and platoon-sized elements execute routine, framework, and objective-specific patrolling.

Despite the pervasiveness of modern information technology, the method of reporting at this level has remained somewhat static. The default form for the patrol report is a text-based, radio-message style report, with any graphics or imagery inserted ad hoc or simply placed – sometimes in sequential order, though most often lacking correlating references – toward the end (an example of this report is included as Appendix A). While such a report can be generally effective in the context of large-scale linear battles between opposing armies – where a patrol would be primarily concerned with reporting that location y is supported by x number of tanks – when used as a template for capturing multiple pages of information that attempt to convey a complicated enemy along with ground and population factors, it quickly becomes very dense. Numerous alternative versions have been created by various task forces and units[2], in order to better organize or emphasize this additional information, but generally fail to fully consider the optimal location and pairing of textual descriptions, supporting graphics, and images.[3] The literature demonstrates that these kinds of structures are not optimized for human information processing, with the result being that when read – even in detail, with significant time allocated for such an activity – much of what has been provided by the writer will be lost to the reader after a short period of time.

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[2] Some of these are addressed specifically in Appendix A, but alternate versions would also include numerous deviations and variations that were identified through interviews with operators and commanders who had worked in Afghanistan between 2008 and 2010.

[3] The North Atlantic Treaty Organization Standardization Agreement (NATO STANAG 2003) specific to patrol reporting that is referenced in some of the more dated doctrinal manuals still in use has been cancelled without replacement allowing for variation and deviation from this template. For more details see http://www.ihs.com/products/industry-standards/org/nato/list/page21.aspx.

There are several practical limitations with respect to improving this information transition. Image-capture equipment is often in short supply and does not always include the kind of features that simplify later correlation. As an example, a camera that packages images with their associated metadata ensures that each image can be linked to a specific location and time. Requiring an operator to go back and manually carry out this task post-operation is time consuming and prone to errors. Likewise, there have not always been a sufficient number of computers or printers available for forward-deployed soldiers, though perhaps this will less often be the case as the military continues to digitize. Lastly, the quality of writing certainly has an effect, as does an operator's ability to manipulate information in any kind of interface provided for recording his findings.

These constraints, as real as they are, are outside the scope of this project. Instead, this research focuses on what can be done with the report template itself. While writing skill, equipment availability, and network considerations will affect the output and certainly need to be looked at extensively to solve some of the military's major information sharing issues, they affect this independent of template design. This may seem a bold assertion, but in the experiment that will be discussed such considerations were held constant. This experiment took a situation that was reported on – this included a detailed textual description of what was observed, a collection of acceptable-quality images, and a few graphics – and manipulated the sequencing and structure of how the information was presented. The question that the experiment – and this research in general – was meant to address was 'given equivalent information, does the presentation affect comprehension and if so to what degree?' To begin to answer this, we need to step back from patrolling for the moment and look to some specific veins of educational psychology.

Section 2.2: Text and Imagery – An Overview

There is substantial literature that demonstrates meaningful improvements in understanding and retention when textual and illustrative materials are blended, but only when these combinations are done in a constructive and complimentary way (Carney and Russell, 2002; Mayer et. al., 1995 and 1996; Moreno, 1999 and 2005; Vekiri, 2002).

The fact that text alone or pictures alone are not as effective as their use in combination is somewhat obvious. The visual medium is capable of illustrating details that are extremely difficult to show using text. This said it is unlikely that any sequence of pictures would ever effectively represent a story that is rich and complex, such as a commander's overall experience on a given patrol or his intuitions about a specific area. There will likely always be a place for some kind of written or possibly voice-recorded assessment that summarizes and draws together otherwise disparate snap shots of events.

Simple combinations can yield profound results. Coupling a picture with a geo-reference and a date / time immediately provides context. Instead of being a seemingly random picture of some non-descript scene, it is given a time and location. Likewise, inserting a relevant image clarifies the meaning of a block of text. These effects are obvious and permeate everyday life in the information age. The aim of this study is to look deeper. What follows are lessons from cognitive and educational psychology that teach effective ways to integrate features in a complex document with a view to creating an optimized report for patrolling.

As a start point, information can be divided into two general categories – verbal and visual (Paivio, 1986; Clark and Paivio, 1991). Verbal information arrives in the form of language, usually either as spoken words or text. Visual information comes as the non-language elements described through pictures, graphics, diagrams, etc.

The following sections should serve to tease out the various fundamentals, forms and elements of each, as well as how they divide and are processed as information. The aim here then is to show the

meaningfulness of this division and, with this perspective, aim to design better interfaces where their elements work in unison.

Verbal Information Sources	Visual Information Sources
Audio Recordings	Pictures
Spoken Words	Diagrams
Text	Video

Figure 1: Sources of Verbal and Visual Information Represented Verbally

Figure 2: Sources of Verbal and Visual Information Represented Visually

Section 2.3: Early Articulation of the Dual Coding Theory

This verbal / visual division is most often described in reference to work done by Paivio (1984) and others in the mid to late 1980s and early 1990s. His dual coding theory is concerned with "basic mental structures and processes ... associative networks of verbal and imaginal representations … [the] development and activation of those structures … [and] the effects of context on the spread and activation among representations" (Clark and Paivio, 1991). This theory is meant to help explain human behaviour, specifically learning, by providing a framework for describing how nonverbal systems are activated by sensory information, specifically how the systems that process imagery can 'unify multiple objects into an integrated image' and how this unification promotes understanding and increases retention (Clark and Paivio, 1991). The main premises of the theory are that:

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[4] Image from http://en.wikipedia.org/wiki/File:Speech_balloon_3_types.svg. Viewed on 12 September 2013.

[5] Image from http://en.wikipedia.org/wiki/File:SONY_BM-610_commons.jpg. Viewed on 12 September 2013.

[6] Sketch of "Rooftops and Trees" by Paul Cézanne. Image from http://en.wikipedia.org/wiki/File:Paul_C%C3%A9zanne-_Rooftops_and_Tree.jpg. Viewed on 12 September 2013.

[7] Image from http://en.wikipedia.org/wiki/File:Canon_HF10_front.jpg. Viewed on 12 September 2013.

1. "Words derive meaning from their semantic relations with other words, as well as from images." (Clark and Paivio, 1991)

2. "Associative relations contribute to the meaning of all words, and are the primary source of meaning for abstract words that lack object referents." (Clark and Paivio, 1991)

3. "The elaborative or 'dual coding' explanation for imagery effects essentially states that the additive effect of imagery and verbal codes is better than a verbal code alone." (Clark and Paivio, 1991)

4. Memory for words and text benefit from elaborative imagery, concreteness, and associative organization, although the collective effect of these processes [is] complex." (Clark and Paivio, 1991)

Along with this summary of the theory, the Clark and Paivio (1991) article argues that at the time of their writing this phenomenon was being 'underemphasized' in information presentation. Looking at educational psychology textbooks – i.e. a type of publication where such considerations should be emphasized – they noted that less than 4% of the pages in the books selected contained any kind of table or figure. Interestingly, this article itself while summarizing the theory that supported the balanced representation and delivery of information in multiple media and reported critically on the infrequency of this approach, included only one graphic, no tables, limited use of font manipulation or white space, and no imagery. Admittedly such inclusions were significantly more difficult given the state of technology at the time, but even today with the prevalence of the kind of tools that allow for such pairings, successful information delivery is not guaranteed and infrequent.

The trend toward the pairing of imagery, illustrations and text and their combination in new mediums has evolved over the last fifty years and is more often dependent on the technology available than their efficiency with respect to human cognition. Carney and Levin (2002) described how the 1960s saw densely worded textbooks, the 1980s saw the number of pictures and graphics increase substantially, while by 2000 an undergraduate would likely study material "richly appointed with pictorial illustrations, diagrams, photos, and the like … [while associated] computer software and internet sites routinely provide pictures and illustrations as adjuncts to text content" (Carney and Levin, 2002). They note that at the time of writing, integrated displays of text and picture (pop-ups) saved space, de-clutter computer screens, improved clarity and legibility all of which promote engagement and user motivation (Carney and Levin, 2002). All of these features have been found to improve retrieval as compared to the kind of non-integrated or split displays that fail to effectively combine the various methods of displaying information (Betrancourt and Bisseret, 1998). Representational images serve to make text more concrete, organizational ones improve coherence, interpretational aid in comprehension, and transformational ones make text memorable (Carney and Levin, 2002). All of these constructs are now readily produced, but often this effectiveness is accidental and achieving such improvements is not universal. Hence a deeper look is warranted.

The following are the three most basic premises derived from the literature surveyed for employing the verbal and visual:

Table 1: Some Basic Tenets of Effectively Presenting Verbal and Visual Information

1.   Visual representations can capture certain kinds of information in greater detail and in less space than text.
2.   Text allows for comments and analysis, and gives context to an image.
3.   Combining related textual and visual elements can promote understanding, so long as this combination is neither redundant, nor arbitrary, nor overwhelming.

Improvements in understanding only occur when text and imagery are combined in a constructive and complimentary way. The efficiency created through the combination of the two inputs has been well established through consistent experimental findings for some time, but research has also clearly demonstrates that simply placing the two mediums on the same page produces only marginal improvements.

This research has a long history, going back to several initial sets of experiments from the 1960s and early 1970s that effectively established – if certainly not definitive solutions – meaningful constructs that would direct future research. In several cases, a template was designed that could be used in repeated experiments to help isolate the effects of the myriad of variables that can affect understanding and retention with respect to the visual and verbal. In the case of Dwyer (1970b), the experimental templated involved the reading of a standardized manual on the human heart and answering a consistently-structured test. This template has been used in a multitude of different experiments, analyzing a variety of variables, over four decades.

Given the pervasiveness of this template (or variants of it) in the literature, it is worth looking at some of Dwyer's earlier articles (1967a through to 1970b), even if the answers for many of what were then open questions have become more certain. The second advantage of this early set of articles selected as a start point is that they provide an apt summary of some of the more significant research that had occurred up to that point. Dwyer (1970b) began with a survey on two decades of studies on the effectiveness of illustration as a learning aide. This included the findings from several of his studies that he had conducted earlier where students' performance was assessed using aids such as slides (Dwyer, 1967a), television (Dwyer, 1968a) and programmed instruction (1967b). Dwyer (1970b) noted that at the time there were no definitive rules for selecting optimal illustrations for the purpose of illustration but that a systematic evaluation of such would be beneficial for enabling achievement. He notes the contentious nature of the more prominent theories at the time, specifically whether increasing the number of visual cues will increase learning, whether and where there comes a point of overload, and whether a more realistic image is ideal or if a simplified abstraction is to be preferred.

Dwyer (1970b) clearly emphasized the recommendations of several earlier authors that noted amongst other similar statements that "it would be a mistake to assume that one cue added to another would increase learning by a linear increment… that merely confronting a person with stimuli identical to those emitted by the real environment is no guarantee that useful information will be retained… [and] the real objective of visual education is not so much to bring the pupil into close touch with reality, but to help students become more effective in dealing with reality" (Dwyer, 1970b attributed to Travers et al., 1964)

As an attempt to answer some of these questions Dwyer (1970b) designed a series of experiment that used the previously referred to 2000-word manual on the human heart to test four types of retention – tested in the forms of drawing, multiple choice, terminology, and comprehension (Dwyer, 1970b and

1973). The novelty of his approach was to present it in different forms; thus it was not a test of what can be done with more information, but instead where improvements can be found when equivalent amounts of information are presented in more and less effective manners.[8] What the study does provide is the following useful guidelines for the use of visual complements to oral instruction:

Table 2: Dwyer's (1970b) Guidelines to the Use of Visual Compliments to Oral Instruction[9]

1.   The use of visuals to complement oral and verbal instruction does not automatically improve student achievement.
2.   Different visuals differ in the effectiveness with which they promote achievement of learning objectives.
3.   The effectiveness of specifications of visual material depends on the method used to present this material to the student.
4.   For students in different grade levels, the same visuals are not equally effective in increasing student achievement of identical objectives.
5.   For specific objectives, the addition of color in certain types of visuals for certain experience-level groups appears to be an important instructional variable in improving student achievement.
6.   The effectiveness of a particular visual in facilitating student achievement of a specific objective depends on the type of information needed by the student to achieve that objective.

The inclusion of graphics and imagery (whether simple line drawings or 'detailed, shaded drawings') was found generally effective in reducing the performance gap seen between individuals when these were absent (Dwyer, 1978). This said, if the material was either too simple or too familiar for the audience, gains were marginal; while if the inclusions were superfluous, overly realistic or complex, improvements were minimal (Dwyer, 1978). Alesandrini's (1984) study summarized the findings from Dwyer's 1970's research thusly:

> The results of [Dwyer's] research effort have generally shown that pictures facilitate adult learning … [however] when visuals are used to supplement verbal information that the learner is already familiar with, no facilitation will occur. On the other hand, if the material to be learned is too complex, presenting a realistic visual may not facilitate learning either. (Alesandrini, 1984)

These preliminary findings formed some of the key principles that would form the basis of another four decades of his research as part of his "Program of Systematic Evaluation". The goal of this was to develop an instructional model to identify the kinds of visual material that by themselves or in combination are most effective for learning and training (Dwyer, 1982 and 2012). Because these experiments use the same experimental tool (the heart manual), it allows for consistent comparison across different samples, such examples will be found throughout this section.

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[8] For further details on this and examples of this methodology in an early form see Dwyer 1968b, 1968c, 1968d, 1969a, 1969b, 1969c, and 1970a.
[9] Modified for layout and formatting from Dwyer, 1970b.

Section 2.4: Early Theory and Selected Findings

Many other early researchers came to similar conclusions. Levie and Lentz (1982) found a 36% improvement for groups reading with supplemented pictures rather than text alone; when this was isolated to the learning of specifically illustrative information, learning was more effective in 98% of experiments using illustrated text than text alone and there was a 9 to 1 preference for illustrated text than for text alone. The same studied employed tools such as graphic organizers (schematic representations of relationships) or diagrams and saw good readers improve by 23% and poor readers by 44%.

The 1984 study from Alesandrini saw similar improvements, but like some of Dwyer's 1970 studies noted that much of the improvement was context dependent. Cantu and Herron (1978) saw improvements using line drawings as did a study by Rigney and Lutz (1976) that saw improvements when text with supplemented line drawings were compared to the text alone but these gains were not as substantial as using memory prompting questions throughout the text.[10] Alesandrini (1984) noted the following results from other studies:

- Line drawings did not improved understanding of abstract concepts in mathematics from Battista (1981);

- 'Visual treatments of geometric topics' improved learning, specifically for those students with the 'greater visualization ability' in Du Rapau and Carry (1980);

- The addition of overly detailed visuals were less effective than simple yet complete representations in Dwyer (1978), leading to a recommendation in favour of line drawings;

- Learner preferences for concrete as opposed to abstract photos in Myatt and Carter (1979) as well as Travers and Alvarado (1970);

- Mixed findings on the effect of verbal ability when interpreting material containing line drawings in Holliday, Brunner, and Donais (1977) and Winn (1981); and

- Mixed findings on the effectiveness of color in Chute (1979) and Reid and Miller (1980), specifically that color can be an effective prompt in some cases, while in other cases acts as a distraction from more relevant information.

At this time this area of research lacked several key features. One was a more standardized method for conducting experimentation (as Dwyer was advocating with tools such as his heart manual). Vekiri (2002) later described this deficiency at the time as the "challenges in synthesizing research on graphic representations [where] there is no standard classification system of graphics and, as a result, the same terms may be used with different meanings from one study to another" (Vekiri, 2002). Her analysis was that "reviews concluded that research conducted prior to the 90s had documented the benefits of visual displays but had failed to provide a theoretical framework to explain how graphics benefit learners" (Vekiri, 2002). Thus the other issue was a more established theoretical construct to explain the phenomenon being examined. In discussing the utility of visual testing as a means of confirming learning, Szabo, Dwyer and DeMelo (1981) notes several studies that advocate a learning model with two independent memory channels, one that takes in the visual information and the other the verbal (Szabo, Dwyer and DeMelo 1981 attributed to Tversky, 1969 and 1973).

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[10] A comparison of these studies can be found in Alesandrini, 1984.

This postulation, that would later be termed the dual coding hypothesis (described in the opening of this section) suggests that information is processed along two paths, thus meaning that, with effective presentation, learning can occur concurrently; whereas with ineffective presentation, one channel can be overloaded even as the other one is virtually unused. Again to quote Vekiri (2002), the basic form of this hypothesis is that "the presence of graphics along with text has additive effects on learning because visual information is represented separately from verbal information in long-term memory" (Vekiri, 2002).

Such a framework can be applied to specific additions, such as color. Lamberski and Dwyer (1983) summarized their findings by saying that color most improves learning during concept acquisition and encoding though not necessarily recall (if presented for retrieval or decoding) but can also form the basis of an effective 'attention-getting strategy' that can 'produce measurable effects on cognitive learning that cannot be accounted for purely by words or labelling', but conclude that its 'primary value .. [is] in providing structure for physical discrimination and associative meaning in self-paced instruction'.

A caution must, however, be added to any kind of over-generalization of effectiveness. Pett and Wilson (1996) argue that while "research findings indicate that random use of color generally is not of value in increasing learning, but is preferred and does add interest" and summarized their findings with a reference to Dwyer (1971a), who stated that "color will not automatically make an illustration more effective … the use of color may have to be justified in terms of contributions to specific kinds of learning. These areas would include attention, search tasks, retention and other measures" (as stated in Pett and Wilson, 1996). Pett and Wilson (1996) summarized this set of experimentation by concluding that "the key factor relating to color and cognition learning seems to be that it is of value when it emphasizes relevant cues, is used as a coding device, or when it is part of the content to be learned".

The above is significant for our purpose. It demonstrates that the simple additions of well-selected visual cues – that are well integrated with an overall delivery strategy – add value, while ad hoc or irrelevant inclusions detract. It shows using the addition of the simplest element – color – that embedding visual information in text increasing understanding and retention with quantifiable results, but that all of this may be task, learning style and experience dependent and is dependent on the kind of recall – identification as opposed to comprehensive – desired. Specifically in regards to the use of maps, earlier studies indicated that colour was more significant than 'size, shape or brightness' (Christ, 1975), but again this is comparing the effects of individual additions rather than the further improvements that can be gain through effective combinations. Further studies indicated that color alone was insufficient and, as with other visual cues, was most effective when paired with numeric coding for identifying location such as is used with contour lines (Pett and Wilson, 1996). This and other use of color coding in mapping and charting is of course well established and is incorporated in the form of representation of relief, contour and grid lines, NATO map symbols, overlays and traces in numerous forms of military presentations and reports.

The Pett and Wilson (1996) paper provides two sets of general guidelines when presenting on computer screens[11] the first is attributed to Pettersson (1991); the second set of recommendations is based on an amalgamation of several sources:

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[11] Specifically cathode ray tubes but fair for extension to comparable surfaces.

Table 3: Pettersson's (1991) Recommendations for Presenting Colored Text on Monitors[12]

1.   The best text color is black which provides good contrast with most background colors;
2.   The best combination is black on a white or yellow background;
3.   Text can be easy to read in any color, provided the background is carefully selected;
4.   The best background color for colored text is black which provides good contrast with most text colors;
5.   Colors such as blue, green, and red are generally preferred but do not necessarily improve the accuracy when reading a message.

Table 4: Pett and Wilson's (1996) Recommendations for Presenting Materials on Computer Screens[13]

1.   Use a maximum of four to six colors per screen;
2.   Be consistent in general color choices throughout a program and be especially consistent in color coding;
3.   Use color to link logically-related information;
4.   Avoid combinations of complementary colors that are the same value such as blue / orange, red / green, or violet / yellow, except with extreme discretion;
5.   Use the brighter colors for the most important information;
6.   Use color to highlight errors;
7.   Use a range of grays to provide a neutral background for two or three other colors;
8.   Use commonplace color coding, such as red for stop / green for go, but research cultural characteristics for color use if designing for a specific group; and
9.   Use significant brightness contrasts between text color and background color to increase readability.

Section 2.5: Integrating Information for Processing

Dwyer's series of experiments looked primarily at the kinds of visual material and how to combine them (Dwyer, 2012); an alternate series of experiments by Richard Mayer, looked at the relationship between imagery and text. The former looks more closely at the individual elements, while the latter looks more closely at how the elements interact.

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[12] From Pettersson, 1991; summarized and adapted in layout and font selection from its presentation in Pett and Wilson, 1996.

[13] Modified in layout and font selection from Pett and Wilson, 1996, based on experimentation conducted by Hoekema (1983), Rambally and Rambally (1987), Faiola and DeBloois (1988), Strickland and Poe (1989), Faiola (1990), and Milheim and Lavix, 1992.

The premise at the core of the latter (Mayer's series of experiments) is that a coherent mental representation is a pre-requisite for effective problem-solving, with the effectiveness depending on an integration of the verbal information generated by text and the spatial information derived from images (Mayer et al., 1995). This elaboration of the dual coding hypothesis found in Mayer and others in the 1990s, theorizes that when a subject's attention is split between two separated sources of information, the two pieces of information have to be learned separately and simultaneously (Chandler and Sweller, 1992; Sweller, 1999). Not only has this been borne out in a series of experiments that have tested understanding and retention (Mayer 1989, 1993; Mayer and Gallini, 1990, Mayer and Anderson, 1991 and 1992; Mayer and Sims, 1994; Mayer et al., 1995) but also in physiological experiments where disjointed information produced unnecessary eye movement indicating additional time require for processing or confusion (Hegarty and Just, 1993; Hannus and Hyönä, 1999). Other studies on brain activity show that the "manipulation of visual, spatial, and verbal information activates different parts of the brain … some parts of the brain are specialized to support depictive representations … [while] perception and imagery activate the same parts of the brain" (Vekiri, 2002).

One of the most effective yet practically challenging ways to apply this theory into practical application is when merging the textual units into corresponding pictorial units (Sweller, 1999).[14] The following would be an example of such an integration:

A poppy field – two weeks until harvest.

Figure 3: An Afghanistan-Specific Example of Integrated Text / Imagery[15]

The image above shows a simple example of such a combination and is in truth nothing more than containing a textual description within a text box, adjusting fonts and colors and overlaying it on the applicable image. In the absence of the image, it is difficult to accurately capture what the poppies look like, in the absence of the text, the relevance (in this case to the Afghan fighting season)[16] is lost. Together, the two form a more complete mental picture than they would have had they appeared as distinct and thus disparate elements.

Again, this view, as described above via Mayer's series of articles and the earlier discussion of this type of process from Dwyer, is generally associated with the dual processing theory as articulated by Pavio in

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[14] These challenges would include supporting technology, familiarity, potentially a requirement to tailor text specifically to each image, and time.

[15] Photo Courtesy of then Lieutenant Kent Miller of Task Force 3-09 Battle Group, Afghanistan, 2010.

[16] While the insurgency maintained pressure on coalition forces in Afghanistan throughout the year through the use of harassing engagements and improvised explosive devices, kinetic engagements dramatically increased every spring. Prior to the start of the fighting season, many insurgent fighters were occupied with the opium, thus the completion of it freed up insurgent manpower and was generally followed by a substantial increase in fighting that would continue until peak temperatures in the Afghan summer made sustained operations exceptionally difficult. The number of days or weeks until the harvest then was effectively a count-down to renewed or increased violence in a given area.

the mid to late 1980s (Paivio, 1986; Clark and Paivio, 1991). In this expanded form it postulates that our working memory consists of a verbal and visual path, with the verbal being the path that interprets text and the visual being the path that interprets images (this summary being a paraphrase from the very apt description of the theory in Erhel and Jamet, 2006).

Each path has only limited capacity to process information. Our working memory is limited and our capacity to process verbal and visual information occurs in segregated, thus concurrently processing areas of the brain. This means that the most effective way to process incoming information for the purpose of constructing meaningful mental models – the kind of models that are necessary for conceptual understanding, problem solving and recall – is to have the information come in along these two distinct and concurrent channels in a way that the information can be correlated and mapped (Mayer and Anderson, 1992). The easiest way to map the two streams is if the information is coming in at the same time from the same place (Mayer and Anderson, 1992). Failing this, one processing channel may be overwhelmed even as the other is dormant.

Lin, Ching, Ke and Dwyer (2007) describe the theoretical construct that best explains any improvements with the addition or use of modal combinations including animation as a teaching tool comes this formulation of Paivio's (1986) dual coding theory, which they describe as "the existence of two cognitive information-processing systems … one system [that] deals with verbal input or linguistic, language-like information and the otherwise visual information such as pictures." They expand by describing how these distinct processing channels work separately when "information is coded respectively" but are in agreement with Mayer and Anderson (1992) that "building referential connections between corresponding elements in the learners' verbal and visual representations" enables a simultaneous processing that is both more efficient and more effective.

Moreno and Mayer (2007) compiled key findings from earlier research to derive the following description of a revised version of the dual coding hypothesis referring to it as the cognitive-affective theory of learning with media or CATLM[17]:

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[17] CATLM is also described in detail in Moreno, 2005.

Table 5: Moreno's and Mayer's (2007) Description of the Cognitive-Affective Theory of Learning with Media[18]

"Humans have separate channels for processing different information modalities (Baddeley, 1992)"
"Only a few pieces of information can be actively processed at any one time in working memory within each channel (Sweller, 1999)"
"Meaningful learning occurs when the learner spends conscious effort in cognitive processes such as selecting, organizing, and integrating new information with existing knowledge (Mayer and Moreno, 2003)"
"Long-term memory consists of a dynamic, evolving structure which holds both a memory for past experiences and a memory for general domain knowledge (Tulving 1977)"
"Motivational factors mediate learning by increasing or decreasing cognitive engagement (Pintrich 2003)"
"Metacognitive factors mediate learning by regulating cognitive processing (McGuinness 1990)"
"Differences in learners' prior knowledge and abilities may affect how much is learned with specific media (Kalyuga et al. 2003; Moreno 2004; Moreno and Durán 2004)"

A coherent mental model requires clear selection, integration and organization of all relevant information; ergo, learning is maximized when the two streams are connected in meaningful ways that optimize these inherent characteristics of our physiology and consciousness (Mayer and Moreno, 1998). This said, Moreno and Mayer (2007) note that "interactive multimodal mixed-modality learning environments do not automatically create understanding. By virtue of their interactivity, they can create excessive extraneous load that disrupts deep learning." The goal of their research in this area is then not simply to look for the individual characteristics that are successful in limited samples but to further develop a "sound theoretical framework that can guide designers in effectively using different representation modes and modalities to promote understanding (Mayer and Moreno, 2003).

Section 2.6: Blended Images

It is worth going into greater detail about what is meant by integrating the two multiple modes of information delivery. A simple example may be the better way to illustrate one of the methods discussed. The first figure includes only the detail-rich yet context-less image.

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[18] All quotations, including the source are from Moreno and Mayer (2007). This series has been reformatted.

This picture captures a patrol moving through open terrain. The open fields, the tree-line and the village on the far side, and the mountains in the distance are all clearly visible. There is substantial information here that would be difficult to capture in words, but even with all of this information, some element is missing. The question remains as to what advantages or disadvantages this terrain offers or the significance of the location.

Figure 4: Stand-Alone Image[19]

This is the assessment of the ground – the commander's comments on how this terrain can be advantageously used for future operations, but even having seen the picture before and seeing the assessment now, there is a disconnect between these two pieces of information.

The open ground south of the village allows for multiple approaches along non-canalizing terrain.

Figure 5: Stand-Alone Description

When the two elements are placed closer together, in this case in same box, the connection is somewhat clearer, but placing pictures or illustrations near text is insufficient to substantially increase understanding. In order to achieve the desired effect well-ordered images must be paired with embedded textual descriptors such as captions or labels as shown below, or with other graphical cues that facilitate mental links (Mayer and Gallini, 1990; Mayer and Anderson, 1991; Mayer et al., 1995).

The open ground south of the village allows for multiple approaches along non-canalizing terrain.

Figure 6: Text and Image Pairing[20]

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[19] Photo Courtesy Ethan Baron of CanWest Media, Afghanistan, 2010.
[20] Ibid.

When the two elements are placed closer together, in this case in same box, the connection becomes somewhat clearer. Placing pictures or illustrations near text is insufficient to substantially increase understanding; to achieve the desired effect, well-ordered illustrations must be paired with embedded textual descriptors such as captions or labels or with other graphical cues that facilitate mental links (Mayer and Gallini, 1990; Mayer and Anderson, 1991; Mayer et al., 1995).
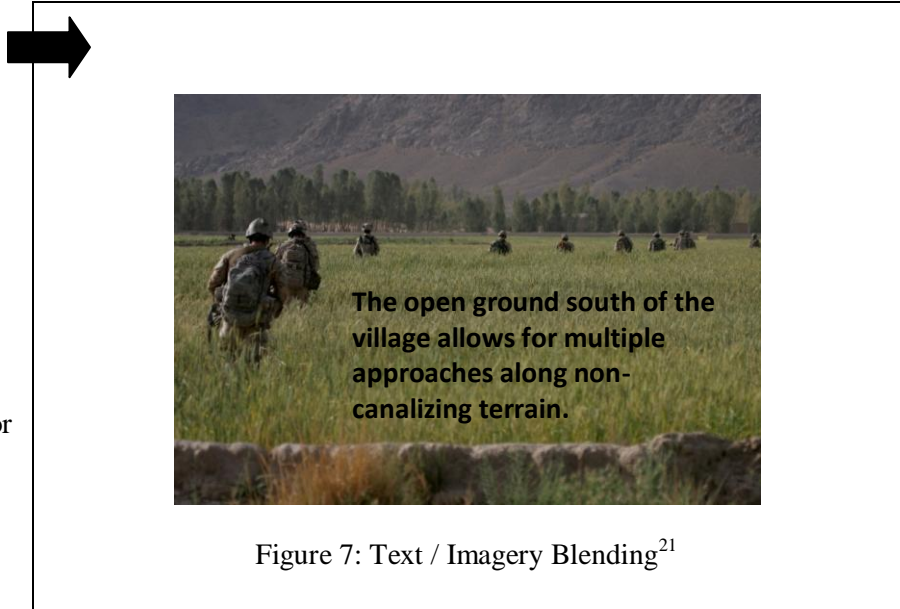
Figure 7: Text / Imagery Blending[21]

When the two elements are fused as above, the connection can immediately be made clearer. This said there is likely a trade-off in terms of effort, not just in cutting and copy-editing text, but in font selection, font size, bolding, or coloring and assumes that there is a segment of the picture with sufficiently general contrast and coloring so as to not obscure the text and be in a location where the text does not obscure some important part of the image. In other words, this can involve not just time but also some level of thought and expertise. There is also the issue of the clarity of the text and the cluttering of the image. Depending on time and resources available and the type of image being combined with the text, something such as Figure 2.6E, that avoids these considerations may in the end be the better form. Based on the literature review so far, there is no definitive answer, only some general trends and techniques that, if kept in mind, will help inform designer's decisions.

Figure 8: Alternate Text / Imagery Blending[22]

In terms of image selection a barrage of pictures does not promote meaning – it can detract from it – as can unsupported text or cluttered combination. On the processing side of this research, it is fair say that

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[21] Ibid.
[22] Ibid.

unconnected words and pictures may do little more than words and pictures alone (Mayer and Anderson, 1991). So while annotated illustrations effectively signal to the reader to make a connection between the verbally and visually represented content; a separate text box and image provide this same content but fail to map the two representations effectively (Mayer et al., 1995).

A potential solution then is to find opportunities to position related verbal and visual information so that their shared subject is reflected in spatial proximity, knowing that this will be limited by numerous factors and that the gains in understanding must be weighed against the cost of production. The claims for the effectiveness of exploiting these opportunities have been quite high – in Mayer et al. (1995) their 'text design principle' saw a 50% improvement in problem solving for low-experienced users and described the effect of their segregated and integrated information packaging as follows:

> The integrated booklet promote['s] the building of referential connections between words and pictures by presenting the illustration and text contiguously and using labels and captions to pinpoint the relation between text and illustrations. In contrast, the separated booklet interferes with the building of referential connections by presenting illustrations at a different time and place than the corresponding text and by not using any verbal cues within the illustration to identify how the illustrations relate to the text. (Mayer et al., 1995)

It is worth noting that in the case of this series of experiments (Mayer et al., 1995) that this improvement only held for inexperienced students and saw no significant difference for high-experienced students. Given the simplicity of the subject – basic meteorology – their deduction that experience alone was sufficient to eclipse any of the gains of effective integration is fair and thus this is not a major counter-example to their significant improvement with low-experienced users or the final experiment in the series that showed that annotated text placed close to text outperformed annotated illustrations that referred to text on a different page text by about 42% and both non-annotated illustrations simply near the text and non-annotated illustrations on a separate page by about 68% (Mayer et al., 1995).

The fact that this integration leads to more effective processing may seem obvious, but that does not make the effect any less powerful nor is it easy or common to get this process right. As Moreno and Mayer (2007) point out the internet and "commercial software are full of examples with these characteristics, but it is fair to challenge whether or not they help people comprehend their messages." A doctrinal patrol report can be electronically-produced and any word processor will allow a user, with some extra time and effort, to insert pictures into the document; the various variants of the doctrinal report including those used by different battle groups in Afghanistan had a place for pictures at the end and a moderately technologically competent user could insert pictures throughout, but neither of these formats truly integrates the two mediums.

Section 2.7: Seductive Imagery

It is clear that there is a requirement to ensure that all of the information represented contributes to an overall understanding of whatever message the author is trying to impart on the audience is essential. This requires that the series of text / image combinations are in a logical sequence, with clear signals for both verbal and visual information (Mayer and Moreno, 1998). This ensures that the set of information is presented in a way that does not overwhelm working memory, but instead promotes mapping of the incoming material to help form a meaningful mental model. Improvements in understanding will generally occur when the text / visual information appear as a chronological sequence and each represent a change in the state of the system (Guri-Rozenblit, 1988; Mayer et al., 1995). Omissions, breaks in this flow, this chronology or a failure to blend the appropriate elements can all detract from understanding. So can poorly selected inclusions.

The open ground south of the village allows for multiple approaches along non-canalizing terrain.
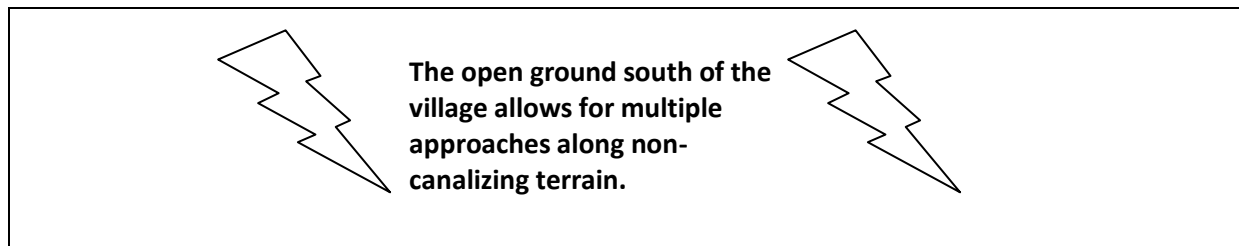
Figure 9: Sample of a Seductive Imagery

The above figure is flanked by superfluous graphics, the kind often inserted to fill space in documents or presentations. This is an example of the kind of seductive image discussed in Harp and Mayer (1997). Seductive imagery is the inclusion of irrelevant, sometimes distracting images, often graphics, backgrounds or borders in PowerPoint and often pictures in reports. Despite their prevalence, they are not helpful. Not all pictures provide meaning and too many detract from the overall perspective. The ready availability of imagery and the ease of its inclusion in multi-media presentations often lead to the inclusion of inappropriate material.

As with imagery, an essential feature of textual representation is that it is concise, coherent and co-ordinated (Mayer et al., 1996). Unnecessary text clouds a document just as negatively as unnecessary imagery. Mayer et al. (1996) demonstrated experimentally that a summary alone increased recall substantially over an unnecessarily-detailed passage and increased recall even over the unnecessarily-detailed passage and the same summary. The summary alone proved twice as effective as a reference for problem solving versus the complete original passage and was rated as useful as the passage and summary together. Not surprisingly a subsequent experiment in the same study, found that when using only summaries, combining text and images in the summary promoted greater understanding and the inclusion of any additional words to the summary directly took away from both explanative recall and problem-solving (Mayer et al., 1996).

These seductive components significantly reduce understanding – in some experiments the inclusion of seductive text or imagery reduced recall by as much as one half; the inclusion of both reduced recall to one-quarter of the baseline in several experiments (Mayer et al., 1996; Moreno, 1999; Mayer, Heiser and Lonn, 2001). Inclusion of these images is generally defended on the basis that it promotes interest in the topic; a counter-argument with respect to interest attributed to Dewey (1913) is that if interest is waning, the solution ought not to be the ad hoc injection of irrelevant material, but instead should be a catalyst to improve the content or the structure of the material being presented through sound techniques. A lesson that can fairly be draw is that not only is a context-less images of limited utility, inclusion of redundant, irrelevant, or simply an unbalanced combination of imagery and text should be avoided. The inclusion of a bulk of text is generally defended for the sake of thoroughness and while there are certainly areas where this would be most desired – in litigation as an example – for the sake of effectively imparting information, brevity is generally the better course. This requires that any unnecessary imagery or text is eliminated.

One of the keys in creating meaningful documents that optimize user understanding is selecting relevant verbal information that is then clearly communicated in the text and selecting relevant pictures or illustrations that build the visual side of the model, while ensuring that the verbal and visual models effectively map with each other (Mayer et al., 1995). Images are most effective when the accompanying text is explanative or informative in nature, when this information is primarily conceptual in nature, and when the image is also explanative with the greatest gains likely to occur with the lowest-experienced users (Mayer and Gallini, 1990).

While effective integration correlates with improved understanding for all users, the magnitude of improvement is generally inversely related to the experience of the user. A subject that is more experienced in a given field requires fewer inputs or cues to create a mental representation as he can draw the missing information from memory; a less experience subject relies exclusively on what is presented. Thus, domain-specific knowledge can compensate for uncoordinated presentation (Mayer and Sims, 1994). A gap in short-term memory can be compensated for if there is material available from long term memory. Not surprisingly then, a low-experience user gains more from well integrated documents than a high-experience user, with low-experience users scoring up to twice as well on conceptual recall and problem solving in some experiments (Mayer and Gallini, 1990; Mayer et al., 1995).

On reflection this may seem somewhat obvious. Illustrations help to create new models. Whether a mental model is of how a bicycle pump or brake system works (as was the case in many of Mayer's experiments and is akin to Dwyer's repeated use of the heart manual), or if it is of the routine pattern of life around a specific patrol base (as may be the subject of a patrol report), a user that already has a well developed sense of the subject will be able to demonstrate an understanding and have recollection regardless of the format of the next report he receives. For a novice in the case of the former or an outsider in the case of the latter, an effectively integrated format has a profound difference on their perception of the state of the system or the state of affairs during their first glance.

From the context of this project, an operator that is highly familiar with a certain area of operations and reporting procedures in general would still gain a greater understanding of a specific mission from a well-integrated report, but would be able to integrate the knowledge from even a text-only report with his previous knowledge (pictures from his memory) to form a mental image. Conversely, an operator with less experience of the specific area or reporting procedures would benefit the most from a well-integrated document, as he has fewer or no relevant images in memory to draw upon.

Section 2.8: Magnitude of Gains in Mayer Thread

In general, verbal explanations are enhanced with the inclusion of diagrams, diagrams are "more effective than a verbal explanation in representing sequential and hierarchical relations ... [and] well-structured verbal explanation cannot replace a visual representation" (Guri_Rozenblit, 1988). How text is designed and presented is more significant than "verbal and visual aptitudes" (Guri-Rozenblit, 1988). In a study involving 416 participants no difference was found between male and female participants (Guri-Rozenblit, 1988).

A user's spatial ability also has an effect on problem solving and retention. Spatial ability compensates for unsynchronized presentation as higher spatial users are able to keep an image in working memory long enough to link it with subsequent or previous text (Mayer and Sims, 1994). This being said, while spatial ability made a significant difference, cognitive style generally does not (John and Boucouvalas, 1999). The magnitude of results then is tied to a user's spatial ability.

As mentioned earlier, the effects of this approach have been significant in some studies – the effective integration of imagery has been shown to generate substantial improvement in problem-solving related to the information presented. There was an average one third improvement (36% increase in score, 0.55 average effect size) in 23 of the experiments reviewed in Levie and Lentz (1982). These specifically compared illustrated text information presented as illustrated text compared to text alone. In ten other studies where illustrations were added to non-illustrated text information and compared to text alone found only a 5% improvement, i.e. inappropriately added illustrations are of marginal utility (Levie and Lentz (1982). Mayer (1989) saw an approximately one-third increase in recall for users of unknown experience levels and Mayer and Gallini (1990) showed a three-fold increase in recall for low

experienced user in selected studies. The magnitude of these differences in recall generally held regardless of how these scores compare to non-conceptual recall and verbatim recall, which are independent of the method of presentation or problem solving, which itself is highly dependent on the mode of presentation (Mayer and Gallini, 1990). In other words whether the scores for conceptual recall are much lower than non-conceptual recall, verbatim recall or problem-solving, or much higher, or relatively the same, the substantial differences between effectively and non-effectively integrated products in terms of user recall remains.

The combination of pictures and words vice either medium alone produce substantial gains, but how the two are combined also has an effect. Mayer and Anderson (1991) demonstrated that embedding the text with the picture as opposed to having the text simply come before or after the image (as is possible using current formats) resulted in a one-third increase in problem solving. Mayer et al. (1995) demonstrated that there was an almost two-fold increase in creative problem solving for groups that had been presented information using annotated vice non-annotated illustrations and an approximately 50% increase in creative problem solving for groups that had integrated versus proximal annotation.

As with experiments using images, experiments that employed animation showed a substantial increase in both problem solving and recall (near two-fold for both in two experiments by Mayer and Anderson, 1992) but only when there was a contiguity of words and pictures that encouraged learners to make connections between incoming verbal and visual information. A decade later, another set of experiments showed that interesting but irrelevant video had the same negative effects as earlier studies that included interesting but irrelevant illustrations or text, with a just lower than 50% reduction in recall and comprehension (Mayer, Heiser, and Lonn, 2001). This same set of experiments further demonstrated that the inclusion of unnecessary text on-screen has the same effect as unnecessary text in books. In this case subjects were given a complete narration and accompanying imagery – a sound combination of mediums – which was compared against this same complete set with redundant text inserted, with the result being a decreased level of understanding and retention for the latter group. A set that included no additional text resulted in somewhat better scores than summary text alone and substantially better scores than the full, overly-detailed textual explanation (Mayer, Heiser, and Lonn, 2001).

This is not to say that on-screen text is not an effective tool; it is when it is the singular verbal medium that accompanies well-integrated visual representation. What this demonstrates is that the inclusion of a redundant modality within either the verbal or visual stream has a tendency to overload the senses. Reading and listening simultaneously is less effective than just reading or listening on their own; the same is true of concurrent viewing of a video clip and an animation sequence; and irrelevant information is distracting regardless of its form. This also demonstrates that there is a danger in text overloading the visual perception of something like say an animation sequence; if the two are not well-integrated, the text ends up competing for the reader's attention as he visually scans the screen (Mayer, Heiser, and Lonn, 2001).

Dialog windows act to reduce the density of material that appears on a screen at any given time, explicitly link the descriptive to the depictive and encourage user interest (Bétrancourt and Caro, 1998; and Erhel and Jamet, 2006). Recent experiments have reinforced earlier findings that integrated pictures and texts on screen, outperform spatially-separated elements, but further demonstrated that integrated text in the pop-up (dialog box) format outperformed static text-picture combinations, likely due to the reduced interference between multiple text-picture units on screen, or through increased user investment in the activity (Erhel and Jamet, 2006).

Similarly in a meta-analysis from Baker (2006) she found that 'directing a learner's attention using properly positioned knowledge generation or discrimination tasks and overt or covert rehearsal

strategies', irrespective of the inclusion or the color of visual aids would increase scores in general from a baseline of 50% to between 56.0 and 60.6% for hard copy material and between 52.6 and 73.1% for instruction on computers. She argued that the inclusion of effective rehearsal strategies "facilitate increased interaction within working memory and activate the retrieval of prior knowledge for processing, encoding, and storage in long term memory of the new information" (Baker, 2006). From a cognitive perspective, she describes the dual coding process as

> The processing of images, audio, and/or text increases the interaction with the visuospatial sketch pad and phonological loop, two slave systems that are within working memory, with working memory's central executive control … the visuospatial sketch pad manipulates visual images. The phonological loop stores and rehearses speech-based information. These interactions, of the information being rehearsed, with the slave systems of working memory are dually coded (i.e., visually and verbally), increasing the interconnectivity of visuals and words (i.e., pictures can be names and words can evoke images) (Baker, 2006)

In the absence of these effective prompts and rehearsal strategies, the signals from sensory inputs (which are only maintained for 0.5 to 2 seconds), will fail to be captured from working memory (where the information is only held for 20 seconds) and will not be effectively "encoded into a meaningful form and transferred to long term memory for storage" (Baker, 2006). She summarizes the process as follows:

> The key components of the human information processing model are that the information is perceived, attended to, encoded, stored, and retrieved. The cognitive processes are based on perception, attention, and encoding. Without the interaction through perception, attention, and encoding, the probability of retaining the information is highly reduced and retrieval for performance on assessments to measure learner achievement is not expected. It is important to assist the learner with which components in instructional materials to perceive, attend to, and encode (Baker, 2006)

Her general findings based on the integration and aggregation of the 640 effect sizes from the 50 studies examined from [Dwyer's] Program of Systematic Evaluation is that the use of rehearsal strategies in all environmental conditions results in an estimated mean population effect size of 0.21." (Baker, 2006) For a learner that would score 50% on the assessment, interaction with properly positioned rehearsal strategies in a computer-based learning environment would increase the learner's score, with 95% confidence, to a score between 52.6% and 73.1%." (Baker, 2006)

If learning simply involved adding information to memory, then a full explanation in words would be of no more value than the same explanation with a picture containing the same information. Think back to the poppy field shown earlier. If information was simply cumulative, then a sufficient verbal description if the flowers would be no more or less meaningful if paired with an image – this information would be redundant and thus gains would be negligible or even slow the process down as attention and energy are wasted. True, the description would take longer to review compared to a simple glance at the picture, but had someone already gone through the reading of a thorough description the notion that memory and learning were simply cumulative would mean that the picture would be of no value. "An alternative idea is that meaningful learning occurs when students mentally construct coherent knowledge representations" (Mayer and Moreno, 2002). Information taken in through unique processing channels is selectively combined with information stored in memory to give mean. This 'cognitive theory of multimedia learning' is premised on three assumptions, which have been borne out in the experimentation discussed (Mayer and Moreno, 2002). These assumptions are the 'dual-channel hypothesis' (Paivio, 1986), the 'limited capacity assumption' – the notion that a limited amount of information can be processed in working memory at a given time, and 'active processing', where

meaningful learning is premised on an engaged participant that selects, organizes, and integrates new knowledge (Mayer and Moreno, 2002).

Carney, Russell, and Levin (2002) provide the following tenets for teachers when selecting text. Such a summary is equally applicable to field report templates:

Table 6: Carney's, Russell's and Levin's (2002) Recommendations for Effective Presentation of Educational Material[23]

Select pictures that overlap with text content.
Easy-to-follow texts already elicits visual imagery and thus the additional of imagery is unlikely to yield increased performance.
Prerequisite basic reading skills are required if positive effects are to be gained from the inclusion of pictures.
Pictures should be selected with an eye toward the function they are to play, i.e. representational, organizational, interpretational, or transformational.
The more complex the text, the more likely that including imagery will be helpful.
Directing that a picture be used for a specific purpose with respect to the text will improve gains.
Integrated (pop-up) displays are generally more effective than split representations.
Individual learning styles may be a factor.
Professionally designed pictures and illustrations may fall short of improving comprehension or recall. What matters is how students use it, not what it was designed to do.

Section 2.9 Triple-Code Theory

Ahsen (1989) suggests that there are three well known strategies within educational imagery research – accompanying pictures that 'supplement verbal strategy', "the 'concreteness' or 'imagery value' of verbal material", and instruction that "direct[s] a learner to visualize the information or concept to be learned". According to Ahsen (1989) dual coding assumes "a direct correlation between image and meaning" but fails to include proprioceptive information, which is included in his proposed alternative – triple code theory – as the somatic response that occurs after the imagery stimulus that contributes to the formulation of meaning within the brain. In the context of triple code theory, motivation and emotional states such as whether the participant is "happy, inquisitive, or anxious" plays a significant role and learning strategy aim to positively effect these factors in addition to providing the proper stimulus through sound presentation techniques (Ahsen, 1989). Thus Ahsen (1984) argues that the "Triple Code Model is shown to be superior to other models such as the Dual Code Model of Paivio which does not account for the somatic response, an important dynamic link between image and meaning.

While this link is a contributing factor in learning, Ahsen's dismissal of the value of the dual coding model is too bold. Baker (2006), Carney and Levin (2002), Guri-Rosenblitz (1988), Lin, Ching, and

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[23] Summarized and paraphrased from Carney, Russell, and Levin, 2002.

Dwyer (2007), Mayer (1989, 1995), Mayer et al. (1995, 1996), and Moreno (1999, 2004, 2005), along with many of the other references already discussed, all demonstrate that meaningful gains in understanding can be achieved through the enhancement and synchronization of the two classic channels, verbal and spatial. Thus while the work of Ahsen (1984, 1989) provides for a structured investigation of additional variables and offers further improvements that can be added to an overall learning strategy, there is still immense value in containing experimentation within the dual coding model to fully understand how the verbal and spatial interact independent on proprioceptive factors.

Section 2.10: Summary

The interviews with operators, commanders and analysts from the field force indicate that there is a clear desire for improved information exchange.[24] Some alternative formats used by allied forces or locally-generated templates for internal use indicated that there was a capacity to employ and appetite for these types changes, but these generally fell short with respect to the considerations discussed over the preceding sections. The literature review indicated significant effects are possible through the re-arrangement of the information presented with a view to promoting simultaneous processing through multi-mediums.

The selection of experiments and theory discussed give clear directions and recommendations with respect to template design and indicate that substantial improvements in understanding and retention can occur when information is packaged in a way that is optimized with respect to human cognition rather than simply formatting it in a single medium or combining ad hoc without the relevant considerations. Such considerations were used to create alternatives to the Army's current patrol report structure.

This project from its inception had been motivated by a desire to promote an understanding of the situation on the ground (in combat) by those at varying degrees of arms-length from it. Whether for a commander taking over a new combat unit, a planner at a higher level headquarters, an intelligence analyst, or a flanking unit operator, it is essential that this situation is articulated as quickly and accurately as a possible. This entails effective presentation. What follows from the knowledge gained through the research presented are recommended forms that a report can take and experimentation to determine the magnitude of improvement that such forms enables.

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[24] These being the interviews conducted circa 2010 with approximately two dozen engineers, patrolmen, snipers, section and platoon commanders, and intelligence analysts from Task Forces 1-08, 3-08, 1-09, and 3-09 (Afghanistan) Battle Groups.

CHAPTER 3: METHODOLOGY

Section 3.1: Experiment Overview

An experiment was conceived to determine if changing the layout of the information presented in patrol reports would have a significant effect on understanding and retention. Based on the techniques derived from the literature review, a new template that saw a greater blending of text, graphics, and imagery was created. This template was then used to describe the findings of notional patrols and was compared to those same findings presented in a control format based on the doctrinal report in Appendix A. A pool of experienced soldiers was sought to determine if the changes made in the experimental template resulted in significantly increased understanding and retention. During this same experimentation, the experience of the members of this pool was queried through the use of a survey. The data from this survey was compared to the results to determine what difference depth of experience made.

Section 3.2: Description of Sample

The experiment for this project was conducted over a two month period, over 11 iterations. Nine of these iterations were conducted in the Louis St. Laurent (LSL) building on the Gatineau, QC side of the National Capital Region in groups of two to six. The first iteration occurred on August 8th, 2013; the last iteration occurred on September 6th, 2013; with the other iterations being roughly evenly distributed in between. All participants in this sample were drawn from the Directorate of Land Requirements (DLR). The other two iterations occurred at the Applied Military Science (AMS) department and involved one iteration with three participants drawn exclusively from the department's staff and a second iteration of 26 that included all put three of this year's students in the department (25 of 28) and one staff. A detailed breakdown of this sample is provided as Appendix B.

All iterations lasted 90 minutes. A total of 30 people participated in the iterations at the AMS department; 27 more from DLR saw the total number of participants as 57.

The experimental packages were delivered in either green or blue folders.[25] All green folders were labelled with sequences containing the 1A2B identifier, ending with even numbers; blue folders were labelled with sequences containing the 1B2A identifier, ending with odd numbers. All green packages contained a control template for the first scenario and an experimental template for the second scenario; all blue packages contained an experimental template for the first scenario and a control template for the second. For iterations with an even number of participants, half received blue folders while the other half received green. For iterations with an odd number of participants, the number of one type of folder was one greater than other type; this would be balanced out in subsequent iterations by ensuring that the lower allocated type was the extra. In the end, 29 participants were part of the green group and 28 were in the blue group. This division of the sample into what will be refer to as the green and blue groups will be important in later discussions.

Table 7: Sample Grouping by Folder Color

Identifier	Numbering	Folder Color	Scenario 1	Scenario 2
1A2B	Even	Green	Control	Experimental
1B2A	Odd	Blue	Experimental	Control

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[25] Selection of dark hues of these generally cold or 'tranquilizing'-associated colors reduce any likelihood of a confounding affect due to color preference; both are reported to have comparable effects with respect to mood and motivation in cases where color selection of experimental tools was found to be a factor (de Craen et al., 1996, Rostami, 2013, Valdez and Mehrabian, 1994).

Section 3.3: Location and General Context Selection

Rather than use actual scenarios from Afghanistan with their inherent security concerns or the standard enemy force planning scenarios used at training establishments that would lend an advantage to certain participants by virtue of previous exposure, it was decided that a unique situation and scenario would be generated specific to the experiment. This would ensure equal exposure to the information across all participants and would allow the flexibility to tailor elements specifically for the experiments purpose. The area of operations selected was rural north-western Romania as it provided a good combination of different terrain types, a balance of open and built-up areas, and was unlikely to be familiar to any potential participants.

The larger area map that would be used to brief the higher-level situation for a notional Army battalion was screen-captured from Google Maps. This included some actual political boundaries (provincial district divisions) and then was overlain with the box for the operational map and the markings for various pieces of notional tactical infrastructure.
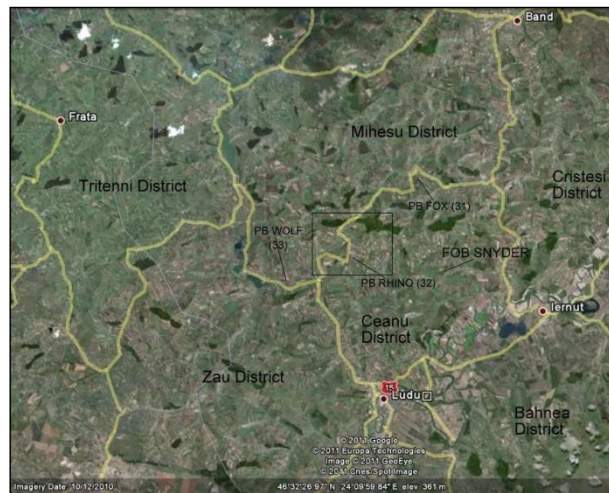
Figure 10: Area Map[26]

From here the view was narrowed (zoomed-in) to the area selected for the operational map. A grid system based on the standard format found on military maps was overlain, though it should be noted that this system does not correspond with an actual geo-reference system and in fact the orientation was changed to achieve the desired balance of terrain
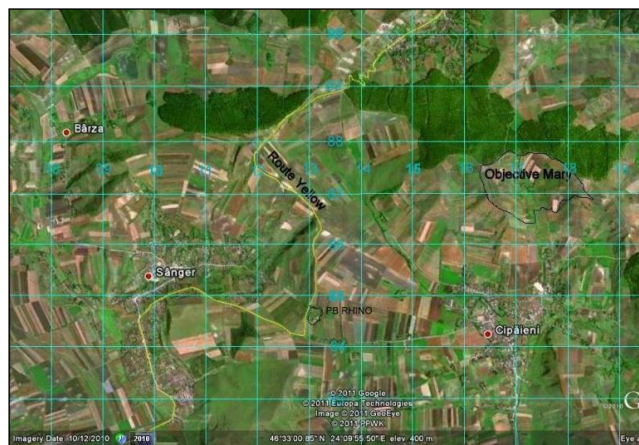
Figure 11: Operational Map[27]

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[26] Background map from https://maps.google.ca/maps?hl=en. Search: Cipăieni, Mures, Romania. Map data appears at the bottom centre of the image. First accessed August 2011.
[27] Ibid. Orientation adjusted. Artificial grid lines and notional tactical infrastructure and operational markers added.

features, i.e. the top of this map and the gridlines are actually oriented significantly toward the northeast (rather than toward an actual grid north). These features, specifically the grid sytesm, were included to give this the appearance of the kind of map that soldiers would typically be issued while on operations. These grids would also be necessary reference points for the tests conducted using this map.

A patrol base was added that would be used as the staging area for a notional mission, along with a named route and an objective area, all necessary elements to understand the patrol commanders story and typical inclusions on operational maps.

Section 3.4: Situation Conception and Design

From here a situation was developed to provide a context for the scenarios that would be presented. This was certainly not written to the level of detail that would be provided to an incoming force, as these would run from the dozens to hundreds of pages.[28] Such a detailed study package would require so much reading so as to preclude the interest or involvement from the majority of potential participants. It was deduced that this depth of information was unnecessary to situate an experimental participant sufficiently and that a condensed presentation would be sufficient for the purpose of this study's ninety minute experiment.

The key elements that most of this kind of report's readers may need were presented – the name of the operation and the units involved, these units' locations in various pieces of tactical infrastructure and their areas of responsibility, and the call signs that these units were being referred to by. The overall mission and the notional battle group executing it was explained, the notional district was described in the context of the rifle company that was responsible for it, and the operational map was briefed within the context of the platoon operating there. The kind of standard cultural and political information that would be known about the local population was provided along with a standard list of enemy factors. Lastly, information on recent activity to set the local picture was articulated. This operation was given the name OPERATION PHANES. This Situation Brief and the time that was allocated to complete the reading of it as part of the experiment are included as Appendix C.

Section 3.5: Control Template (Doctrinal Report) Design

The next step was to design a scenario specific to this situation for the purpose that could be used as part of testing for understanding and retention. A unique situation was devised, one that involved a platoon-minus patrol initially tasked to find an improvised explosive device (IED) but that ends up getting re-directed to the far side of its area of operation once the IED site is found to be empty. On the far side of its area of operations, this platoon finds a large cache of heavy weapons – which seems to contradict the relatively stable situation briefed. It further discovers an observation post that appears to be recently occupied, oriented toward the patrol's base. Most significantly, one member is exposed to what could be a chemical weapon, at that point unheard of in their theatre of operations.

This scenario was first constructed in the format that this project refers to as the Doctrinal Patrol Report or doctrinal template or, specific to the experiment, as the control template. This type of patrol report (included in its most basic form as Appendix A) is an example of the standard patrol report currently used by field forces. While there are alternatives used in different theatres or on different overseas rotations, this remains the standard taught by the Advanced Reconnaissance Cell at the Infantry School,

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[28] Such a product would likely be the Intelligence Preparation of the Battlefield (IPB) and various collections of lessons learned and After Action Reviews; with all of this in addition to the weeks to months that the relieving unit would have spent conducting Theatre-Mission Specific Training (TMST).

the Centre of Excellence for dismounted patrolling.[29] When submitted as a handwritten document, which was done as recently as five years ago in operations and is still done frequently in training, images are rarely included and graphics usually include sketches, range cards and route cards. When submitted electronically, imagery is usually simply pasted into the end of the patrol report, sometimes chronologically, and graphics are almost never included.

The goal for this control template was to develop the optimal report using this standard, i.e. to attempt to develop the best possible patrol report for this scenario within the constraints of this doctrinal format. The level of detail provided in the text of the report aimed to represent the top 1% of reports that would be expected in an infantry battalion.[30] The sample report developed was almost completely free from typographical errors (exceptional for this kind of document, hence why some were intentionally left in) and some jargon and acronyms were used – as were the errors – in order to capture the kind of voice these documents are written with and so that they would read normally for an experienced participant. The imagery[31] (itself sporadically included in most field reports) was numbered within the corresponding text – a sound technique but almost never done by a report writer – providing a level of context and sequencing expected to promote higher understanding than would otherwise occur with a more typical report of this type. The first control template used in the experiment is included as Appendix D.

Section 3.6: Experimental Template (Blended Report) Design

This control template was compared against an alternative template that was designed with a view to balancing the information found in the doctrinal template in accordance with the principles articulated in the literature review. As with many of the experiments discussed in the literature review, the goal here was to determine if the same information, presented differently, made a significant difference in terms of retention and understanding. Information appeared chronologically; images, graphics and texts were placed side-by-side in logical pairings, cluttering was minimized; white space was retained. Information that appeared textually in the doctrinal report was, where appropriate, converted into graphic representation.

The first page was a Mission Overview that covered most of the significant points in terms of the situation, patrol composition, mission, and execution, i.e. a snap-shot of what the patrol new about the objective prior to departure. Capturing this separately and completely rather than having elements of this information fragmented across the report, as is done with the doctrinal report, has the practical advantage of being easier for the report writer to capture as all of this can be cut-and-pasted from his orders. From an information presentation stand-point this blending of thematically-linked text and their associated graphics and images in a single box focuses the reader's attention to this picture emphasizing the time at which this information was known (Mayer et al., 1995), i.e. this better imparts the knowledge of the patrol prior to their departure. By converting some of what was long, disparate, textual descriptions in the doctrinal template, into concise graphics, information that is difficult to immediately comprehend in the verbal becomes instantly clear in the visual.

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[29] Personal correspondence with the members of the Advanced Reconnaissance Cell within Alpha Company, Infantry School, Combat Training Centre – Gagetown, first initiated in relation to this project in the Fall of 2011. Confirmed with a senior representative of this cell, Warrant Officer Kim Doerr, employed as the Advanced Reconnaissance Subject Matter Expert, in January 2013.

[30] To further qualify this statement, it should be noted that the author of this report was one of only ten officers to have commanded a reconnaissance platoon in Kandahar where he was twice singled out by the task force operations and intelligence sections respectively as providing the most detailed and clear reports of all platoons in the province.

[31] All imagery was captured by the researcher in Kingston and the surrounding area.

Mission Information

Situation: Reliable source indicated the existence of an improvised explosive device in a culvert. Time of emplacement unknown. Improvised explosive devices have been encountered relatively frequently over the past two months, but these are generally assessed to be legacy munitions or the work of religious fundamentals or foreign jihadists transiting from other areas, rather than any kind of local resistance and are thought to be viewed negatively by and receive little to no support from either district's Muslim minority.

Call Sign: 32 / Patrol Leader: Capt Smith / Size: 26

Organization: Two rifle sections (32A and 32B), elements of C/S 32 platoon headquarters and the weapons detachment, one medic, one interpreter, four engineers.

Mission: 32 will SECURE the area in and around the suspected improvised explosive device at Grid 1211 8753 no later than 12 1600 January 2011 to determine if exploitation or destruction is required by CIED.

Intent: 32 will establish a secure perimeter around the site blocking traffic from both directions, prior to search and exploitation by engineer elements with intimate security from platoon headquarters.

Scheme of Manoeuvre: 32 will depart current location through the west gate, skirt ROUTE YELLOW via the fields on the west side and cross after the ridgeline where the road turns toward the northwest. From here, the patrol will push well north before hooking back toward the southwest to establish an objective rendez-vous (ORV) on the eastside of the road. Once secure, sections will be dispatched with one section (A) north of the threat area and two section (B) south. Once these elements are set the engineers with headquarters will conduct a search of the area. If a device is found, it will be called in and the cordon will be maintained until CIED arrives on location. If no device is found, the patrol will collapse back to the ORV then move south, hand-railing ROUTE YELLOW on the east side, to enter through the east gate.

Main Effort: Destruction of any IED within the objective area.

End State: Back in PB RHINO to continue with tasks as per the patrol matrix.

Figure 12: Sample Mission Overview

The remaining pages capture the commander's story as snap shots of incidents or segments of the patrol. Each page generally includes a segment of the map, either as a stand-alone image in the frame or as its background, thus a map that is available in the doctrinal report is repeated throughout the blended template with specific events tied to their applicable locations. This change, along with directional arrows reinforcing textual descriptions of bearings and routes, aids in the recall of specific incidents but also reinforces the route taken and the time at which the patrol conducted various activities.

In the doctrinal report pictures were simply included chronologically with reference numbers; in the blended template the pictures were interspersed throughout the document. Frequently with the latter, the picture would be linked to a location on the map through the use of indicating arrows or lines with the applicable text as close as was felt optimal given the other elements of any given frame. The following figure shows how a suspected IED location was presented:

Figure 13: Blended Representation of Suspected IED Location (Scenario 1 Initial Objective)

A trace was included to visually represent the route described in the doctrinal report through the use of a route card (as is generally within current reporting practices). Traces are frequently used in mission presentation and planning and are included as a feature all most all commercially-available GPS. This is another example of how something that is difficult to comprehend in the verbal becomes immediately clear when the identical information is presented visually. Keen readers will notice that there is a discrepancy between what is available in terms of the details about the ground covered, i.e. the route card only covers straight-line approximations with defined start and end point while the trace maps out the exact (winding) route walked. To compensate for this possible information disparity between the control and experimental template, all related test questions required knowledge only of the single points described in the route card, thus full marks would be possible if straight lines were drawn between them.

Map Trace	Route Card (less Comments)			
	Start GR	End GR	Bearing	Straight-line Distance
	1299 8759	1338 8739	2500	400
	1338 8739	1380 8760	0700	700
	1380 8760	1472 8771	1500	1000
	1472 8771	1484 8579	3000	1900
	1484 8579	1569 8577	1600	900
	1569 8577	1621 8607	0900	700
	1621 8607	1611 8761	0200	1500
	1805 8652	1690 8580	4200	1300
	1690 8580	1681 8576	6400	300
	1692 8219	1606 8564	5600	900
	1606 8564	1550 8561	4800	500
	1550 8561	1548 8534	6400	300
	1548 8534	1495 8551	5200	600
	1495 8551	1371 8490	4300	1200
	1371 8490	1328 8471	4100	700

Figure 14: Route Card and Map Trace

The majority of the first blended template consists of pages with a clustering of graphics, images and text centre around a single theme or segment of the patrol. The images and text was cut-and-pasted from the doctrinal report and reformatted into tables, thus retaining the same content, simply in a new form. Graphics, generally in the form of maps with overlays were included in these clusters, but, again, these did not represent new information, only the same information represented in a new way to promote the understanding and retention that this new template was meant to promote. The following are some examples of this approach:

Figure 15: Sample Page from Draft Blended Template (1)

At 1400hrs, we started following a generally easterly path snaking toward the 15 easting,

Then turned south roughly along that easting for 1500 meters.

What appears as a darkened green path between the 14 and 15 easting between the 855 and 875 northings is in fact a stream.

Figure 16: Sample Page from Draft Blended Template (2)

The first blended template ends with a brief (textual) summary of the commander's assessments. While there would be some utility in graphically representing part of these recommendations, it was determined that this was of limited value given the assessment for this particular patrol. This first experimental (blended) template used in the experiment is included as Appendix E.

Section 3.7: Inclusion of Second Scenario

There was a danger that any potential results may be specific to the scenario presented or some single feature (positive or negative) of the reports about it. A single-scenario approach would have also required some form of confirmation that the two participant groups were equivalent. The obvious mitigation of these factors was the inclusion of a second scenario.

The second scenario was written as an engineer-lead patrol of comparable size, tasked as a follow-on mission to the original scenario that had notionally occurred a few days prior. In addition to providing confirmation of some of the information from what will now be referred to as Scenario 1, this second patrol (designated Scenario 2) was to conduct reconnaissance on the various routes leading to, obstacles near, and the suitability of the approaches toward the notional rifle company's future objective. This second scenario was of comparable length with comparable textual detail, near the same number of

pictures, a comparably complicated route, covering roughly the same number of significant incidents over the approximately the same duration.

As was done with Scenario 1, a doctrinal format was written using the standard sequence and formatting followed by pictures that were numbered to the corresponding text, ending with the route card and area map. Again, this sample of a doctrinal report was representative of the top 1% of reports that would be submitted within an infantry patrol group on operations. This became the Control Template for the Scenario 2 and is included as Appendix F.

This doctrinal version was converted into a blended format that consisted of chronological combinations of the text and images cut-and-pasted from the doctrinal format along with graphic representations of that same information (as shown below):

Conducted long halt at entrance to woods, 61A moved east form about 1km to recce edge of woods, remainder was in vicinity for about two hours observing south.

At the Mouth of Woods, the Canal ends and water pools near the entrance to M1.

Reforms as a canal through M1. Pic shows steepness of bank.
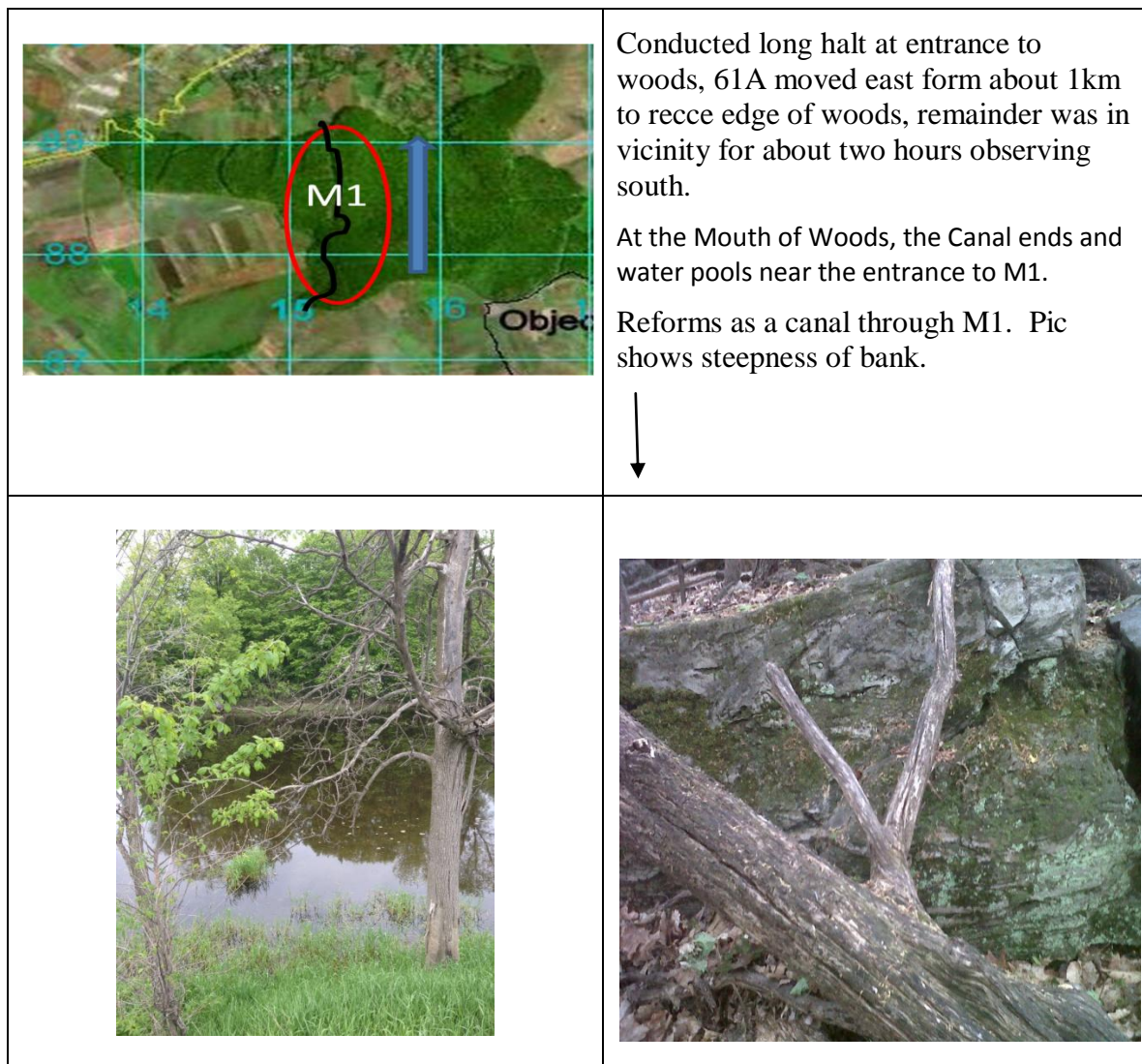
Figure 18: Sample from Scenario 2 Blended Format (1)

With respect to the mission overview and the thematic pages, the blended format used for Scenario 2 was similar in composition to the experimental (blended) format for Scenario 1.
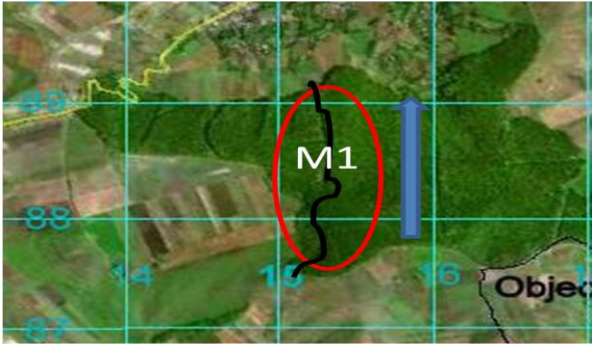
	Commenced movement up M1. Starting about 50m in, woods become thick and overgrown making movement difficult.
Started movement at approximately 1600hrs, at end of path at the 89 northing by 1900hrs. The path visible on the map is the stream, banks level off somewhat but would still be too steep for vehicles. This picture is at small opening in trees (they are usually closer to the edge).	

Figure 19: Sample from Scenario 2 Blended Format (2)

The experimental (blended) template for Scenario 2 is included as Appendix G. This makes for a total of four reports used as part of the experiment – a control (doctrinal) report and an experimental

(blended) report for Scenario 1 and a control and experimental report for Scenario 2. It is well-worth reviewing Appendices C through G before reading further.

This blended format for Scenario 2 made greater use of the tables from Microsoft Word as opposed to re-arranging the various elements in Microsoft PowerPoint before being replaced in the document. This sped the process up, though admittedly still took far longer (approximately eight hours) than would be reasonable by a commander writing such a report when deployed. The major difference between the blended templates from Scenario 1 and 2 is not found in these minor stylistic differences but instead with the inclusion of graphics as part of the commander's recommendations.
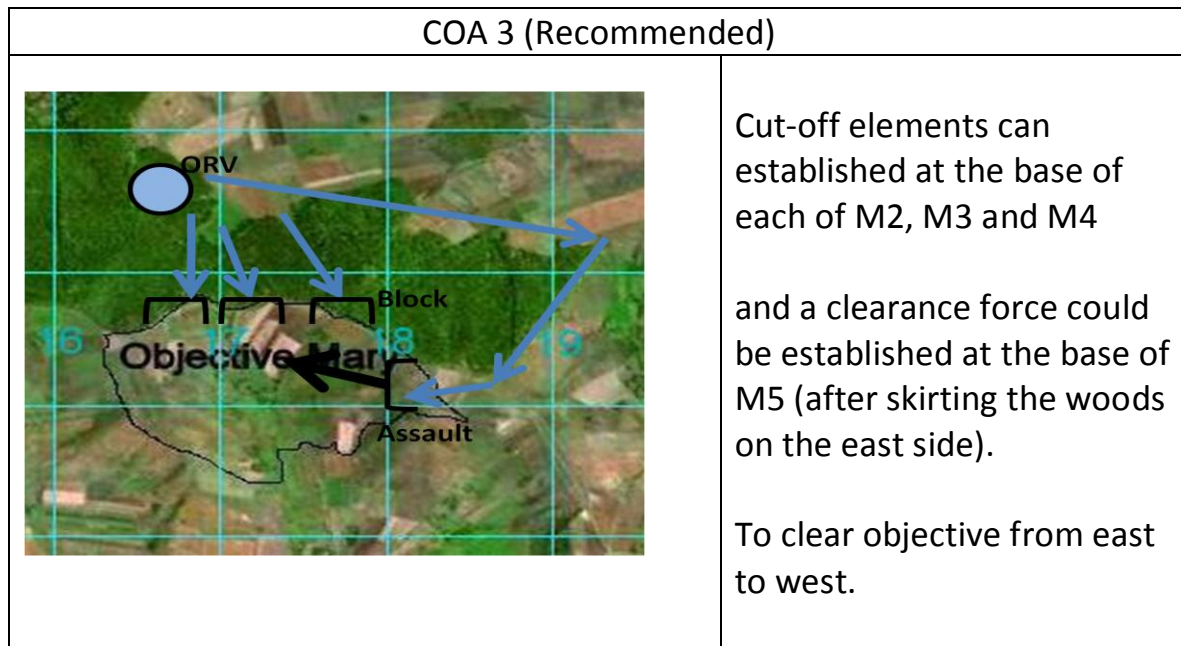
Figure 20: Segment of Commander's Assessment from Scenario 2 Blended Format

Section 3.8: Testing

To compare the two templates, a test was developed for each scenario. This test consisted of three parts. Part 1 were simple true / false, yes / no, and multiple choice questions representing primarily verbal information and weighted as just under a third of the overall score. Part 2 focused on visual information and was weighted as just under half of the overall score. Part 3 required deeper assessments of the material presented with the use of short answer questions and was weighted at just under a third of the overall score. To ensure that no one part was given greater weight due to the order of its presentation, the questions comprised the various parts were dispersed throughout each test.

The tests were designed to be used under time constraint so that even participants that gleaned the majority of information from the reports would be pressed to complete them and would have to selectively focus their efforts. In the absence of this constraint, participants would have been able to compensate for inefficient learning with this additional time. During an early round of pilot testing, the average scores between the control group and the experimental group were fairly close, while the time required to read and write the tests were markedly different with participants generally needing less than ten minutes for either task when using the experimental template, while usually taking in excess of 20 minutes when working with a control version. When time constraints were added in subsequent rounds of pilot testing this same general trend was observed – participants working with the experimental

template would complete all questions in ten minutes, whereas those using the control version were pressed to complete test within twenty to twenty-five minutes where working with the control version. During the final round of panel testing with the experts that would be employed as markers for the short-answer question, all four agreed that 20 minutes was a sufficient amount of time to read either scenario through at least once and that 15 minutes was a sufficient amount of time for someone that understood the material to complete the test. Appendix H includes the answer key for the Scenario 1 Test along with a selection of top scoring short answer responses. Appendix I includes the same information for the Scenario 2 test.

Section 3.9: Sequencing and Time Allocation

The sequence of events for the experiment was as follows:

Table 8: Sequence for Experiment

Topic	Time Allocated (Minutes)	References
Introduction and Administration	5	Letter of Introduction
		Doctrinal Report Description (similar to Appendix A)
		Informed Consent Form
		Participant Background Survey
Situation Brief	10	Situation Brief (Appendix C)
Scenario 1 Reading	20	Green Group: Scenario 1 Report Version A (Control Group – Appendix D)
		Blue Group: Scenario 2 Report Version B (Experimental Group – Appendix E)
Scenario 1 Test	15	Scenario 1 Test (Appendix F)
Scenario 2 Reading	20	Blue Group: Scenario 2 Report Version A (Control Group – Appendix G)
		Green Group: Scenario 2 Report Version B (Experimental Group – Appendix H)
Scenario 2 Test	15	Scenario 2 Test (Appendix I)
Final Survey and Administration	5	General Survey (Appendix J)
		Contact Sheet
Total	90	N/A

Section 3.10: Reading and Testing for Scenario 1

For the first scenario, roughly half of each iteration's subjects (the green group) were presented the control template, something akin to the doctrinal report described throughout this paper, while the remainder (the blue group) read the experimental (blended) version.

Mission Overview	Textual Description	Imagery
A. Call Sign: 32 B. Patrol Leader: Captain Smith (8 Platoon Commander) C. Patrol Size: 26 D. Composition of Patrol: Two rifle sections (32A and 32B), elements of platoon headquarters and the weapons detachment, one medic, one interpreter, four engineers E. Task / Mission: 32 will SECURE the area in and around the suspected improvised explosive device at Grid 1211 8723 no later than 12 1600 June 2014 to determine if exploitation or destruction is required by CIED. HUMINT claimed that reliable source was reporting the emplacing of a device in a specific culvert along ROUTE YELLOW. Situation: Reliable source indicated the existence of an improvised explosive device in a culvert [Picture 1]. Time of emplacement unknown. Improvised explosive devices have been encountered relatively frequently over the past two months, but these are generally assessed to be legacy munitions or the work of religious fundamentals or foreign jihadists transiting from other areas, rather than any kind of local resistance and are thought to be viewed negatively by and receive little to no support from either district's Muslim minority. Execution: Intent: 32 will establish a secure perimeter around the site blocking traffic from both directions, prior to search and exploitation by engineer elements with intimate security from platoon headquarters. Scheme of Manoeuvre: 32 will depart current location through the west gate, skirt ROUTE YELLOW via the fields on the west side and cross after the ridgeline where the road turns toward the northwest. From here, the patrol will push well north before hooking back toward the southwest to establish an objective rendez-vous (OR) on the eastside of the road. Once secure, sections will be dispatched with one section (A) north of the threat area and two section (B) south. Once these elements are set the engineers with headquarters will conduct a search of the area. If a device is found, it will be called in and the cordon will be maintained until CIED arrives on location. If no device is found, the patrol will collapse back to the ORV then move south, hand-railing ROUTE YELLOW on the east side, to enter the patrol base through the east gate. Main Effort: Destruction of any IED within the objective area. End State: Back in PB RHINO to continue with tasks as per the patrol matrix. Secondary task given mid-patrol via radio from 39er was to determine the feasibility of the west to east approaches to OBJECT MARY centered on grid 173 873. F. Departure Date Time Group: 12 0600 June 2014 from PB RHINO.	At 1400hrs, we started following a generally easterly path snaking toward the 15 easting, then turned south roughly along that easting for 1500 meters. What appears as a darkened green path between the 14 and 15 easting between the 855 and 875 northings is in fact a stream [5]. With steep, rocky banks on both sides that rise as far as five feet and a depth over -head height, this is a significant obstacle [6 and 7]. The fields on either side are relatively open [8] and pose no obstruction to dismounted movement and are suitable for vehicle movement as far as 159 easting with the exception of the river. The area west of OBJ MARY is a substantial swamp [45 and 46]. Dismounted movement is difficult and anything less than tracked vehicles will quickly get bogged down. The heavy wooded areas to the north are passable by dismounted soldiers but consist of thick trees that may impede vehicle movement [47 and 48]. We continued to cloverleaf the objective area moving east. We set-up a series of observation positions (32A looking northeast, 32B northwest, HQ south) on a high feature at GR 169858 to get further definition of the westerly approaches, to try to get eyes on to the objective area itself and to determine traffic patterns between OBJ MARY and the nearby town of CIPAIENI. Plan was to maintain observation until around midnight, then return to PB under cover of darkness. At approximately 1930hrs, HQ OP observed what appeared to be an oddly shaped metal object in a barn located at GR 1681 8276 [9]. Further observation indicated that the barn warranted closer observation. The HQ and 32A OPs were collapsed with 32B remaining on the high feature, now positioned in overwatch. While there was significant Pattern of Life observed in the surrounding area two hours prior to collapse, mostly farming and moving from distant residences to fields or benign traffic north and south along the foot trails, nothing was observed in or around this barn.	11 viewed from NW 12 viewed from south 13 [not visible in other two pictures]

Figure 21: Samples from Scenario 1 Doctrinal Template
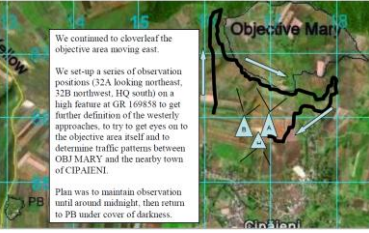
Mission Overview	Blended Information Block	Blended Information Block
	We continued to cloverleaf the objective area moving east. We set-up a series of observation positions (32A looking northeast, 32B northwest, HQ south) on a high feature at GR 169858 to get further definition of the westerly approaches, to try to get eyes on to the objective area itself and to determine traffic patterns between OBJ MARY and the nearby town of CIPAIENI. Plan was to maintain observation until around midnight, then return to PB under cover of darkness.	At approximately 1930hrs, HQ OP observed what appeared to be an oddly shaped metal object in a barn located at GR 1681 8576

Figure 22: Samples from Scenario 1 Control Template

Following the time allocated for reading, all participants received the same test, consisting of three types of questions, mixed throughout the test. The first part, which included all questions numbered 1.1 through 1.12 were simple memory questions that required participants to select yes / no or true /false or selected a letter a. through d. for multiple choice. Yes / no and true / false questions were scored as 0 or 1 out of 1; multiple choice were scored as 0 or 2 out of 2. The total value of this part was 30 marks.

The second part (numbered 2.1 through 2.6) focused on imagery comprehension and was scored out of 45. It consisted of four questions that required students to identify where an event occurred (each of five), a multiple choice question to identifying one of the key images from the scenario (also marked out of 5) and required the participant to sketch out the route the patrol walked (marked out of 20).

The third part (numbered 3.1 through 3.6) consisted of short answer questions that were meant to demonstrate a deeper level of understanding of the findings and effects of the patrol. Each of these questions was allocated roughly one-third to a full page of white space to fill-in and was scored out of 5 for a total of 30 marks for this section. The entire test was scored out of 105. For ease of presentation this was then converted to a percentage.

Section 3.11: Reading and Testing for Scenario 2

For the second reading, the control and experimental group were reversed, i.e. the green group now became the experimental sample, while the blue group became the control. The advantage to such a switch was that both groups participated as part of the control and experimental groups at different stages of the experimental, thus minimizing any effects of the participants' backgrounds.

Immediately following the twenty minutes allowed for reading, participants were instructed to close the report and commence with the second test (Appendix I). As was the case with the first test, they were allowed to refer back to the Situation Brief, while the report was to remain inaccessible. Again, both groups received the same test, with the same three elements, which appeared in the same order they appeared in previously, and had fifteen minutes for silently writing their responses.

Experimentation concluded with the writing of a short survey on the utility of the various elements presented (Appendix J).

CHAPTER 4: RESULTS

Section 4.1: Groupings to be Compared

Details as to how marking was conducted including the templates and methodology used for determining the accuracy of location selection and trace drawing and the expert panel used for marking short answer questions are included as Appendix K.

The following sections look at four groupings to determine whether any of the selection criteria for these groups had a significant effect on the performance of the participants. The first grouping to be examined will be a comparison of Scenario 1 and Scenario 2, followed by a comparison of the blue and green groups, next a comparison of the group employed at the Directorate of Land Requirements in Gatineau (LSL) and the group employed in the Applied Military Science Department in Kingston (AMS), finally the control and experimental groups will be compared.

Section 4.2: Comparison of Results – Between Scenarios

Both scenarios had a sample size of 57. Both scenarios were of comparable length. The doctrinal scenarios were 31 and 26 pages respectively; the blended scenarios were 26 and 28 pages each. In terms of structure the formats were virtually identical scenario to scenario, included roughly equal information and detail, followed the same sequencing, and employed the same memory tools. If there was a difference in performance, an examination of whether some kind of fatigue effect occurred over the 90 minutes of the experiment or if there was a learning effect given the familiarity with the subject matter and the testing format from the first scenario to the second would be necessary.

During Scenario 1, the 29 participants randomly assigned to the green group used the control template and achieved an average score of 50%. In Scenario 2, this same group used the experimental template and achieved a score of 59%, a percentage difference of within the group of 9% and a percentage improvement within the group of 18%. This could be indicative of a learning effect except when compared to the performance within the blue group. In Scenario1, the 28 participants in the blue group used the experimental template and achieved a score of 57%. In Scenario, the blue group used the control template and achieved a score of only 47%, a percentage difference within the group of 10% and a comparative percentage reduction in performance of 18%. Between the two colored groupings, the improvement within the green group was almost identical in magnitude to the reduction in performance within the blue group. Given this, no learning nor fatigue effects appear to have occurred.

The average score for the Scenario 1 Test, irrespective of which template was used a given participant undertaking that test was 53.51%. The average score for the Scenario 2 Test, again irrespective of which comparably sized group a participant was a member of, was 53.16%.

Table 9: Overall Scores by Scenario

	Overall Score	Sample Size
Scenario 1	53.51%	57
Scenario 2	53.16%	57

t-Test	0.14
Result	Not Significant

A t-Test was run on each of the comparisons included in this section. The t-Test run comparing the average score between all participants on Scenario 1 and all participants on Scenario 2 resulted in a score of 0.14. This difference was not significant, thus any difference in scores was not specific to the scenarios.

Section 4.3: Comparison of Results – Between Random Color Group Assignment

With respect to the blue and green grouping, these cannot be looked at in conjunction with individual scenarios, as for any scenario each group was either exclusively part of the control or experimental group. This said, this grouping can be examined in terms of overall results. This analysis sees each grouping having completed the test after reading an equal number of control and experimental templates.

The blue group started the experiment with a distinct advantage in terms of experience. This randomly selected group had 11% more time in, 44% more months deployed, 28% more time in an operational unit, had written an estimated 134% more patrol reports, read 49% more, and was somewhat more familiar with the military grid system and foreign weapons. A full description of the sample and the general findings of the background survey are included as Appendix B.

This did not translate into improved results. The green group consisted of 29 participants (13 from LSL / 16 from AMS), each of which wrote two tests, for a sample size of 58. The blue group consisted of 28 participants (14 from LSL / 14 from AMS), thus a sample size of 56. Within the green group the average score as the control group (Scenario 1) was 50% while within the green group the average score as the experimental group was 59% (Scenario 2). The average for both tests, irrespective of which template was used, was 54.30% within the green group.

Within the blue group the average scores as the control group (Scenario 2) was 47% while within the blue group the average score as the experimental group (Scenario 1) was 57%. The average for both tests, again irrespective of the template used was 57%. This is a difference between the less-experienced green group (which scored better on average) and the more-experienced blue group of 1.96% and an improvement of 3.75%.

Table 10: Overall Score by Green and Blue Grouping

	Overall Average Score	Group Size	Sample Size
Green Group	54.30%	29	58
Blue Group	52.34%	28	56

t-Test	0.78
Result	Not Significant

The t-Test run comparing the green and blue grouping above resulted in a score of 0.78. The difference between these two groups is not significant. Participant background in terms of the experiential data surveyed or the random assignment of the sample into the coloured groups which affected the order in which they received the doctrinal and blended templates was not significant.

One would assume that given the greater familiarity and experience of the blue group that it would have scored better overall. A possible explanation is that these results are indicative of some kind of ceiling effect – given that the overwhelming majority of participants were highly experienced soldiers thus

meeting some minimum threshold of competency over and above which additional experience has a negligible effect. Exactly what that the threshold is and what the indicative factors is not determined and will be discussed in the final sections of this thesis.

Section 4.4: Comparison of Results – Between Location / Current Employment

A third potential difference may have occurred based on current employment, i.e. whether a participant came from the LSL or AMS sample. This was a potential issue identified by the Deputy Director of AMS.[32] He noted that his students and staff were currently working in an academic environment and had just finished a forty hour course on Chemical, Biological, Radiological and Nuclear warfare (CBRN), which could have given them an advantage with respect to assessing some of the findings from Scenario 1. His assessment was that given this the tests may be biased in favour of AMS. A counter-argument could be made that considering most of the LSL staff were technical staff graduates that they would have not only the advantage the CBRN course (even if it had been some years since this study) they would also have the advantage of having completed AMS' modern weapon systems and intelligence, surveillance, target acquisition, and reconnaissance course (ISTAR), parts of which would be applicable to the experimental content and which had yet to be undertaken by the current AMS class. Given these arguments, any disparity in performance between the two groups would warrant a deeper examination of the background of the students at AMS compared to LSL, as well as a determination of other potential factors that could have contributed to this result. Examining the data, division of the sample according to this grouping seems to have had a no effect.

Within the AMS sample, performance was comparable regardless of scenario(less than 2% difference) and regardless of which color grouping the members of this sample were associated with (less than 1.5% difference. Within the LSL sample, performance was comparable regardless of scenario (less than 1.5% difference) and with a small difference in which color grouping they were associated with (just over 4% difference). Between the two samples, the AMS sample performed marginally better on Scenario 1 than the LSL group but marginally worse by the same magnitude on Scenario 2. The AMS participants assigned to the green group performed marginally better than the LSL participants assigned to that same group, while the AMS participants in the blue group performed marginally worse by the same magnitude compared to the LSL participants in that same group. Overall AMS subjects averaged a score of 53.34% irrespective of scenario or color grouping (with a sample size of 60) while the LSL sample averaged 53.33%.(with a sample size of 54).

Table 11: Overall Score by AMS and LSL Grouping

	Scenario 1 Average	Scenario 2 Average	Blue Group Average	Green Group Average
Within AMS	54.2%	52.5%	53.5%	53.2%
LSL	52.7%	53.9%	51.2%	55.6%

	Overall Average	Group Size	Sample Size
AMS	**53.34%**	**30**	**60**
LSL	**53.33%**	**27**	**54**

t-Test	**0.003**
Result	**Not Significant**

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[32] Personal correspondence with Lieutenant-Colonel Sylvain Gagne, Deputy Director of AMS, September 2013.

The t-Test run comparing the AMS and LSL grouping above resulted in a score of 0.003. This difference was not significant.

Of note, the LSL group was more experienced than the AMS group. On average, the LSL group had 24% more years of service with a comparable 25% more months deployed, and 9% more time in operational units. The LSL group had written 70% more patrol reports and read 11% more. 100% of all LSL participants identifying themselves as having experience specific to the military grid system, foreign weapons, and CBRN compared to the AMS group where only 97% expressed familiarity with the military grid system, and only 90% claimed to be familiar with foreign weapons. This result is a further indication that experience over a given threshold is not a significant factor.

Section 4.5: Comparison of Results – By Control and Experimental Group for Scenarios 1 and 2

The fourth grouping examined is the control and experimental grouping. This was examined from multiple angles.

First this was examined specifically to the individual scenarios. Within Scenario 1, the overall average for both groups was 53.5%. The average score for the control group (which in this case was the green group, numbering 29 participants) was 49.8%. The average score for the experimental group (which in this case was the blue group, numbering 28 participants) was 57.4%. This represents a percentage difference of 7.6% and percent improvement of 15.3% between the control and experimental groups.

Table 12: Overall Score for Scenario 1 by Control and Experimental Grouping

Scenario 1 Control	49.8%
Scenario 1 Experimental	57.4%
Percent Difference	7.6%
Percent Improvement	15.3%

Sample Size
29
28

t-Test	2.31
Result	Significant

The t-Test run comparing the experimental to the control grouping for Scenario 1 resulted in a score of 2.31. This difference was significant.

Within the second scenario the average for both groups was 53.2%. The average score for the control group (this time the blue group with a sample size of 28) was 47.3%. The average score for the experimental group (the green group with a sample size of 29) was 58.8%. This represents a percentage improvement of 11.5% and percent improvement of 24.4% between the two groups specific to this scenario.

Table 13: Overall Score for Scenario 2 by Control and Experimental Grouping

			Sample Size
Scenario 2 Control	47.3%		28
Scenario 2 Experimental	58.8%		29
Percent Difference	11.5%		
Percent Improvement	24.4%		

t-Test	2.98
Result	Significant

The t-Test run comparing the experimental to the control grouping for Scenario 2 resulted in a score of 2.98. Even higher than the score for Scenario 1, this difference was also significant.

Section 4.6: Comparison of Results – By Control and Experimental Group as either Green or Blue Group

This factor can also be examined through the lens of the blue and green group. Ignoring the order in which the two groups were either the experimental or control group (as this has already been shown to be insignificant) and looking only at the difference in performance between their two attempts at the test the same trend was event.

Within the green group there was an average score of 49.8% when tested after using the control template, but an average of 58.8% when tested after using the experimental template. This was a percentage difference of 9.0% and percent improvement of 18.2% within the green group.

Table 14: Overall Score for Green Group by Control and Experimental Grouping

Subjects	29
Control Score	49.8%
Experimental Score	58.8%
Percent Difference	9.0%
Percent Improvement	18.2%

t-Test	2.68
Result	Significant

The t-Test run comparing the green group as the experimental and control resulted in a score of 2.68. This difference was significant.

The blue group had an average score of 47.3% as the control group and 57.4% as the experimental group. This is a percentage improvement of 10.1% and percent improvement of 21.3% within the blue group.

Table 15: Overall Score for Blue Group by Control and Experimental Grouping

Subjects	28
Control Score	47.3%
Experimental Score	57.4%
Percent Difference	10.1%
Percent Improvement	21.3%

t-Test	2.66
Result	Significant

The t-Test run comparing the blue group as the experimental and control resulted in a score of 2.66. This difference is significant and as it is almost identical to the green group's score is a further indication that the experience in-balance between the two groups was inconsequential.

Section 4.7: By Control and Experimental Group Overall

While the previous positive results from selected segments of the overall data are important, the most significant findings are the overall results between the control and experimental groups.

The overall average of all tests for both scenarios was 53.3%. The average for all 57 tests written in both scenarios after participants had read the control (doctrinal) template was 48.6%. The average for all 57 tests written in both scenarios after participants had read the experimental (blended) template was 58.1%. This is a percentage difference of 9.6% and a percent improvement of 19.7%.

Table 16: Overall Score by Control and Experimental Grouping

Average for all Tests	53.3%

Average for all Control Group Tests	48.6%
Average for all Experimental Group Tests	58.1%
Percent Difference	9.6%
Percent Improvement	19.7%

t-Test	3.78
Result	Significant

The t-Test run between the experimental and control groups for both tests resulted in a score of 3.78. This difference is significant. Overall the data indicates that there was a significant difference between the experimental and control groups. A result of this magnitude – having discounted the other obvious

alternative explanations as insignificant – clearly demonstrates that there are gains specific to patrol reporting from the informed manipulation of information presentation.

Section 4.8: General Survey Data

In addition to results clearly favouring the blended template with respect to comprehension and retention, the experiment also included a survey that allowed participants to express their preference for the templates shown and for the presentation methods employed (Appendix J). While not as crucial, the literature review showed that presentation preference matter as they affect the degree of engagement and motivation toward completing a task, in this case report reading. Thus, if the survey showed that users preferred a given format or presentation element, this alone would warrant further investigation even if the results had not been as favourable. The fact that they were, means that such a survey can be used to identify specific elements for further development and for the weighting of their importance for future template design.

These questions were specific to the techniques used in blended format rather than more general questions about overall preference or difficulty. One question asked directly whether route traces were an improvement over routes cards, another asked if trace segments were an improvement over textual descriptions. The other queried the importance of image placement, the use of white space, color, or bolding, and the utility of the mission overview block, insertion of map segments throughout the body of the report and directional arrows. The 57 participants each provided responses to 9 questions rating the utility of various elements of the blended template. Of these 513 scores 24 (4.7%) were negative, 44 (8.6%) were neutral, 9 (1.8%) were undecided, while 436 (85.0%) were positive.

 Thus all of the elements included were seen as an improvement on average. The inclusion of directional arrows rated highest and was in the upper half of the improvement to significant improvement range. The use of global positioning system (GPS) track segments as opposed to textual descriptions, the side-by-side placement of imagery and text, the use of color, and the GPS trace as opposed to the route card were all in this same, highest range of user satisfaction. The other four elements queried were all in the next highest range as a mild improvement to an improvement, with the use of map segments, the mission overview block and the use of white space all being in the upper half of this range, with only bolding in the lower half.

Table 17: Participants' Preferences for Various Presentation Elements (out of 10)

Inclusion of Directional Arrows	9.2
Use of GPS Track Segments vice Textual Description	8.9
Side-by-side placement of imagery and text	8.7
Use of Color	8.6
GPS Trace as Opposed to Route Card	8.5
Use of Map Segments Throughout	7.9
Mission Overview Block	7.4
Use of White Space to De-Condense Text	7.1
Bolding	6.7

Most significantly, when asked to rate the control template, the average participant scored this template only 5.4 out of ten. Compare this to the experimental template, where the average participant scored this alternative to the doctrinal version as 8.3 out of ten. A full breakdown of the data from the general survey is included as Appendix K.

Section 4.9: Summary of Experiment

The experiment conducted saw 57 participants randomly assigned into two near-evenly sized groups, designated the green and blue groups respectively. Even though the blue group appeared to have a significant advantage with respect to their background and participated as the control and experimental groups in reverse order, the two groups had insignificantly-different overall scores. Whether a participant was employed as a requirements officer / project director in DLR (with generally more relevant experience) or as a technical program student or staff at AMS (with recent study in areas specific to the patrol's findings and more frequently required to undertake academic testing) made no difference with respect to the overall results and the average scores were virtually identical for each of the scenarios presented.   This indicates that there is a ceiling effect with respect to experience – over some undetermined minimum threshold of experience additional knowledge in these areas does not correlate with improved performance.

There was a significant difference between the control and experimental groups with an overall percentage improvement of 19.7% and a t-Test score of 3.78. This improvement was echoed by a survey, issued at the end of the experiment that saw the blended format rated at 8.3 / 10 in terms of overall utility, compared to optimum forms of the doctrinal format that only scored 5.4. These results indicate that the use of blended templates for military reporting will see a significant increase in understanding and retention for report readers over current methods.

CHAPTER 5: SUMMARY AND CONCLUSIONS

Section 5.1: Further Analysis of Experimental Findings

The lack of significant differences between the green and blue groups and the AMS / LSL grouping shows that the participants' backgrounds were inconsequential. This may have been due to the fact that they were all experienced officers and senior non-commissioned officers and thus, after some undetermined threshold was surpassed by some critical mass of participants, that additional experience over and above it was irrelevant. What that threshold is that separates experienced readers from inexperienced ones is an interesting variable worth pursuing with subsequent experimentation.

Within the same vein of examination, the scores for specific parts or questions could be looked at in isolation. Considering that the scores for Part 1 for both tests were almost identical between different sample groupings these could be removed and the scores for only Part 2 or Part 3 or the combination of both could be examined.[33] In the analysis conducted, the overall trend held regardless of how the participants were grouped or how the overall scores were examined. The experimental group out-performed the control group in Scenario 1 by a score of 52% to the control group's 36% for Part 2 in Scenario 1 and the difference of 63% to 47% in Scenario 2. With respect to Part 3 of the tests, the experimental group averaged 57% to the control group's 50% in Scenario 1 and 59%, so over the control groups 47%, for Scenario 2. So while any isolation of Part 2 or 3 may demonstrate some change in the magnitude of the effect size, the trend would be the same and the effect size nonetheless significant simply by varying degrees, though what that variant is may be interesting. With respect to Part 1, a deeper investigation may identify specific areas or questions were there was a difference between the control and experimental groups.

Likewise with the general survey, there is no obvious difference in the responses of the various groupings. On average the green and blue groups saw all of the features queried as positive additions by about the same magnitude and expressed virtually the same assessment of the utility of the two types of templates.

Section 5.2: Proposed Experimentation Plan

Additional data is required to further articulate the effectiveness of certain features – for example, to determine if there are major differences for experienced and inexperienced readers and to try to identify in general what the minimum experience threshold is that separates that two and, based on the data seen so far, over which additional experience seems to have a negligible effect. A possible division would be to look at officers on their first regimental tour of duty compared to those on their second, as this clear separation of experience may be the dividing line between low experienced and high experienced users.

Spatial ability was not assessed as part of the background survey for this experiment. While considered for inclusion, this was not included in order to focus the experiment and limit the number of variables being assessed. Given that it was unknown whether and to what degree experience impacted the results, which specific inclusion were assessed as enhancing or detracting, whether there was marked difference in the scores of the two scenarios, and, most importantly, whether there was an difference between teh control and experimental group, additional complexity with the addition of something like spatial ability was considered premature. Having established that within high experience users that their degree of experience is inconsequential, that there is no marked differences from scenario to scenario, and, amongst the other clear findings already described, that there was a significant difference between the

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[33] For Scenario 1, the green and blue group both average 67% for Part 1. For Scenario 2, the blue group (with the control template) averaged a score of 59% for Part 1 to the green group's 63% (using the experimental template).

doctrinal and blended templates used, it would now be a useful addition for future testing as would having future participants repeat the Scenario 1 and 2 tests 24 to 48 hours after their first attempt to determine retention patterns. There is also further work to be done to determine how to best tailor interfaces to aid the report's writer and to determine if there is an advantage in further digitizing reports of this type.

It is best if this experimentation is moved away from the headquarters and instead use soldiers employed in field units. First the experience within such units is more varied, ranging from first year privates to warrant officers that may have spent twenty consecutive years with a battalion. Second, it would be interesting to see if there was some kind of skill-fade effect between the operators routinely immersed in patrolling activities as compared to those now filling more staff-type positions, who, though possibly possessing more experience overall, have not employed these skills in some time. Such units would also be an opportunity to see additional scenarios generated and compare reports written by the soldiers themselves.

This will be a significant challenge given the many competing priorities that operational units have, but given the end of the Afghan War and the dwindling budget that the military is likely to obtain over the coming years, experimentation that is inexpensive, simultaneously offers training value, and can be done concurrently with other activities is most probably achievable.

A possible next experiment within this area of research is conducting testing with a regular force infantry battalion. The experiment could be repeated in its current format, with cosmetic changes to the background survey, reports and tests based on feedback from the general survey during the experimentation already conduct. Such an experiment would have see responses from a wider range of experience and unlike a headquarters it would be relatively certain that anyone committed to a follow-up test would attend, so testing for retention would certainly be feasible.

It should employ the same division into green and blue groups that alternate as the control and experimental groups. The selection of blue and green was wholly arbitrary but for the sake of continuity experiment-to-experiment there is no compelling reason to choose any other two. The addition of a short spatial ability test at the beginning would still see this as an initially ninety-minute exercise as the assessment survey would be held off until a second session was completed for each iteration. This second session would be a follow-up, 48 hours later for each group of participants. During this, they would spend forty minutes rewriting the Scenario 1 and 2 tests to determine information retention over time.

If a unit was selected that was in a relatively low state of readiness it may be possible to fit such testing into the weekly training schedule, ideally of two rifle platoons and the reconnaissance platoon. Aiming for two-thirds of these platoons to be available, this experimentation should be able to achieve a sample size in the vicinity of 60. Particular attention should be paid with respect to the final survey, especially the comments section as there is no better source of recommendations than the group that would most benefit from any changes and that is the most likely to use any future template.

The availability of cadets at the Royal Military College (RMC) should be taken advantage of. With the exception of those fourth-year combat arms cadets that have completed courses as comparable to an infantry dismounted platoon commander or armour reconnaissance troop commander course (who would be considered minimally experienced operators) almost all participants would be low or no experience subjects with respect to patrolling or reporting. This would be an ideal opportunity to repeat the experiment with only aesthetic changes and the inclusion of the spatial ability test – i.e. not including follow-up testing for retention over time – with a view to determining improvement patterns, if any, when moving from doctrinal to blended templates and comparing the differences in scores between

these low experience users and the high experience users that participated in this research's experimentation. Of course, such an experiment could be conducted at any other academic institution, so long as care was taken to explicitly identify veterans and reservists lest their results be inappropriately mixed in with those of participants with no experience.

Given that there was almost no difference between the AMS and LSL or the green and blue groupings, there is little value in repeating this experiment with a subsequent serial of the programs at AMS. Though this is a readily available sample that would benefit in their course of study by participating in an activity like this, it would be highly unlikely that the results would be substantially different and increasing the sample size is not required given the significance of the findings here. Should an AMS candidate wish to pursue a project in this area, they would be better served overseeing a round of experimentation as described in the preceding paragraphs either using the RMC cadets or soldiers from the Royal Canadian Dragoons or the First or Third Battalion of the Royal Canadian Regiment, all based in Petawawa, ON. A guideline for a more ambitious experiment run over the course of two weeks with soldiers from an infantry battalion is included as Appendix L.

There are several other variants of the experiment that could be executed to determine the impact of certain variables. The obvious area to investigate would be to determine if improvements occur using animation as opposed to the still verbal / visual combinations employed thus far. The doctrinal report from Scenario 1 could be given to all participants to establish baseline competency more accurately than the background survey or spatial test alone provide. Following this, the sample could be split into green and blue groups with the green group receiving the blended format for Scenario 2 from this research's experiment while the blue group received a new, animated report on Scenario 2. A third scenario would be required (something that would reasonably follow in the OP PHANES situation), with the green group now using an animated report while the blue group receive a blend report for the scenario. Interesting results from such an experiment may warrant repeating this process using a different set of scenarios, i.e. a selection of those generated by the infantry patrol commanders. A recommendation for automated templates in general and specific recommendations with respect to automating Scenario1 are included as Annex M.

A further variable would be the effect of replacing text with speech. Mayer and Moreno (1998) demonstrated that there are efficiencies within the medium as well. Their findings were that narrative information delivered verbally instead of being rewritten as text increased retention, matching of relevant information, and information transfer (Mayer and Moreno, 1998). While not attempted as part of this experiment, future studies may want to look at embedding voice clips, for example. a contact report delivered across the radio net, into the timeline (with an accompanying text box, of course). This would require recording equipment that is uncommon in the Canadian Army, not currently set-up for its radio interfaces, speakers that are not included with all ruggedized laptops and several other practical restrictions, but should not necessarily be dismissed out of hand. Any one of the previous experiments, including the experiment discussed in this paper, would suffice. Ideally this experiment would be run in two serials – the first substituting text with speech in a blended format compared to simply a blended format; the second substituting text with speech in an animated format compared to the original animated (but text-based) report.

In this thesis, information from the body, joint positioning and proprioceptive images were not extensively utilized. Rather the two main channels of information within dual coding theory were investigated and the aim of improving the reporting procedure by enhancing and synchronizing the verbal and spatial inputs and responses. Future research may want to expand on these findings with the inclusion of considerations from triple code theory. Emotional factors such as comfort, motivation, encouragement, and stress could be investigated by conducting experiments in harsher environmental

conditions, with increased rewards for positive performance, with explicit positive reinforcement throughout an experiment, or under increasing levels of time constraint.

Section 5.3: Institutional Resistance to Change

It is as of yet undetermined how much additional time, if any, will be required for a user to write a report akin to what this thesis is recommending. Cut and pasting from a doctrinal report using products like MS Word and PowerPoint as was done here was generally time consuming. This said there is no reason why an operator would write the doctrinal version first then convert it – such a process would make little practical sense – so this is not a useful indicator of the amount of time required. Moreover, the amount of time required to produce these products will be very much dependent on how much of the processes is automated, so on the kind of supporting software and interface. As described in the previous sections, automating the sketching of the trace by using the GPS track log, automatically overlaying a trace that includes all pictures taken, prompting for comments, and allowing for orders segments to be cut-and-pasted to form the bulk of the mission overview, amongst other techniques discussed, will likely substantially shorten a process that currently requires writers to do this manually. How much time is saved versus how much additional time is required to balance various elements is yet to be determined, though much could be learned through the proposed experimentation already described.

As with the introduction of any capability, there will be a cost, specifically in terms of time, associated with training operators and commanders in the writing and reading of a new kind of report. It could well be argued that perhaps comprehension can be improved simply by committing more time and resources to sound writing and assessment practices, but whether the training system currently places enough emphasis on apt reporting techniques or writing skills is irrespective of what type of format the Army ends up using. Whatever the training requirements that are identified through further analysis are, this bill will be counter-balanced first by the amount of time that will be reduced in the teaching the doctrinal template through formal courses or by reducing the amount of time spent learning unit or task force-generated variants (though the cost of this activity is rarely tracked at this time). The most significant gains, however, will come outside of individual training, where collective understanding will be improved through using tools that better promote situational awareness by virtue of design and ultimately on operations were less staff effort is spent trying to make sense of dense textual assessments and the information captured in a report is both easier to search electronically and easier to comprehend at a glance. All of this is in line with the broad aims laid out in Designing Canada's Army of Tomorrow (Directorate of land Concepts and Design, 2011) that notes that while "human capacity to synthesize issues in terms of number, depth, breadth and complexity will not be significantly altered, the capability goal is the merger of humans and technology in a manner that can leverage human strengths of synthesis, innovation and creativity while harnessing the speed and responsiveness of automated systems."

The blended template was designed primarily to mitigate issues associated with the increased information demands most associated with counter-insurgency and peace support operations, but arguably it would retain the same level of improved utility in all out war. While the depth and breadth of information may be reduced – for example many patrols against a peer enemy would focus only some specific enemy capability and be less interested in the local population – a blended format would still likely be preferable as a way to quick capture the pertinent information. Going back to the simplest example (which was provided in the problem space) if a patrol was seeking to determine if location y was supported by x number of tanks, it would be desirable to have images of the tanks location, their orientation and general condition, and to determine if there was some specific variant that might entail improved or reduced capability of enemy armour in that area. The doctrinal report will still have utility when used for what it was designed for, as a simple, concise, spoken-report sent by radio, as a means of

a quick update but it will simply no longer be used to record the kind of detailed information that it is not optimized to convey.

Section 5.4: Conclusion

The single most important deduction that this study illustrates is that design considerations with respect to how people process information must be explicitly included as requirements when designing new templates and interfaces. Given the wealth of study, theory, and recommendations that are available in the realm of educational psychology, there is no reason to simply re-cycle dated formats into new media nor to continue to assemble reports and interfaces ad hoc.

Interfaces must be simple and as much as can be transparent to the user must be designed as such. Operators cannot be expected to know how to build their own templates and weak templates cannot be expected to be compensated for by additional effort on the part of patrol report writers. Though many writers are likely sufficient knowledgeable that they can employ some of the ready available programs, they likely lack an informed understanding of human information process. They are, in the end, operators and soldiers. There is a fair expectation that they can write well enough to express their observations and deductions and that they can take pictures. It should not fall to them to determine optimal layouts nor should they be forced to spend excessive amounts of time trying to transfer these thoughts and photos into something that falls short by design.

Soldiers on operations are consistently tired and constrained with respect to time. If they are forced to choose between recording their last mission or planning for their next, they will, in the interest of the immediate objectives on the mission and for the sake of their own and their soldiers' survival, choose the latter. In the end, their primary job is to execute physically and mentally taxing operations under harsh and dangerous conditions.

Thus, as much as possible – within the constraints of available equipment and network capability – must be automated. This should include not only the ability to seamlessly include GPS traces and images, but should include features that assist in sorting out irrelevant tracks and images, correlate these with their location and time, make them into readily-producible overlays, and prompt for comments.

Not all significant incidents will have accompanying images, as it is generally difficult to take pictures when under contact, and if the choice is between taking a picture and firing a shot, soldiers will rightly choose the latter. Thus interfaces need to be able to include information generally captured by higher-level reporting stations such as Contact Reports or calls for fire. Interfaces should also include the ability to create simple graphics that depict incidents such as the layout of an enemy ambush, the layout of the interior of buildings, range cards, etc.

Anything more than short video clip is unlikely to be a common addition, as equipment is in short supply and compatibility will be an issue, as would the bandwidth required to send a report that included such large features, but the requirement to include these should nonetheless be considered. Voice is an interesting verbal option to text but has its own considerations. There is a wealth of literature on this and it must be reviewed before such a feature is simply included.

Concurrent with the goal of improving understanding for the reader should be the goal of reducing the time it takes for a commander to write. Too often technology, while allowing for more effective presentation, entails more time spent preparing it. Given the fleeting hours that a commander has to execute this task, adding time to the process must be viewed as unacceptable.

Ultimately, less emphasis needs to be placed on whether all of some set of boxes is filled in and more emphasis needs to be placed on whether the information presented – be it sparse or lush – is presented in a way that will help the reader understand the report.

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APPENDICES

APPENDIX A
AN OVERVIEW OF PATROLLING

Patrols are conducted by a wide variety of elements for varied purposes, but the essence of the task is to go out, interact with the people and the environment and report back what was seen to all interested parties. The purpose of a patrol report is to provide a detailed synopsis of all relevant observations by that patrol.

Every patrol has a mission. In the contemporary operating environment there is a wide span of possible tasks that include everything from determining if mountains are passable or establishing contact with insurgent forces, to meeting with local leadership to discuss issues with water and infrastructure. Irrespective of the task, each mission employs visual observation or other detection methods in order to gain information about an adversary or potential threat or to secure data concerning the environment or the ground in a particular area. Patrolling is a unique form of intelligence gathering. Unlike other sensors that are by nature passive, patrolling motivates a response by the people in the area, sometimes friendly, sometimes hostile and it is the role of the patrol's commander to react to and report on that. Alternatively, it provides an assessment of the terrain that simply is not possible through the use of aerial sensors or assets.

At the end of every mission, a patrol commander summarizes his observations in as detailed a report as time allows to ensure that his superior commander is apprised of his assessments of an area, to help the intelligence analyst build their picture of the area of operations, make suggests to planners for future operations, inform flanking commanders of issues or trends that may affect their areas and as a reference for the future patrol commanders that will likely operate on the same ground.

This is the format for a doctrinal report:

PATROL REPORT

A. Call Sign
B. Patrol Leader
C. Patrol Size
D. Composition of Patrol
E. Task / Mission
F. Departure Date Time Group
G. Return Date Time Group
H. Routes In and Out
I. Terrain
J. Info Enemy
K. Map Corrections
L. Misc Info
M. Result of Enemy Encounters
N. Condition of Patrol
O. Support Received / Required
P. Communications
Q. Friendly / Neutrals
R. Conclusions / Recommendations

Figure A-1: Doctrinal Patrol Format

Some variations of this report can be found in doctrinal references and common practice. Example of the former are a more expansive version with detailed sub-paragraphs in Standing Operating Procedures (SOP) for Land Operations (Directorate of Army Doctrine, 2009) and a variation in the Land Force Information Operations Field Manual for Intelligence (2001) that has the paragraphs in a different sequence and includes some additional information requirements that would be completed by the reviewing intelligence staff such as classification and message number. These nonetheless conform to the same structure. An example of variation in common practice would be an operation specific example, such as the kind used for Task Force 3-09 Afghanistan that used a revised sequence with more emphasis on terrain, IED indicators and events, and the local population but was similarly textually dense and required the pictures be placed in a table format at the end with no additional instruction on or structured inclusion of visual information. As noted in the main body, there is no standardized agreement like a NATO STANAG definitely determines the form that this type of report must take.[34]

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[34] http://www.ihs.com/products/industry-standards/org/nato/list/page21.aspx.

APPENDIX B
DESCRIPTION OF SAMPLE

During the initial stages of this research it was determined that the desired sample were the members of the Land Forces Technical Staff Program (LFTSP) and the Army Technical Warrant Officer (ATWO) course run out of the AMS department. Combined, the courses usually had in the vicinity of just under 30 students (it has been 28 total for the previous last two years). An inter-departmental report written by this paper's author described this sample as follows (specific to the courses graduating in 2011):

"The [LFTSP] and the [ATWO] are run concurrently within the Applied Military Science Department (AMS). Their purpose is to provide select candidates with the academic, institutional and scientific background necessary for their subsequent employment in technical and procurement-related positions within the army. The LFTSP and ATWO consist of fourteen officers (Captains and Majors) and fourteen Senior Non-commissioned Officers (Warrant Officers and Master Warrant Officers) respectively from across the army to undertake these year-long, full-time programs overseen by the Royal Military College of Canada (RMC). These programs commence in July each year and end in the following June, though graduate students sometimes remain in AMS for up to three months after the completion of the formal LFTSP to complete their graduate thesis.

In this year's [2011's] serial of these programs, all students are male and all but two are over 30. As would be expected, ATWO students are generally older, most with over 20 years of service and several with over 25. While none of the ATWO students have undergraduate degrees, many have several years of post-secondary education while some only have a high school diploma. LFTSP students generally have fewer years of service though all but three have undergraduate degrees in a broad range of disciplines from chemical engineering to philosophy. At present, none of the students have masters-level degrees though several students were registered in the two graduate options that are run concurrently with the LFTSP, these being the Masters of Defence Engineering and Management (MDEM) and the Masters of Public Administration (MPA).

Students arrived with a variety of backgrounds, coming from schools, field units and staff positions. In terms of operational experience, all ATWO and all but one LFTSP student have completed at least one tour of Afghanistan. Four of the students returned from Afghanistan immediately prior to starting the summer term of their respective program – two from operations positions within headquarters, one from the Reconnaissance Platoon and the last from the Counter-Improvised Explosive Device Squadron.

By virtue of their ranks, all students would have attended several courses that included components of management, written communications, staffing procedures, public speaking and computer skills. All of the Warrant Officers (WO) have completed the Intermediate Leadership Qualification (ILQ); almost all of the officers have completed the Army Junior Officer Staff Qualification (AJOSQ) and Army Tactical Operations Course (ATOC) or their equivalents with just over half of the officers (seven of 12) having completed the Army Operations Course (AOC). Coming into the programs, several students had strong math, science and engineering backgrounds – the main focus of the summer and fall semesters – however, these skills were concentrated only in these few individuals with the majority of the class' background in hard sciences being limited

to high school or introductory level undergraduate courses in these subjects. All respondents volunteered for their respective program."[35]

This report was specific to a single serial of each of the LFTSP and ATWO, which based the assessment of the programs' Deputy Director at the time, were likely more experienced than most of the serials of these courses that have been run by AMS.[36] Regardless, the above description and the charts below specific to 2011 nonetheless can provide a perspective of the general make-up of these programs year-to-year. The graduating classes of 2011 broke down as follows:
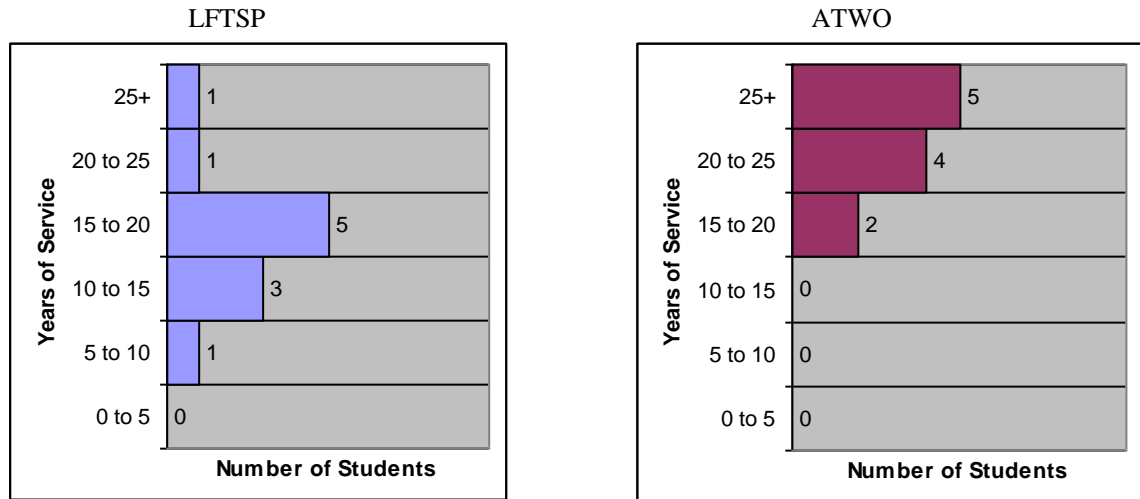
Figure B1: LFTSP and ATWO Course (2011) – Years of Service[37]

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[35] MacKillop, "Efforts, Grades and Satisfaction: An Analysis of the Fall Term for Applied Military Science Department", 3.

[36] This assessment was made by the Deputy Director of these programs during these serials, Lieutenant-Colonel Sylvain Beauséjour. His description of the program's usual mixture of candidates follows this section.

[37] MacKillop, "Efforts, Grades and Satisfaction: An Analysis of the Fall Term for Applied Military Science Department", Annexes A and D.
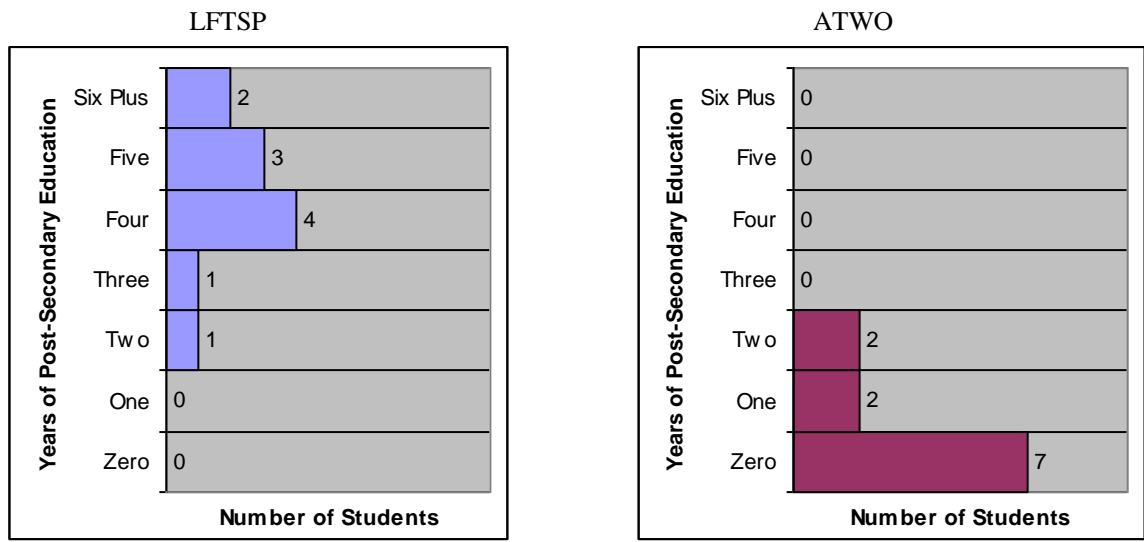
LFTSP

ATWO

Figure B2: LFTSP and ATWO Course (2011) – Years of Post-Secondary Education[38]
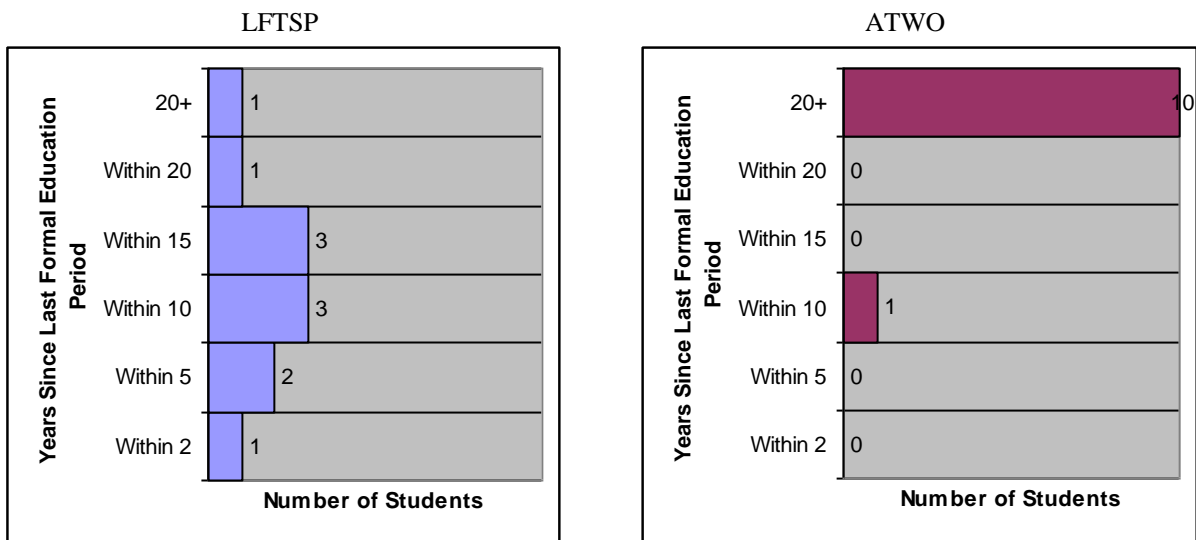
LFTSP

ATWO

Figure B3: LFTSP and ATWO Course (2011) – Years since Last Formal Education Period[39]

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[38] Ibid.
[39] Ibid.
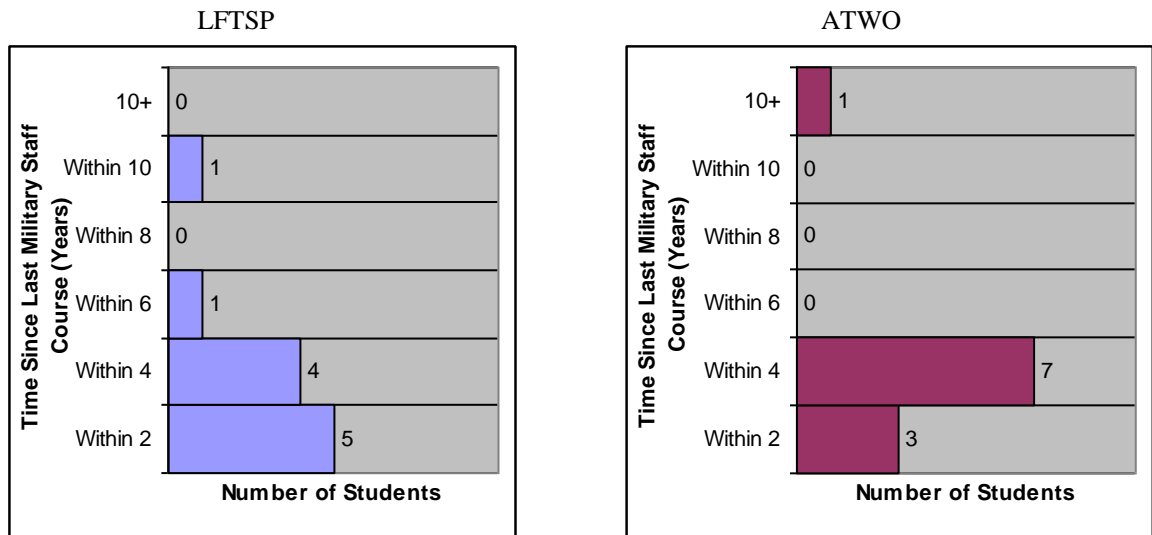
LFTSP ATWO

Figure B4: LFTSP and ATWO Course (2011) – Time since Last Military Staff Course[40]
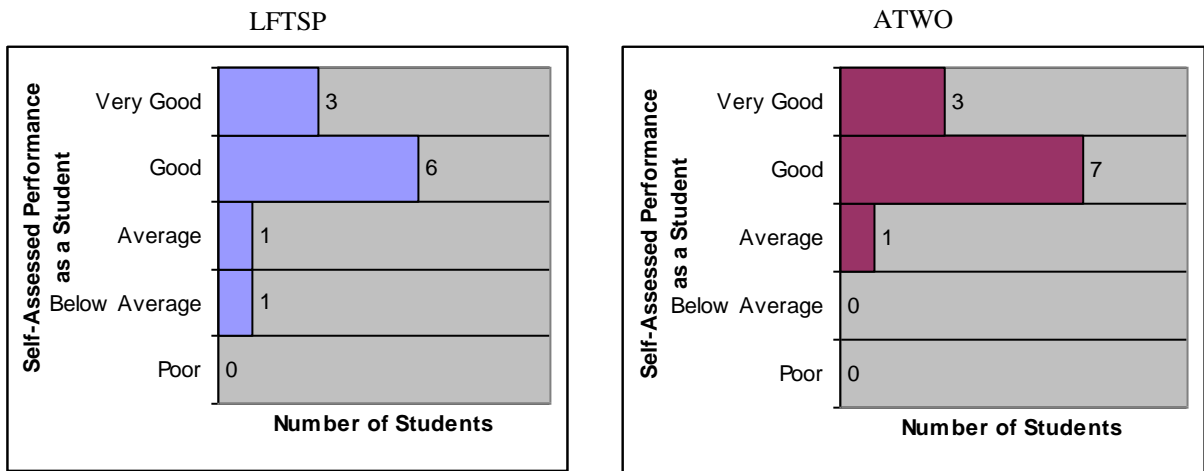
LFTSP ATWO

Figure B5: LFTSP and ATWO Course (2011) – Self-Assessment of Performance[41]

In addition to this educationally-focused data – more specific to operations and report interpretation – these programs can be described as follows:

"The LFTSP [now renamed] ATSOP[42] have consisted of captains and majors that generally have at least five, sometimes over ten years of service, generally distributed between commander position in field units and staff positions in various headquarters, agencies and schools. Over the many years that the program has been delivered, the average time-in for officers is in the vicinity of 5 years with a standard deviation of around 1.5. They are drawn primarily from

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[40] Ibid.

[41] Ibid.

[42] In 2013, the Land Forces Technical Staff Program was renamed the Army Technical Staff Officer Program (ATSOP). The structure and mandate of the program remains unchanged.

the combat arms and operational experience is a consideration in the selection of candidates. This selection criteria breaks down as 25% for performance, 5% for bilingualism, 25% for academic strength, 25% assigned for professional and operational experience, and 20% for potential. It is a fair assessment that they would be experienced with staff work and analysis including standardized formatting, specifically patrol reporting, at the very least as part of their baseline officer training.

The students in the ATWO program generally are more experienced, usually with at least ten years of service with a standard deviation of 2. These candidates are also drawn primarily from the combat arms, have all received formal training in reports and returns (at the very least as part of their junior leadership training) and have almost exclusively spent the majority of their career in a field unit. By virtue of this employment trend, they likely have less administrative training in general but likely have written and read more patrol reports than those in the LFTSP / ATSOP."[43]

The above description expands on the previous specific data from a specific year to a more general assessment of the programs' make-up over numerous years. Together these show what can be expected in terms of experience of the candidates of these programs on any given year. From these, there should be little doubt that most of the LFTSP and ATWO students would be experienced users specific to the doctrinal report (an informal survey of the classes of 2011 indicated that over half of those polled would have written more than 50 reports and read more than 100, the respective maximum ranges for the experimental survey, while the other half was generally toward these upper limits). The staff of AMS is also relatively small and consists of a colonel, two lieutenant-colonels, three or four majors, a chief warrant officer and a master warrant officer, all with similar backgrounds (though likely more time-in and operational experience) and thus would also considered to be an ideal sample.[44]

Mass concentrations of these kinds of high-experience users are rare outside of operational units, outside of which such officers and warrant officers are usually dispersed across headquarters and schools. Operational units and schools were discounted as viable options as the high-experience users were concentrated within these organizations' leadership, which is generally only together during periods of low availability. Within field units the leadership is usually dispersed across a large number of tasks in various locations and come together only during collective training events or deployments, during which period they would not be available for this kind of experimentation. Schools have a similar issue. All of this to say, these programs represent a rare combination of experience and availability.

As described in the body of this document, this sample was extended to included members of the Directorate of Land Requirements (DLR), a common post-technical staff billet consisting primarily of technical staff-qualified officers and warrant officers, i.e. soldiers of comparable background.

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[43] General description of the programs from Lieutenant-Colonel Sylvain Beauséjour, the Deputy Director of the Applied Military Science Department until 2012 and the instructor for the programs' Critical Thinking course for the 2012 / 2013 and 2013 / 2014 serials. Provided to the researcher via email correspondence in Nov 2013.

[44] This was the staff breakdown circa 2008 to 2012, confirmed in interviews with several members of the programs directing staff. In 2013 the master warrant officer (Master Gunner) position was eliminated.

In order to describe the sample, a brief survey was administered. It asked the following questions:

P1.   MOSID (or MOC): _____

P2.   Rank: _____

P3.   Years of Service (regular or reserve, including as a student): _____

P4.   Number of Months Deployed on Operations (Domestic or Overseas): _____

P5.   Number of Years spent in a front-line unit: _____

P6.   Number of Patrol Reports Written (on courses, in training or operations):
        0 – 10 ____
        11 – 20 ___
        21 – 30 ___
        31 – 40 ____
        41 – 50 ____
        50+ _____

P7.   Number of Patrol Reports Read (on courses, in training or operations):
        0 – 20 ____
        21 – 40 ____
        41 – 60 ___
        61 – 80 ____
        81 – 100 ___
        100+ ____

P8.   Are you familiar with the military grid reference system, i.e. if given a grid reference can you find that location on a map and vice versa, if shown a location on the map, can you determine the grid reference?
        Yes (to all) _____   No (to at least one element) _____

P9.   Can you tell the basic differences between Soviet style small arms, e.g. can you identify an AK 47, have a general idea of what the PKM light machine gun looks like and have a rough idea of what features would indicate a precision weapon like a sniper rifle?
        Yes (to all) _____   No (to at least one element) _____

P10.   Do you have a general understanding of some of the threat indicators for Chemical Biological Nuclear and Radiological threats, such as what some of the commonly known chemical weapons are (mustard gas, sarin, etc.), what kind of protective equipment soldiers carry and what the various levels of Mission-Oriented Protective Posture (MOPP)?
        Yes (to all) _____   No (to at least one element) _____

The following figures illustrate the actual breakdown of this experiments sample.   With respect to trade, one third of all participants (19 out of 57) were infantry officer, followed by officers from the other combat arms – artillery officers (7), armour officers (6), and engineer officers (5).

Trade	Number of Participants
AERE	1
Armour Officer	6
Armoured Crewman	1
Artillery Officer	7
Artilleryman	4
Combat Engineer	3
Comms Researcher	1
Engineer Officer	5
Infantry Officer	19
Infantryman	3
Intelligence Operator	1
REME Officer	1
Signals Officer	4
Signals Operator	1
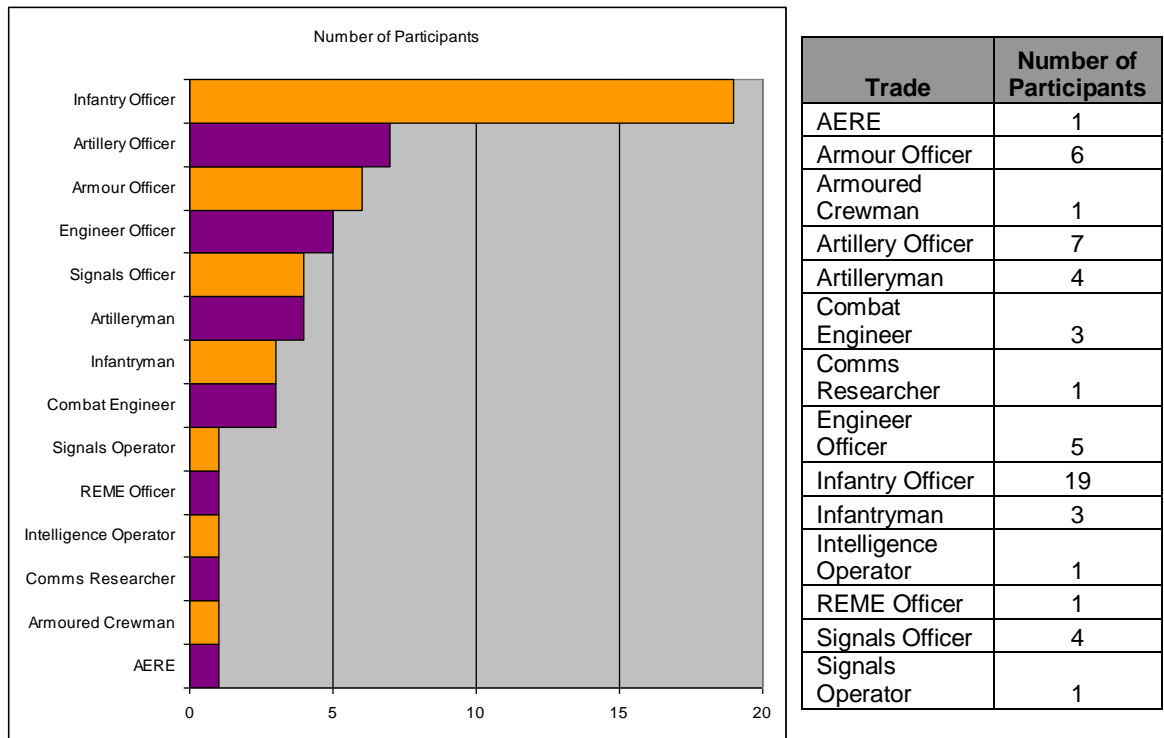
Figure B6: Breakdown of Experimental Sample by Trade

By rank, just under half of the sample were captains (28 out of 57), followed by majors (13), then warrant officers (10).

Number of Participants

Trade	Number of Participants
LCol	2
Major	13
Capt	28
MWO	3
WO	10
Sgt	1
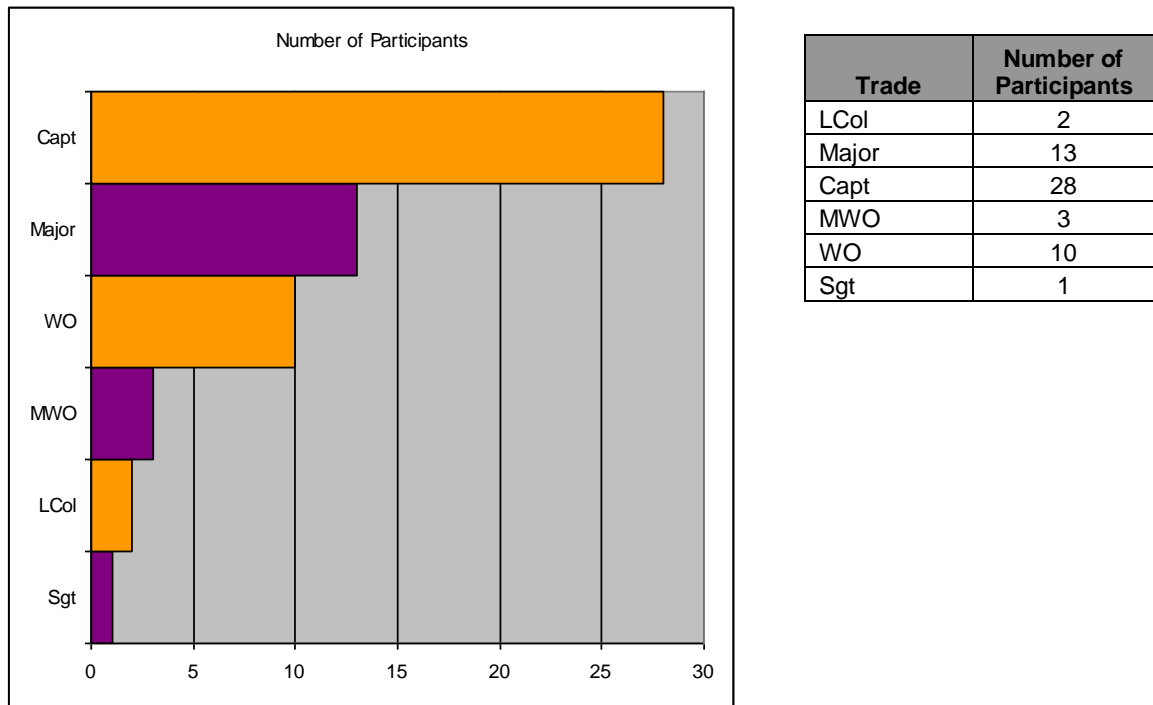
Figure B7: Breakdown of Experimental Sample by Rank

The longest serving participant had 37 years of service; the shortest serving had served for 4. On average participants had 19.2 years of service with a standard deviation of 8.7. The fewest months deployed by a participant were two while the highest was a staggering 96. The latter was a combat engineer warrant officer with 27 years of service, 25 of which was spent in an operational unit. While this seems quite high, given our most recent familiarity with operations in Afghanistan that range from five to 12 months or our previous experience with rotations to the former Yugoslavia that ranged from five to seven months, many of the soldiers 25 years of service or more had served in Germany, an operational deployment that saw families moved with the deploying soldier and often lasting several years. The average time on deployment was 17.2 months with a standard deviation of 14.5. Only one participant, a signals officer, had spent no time in an operational unit, while the most experienced from this perspective had spent 28 years in a front line organization. The average time in a line unit was 10.3 years with a standard deviation of 7.0.
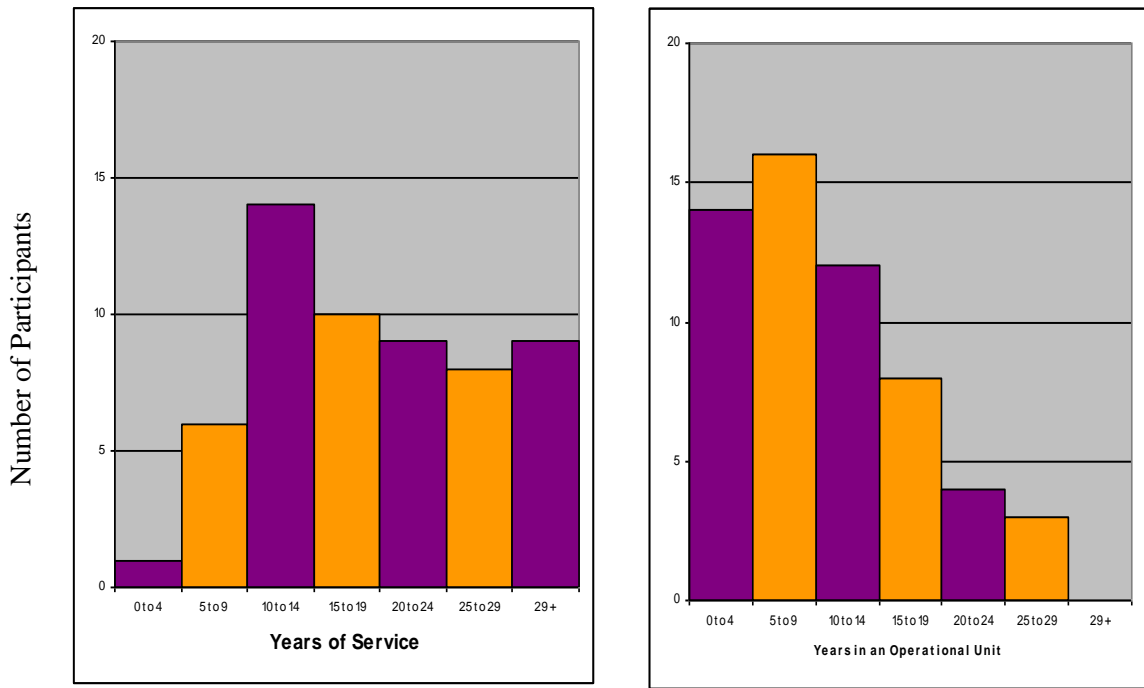
Figure B8: Participant Years of Service and Years in an Operational Unit
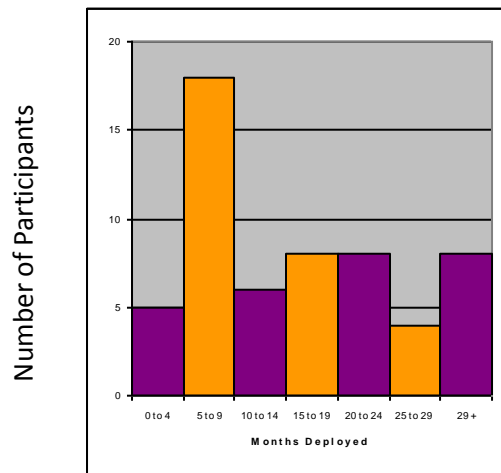
Figure B9: Participant Months Deployed

Participants were asked to select one of six ranges that described the number of patrol reports they had written and read. For reports written the minimal range was between zero and 10, with ranges increasing by tens until the maximum range of 50+. For reports read the minimum range was zero to 20, with subsequent ranges increasing by twenties until the maximum range of 100+. To determine an average number of reports written, the ranges were converted to scores between 0 and 5, with a score of zero allocated for those in the lowest range (zero to 10), one point for the next range (11 to 20), with scores increasing by one full point for each subsequent range, to a

maximum of 5 points (for those responses in the 50+ range). Similarly, to determine an average number of reports read, a ranges were converted to scores between 0 and ten. Those in the lowest range were scored as zero, those in the next range (21 to 40), were scored as two out of 10, with each subsequent range seeing a score increased by two points. The maximum range (100+) were scored as 10 / 10.

Converted Score	Reports Written	Number of Respondents
0	0 to 10	22
1	11 to 20	10
2	21 to 30	6
3	31 to 40	3
4	41 to 50	1
5	50+	15

Converted Score	Reports Read	Number of Respondents
0	0 to 20	20
2	21 to 40	6
4	41 to 60	11
6	61 to 80	3
8	81 to 100	2
10	100+	15
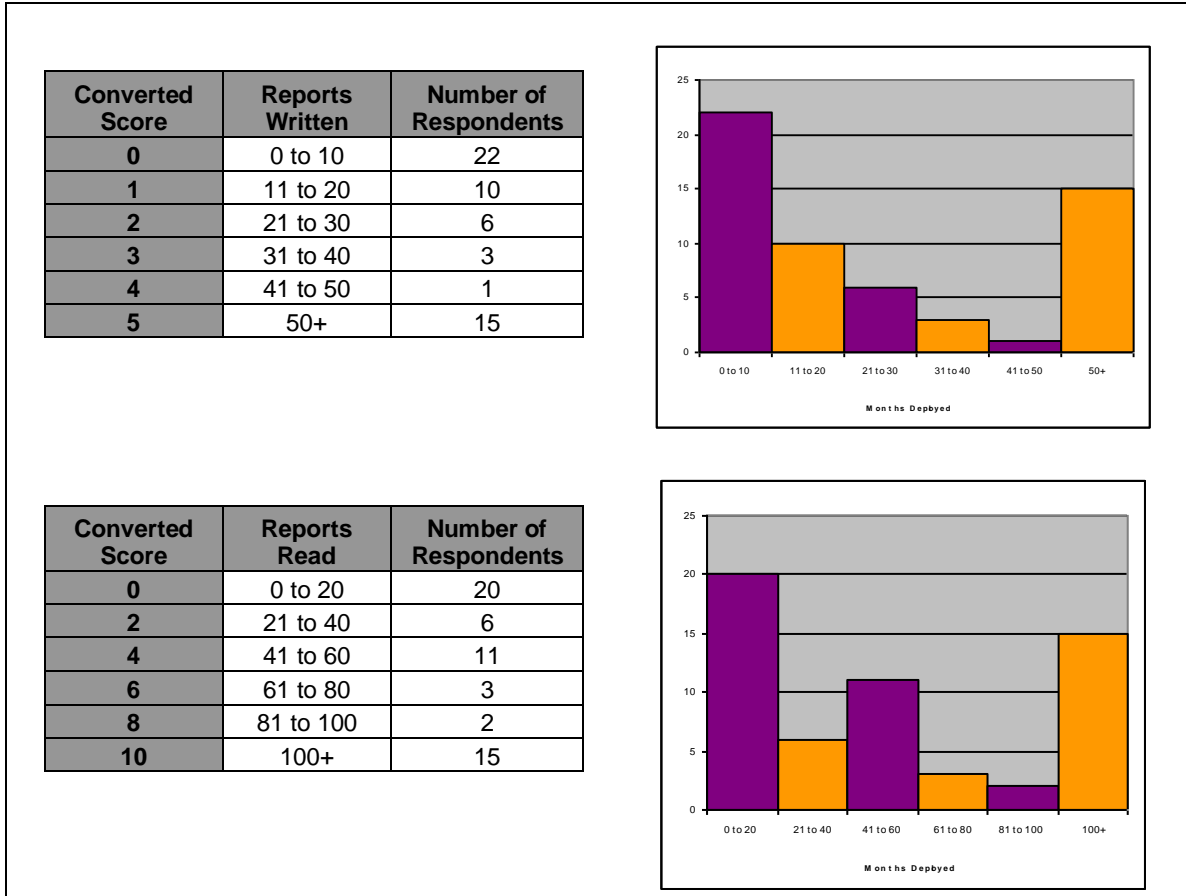
Figure B10: Participant Reports Written and Read

The average score for reports written was 1.9 / 5 with a standard deviation of 2.1, so on average participants had written toward the upper of limit of between 11 and 20 reports. The average score for reports read was 4.2 / 10 with a standard deviation of 4.1, so on average participants had read toward the lower limit of 41 to 60 reports.

The last three questions focused on whether the participants were familiar with some of the information that would be presented in the report. These questions asked whether or not a participant had knowledge of the military grid system, foreign weapons, and chemical, biological, nuclear and radiological defence (CBRN). All but one respondent expressed familiarity with the military grid system, though given the long service and extensive period on operations for this individual this was likely due to confusion about exactly what the question was asking rather than a lack of understanding with respect to navigation and mapping. 91% of respondents were familiar with foreign weapons. All participants expressed a baseline familiarity with CBRN.

This sample was randomly divided into two groups, designated as the blue and green groups respectively. It is interesting to examine what turned out to be a significant difference in terms of experience between the two groups. Examining the blue and green groups through the metrics in the background survey, the blue group appeared to have a substantial advantage going into the experiment. The blue group had 11% more years of service to the Crown (20.21 compared to 18.21 years). They had spent 44% more time deployed (20.39 months as opposed to 14.21 months) and 28% more time in an operational unit (11.61 compared to 9.10 years). The blue group had written 134% more patrol reports, read 49% more, and were more familiar with foreign weapons.

Table B1: Background Comparison of Blue and Green Groups

		Green Group	Green SD	Blue Group	Blue SD	Blue Percentage Improvement over Green	Green Percentage Improvement over Blue
P3	Years In	18.21	9.14	20.21	8.21	11%	-10%
P4	Months Deployed	14.21	10.75	20.39	17.17	44%	-30%
P5	Years in a Line Unit	9.10	7.04	11.61	6.80	28%	-22%
P6	Written Report Score	1.26	1.81	2.95	2.40	134%	-57%
P7	Read Reports Score	3.45	4.10	5.14	3.79	49%	-33%
P8	Military Grid Familiarity	97%	N/A	100%	N/A	4%	-3%
P9	Foreign Weapons Knowledge	86%	N/A	96%	N/A	12%	-11%
P10	CBRN Knowledge	100%	N/A	100%	N/A	0%	0%

This advantage appears substantial, but in the end, this appears to have made no difference as shown in the main body where the results for the two groups is virtually identical.

It is worth noting that two variables specific to the two samples were not included as part of the background survey, these being gender and linguistic profile. The former was identified as a potentially significant factor for any experimentation in social science by the RMC REB but was not included as the samples from these two organizations happened to consist of virtually exclusively male military personnel. While this is not wholly representative of the combat arm's leadership in Canada, women still represent an exceptionally small minority of this overall population. Within the regular force infantry in Canada there is a total of 23 female officers: three second-lieutenants, one lieutenant, fourteen of the infantry's 647 captains (2.2%) and five of the infantry's 305 majors (1.6%) are female, with zero women ranked lieutenant-colonel and above.[45]

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[45] From Directorate of Military Careers 3-5, Infantry Career Manager, this being the officer responsible for tracking and posting all infantry officers. Provided on 9 August 2013.

Table B2: Female Infantry Officers in the Canadian Army[46]

Rank	Total Both Genders	Total Female	Percentage Female
Captain	647	14	2.2%
Major	305	5	1.6%

For non-commissioned ranks there are a total of seven female recruits of the 490 total within the training system (as of Fall 2013), one trained female private out of two hundred, fifteen female corporals from a total of 2621, two female master corporals out of 747, two female sergeants out of 834, one female warrant officer out of 512 and zero master warrant officers or chief warrant officers, which number 150 and 36 respectively within the Princess Patricia's Canadian Light Infantry (PPCLI)[47] regiment.[48] Thus only three female soldiers within the PPCLI would meet the rank requirements of sergeant or above and represent only 0.14% of all Warrant Officer ranks within the infantry.[49] The following table breaks down the distribution of women across the various non-commissioned ranks. This is specific to the Princess Patricia's Canadian Light Infantry (PPCLI) but representative of the overall population of women in the infantry:

Table B3: Female Infantry Non-Commissioned Officers in the PPCLI[50]

Rank	Total Both Genders	Total Female	Percentage Female
Private (Basic)	490	7	1.43%
Private (Trained)	200	1	0.50%
Corporal	2621	15	0.57%
Master Corporal	747	2	0.27%
Sergeant	834	2	0.24%
Warrant Officer	512	1	0.20%
Master Warrant Officer	150	0	0%
Chief Warrant Officer	36	0	0%

Of the desired sample (Sergeants and Warrant Officers, Captain, Majors and Lieutenant Colonels), women represent only 0.78% of the infantry population.

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[46] Ibid.

[47] The PPCLI is one of the three regular force infantry regiments and thus consists of more or less one third of all regular infantry soldiers in Canada. Discussion with members of the other two regular regiments – the Royal Canadian Regiment (RCR) and the Royal 22nd Regiment (abbreviated R22eR, also known as the Vingt-Deux, often anglicized as the Van Doos) – confirmed a comparable distribution across all non-commissioned ranks.

[48] From the Directorate of Military Careers 3-5-3-3, the PPCLI Career Manager, this being the master warrant officer responsible for tracking and posting all PPCLI non-commissioned officers and members. Provided on 9 August 2013.

[49] Ibid. The total number of warrant officers, master warrant officers and chief warrant officers in the PPCLI is 698 of which only one is female thus the percentage of 0.14%. Discussion with the other infantry career managers and roughly a dozen officers from each of the R22eR and RCR indicated a similar make-up of female warrant officers in the other two regular infantry regiments.

[50] Ibid.

Since there were no female participants, there was no need to include a question identifying gender. A broader future study may want to determine if any of the effects are gender specific or dependent, specifically this may be of value in an experiment that studies low experience users such as the cadets at RMC where the population is more balanced. This said, any experiment that tried to specifically look at this variable with high experience users would be met with the significant challenge of trying to find a sufficiently sized sample of female combat arms leaders due to their low numbers and geographic dispersion.

The second variable, linguistic profile was also not included due to the make-up of the samples. While many of the participants were likely to be Francophone, both the AMS and DLR require a minimum English profile of BBB[51] and the *de facto* working language is English. Given the nature of the work performed in these two organizations it was considered safe to assume a sufficiently high level of competency in English that this variable should not be a factor. Furthermore, given that each participant is variably part of both the control and experimental group over the course of the experiment, any disadvantage would apply equally and effectively be cancelled out.

References Cited

MacKillop, Captain Mike. "Efforts, Grades and Satisfaction: An Analysis of the Fall Term for Applied Military Science Department." Originally written and presented as part of MDEM 513 Decision, Analysis, Probability and Statistics (RMC, February 2011). Internal document distributed as a reference for future program development for the LFTSP and ATWO in December 2011.

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[51] The public service uses a five point rating systems for second language reading, writing, and speaking skills with a score of X being the lowest, then ascending through A, B, then C levels to the highest leve of E for excempt. This minimum profile then indicates that all francophone members of DLR are functually proficient reading and writing in their second language. Technically this same minimum second language profile is a requirement for Anglophones, but is not as frequently achieved or necessary.

APPENDIX C
SITUATION BRIEF

OP PHANES is a multinational peace support operation.

The 1 PPCLI Battle Group, based out of the city of IERNUT, is responsible for a large area in the western province of CATINA, with Charlie Company tasked with maintaining security in the MIHESU and CEANU districts in partnership with the national police force.

These two districts are recent, arbitrary creations and are roughly divided by a newly improved roadway currently named simply ROUTE YELLOW.
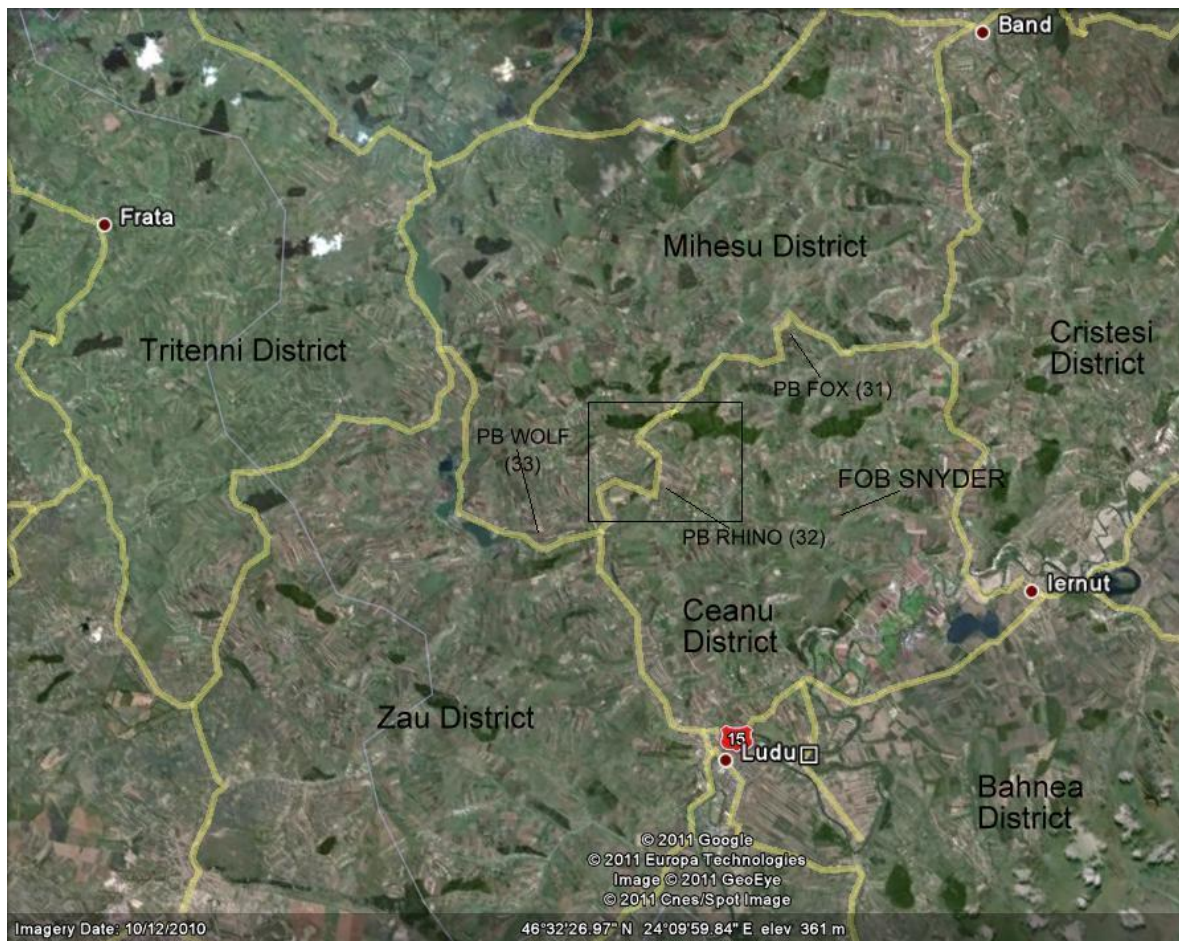
C Coy maintains four piece of tactical infrastructure: a Forward Operating Base (FOB SNYDER) and three patrol bases each manned by a mechanized platoon these being PBs FOX for C/S 31 (7 platoon), RHINO for 32 and WOLF for 33.

The population of both districts is generally neutral toward the coalition presence and while it takes issues with several of the national government's policies, specifically with regards to mineral rights, compensation for damage caused during the recent conflict and widespread corruption, these objections have generally been dealt with peacefully and even to some extent within the legal system that is slowly being seen as legitimate.

Part of this favourable attitude is due to successful government programs and an increasingly respected national police force; part is due to the increased security. Prior to a surge of international soldiers starting two years ago, these small towns and rural centres were generally of a secondary consideration as forces tended to be bogged down in and around the main cities of LUDU and IERNUT and in the more volatile neighbouring provinces to the south. These districts then became bastions that insurgent forces used to stage operations from.

While these districts still represent a significant area in terms of size alone, the presence of a fully-enabled mechanized combat team, numbering 270 with all attachments and substantial aerial observation platforms, in this area has transitioned it from an insurgent-control (if not aligned) territory into an area where aid moves relatively freely, government and NGO projects are having initial successes and the continued presence of foreign soldiers is seen by many as unnecessary given the relative security.

Improvised explosive devices (IEDs) have been encountered but these are generally assessed to be legacy munitions or the work of religious fundamentalists or foreign jihadists transiting from other areas, rather than any kind of local resistance and are thought to be viewed negatively by and receive little to no support from either district's Muslim minority.
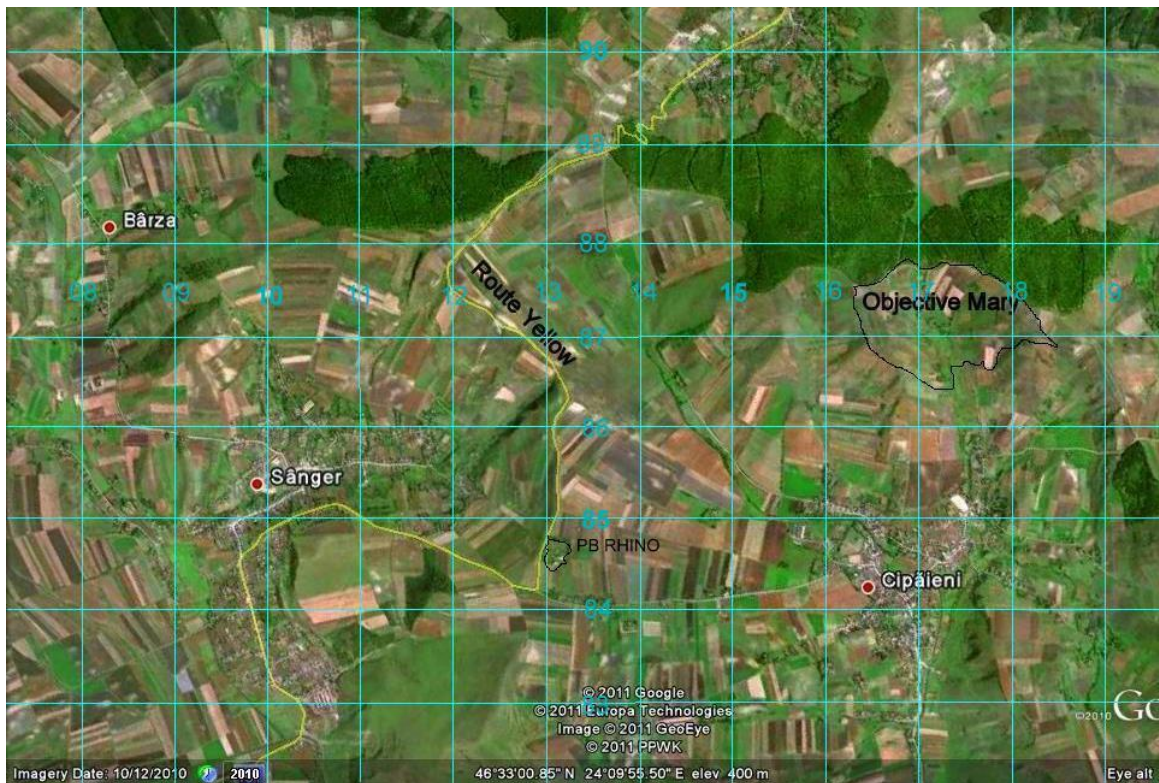
Eight Platoon (Call Sign 32) is based out of a well-established patrol base along ROUTE YELLOW and is primarily responsible for maintaining coalition and local national freedom of movement along one of the provinces main west-east routes, as well as maintaining relations with the main population centres of SANGER, BARZA and CIPAIENI in partnership with the national police force elements in the area, primarily based out of SANGER. 32 has established good relationships with several reliable sources in the area, one of which has indicated that there is a possible IED in one of the culverts along ROUTE YELLOW. C/S 32 has had 14 finds two

months into its tour based mostly on tips like this but has had one strike, luckily with no serious casualties.

In addition to 8 Platoon, PB Rhino houses two sections of engineers from 1 Troop, B Squadron, a CIMIC detachment, several contracted dog teams and interpreters, and a HUMINT detachment. A detachment from Recce Platoon (62A) is currently attached to 8 Platoon to assist with the definition of OBJECTIVE MARY.

With the exception of the single engagement of an Alpha Company (BAHNEA DISTRICT) patrol early on, no elements of the Battle Group have been in a direct fire engagement and no tactical infrastructure has been targeted, though US forces operating in the eastern provinces have been targeted, ranging from intermittent small arms fire against dismounted patrols to a recent mortar attack on an austere patrol base.

Assessment of the insurgent threat, specific to C Coy, is as follows:
- **Size**: generally work in small elements, rarely larger than detachment to section size.
- **Activity**: outside elements have been known to harass the population or local government officials, have attempted to emplace IEDs, primarily along roadways and are involved in drug trade and other criminal activities.
- **Location**: There are no current know locations.
- **Uniform**: No distinguishing features or markings.
- **Time**: Not applicable.
- **Equipment**: Have the capability to build IEDs of sufficient explosive power to penetrate light armoured vehicles, likely carry small concealable arms for protection when moving into area, most probably pistols, possibly rifles.
- **Habits**: Generally move in from surrounding area by vehicle, emplace device, maintain observation until detonated or compromised, then withdraw. Unlikely to engage kinetically or to maintain permanent presence due to the large number of coalition and government soldiers.
- **Intent**: Attempt to erode public support for government, coalition or CF through intimidate and violence. Most likely course of action: continued use of deliberately placed IEDs along main routes; most dangerous course of action: targeting of tactical infrastructure with light indirect fires.
- **Morale**: Unknown.

While there are substantial legacy minefields in other parts of the country, the few that exist within C Coy's AO are well-defined and marked. There have been no incidents involving toxic industrial chemicals (TICs), is no known CBRN threat and as the use of such weapons is considered extremely unlikely, MOPP is 0.

Officer Commanding Charlie Company's (C/S 39er's) intent is to continue to expand partnered coalition presence into the more isolated and rural areas. OBJECTIVE MARY is one of six pockets within the Company's Area of Operations that was selected as a likely candidate for such a mission.

APPENDIX D
CONTROL TEMPLATE
SCENARIO 1[52]

You are the Officer Commanding, Charlie Company (39er). Your 8 Platoon commander has submitted the following eight hours after return from his patrol. Following review by 39C it has been handed over to you for your assessment.

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[52] Images have been adjusted to conform to RMC graduate thesis guidelines with respect to layout and margins.

PATROL REPORT

A.   Call Sign: 32

B.   Patrol Leader: Captain Smith (8 Platoon Commander)

C.   Patrol Size: 26

D.   Composition of Patrol: Two rifle sections (32A and 32B), elements of platoon headquarters and the weapons detachment, one medic, one interpreter, four engineers

E.   Task / Mission: 32 will SECURE the area in and around the suspected improvised explosive device at Grid 1211 8723 no later than 12 1600 June 2014 to determine if exploitation or destruction is required by CIED. HUMINT claimed that reliable source was reporting the emplacing of a device in a specific culvert along ROUTE YELLOW.

Situation: Reliable source indicated the existence of an improvised explosive device in a culvert [Picture 1]. Time of emplacement unknown. Improvised explosive devices have been encountered relatively frequently over the past two months, but these are generally assessed to be legacy munitions or the work of religious fundamentals or foreign jihadists transiting from other areas, rather than any kind of local resistance and are thought to be viewed negatively by and receive little to no support from either district's Muslim minority.

Execution:
Intent: 32 will establish a secure perimeter around the site blocking traffic from both directions, prior to search and exploitation by engineer elements with intimate security from platoon headquarters.

Scheme of Manoeuvre: 32 will depart current location through the west gate, skirt ROUTE YELLOW via the fields on the west side and cross after the ridgeline where the road turns toward the northwest. From here, the patrol will push well north before hooking back toward the southwest to establish an objective rendez-vous (OR) on the eastside of the road. Once secure, sections will be dispatched with one section (A) north of the threat area and two section (B) south. Once these elements are set the engineers with headquarters will conduct a search of the area. If a device is found, it will be called in and the cordon will be maintained until CIED arrives on location. If no device is found, the patrol will collapse back to the ORV then move south, hand-railing ROUTE YELLOW on the east side, to enter the patrol base through the east gate.

Main Effort: Destruction of any IED within the objective area.

End State: Back in PB RHINO to continue with tasks as per the patrol matrix.

Secondary task given mid-patrol via radio from 39er was to determine the feasibility of the west to east approaches to OBJECT MARY centered on grid 173 873.

F.   Departure Date Time Group: 12 0600 June 2014 from PB RHINO.

G.   Return Date Time Group: 13 1900 June 2014 to PB RHINO.

H.   Routes In and Out: Departed from the west gate of PB Rhino. Skirted ROUTE YELLOW via the fields of the west side. Cross just after the turn at GR 1291 8691 and continued north until the 878 northing to avoid observation from the farmhouses located at GR 124 874 before swinging south to approach the suspected IED area from the fields to the north.

We established an ORV just NE in some low ground at GR 1221 8771. Density of this strip of foliage between unharvested fields allowed for undisturbed observation from a hastily established vantage point for approximately two hours. UAV observations from the previous 24 hours saw multiple vehicles cross over the suspected area so pressure plate was not considered likely mechanism. We established a vantage point to try to determine likely firing position and observe pattern of life. This was maintained for approximately two hours. During this time seventeen vehicles including four cars, ten motor cycles and three pick-up truck crossed the suspected location, as well as six local nationals on bicycles and four on foot (in two groups of two).

Collapsed VP, had established security with one section blocking the road from the north and two section blocking from the south, taking platoon headquarters and engineer assets to investigate the site once the sections were set. Suspected site was on small secondary roadway, just off of ROUTE YELLOW to the SW. After thorough investigation it was determined that the culvert was empty [Pictures 2 and 3], there was no indication of disturbed earth on the road for one hundred meters in either direction and nothing found twenty meters in from either side of the road. Conducted search of surrounding area and determined that there are several positions where covert observation could be maintained on the location and used as firing points, none had any indication of recent use.

This was reported back to C/S 3 and the patrol was redirected to determine feasibility of a west to east approach on OBJECTIVE MARY. We moved off the suspected IED location, after speaking with the driver of the only truck that was stopped by either section during the two hours spent on the road, and moved east, before conducting a long halt at GR 138 878, near the abandoned barn where C/S 31A had maintained an OP last week. 32A investigated the area around the barn and no indicators of any recent activity in the area [4].

At 1400hrs, we started following a generally easterly path snaking toward the 15 easting, then turned south roughly along that easting for 1500 meters. What appears as a darkened green path between the 14 and 15 easting between the 855 and 875 northings is in fact a stream [5]. With steep, rocky banks on both sides that rise as far as five feet and a depth over -head height, this is a significant obstacle [6 and 7]. The fields on either side are relatively open [8] and pose no obstruction to dismounted movement and are suitable for vehicle movement as far as 159 easting with the exception of the river. The area west of OBJ MARY is a substantial swamp [45 and 46]. Dismounted movement is difficult and anything less than tracked vehicles will quickly get bogged down. The

heavy wooded areas to the north are passable by dismounted soldiers but consist of thick trees that may impede vehicle movement [47 and 48].

We continued to cloverleaf the objective area moving east. We set-up a series of observation positions (32A looking northeast, 32B northwest, HQ south) on a high feature at GR 169858 to get further definition of the westerly approaches, to try to get eyes on to the objective area itself and to determine traffic patterns between OBJ MARY and the nearby town of CIPAIENI. Plan was to maintain observation until around midnight, then return to PB under cover of darkness.

At approximately 1930hrs, HQ OP observed what appeared to be an oddly shaped metal object in a barn located at GR 1681 8276 [9]. Further observation indicated that the barn warranted closer observation. The HQ and 32A OPs were collapsed with 32B remaining on the high feature, now positioned in overwatch. While there was significant Pattern of Life observed in the surrounding area two hours prior to collapse, mostly farming and moving from distant residences to fields or benign traffic north and south along the foot trails, nothing was observed in or around this barn.

32A established security, while HQ including the engineers investigated. We were able to clearly see the muzzle of a weapon inside the building and decided this was sufficient grounds to cut the lock using a set of bolt-cutters and enter the barn. Inside we found an AK 47[16] and 74 [17], an RPK [18], a Dragonov [19] sniper rifle and the bipod [20] for a medium mortar, as well as several military-style packaging boxes that contained cans of food and some bottles of water and alcohol [14 and 15].

We informed C/S 3 and were told to secure this position overnight for handover to the national police force some time the following morning. We were also granted authority to search the surrounding buildings which included a small residence and another barn. Nothing was found in either location and no persons were in the residence or seen in the area [10].

Shortly after first light, 32B noticed significant movement in the adjacent fields to the west [11]. A farmer was unloading a large number of boxes from a pick-up truck into a barn. Half of 32A remained with the cache in the barn while the other half of 32A and HQ moved to the adjacent fields. We managed to surprise the farmer in the barn and conducted a search of his vehicle. The boxes that he was moving consisted of large quantities of canned or preserved food and water. Inside this barn (GR 1692 8219) [12], we found an even larger cache [21] consisting of 10 AK 47 [22-31] variants. In the basement of the house next to the barn (the two appear as a single image on the map) [13], we found two pistols in a bedroom [32 and 33] and a heavy machine gun with mount (DShK) [34-39] in the basement under some blankets. Oddly, the only ammunition found in either cache was a few boxes of pistol and shotgun ammunition.

The individual provided no name and refused to answer any of our questions so was detained at 0850hrs [44].

At 1025hrs, a platoon of national police arrived in military transport trucks. We handed over all weapons seized as well as the detainee. The detachment commander, Captain Alexandru Vladimerscu, advised that he intended to remain on the site for a more detailed search of these buildings and the rest of the area.

From here we skirted the north side of CIPAIENI, crossed the river at roughly the 15 easting, then moved SW to enter PB RHINO through the east gate.

I.   Terrain: The route taken from the IED site to OBJECTIVE MARY is relatively flat with open fields and copses of trees ranging from small and thin to quite dense along the ridgeline that rises northwest from SANGER. There are several possible routes from the IED site to as far as the 159 easting that are sufficiently flat and open to allow for B vehicle traffic, with the exception of the river. The banks on the north side of both rivers are quite steep and while they may be traversable by tracked vehicles, engineering assets would be require for any other mounted force.

The long grasses and high growth of all of the crops provides good cover while on the move and for establishing positions of observation but could be used to cache materials in the fields with almost no chance of finding it unless either a thorough search is conducted of that specific field or unless we wait until after the harvest expected early next month. Though there were reports that marijuana crops are being grown in the area, none were observed. Most fields were growing grapes or grains [49 and 50].

J.   Info Enemy: Nothing additional to report.

K.   Map Corrections: Several areas that appear as open terrain are actually deep swamps, specifically the area west of OBJECTIVE MARY. This area represents a significant obstacle to mounted or dismounted movement.

What appears as trees on the current issue of the map along the 87 northing between the 14 and 15 easting has recently been cut-down [51 and 52].

L.   Misc Info: While conducting a search of the area where the DShK was found, one member of the patrol, Cpl Johnson knocked over a jar containing an unknown substance. He remembered getting some spilled on his armpit but did not notice anything immediately and thought nothing of it. Shortly after he returned to camp he noticed a blistering rash that he originally attributed to heat or chaffing [40-43]. When it became more painful he went to the medics and was told that this was some sort of nerve rash, at which point he remember the jar of liquid he came into contact with. The injury is currently being investigated further by the medics.

M.   Result of Enemy Encounters: While moving back toward ROUTE RED we came across what is assessed to be a possible OP at GR 1371 8490 oriented west [no imagery available]. There are several recently dug holes dug into and beside some stone ruins, as well as obvious cuts to the original materials to observe the main road on the west side

of CIPAIENI. Food garbage was found hastily buried next to one of the observation windows as well as numerous cigarette butts pushed into the dirt.

N.   Condition of Patrol: Cpl Johnson is with the medics for further investigation. No issue with the remainder of the platoon.

O.   Support Received / Required: The national police dispatched a platoon from their station in SANGER to seize the weapons that we had found. At the main cache we handed over the ten AKs found in the shed and the DShk and mount and pistols found in the house. At the original find, the one secured by one section, we handed over two AK variants, an RPK, the dragonov (sniper rifle) and the mortar mount.

P.   Communications: No issues with own equipment, communications with PB RHINO were maintained and loud and clear throughout. No communications were intercepted via the interpretter's radio.

Q.   Friendly / Neutrals: Nil

R.   Conclusions / Recommendations: Follow-up action should be taken reference the unknown substance that caused Cpl Johnson's injuries. This should include further exploitation of the source site, including an assessment by subject matter experts.

Significant weapons caches likely mean that insurgent leadership intends to move fighters back into the area at some time. Based on the recently used observation post it is likely that there are already sympathizers or reconnaissance elements in the area of operations at this point in time.

Western and northern approaches are not optimal for mounted, less armoured, movement toward OBJECTIVE MARY without engineering assets and pronounced damage to local infrastructure.

<u>PICTURES</u>

1

2

3

4

7

8

9

10

11 viewed from NW

12 viewed from south

13 [not visible in other two pictures]

14

15

16

Chinese 56
56-1 27092509

17

AK 74
86 02 7284

18

RPK
1974K3-1248

19

Dragonov

Serial Number

20

Mortar Bipod

21

22

86027284

61P3951

80 1E 1214

25

69N 2102

26

62 A 239

ZG 2887

ZG 2739

1L2817

30

ML 2581

31

T48195

32

Star on handguard, B661 1941

33

A9 5218

34

DsHK

35

290467 300339

38

39

40

41

42

43
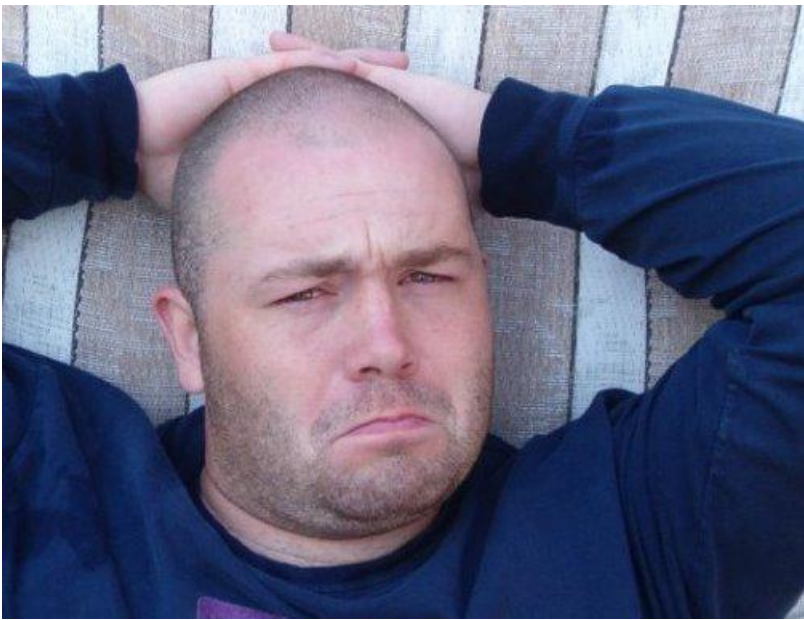
44

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50

51

52

Route Card

Start GR	End GR	Bearing	Straight-line Distance	Comment
1302 8475	1265 8482	5200	350	Depart PB
1265 8482	1295 8780	0200	2900	Turn North
1295 8780	1221 8771	5100	750	ORV
1261 8723	1299 8759	0400	450	Departed from 2 Sect Block
1299 8759	1338 8739	2500	400	Nil
1338 8739	1380 8760	0700	700	Long Halt
1380 8760	1472 8771	1500	1000	Nil
1472 8771	1484 8579	3000	1900	Nil
1484 8579	1569 8577	1600	900	Nil
1569 8577	1621 8607	0900	700	Nil
1621 8607	1611 8761	0200	1500	From hear began cloverleaf of objective along its southern boundary until the 1805 easting
1805 8652	1690 8580	4200	1300	OP Location
1690 8580	1681 8576	6400	300	First Cache
1692 8219	1606 8564	5600	900	First Leg Route Back (39C COMMENT GRID SHOULD READ 1692 8519)
1606 8564	1550 8561	4800	500	Old Treeline
1550 8561	1548 8534	6400	300	Start skirt road
1548 8534	1495 8551	5200	600	Crossed river
1495 8551	1371 8490	4300	1200	Suspected OP
1371 8490	1328 8471	4100	700	East gate

AREA MAP

OBJECTIVE MAP
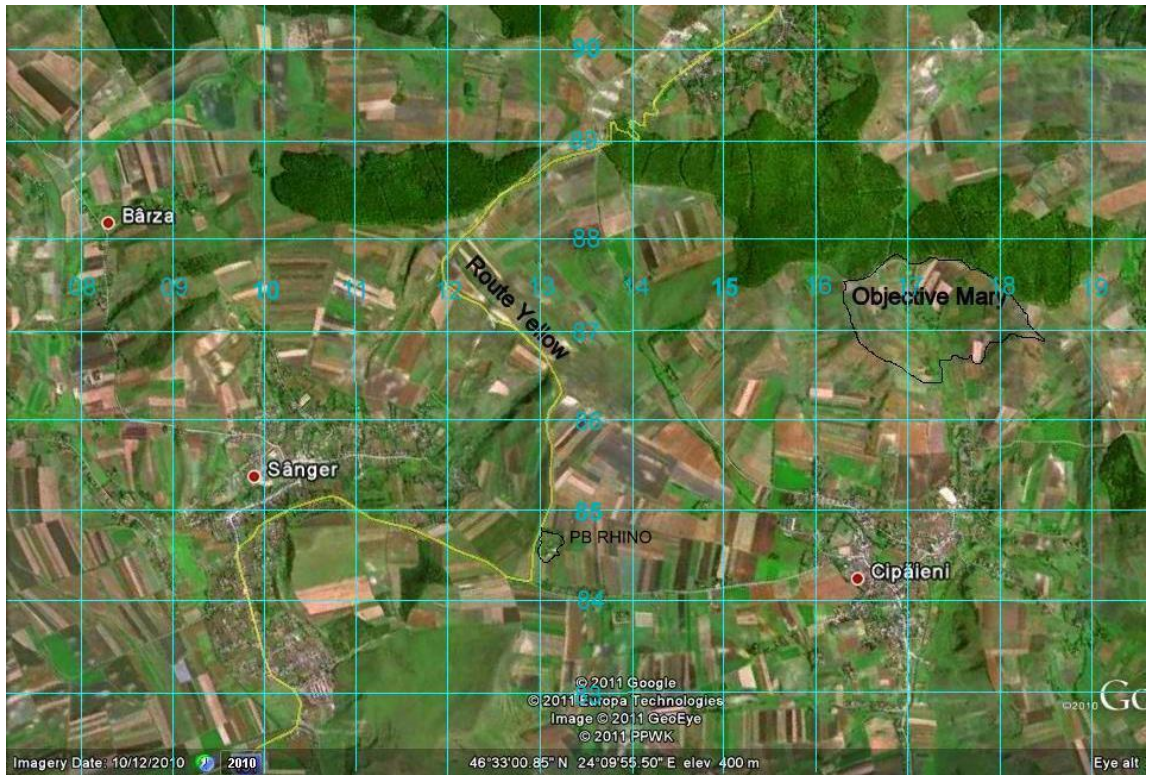
APPENDIX E
EXPERIMENTAL TEMPLATE
SCENARIO 2[53]

You are the Officer Commanding, Charlie Company (39er). Your 8 Platoon commander has submitted the following eight hours after return from his patrol. Following review by 39C it has been handed over to you for your assessment.

---

[53] Images have been adjusted to conform to RMC graduate thesis guidelines with respect to layout and margins.

PATROL REPORT

GENERAL INFORMATION

Mission Information

Situation: Reliable source indicated the existence of an improvised explosive device in a culvert. Time of emplacement unknown. Improvised explosive devices have been encountered relatively frequently over the past two months, but these are generally assessed to be legacy munitions or the work of religious fundamentals or foreign jihadists transiting from other areas, rather than any kind of local resistance and are thought to be viewed negatively by and receive little to no support from either district's Muslim minority.

Call Sign: 32 / Patrol Leader: Capt Smith / Size: 26

Organization: Two rifle sections (32A and 32B), elements of C/S 32 platoon headquarters and the weapons detachment, one medic, one interpreter, four engineers.

Mission: 32 will SECURE the area in and around the suspected improvised explosive device at Grid 1211 8753 no later than 12 1600 January 2011 to determine if exploitation or destruction is required by CIED.

Intent: 32 will establish a secure perimeter around the site blocking traffic from both directions, prior to search and exploitation by engineer elements with intimate security from platoon headquarters.

Scheme of Manoeuvre: 32 will depart current location through the west gate, skirt ROUTE YELLOW via the fields on the west side and cross after the ridgeline where the road turns toward the northwest. From here, the patrol will push well north before hooking back toward the southwest to establish an objective rendez-vous (ORV) on the eastside of the road. Once secure, sections will be dispatched with one section (A) north of the threat area and two section (B) south. Once these elements are set the engineers with headquarters will conduct a search of the area. If a device is found, it will be called in and the cordon will be maintained until CIED arrives on location. If no device is found, the patrol will collapse back to the ORV then move south, hand-railing ROUTE YELLOW on the east side, to enter through the east gate.

Main Effort: Destruction of any IED within the objective area.

End State: Back in PB RHINO to continue with tasks as per the patrol matrix.

39C Note: DTG for Mission should read 12 1600 June 2014, not 12 1600 January 2011.

Suspected emplacement location IVO
GR 1211 8723

SEQUENCE OF EVENTS

Departure Date Time Group: 12 0600 June 2011 from PB RHINO.

Return Date Time Group: 13 1900 June 2011 to PB RHINO.

	Departed from the west gate of PB Rhino.
	Skirted ROUTE YELLOW via the fields of the west side.
	Cross just after the turn at GR 1291 8691 and continued north until the 878 northing
	Avoided observation from the farmhouses located at GR 124 874
	Swinging south to approach the suspected IED area from the fields to the north.
	We established an ORV just NE in some low ground at GR 1221 8771.

Density of this strip of foliage between unharvested fields allowed for undisturbed observation from a hastily established vantage point for approximately two hours. UAV observations from the previous 24 hours saw multiple vehicles cross over the suspected area so pressure plate was not considered likely mechanism.

We established a vantage point to try to determine likely firing position and observe pattern of life.

This was maintained for approximately two hours.

During this time seventeen vehicles including four cars, ten motor cycles and three pick-up truck crossed the suspected location, as well as six local nationals on bicycles and four on foot (in two groups of two).

Collapsed VP

Had established security with one section blocking the road from the north and two section blocking from the south, taking platoon headquarters and engineer assets to

Site was just SW of Route Yellow on a small secondary road that intersects it

After thorough investigation it was determined that the culvert was empty

There was no indication of disturbed earth on the road for one hundred meters in either direction

Nothing found twenty meters in from either side of the road.

Conducted search of surrounding area

Determined that there are several positions where covert observation could be maintained on the location and used as firing points

None had any indication of recent use.

Secondary task given mid-patrol via radio from 39er was to determine the feasibility of the west to east approaches to OBJECT MARY centered on grid 173 873.

We moved off the suspected IED location, after speaking with the driver of the only truck that was stopped by either section during the two hours spent on the road

Starting from 2 Section's Blocking Position, moved east, before conducting a long halt at GR 138 878

Near the abandoned barn where C/S 31A had maintained an OP last week.

32A investigated the area around the barn and **no indicators of any recent activity in the area**.

Route Yellow

At 1400hrs, we started following a generally easterly path snaking toward the 15 easting,
Then turned south roughly along that easting for 1500 meters.
What appears as a darkened green path between the 14 and 15 easting between the 855 and 875 northings is in fact a stream.

With steep, rocky banks on both sides that rise as far as five feet and a depth over -head height. is a significant obstacle.

The fields on either side of the river are relatively open

Pose no obstruction to dismounted movement and are suitable for vehicle movement

As far as 159 easting with the exception of the river.

The area **west** of OBJ MARY is a substantial swamp
Dismounted movement is difficult and anything less than tracked vehicles will quickly get bogged down.

The heavy wooded areas to the **north** are passable by dismounted soldiers
But consist of thick trees that may impede vehicle movement

We continued to cloverleaf the objective area moving east.
We set-up a series of observation positions (32A looking northeast, 32B northwest, HQ south) on a high feature at GR 169858 to get further definition of the westerly approaches, to try to get eyes on to the objective area itself and to determine traffic patterns between OBJ MARY and the nearby town of CIPAIENI.

Plan was to maintain observation until around midnight, then return to PB under cover of darkness.

At approximately 1930hrs, HQ OP observed what appeared to be an oddly shaped metal object in a barn located at GR 1681 8576

Further observation indicated that the barn warranted closer observation.

The HQ and 32A OPs were collapsed with 32B remaining on the high feature, now positioned in overwatch.

While there was significant Pattern of Life observed in the surrounding area two hours prior to collapse, mostly farming and moving from distant residences to fields or benign traffic north and south along the foot trails

Chinese 56
56-1 27092509

AK 74
86 02 7284

RPK
1974K3-1248

32A established security, while HQ including the engineers investigated.

We were able to clearly see the muzzle of a weapon inside the building and decided this was sufficient grounds to cut the lock using a set of bolt-cutters and enter the barn. Inside we found

An AK 47 and 74

An RPK

A Dragonov sniper rifle

The bipod for a medium mortar

Dragonov

Mortar

GR 1681 8576

As well several military-style packaging boxes that contained cans of food and some bottles of water and alcohol

We informed C/S 3 and were told to secure this position overnight for handover to the national police force some time the following morning.

We were also granted authority to search the surrounding buildings which included a small residence and another barn.

Nothing was found in either location and no persons were in the residence or seen in the area.

Shortly after first light, 32B noticed significant movement in the adjacent fields to the west

A farmer was unloading a large number of boxes from a pick-up truck into a barn. Half of 32A remained with the cache in the barn while the other half of 32A and HQ moved to the adjacent fields. We managed to surprise the farmer in the barn and conducted a search of his vehicle. The boxes that he was moving consisted of large quantities of canned or preserved food and water.

Viewed from NW

Inside this barn (**GR 1692 8219, viewed from south**), we found an even larger cache consisting of 10 AK 47.

86027284

61P3951

80 1E 1214

69N 2102

62 A 239

ZG 2887

ZG 2739

1L2817

ML 2581

T48195

39B COMMENT: Grid should read 1692 8519

In the basement of the house next to the barn [not visible in other two pictures] (the two appear as a single image on the map)

We found two pistols in a bedroom

And a heavy machine gun with mount (DShK) in the basement under some blankets.

Oddly, the only ammunition found in either cache was a few boxes of pistol and shotgun ammunition.
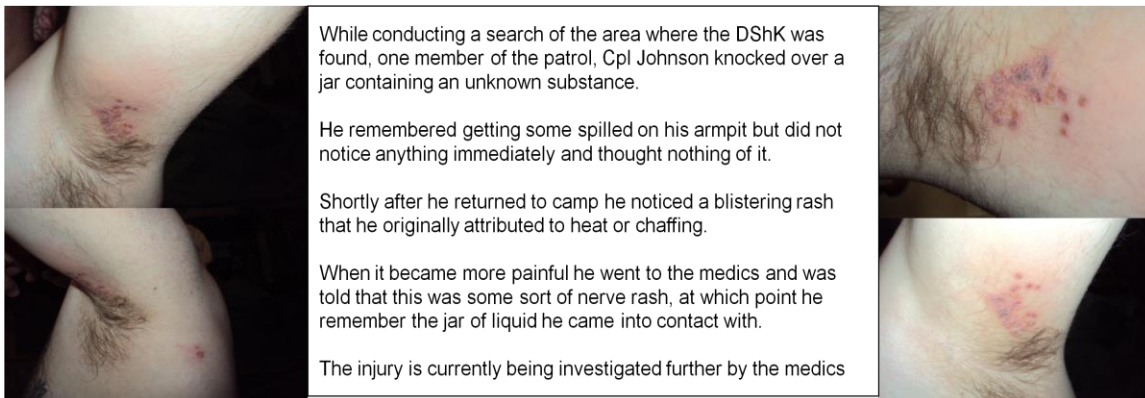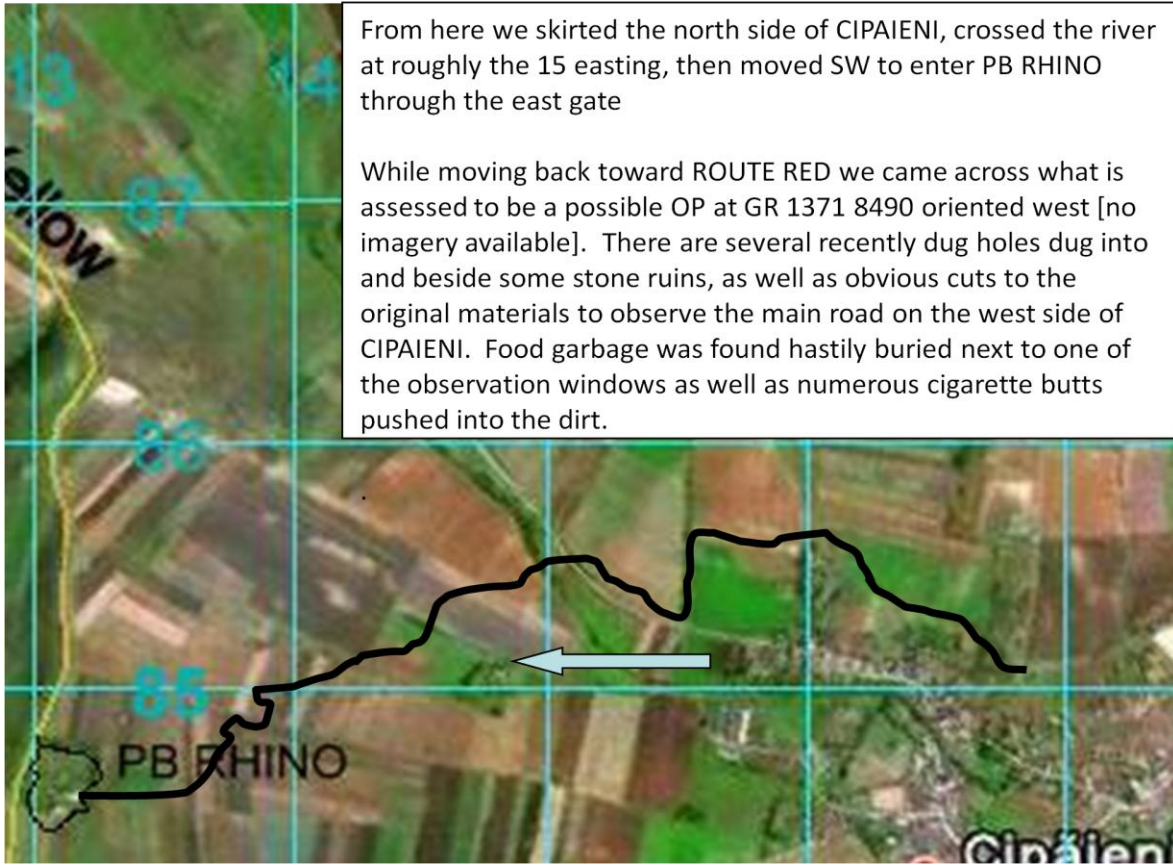
Star on handguard, B661 1941

A9 5218

290467 300339

The individual provided no name and refused to answer any of our questions so was detained at 0850hrs.

While conducting a search of the area where the DShK was found, one member of the patrol, Cpl Johnson knocked over a jar containing an unknown substance.

He remembered getting some spilled on his armpit but did not notice anything immediately and thought nothing of it.

Shortly after he returned to camp he noticed a blistering rash that he originally attributed to heat or chaffing.

When it became more painful he went to the medics and was told that this was some sort of nerve rash, at which point he remember the jar of liquid he came into contact with.

The injury is currently being investigated further by the medics

.

At 1025hrs, a platoon of national police arrived in military transport trucks. We handed over all weapons seized as well as the detainee. The detachment commander, Captain Alexandru Vladimerscu, advised that he intended to remain on the site for a more detailed search of these buildings and the rest of the area

The national police dispatched a platoon from their station in SANGER to seize the weapons that we had found. At the main cache we handed over the ten AKs found in the shed and the DShk and mount and pistols found in the house. At the original find, the one secured by one section, we handed over two AK variants, an RPK, the dragonov (sniper rifle) and the mortar mount.

From here we skirted the north side of CIPAIENI, crossed the river at roughly the 15 easting, then moved SW to enter PB RHINO through the east gate

While moving back toward ROUTE RED we came across what is assessed to be a possible OP at GR 1371 8490 oriented west [no imagery available]. There are several recently dug holes dug into and beside some stone ruins, as well as obvious cuts to the original materials to observe the main road on the west side of CIPAIENI. Food garbage was found hastily buried next to one of the observation windows as well as numerous cigarette butts pushed into the dirt.
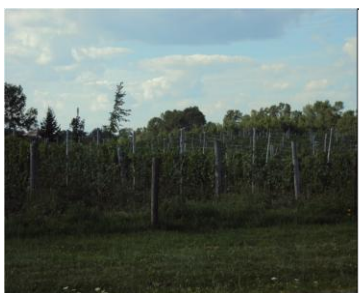
PB RHINO

GENERAL OBSERVATIONS

Communications: No issues with own equipment, communications with PB RHINO were maintained and loud and clear throughout. No communications were intercepted via the interpretter's radio.

Terrain: The route taken from the IED site to OBJECTIVE MARY is relatively flat with open fields and copses of trees ranging from small and thin to quite dense along the ridgeline that rises northwest from SANGER. There are several possible routes from the IED site to as far as the 159 easting that are sufficiently flat and open to allow for B vehicle traffic, with the exception of the river. The banks on the north side of both rivers are quite steep and while they may be traversable by tracked vehicles, engineering assets would be require for any other mounted force.

Several areas that appear as open terrain are actually deep swamps, specifically the area west of OBJECTIVE MARY. This area represents a significant obstacle to mounted or dismounted movement.

The long grasses and high growth of all of the crops provides good cover while on the move and for establishing positions of observation but could be used to cache materials in the fields with almost no chance of finding it unless either a thorough search is conducted of that specific field or unless we wait until after the harvest expected early next month. Though there were reports that marijuana crops are being grown in the area, none were observed.

Most fields were growing grapes or grains.

What appears as trees on the current issue of the map along the 87 northing between the 14 and 15 easting has recently been cut-down

COMMANDER'S ASSESSMENT AND RECOMMENDATIONS

Follow-up action should be taken reference the unknown substance that caused Cpl Johnson's injuries. This should include further exploitation of the source site, including an assessment by subject matter experts.

Significant weapons caches likely mean that insurgent leadership intends to move fighters back into the area at some time. Based on the recently used observation post it is likely that there are already sympathizers or reconnaissance elements in the area of operations at this point in time.

Western and northern approaches are not optimal for mounted, less armoured, movement toward OBJECTIVE MARY without engineering assets and pronounced damage to local infrastructure.

REPORT ENDS

AREA MAP

APPENDIX F
CONTROL TEMPLATE
SCENARIO 2[54]

You are the Battle Group Intelligence Officer (S2). As requested, one of your analysts has forwarded you this report out of Charlie Company.

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[54] Images have been adjusted to conform to RMC graduate thesis guidelines with respect to layout and margins.

PATROL REPORT

A.   Call Sign: E21B

B.   Patrol Leader: Sgt D. Turner (2 Section Commander, 1 Troop)

C.   Patrol Size: 13

D.   Composition of Patrol: 2 Section Complete, one det from Recce Platoon (62A), and one interpreter.

E.   Task / Mission: E21B will DEFINE the dismounted and mounted approaches in the wooded area north of OBJECTIVE MARY no later than 18 Jun 2014 as part of the options analysis for future C/S 3 operations.

Situation: Officer Commanding Charlie Company's (C/S 39er's) intent is to continue to expand partnered coalition presence into the more isolated and rural areas. OBJECTIVE MARY is one of six pockets within the Company's Area of Operations that was selected as a likely candidate for such a mission

From 39: "The wooded areas north of the objective area are likely avenues for a friendly dismounted approach for this operation. Alternatively these will likely require cut-off elements to ensure containment if the approach ends up being from another direction. Regardless these tracks require further definition in terms of utility for dismounted and potentially mounted movement, including vehicle extraction of potential casualties. Assessment is required on optimal cut-off positions, potential areas where belligerent elements may attempt to place IEDs or ambush, any necessary clearance or reinforcement, along with an assessment of any obstacles such as steep incline or declines, water, etc., distance from the objective that a force remains in depth to observation from the objective, and any other observations that would affect planning for this operation."

Patrol Report by C/S 32 on 12 – 13 June assessed the north-south water feature to the west of the objective and the woods to the north as follows: "darkened green path between the 14 and 15 easting between the 855 and 875 northings is in fact a stream. With steep, rocky banks on both sides that rise as far as five feet and a depth over -head height, this is a significant obstacle. The fields on either side are relatively open and pose no obstruction to dismounted movement and are suitable for vehicle movement as far as 159 easting with the exception of the river. The area west of OBJ MARY is a substantial swamp. Dismounted movement is difficult and anything less than tracked vehicles will quickly get bogged down. The heavy wooded areas to the north are passable by dismounted soldiers but consist of thick trees that may impede vehicle movement."

Execution:

Intent: E21B will define each of the five major tracks through the northern woods, numbered M1 through M5 in that chronological order.

Scheme of Manoeuvre: This will be a 3 phase operation. In phase 1, E21B with 61A will move north east under the cover of darkness from Patrol Base to the water feature between the 14 and 15 eastings and follow it north, then continue northeast through the woods and establish an ORV in the vicinity of GR 169 886 and observe pattern of life in the area. In phase 2 the section will recce the major trails between the 16 and 19 eastings. In phase 3, the section will depart from the ORV and move to GR 1667 9140 for pick-up by Z-LAV back to PB.

Main Effort: Definition of the main approaches (M2, M3, M4, see objective map).

End State: Back in PB RHINO to continue with tasks as per the patrol matrix.

F.   Departure Date Time Group: 16 0200 June 2014 from PB RHINO.

G.   Return Date Time Group: 18 0100 June 2014 to PB RHINO.

H.   Routes In and Out: Departed RHINO under cover of darkness and moved north east. Conducted long halt upon reaching the stream at approximately GR 150 855 at around 0400hrs. Travelled north along the west side of the river. Banks are steep enough to prevent vehicle, they basically form a steep trench, like an anti-tank ditch along its entire path from our start point to where it flows from the woods. Average water depth is at around chest height on most soldiers, see Terrain. There are foot bridges as 1434 8635 and 1480 8741, first was crossed by a local farmer, second was crossed by a woman and two children. Several long halts (about 30 minutes each) were conducted en route to observe pattern of life in vicinity. Most fields are being worked by local farmers using a combination of machinery in various states of repair and work by hand, nothing significant to report [Pictures 1, 2, 3, 4]. Patrol maintained stand-off from local elements, this portion of patrol we were either unnoticed or if observed locals showed no interest in our activities [Picture 5].

Conducted long halt at entrance to woods, 61A moved east form about 1km to recce edge of woods, remained was in vicinity for about two hours observing south [6, 7]. From 61A, edge of woods are relatively light with limited undergrowth allowing for relatively easy movement with good cover from the roll of the ground. Platoon-sized element would be able to skirt the southern edge of the woods toward OBJECTIVE MARY with relative cover and ease [8, 9]. Unlike the fields observed en route, no persons or activity was observed in the fields immediately south of the woods and they are somewhat overgrown. Contrary to what appears on our maps, 61A observed that the area immediately west of OBJECIVE MARY (everything from about the 16 easting east) is no longer fields and is a swamp (8 Pl observed the same on their patrol) [10, 11, 12].

Commenced movement up M1. Starting about 50m in, woods become thick and overgrown making movement difficult [13, 14]. Started movement at approximately 1600hrs, at end of path at the 89 northing by 1900hrs. The path visible on the map is the stream, banks level off somewhat but would still be too steep for vehicles [15a and b]. There are well worn tracks on either side that meander through the trees on either side and as the woods are relatively light on either side, multiple formations are possible and flank security elements can be employed [17, 18]. Ground is relatively rolling, with no major cliffs along the path and is swampy at low points. This path would be the best location for dismounted troops to cross the stream as it affords good cover and some trees are thick enough to support rope bridges [19a and 19b]. Recommended crossing have small clearings off-set as a halt areas on both sides, these are at the 8834 and 8877 northings [20, 21].

Area north of woods is significant swamp [22]. This is what drains and feeds the river at M1. This is a significant obstacle to vehicle and dismounted movement. If we plan to move troops into a staging location north of objective Mary put, recommend moving through the fields on the west side of the river, cross at recommended points in the woods, then skirt the northern edge of the woods. This is somewhat elevated on the east side of the stream, so is not as boggy and at about twenty meters a small rise with a network of well-used tracks that allow for relatively unobstructed movement under cover [23]. These were the path we took, moving around the horn at the northern extreme of the woods after (east) of which the ground is relatively dry and open. We halted at the horn at approximately 2100hrs, wait until last light at around 1000hrs, then moved through the open fields and set-up our ORV at the edge of the woods at 1679 8865. This was at the eastern edge of an L-shaped path that can be seen on the map.

This appears to be a established and frequently used and relatively clear track. This could be a good hide for a platoon-plus [24, 25]. At 2300, the patrol was split into three elements with 61A recce-ing M4 and E21B moving to the clearing north of M2 and M3, then splitting with one det moving down M2 and the other down M3.

All three dets maintained observation at the end of the path for approximately two hours. No movement was observed in the fields. There were lights on in the eastern most of the cluster of buildings but nothing was heard and no persons seen [26, 27, 28].

All three dets moved back to the ORV and linked-up prior to first light.

Observation was maintained on the approaches until 1000hrs. No traffic was observed and no work was done in the fields. Patrol then moved along the 895 northing then pushed down to investigate M5. This was likely at one point a cut line but is now clogged with fallen trees and overgrowth [29, 30]. Vehicle movement through here would be as obstructed as moving through any other area of the forest and dismounted movement would be better by skirting the edge of the woods to the east (this edge was recce'd by patrol – as with the rest of the woods it provides covered movement through light, tall vegetation to a depth of about 40m and is flanked by open fields, most of which have recently been tilled, also no drug crops were observed on this patrol).

Patrol moved back to ORV at 1700hrs then skirted treeline to the horn [31]. Remained in location until 2200hrs. From here pushed north, bypassing swamp until roughly the 91 northing [32]. Link-up with pick-up at 0015hrs and taken back to PB.

I. Terrain: River depth was taken at six points:
1501 8551 – 130cm depth, width 480 cm
1481 8592 – 135cm depth, width 462 cm
1441 8630 – 106cm depth, width 215cm (river is split along two channels from here until 1421 8690)
1445 8705 – 140cm, 612cm
1470 8723 – 143cm, 598cm
1510 8756 – 134cm, approx 20 feet (point at which the river comes out of the northern woods)

All three of M2, M3 and M4 are cutlines. M4 is about 15m across throughout, overgrown (probably been a few years since cleared) but only enough deter B vehicle or ATV movement but suitable for LAVs. Limited if any foot traffic has gone through for some time and no bike or vehicle tracks observed. Movement along entire track is in depth to observation from buildings in OBJECTIVE MARY. [33]

M3 is has also not been cleared for a few years but has evidence of relatively frequent foot traffic through it as there a established paths where brush has been moved out of the way. There are several large fallen trees that would prevent unsupported vehicle movement. Southern mouth of the path is only about thirty meters from the building cluster in OBJECTIVE MARY. This is a good dismounted approach that would get a force very close to objective or would be the most important dismounted cut-off as it would be the likely path that belligerents would use to get out of this area without being seen by a force coming from the south. [34a and b]

M2 is approximately 30m wide throughout. It is clear and flat and hardened and has recently seen a large amount of foot, bike and vehicle traffic. This is being used as a major route in and out of OBJECTIVE MARY. No traffic was observed on this or the other two lanes the night of the recce. It is suitable for B-vehicle movement with no obstacles. Several recently fallen trees were moved off of this trail and trees along the edge were recently felled to widen the path. The clearing to the north has garbage and firepits indicating recent use. There was trash and cigarette butts all along the path. Most likely vehicle come out of the objective area along this path, through the clearing, and then move north, staying on the east side of the swamp to eventually link up with ROUTE YELLOW. There was a cache of filled fuel containers in the clearing, a large number of digging tools and a large pile of fertilizer in the woods on the west side of the clearing (GR 1682 8831). [35]

J. Info Enemy: Nil.

K. Map Corrections: As described in terrain.

L.   Misc Info: Nil

M.   Result of Enemy Encounters: Nil

N.   Condition of Patrol: All Okay, in PB

O.   Support Received / Required: Nil

P.   Communications: Nil

Q.   Friendly / Neutrals: Nil

R.   Conclusions / Recommendations:

COA 1: northern approach to objective is viable by following our out route – move by vehicle to pick-up point, then move either dismounted or with LAV through fields and into clearing or L-path. Cut-off should be established on M4 and eastern edge of objective area, FB / overwatch could be positioned at the end of M2 and dismounted force can move down M3.

COA 2: Dismounted force could move from patrol base to river, skirt on west side, cross at recommend position, skirt north side of woods and establish in L-path.   Three elements could be moved down each of M2, M3 and M4 to form assault line at the base. Fire base could be established in open area east of objective area oriented west-northwest.

COA 3 (Recommended): Cut-off elements can established at the base of each of M2, M3 and M4 and a clearance force could be established at the base of M5 (after skirting the woods on the east side). To clear objective from east to west.

PICTURES

1.

2.

3.

4.

5.

6. Mouth of Woods
Canal ends and water pools near the entrance to M1.

7. Reforms as a canal through M1. Pic shows steepness of bank.
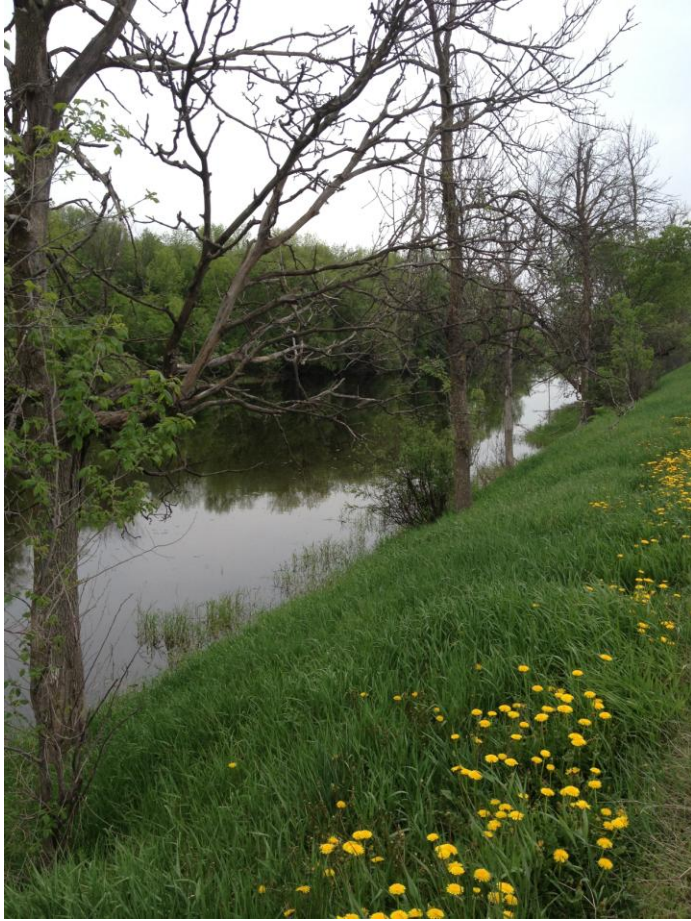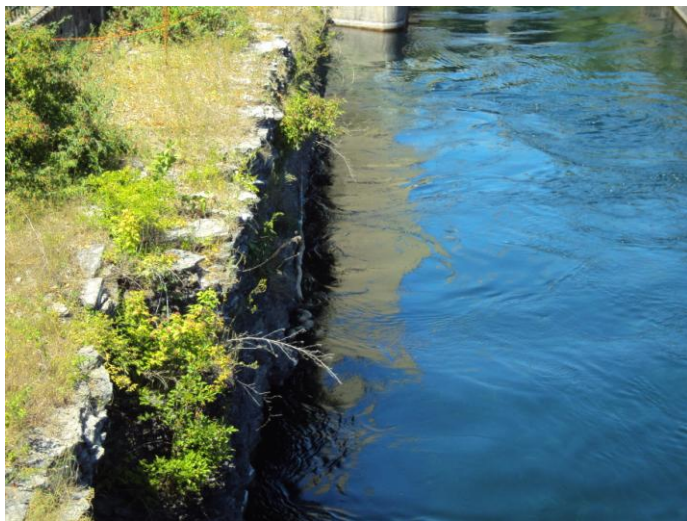
8.

9.

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12.

13.

14.

15a. River bank in M1
Picture at small opening in trees (they are usually closer to the edge)

15b. River bank in M1
South of woods river is similiar – a canal cut into the rocky ground.

16. not used

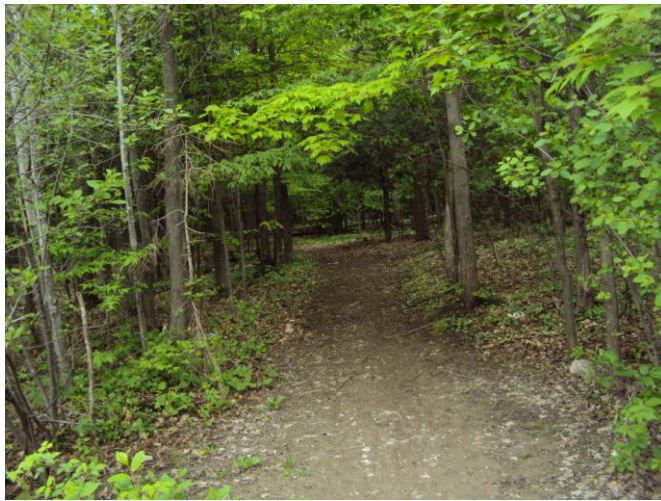
17.

18.

19a. West-side anchor

19b. East-side anchor
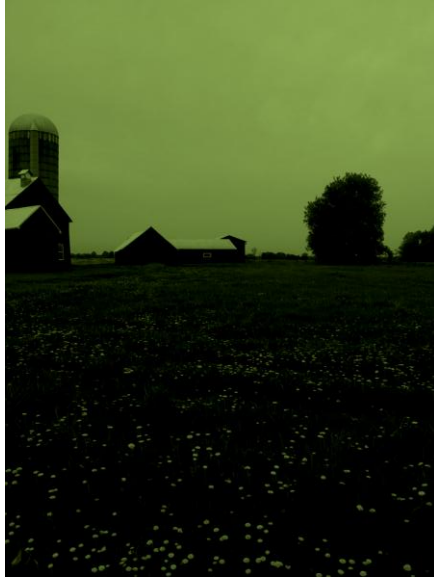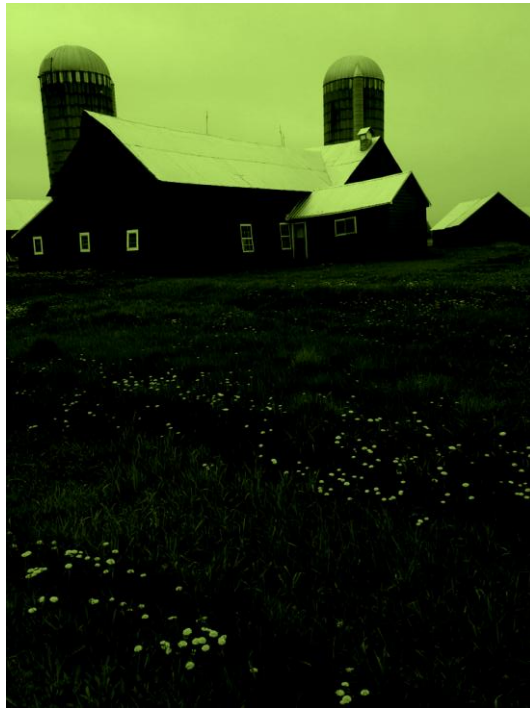
20.

21.

22.

23.

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30.

31. View of horn from the North.

32.

33. M4

34a. Obstacle on M3

34b. M3
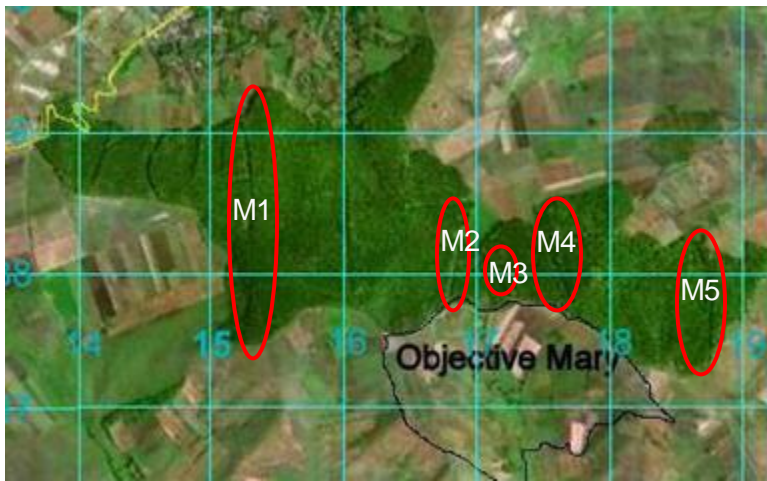
35. M2

AREA MAP

OBJECTIVE MAP
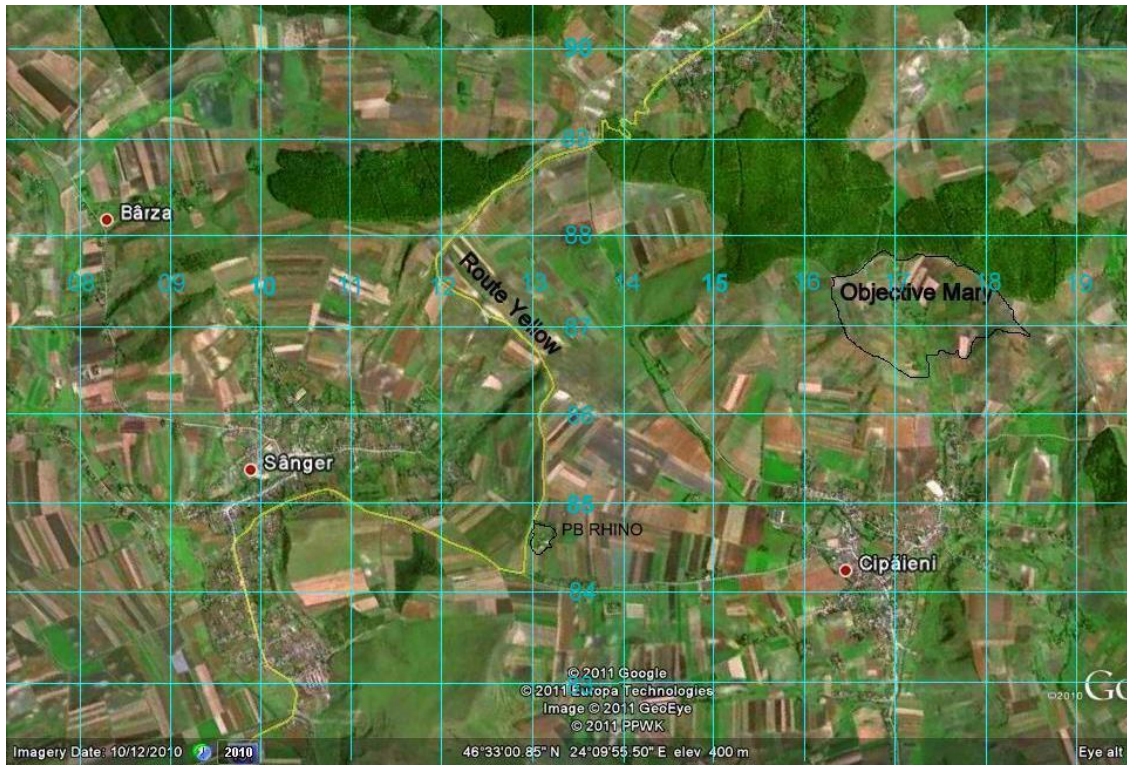
Route Card

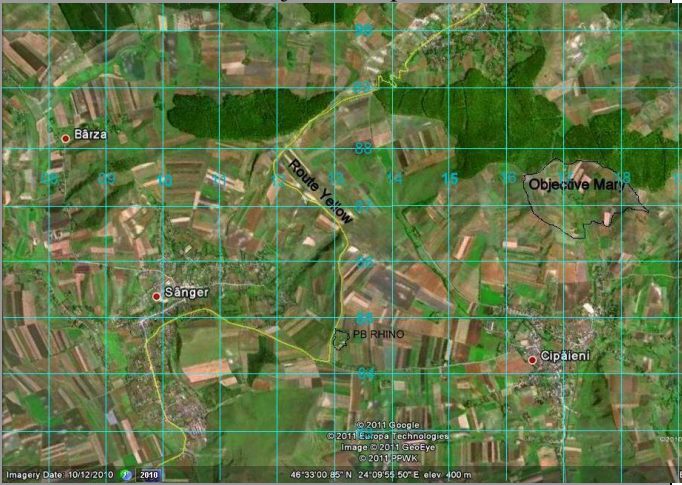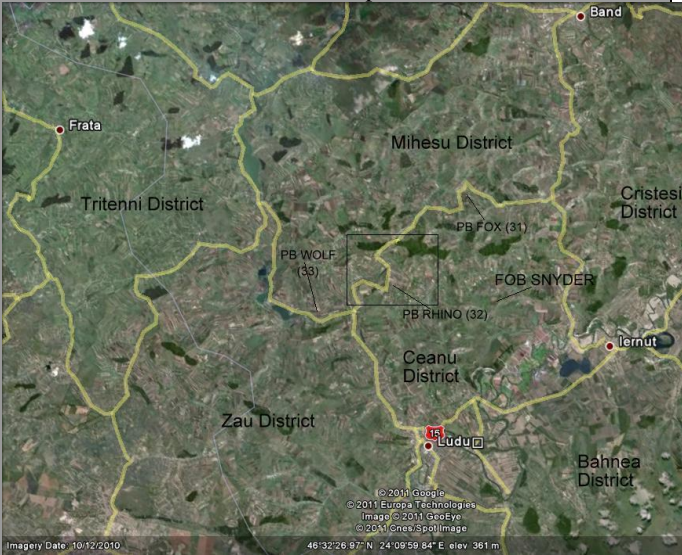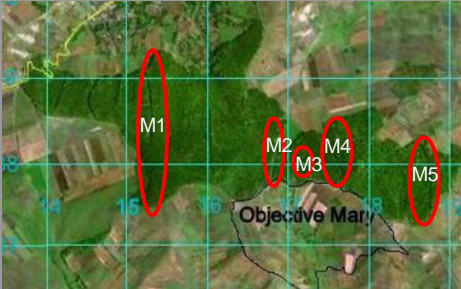| Start GR	End GR	Bearing	Straight-line Distance	Comment
1310 8470	150 855	1100	2400	At river
150 855	1424 8695	5600	1600	Western bend of river. Open terrain with some minor obstacles and one major one (river)
1424 8695	1527 8755	0900	1200	Entry to woods
1527 8755	1528 8911	6400	1500	Exit of M1. Close terrain with major obstacle.
1528 8911	1658 8970	1250	1900	Horn. Lightly wooded path.
1658 8970	1679 8865	2700	1400	ORV in L-path
1679 8865	1880 8811	1400	2100	M2-4 Recces complete, from ORV to M5
1880 8811	1871 8815	3200	900	Start of M5
1871 8815	1869 8752	3200	600	End of M5 (woods skirted on east side)
1869 8752	1871 8815	6400	600	Start of M5
1871 8815	1679 8865	5200	2300	Skirted north treeline to ORV
1679 8865	1658 8970	5900	1400	Horn
1658 8970	1652 9101	6400	1300	Pick-up. Open terrain
1652 9101	1310 8470	N/A	N/A	Move to PB along Route Yellow

REPORT ENDS

APPENDIX G
EXPERIMENTAL TEMPLATE
SCENARIO 2[55]

You are the Battle Group Intelligence Officer (S2). As requested, one of your analysts has forwarded you this report out of Charlie Company.

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[55] Images have been adjusted to conform to RMC graduate thesis guidelines with respect to layout and margins.

PATROL REPORT

Situation

Officer Commanding Charlie Company's (C/S 39er's) intent is to continue to expand partnered coalition presence into the more isolated and rural areas. OBJECTIVE MARY is one of six pockets within the Company's Area of Operations that was selected as a likely candidate for such a mission

Objective Map

From 39: "The wooded areas north of the objective area are likely avenues for a friendly dismounted approach for this operation. Alternatively these will likely require cut-off elements to ensure containment if the approach ends up being from another direction. Regardless these tracks require further definition in terms of utility for dismounted and potentially mounted movement, including vehicle extraction of potential casualties. Assessment is required on optimal cut-off positions, potential areas where belligerent elements may attempt to place IEDs or ambush, any necessary clearance or reinforcement, along with an assessment of any obstacles such as steep incline or declines, water, etc., distance from the objective that a force remains in depth to observation from the objective, and any other observations that would affect planning for this operation."

Area Map

Patrol Report by C/S 32 on 12 – 13 June assessed the north-south water feature to the west of the objective and the woods to the north as follows: "darkened green path between the 14 and 15 easting between the 855 and 875 northings is in fact a stream. With steep, rocky banks on both sides that rise as far as five feet and a depth over -head height, this is a significant obstacle. The fields on either side are relatively open and pose no obstruction to dismounted movement and are suitable for vehicle movement as far as 159 easting with the exception of the river. The area west of OBJ MARY is a substantial swamp. Dismounted movement is difficult and anything less than tracked vehicles will quickly get bogged down. The heavy wooded areas to the north are passable by dismounted soldiers but consist of thick trees that may impede vehicle movement."

Mission Information	
	Call Sign: E21B / Patrol Leader: Sgt D. Turner (2 Section Commander, 1 Troop) / Patrol Size: 13
	Organization: 2 Section Complete, one det from Recce Platoon (62A), and one interpreter.
	Mission: E21B will DEFINE the dismounted and mounted approaches in the wooded area north of OBJECTIVE MARY no later than 18 Jun 2014 as part of the options analysis for future C/S 3 operations.
	Intent: E21B will define each of the five major tracks through the northern woods, numbered M1 through M5 in that chronological order.
	Scheme of Manoeuvre: This will be a 3 phase operation. In phase 1, E21B with 61A will move north east under the cover of darkness from Patrol Base to the water feature between the 14 and 15 eastings and follow it north, then continue northeast through the woods and establish an ORV in the vicinity of GR 169 886 and observe pattern of life in the area. In phase 2 the section will recce the major trails between the 16 and 19 eastings. In phase 3, the section will depart from the ORV and move to GR 1667 9140 for pick-up by Z-LAV back to PB.
	Main Effort: Definition of the main approaches (M2, M3, M4)
	End State: Back in PB RHINO to continue with tasks as per the patrol matrix.

SEQUENCE OF EVENTS

Departure Date Time Group: **16 0200 June 2014** from PB RHINO.
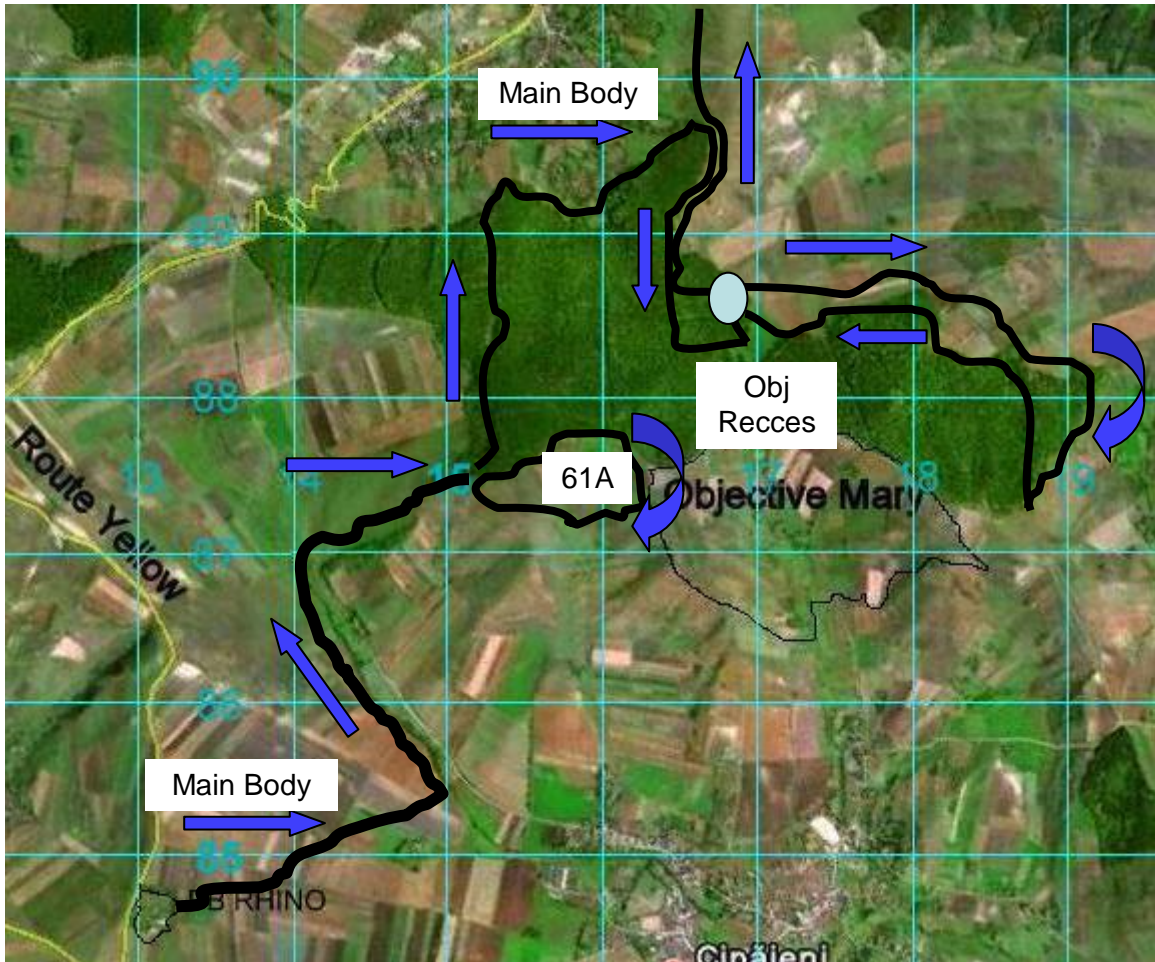
Return Date Time Group: **18 0100 June 2014** to PB RHINO.

	Departed RHINO under cover of darkness and moved north east.

Conducted long halt upon reaching the stream at approximately GR 150 855

at around 0400hrs. |

Travelled north along the west side of the river. Banks are steep enough to prevent vehicle, they basically form a steep trench, like an anti-tank ditch along its entire path from our start point to where it flows from the woods. Average water depth is at around chest height on most soldiers.

At the Western bend of river, terrain is open with some minor obstacles and one major one (river)

River bank in M1 →

South of woods river is similiar – a canal cut into the rocky ground.
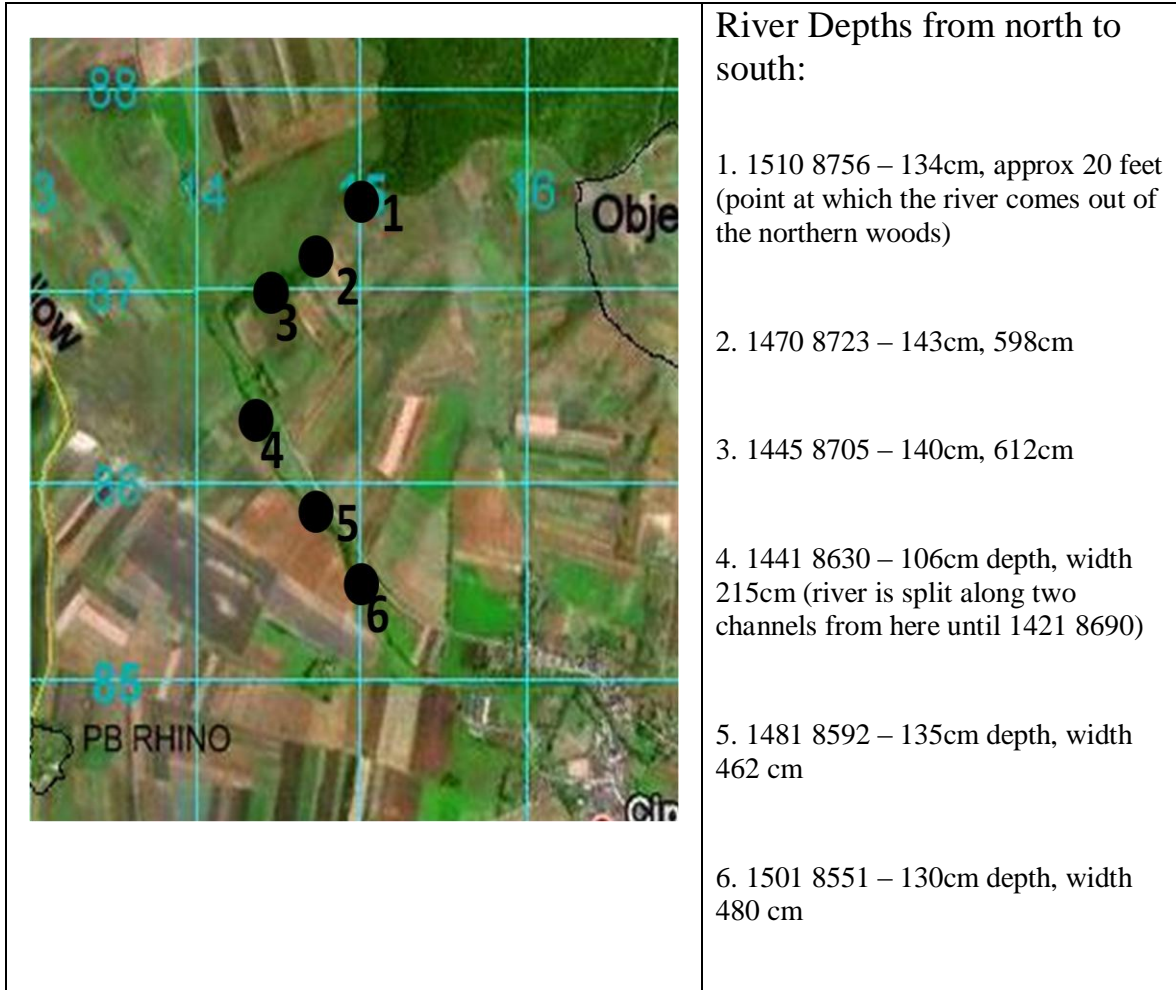
River Depths from north to south:

1. 1510 8756 – 134cm, approx 20 feet (point at which the river comes out of the northern woods)

2. 1470 8723 – 143cm, 598cm

3. 1445 8705 – 140cm, 612cm

4. 1441 8630 – 106cm depth, width 215cm (river is split along two channels from here until 1421 8690)

5. 1481 8592 – 135cm depth, width 462 cm

6. 1501 8551 – 130cm depth, width 480 cm

There are foot bridges as 1434 8635 and 1480 8741, first was crossed by a local farmer, second was crossed by a woman and two children. Several long halts (about 30 minutes each) were conducted en route to observe pattern of life in vicinity.

Most fields are being worked by local farmers using a combination of machinery in various states of repair and work by hand, nothing significant to report. Patrol maintained stand-off from local elements, this portion of patrol we were either unnoticed or if observed locals showed no interest in our activities.
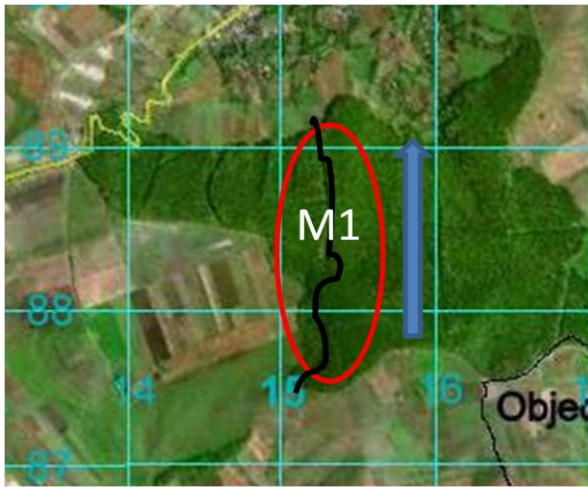
Conducted long halt at entrance to woods, 61A moved east form about 1km to recce edge of woods, remainder was in vicinity for about two hours observing south.

At the Mouth of Woods, the Canal ends and water pools near the entrance to M1.

Reforms as a canal through M1. Pic shows steepness of bank.
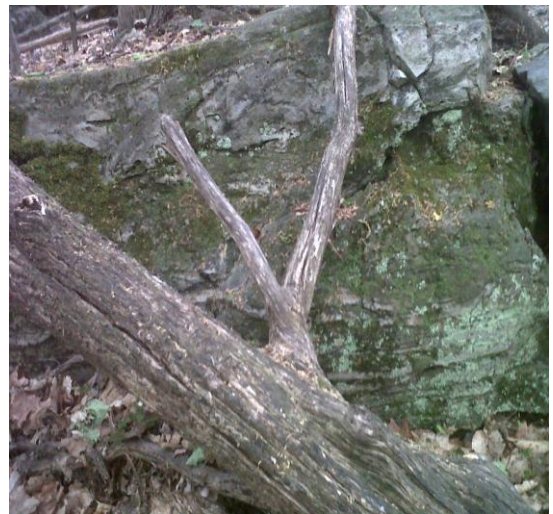
From 61A, edge of woods are relatively light with limited undergrowth allowing for relatively easy movement with good cover from the roll of the ground. Platoon-sized element would be able to skirt the southern edge of the woods toward OBJECTIVE MARY with relative cover and ease.
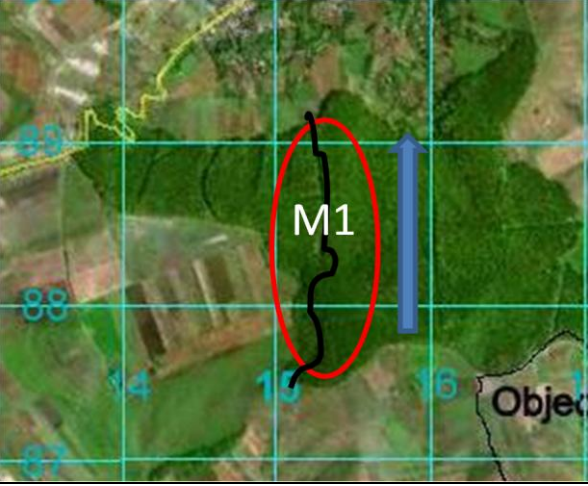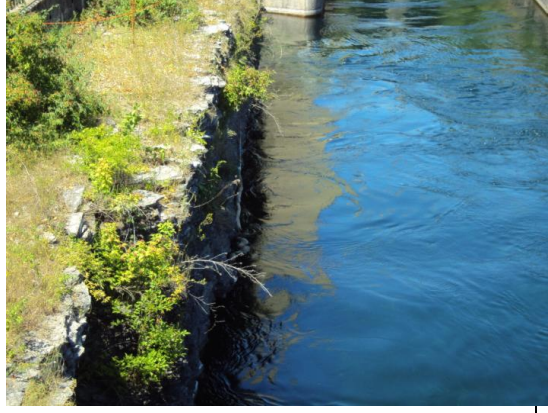
Unlike the fields observed en route, no persons or activity was observed in the fields immediately south of the woods and they are somewhat overgrown.

Contrary to what appears on our maps, 61A observed that the area immediately west of OBJECIVE MARY (everything from about the 16 easting east) is no longer fields and is a swamp (8 Pl observed the same on their patrol)

Commenced movement up M1.

Starting about 50m in, woods become thick and overgrown making movement difficult.

Started movement at approximately 1600hrs, at end of path at the 89 northing by 1900hrs. The path visible on the map is the stream, banks level off somewhat but would still be too steep for vehicles.

This picture is at small opening in trees (they are usually closer to the edge).

M1: There are well worn tracks on either side that meander through the trees on either side and as the woods are relatively light on either side, multiple formations are possible and flank security elements can be employed.

Ground is relatively rolling, with no major cliffs along the path and is swampy at low points. This path would be the best location for dismounted troops to cross the stream as it affords good cover and some trees are thick enough to support rope bridges.
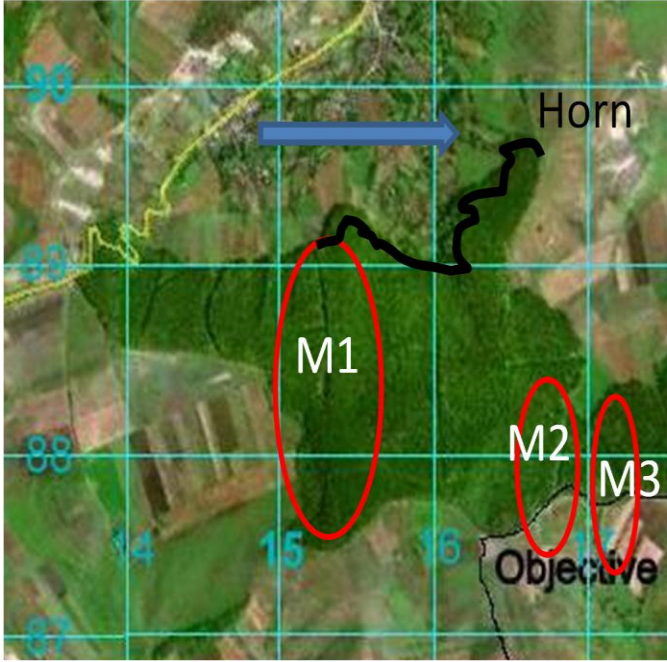
West-side anchor
→
clearing

East-side anchor
←
clearing

Recommended crossing have small clearings off-set as a halt areas on both sides, these are at the 8834 and 8877 northings.

Area north of woods is significant swamp.

This is what drains and feeds the river at M1.

This is a significant obstacle to vehicle and dismounted movement.

If we plan to move troops into a staging location north of objective Mary put,

Recommend moving through the fields on the west side of the river,

Cross at recommended points in the woods, Then skirt the northern edge of the woods.

This is somewhat elevated on the east side of the stream, so is not as boggy

At about twenty meters a small rise with a network of well-used tracks that allow for relatively unobstructed movement under cover.

These were the path we took, moving around the horn at the northern extreme of the woods after (east) of which the ground is relatively dry and open

We halted at the horn at approximately 2100hrs, wait until last light at around 1000hrs, then moved through the open fields and set-up our ORV at the edge of the woods at 1679 8865.

This was at the eastern edge of an L-shaped path that can be seen on the map.

This appears to be a established and frequently used and relatively clear track.
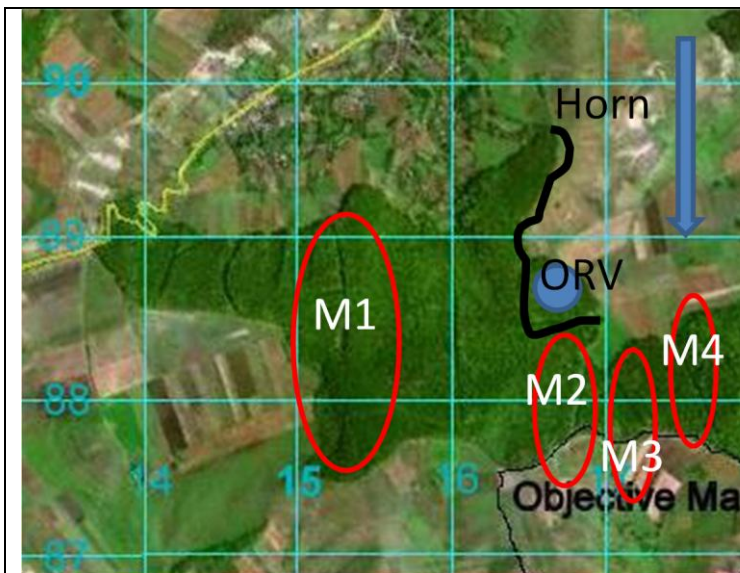
This could be a good hide for a platoon-plus.

At 2300, the patrol was split into three elements with

61A recce-ing M4 and E21B moving to the clearing north of M2 and M3,

then splitting with one det moving down M2 and the other down M3.

All three dets maintained observation at the end of the path for approximately two hours. No movement was observed in the fields. There were lights on in the eastern most of the cluster of buildings but nothing was heard and no persons seen.

All three dets moved back to the ORV and linked-up prior to first light.

All three of M2, M3 and M4 are cutlines.

M2 is approximately 30m wide throughout. It is clear and flat and hardened and has recently seen a large amount of foot, bike and vehicle traffic. This is being used as a major route in and out of OBJECTIVE MARY.

No traffic was observed on this or the other two lanes the night of the recce. It is suitable for B-vehicle movement with no obstacles.

Several recently fallen trees were moved off of this trail and trees along edge were recently felled to widen the path.

The clearing to the north has garbage and firepits indicating recent use. There was trash and cigarette butts all along the path.

Most likely vehicle come out of the objective area along this path, through the clearing, and then move north, staying on the east side of the swamp to eventually link up with ROUTE YELLOW.

There was a cache of filled fuel containers in the clearing, a large number of digging tools and a large pile of fertilizer in the woods on the west side of the clearing (GR 1682 8831).

M3 is has also not been cleared for a few years but has evidence of relatively frequent foot traffic through it as there a established paths where brush has been moved out of the way.

There are several large fallen trees that would prevent unsupported vehicle movement.

Southern mouth of the path is only about thirty meters from the building cluster in OBJECTIVE MARY.

This is a good dismounted approach that would get a force very close to objective

or would be the most important dismounted cut-off as it would be the likely path that belligerents would use to get out of this area without being seen by a force coming from the south.

M4 is about 15m across throughout, overgrown (probably been a few years since cleared) but only enough deter B vehicle or ATV movement but suitable for LAVs.

Limited if any foot traffic has gone through for some time and no bike or vehicle tracks observed.

Movement along entire track is in depth to observation from buildings in OBJECTIVE MARY

When M2-4 Recces complete

Observation was maintained on the approaches until 1000hrs. No traffic was observed and no work was done in the fields.

Patrol then moved along the 895 northing then pushed down to investigate M5. This was likely at one point a cut line but is now clogged with fallen trees and overgrowth.

Vehicle movement through here would be as obstructed as moving through any other area of the forest and dismounted movement would be better by skirting the edge of the woods to the east

Patrol moved back to ORV at 1700hrs then skirted treeline to the horn.

(this edge was recce'd by patrol – as with the rest of the woods it provides covered movement through light, tall vegetation to a depth of about 40m and is flanked by open fields, most of which have recently been tilled, also no drug crops were observed on this patrol).

Remained in location until 2200hrs.

.

From here pushed north, bypassing swamp until roughly the 91 northing.

Link-up with pick-up at 0015hrs and taken back to PB

View of horn from the North.

View of open terrain to the north

Conclusions / Recommendations

COA 1

Northern approach to objective is viable by following our out route – move by vehicle to pick-up point,

then move either dismounted or with LAV through fields and into clearing or L-path.

Cut-off should be established on M4 and eastern edge of objective area,

FB / overwatch could be positioned at the end of M2 and

dismounted force can move down M3.

COA 2

Dismounted force could move from patrol base to river,

skirt on west side, cross at recommend position, skirt north side of woods and establish in L-path.

Three elements could be moved down each of M2, M3 and M4 to form assault line at the base.

Fire base could be established in open area east of objective area oriented west-northwest.

COA 3 (Recommended)	
	Cut-off elements can established at the base of each of M2, M3 and M4 and a clearance force could be established at the base of M5 (after skirting the woods on the east side). To clear objective from east to west.

Nothing further to report on enemy, communications, neutrals, support required or miscellaneous.

Patrol complete back in PB, all okay.

SIGNED
Sgt D. Turner (2 Section Commander, 1 Troop); E21B
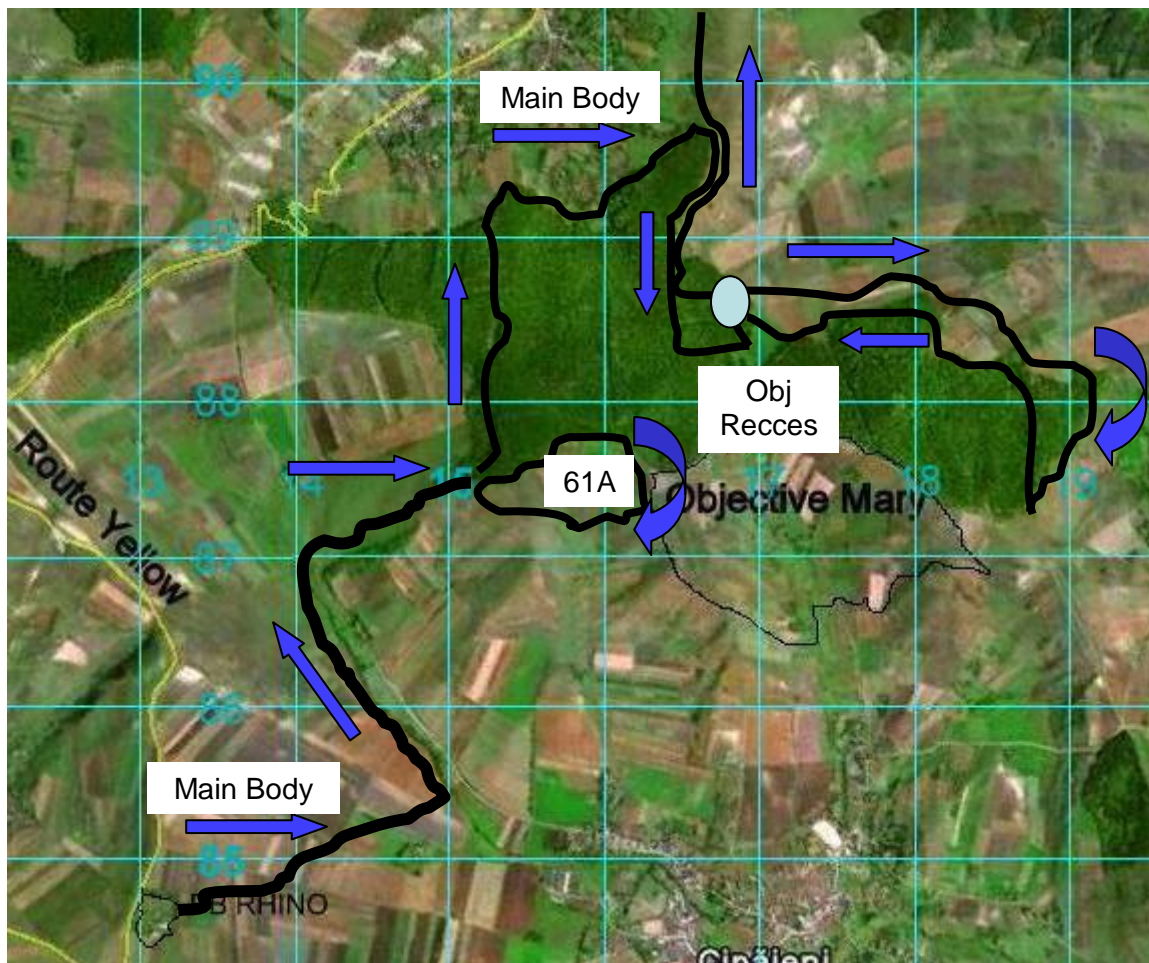
REPORT ENDS

APPENDIX H
SCENARIO 1 TEST WITH SOLUTIONS

1.1.   Were any of the following found throughout the patrol (circle yes or no)?

     a.   Canned Food (Yes / No)

     b.   Unexploded Ordnance (UXO) (Yes / No)

     c.   Improvised Explosive Devices (IED) (Yes / No)

     d.   Empty Shell Casings (Yes / No)

     e.   Alcohol (Yes / No)

/ 5

2.1.   Center a dot anywhere in the grid square where the suspected IED supposed to be located in.
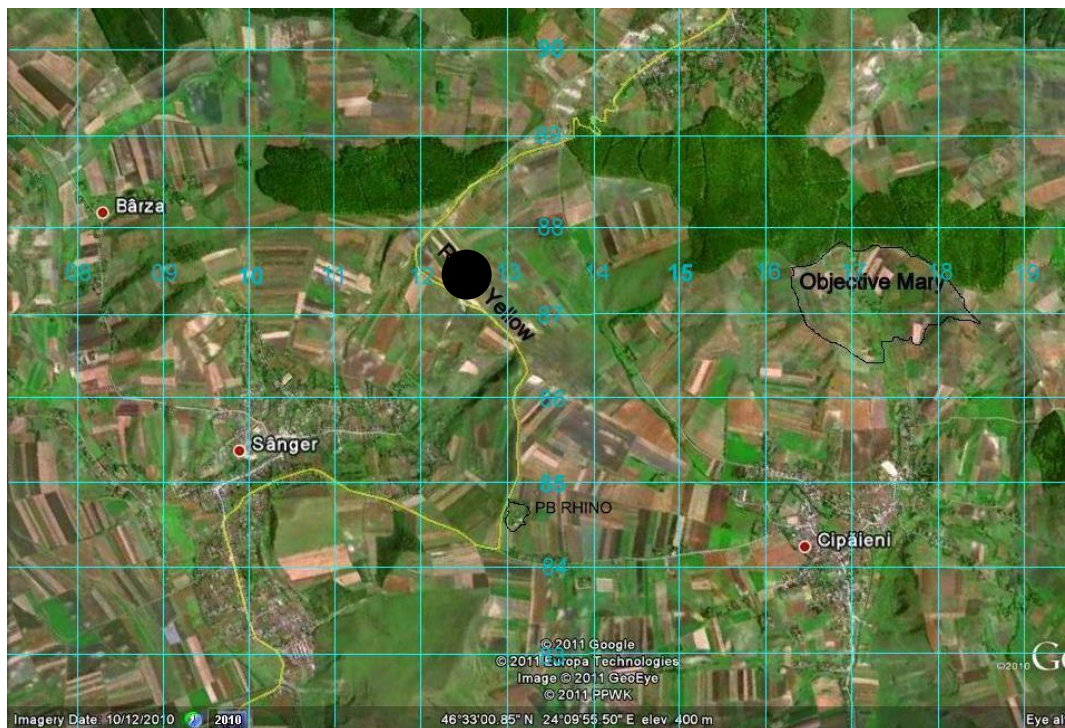
GR 12 87

/ 5 (full points for the correct grid square;
3 points for any of the adjacent grid squares / 2 for any diagonal square)

2.6   Using the marker provided, sketch the patrol's route from the patrol base to the objective area and back to the patrol base.
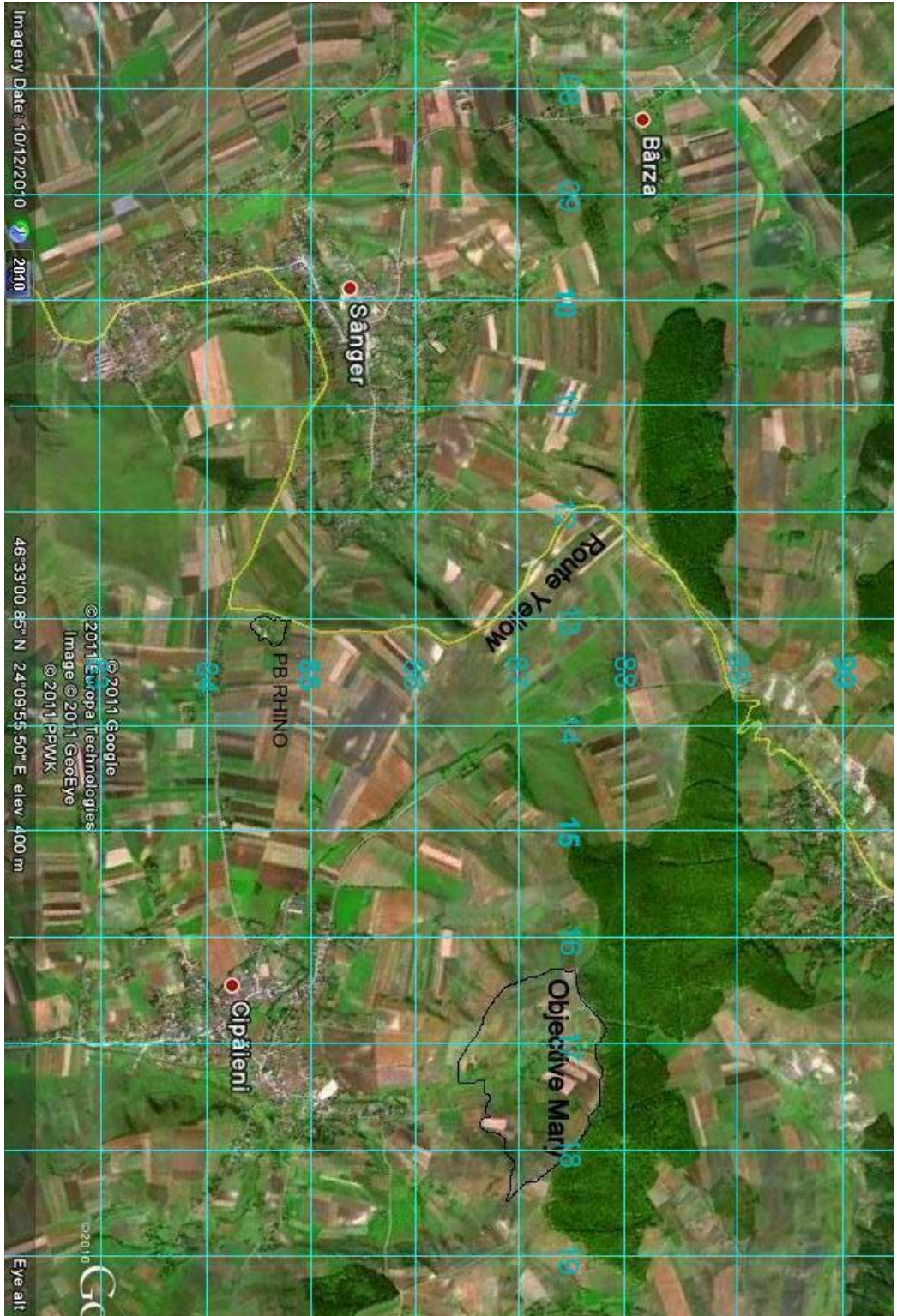
ACTUAL TRACE

Solution (trace from Blended Template, bullets centred on locations given in Doctrinal Format)
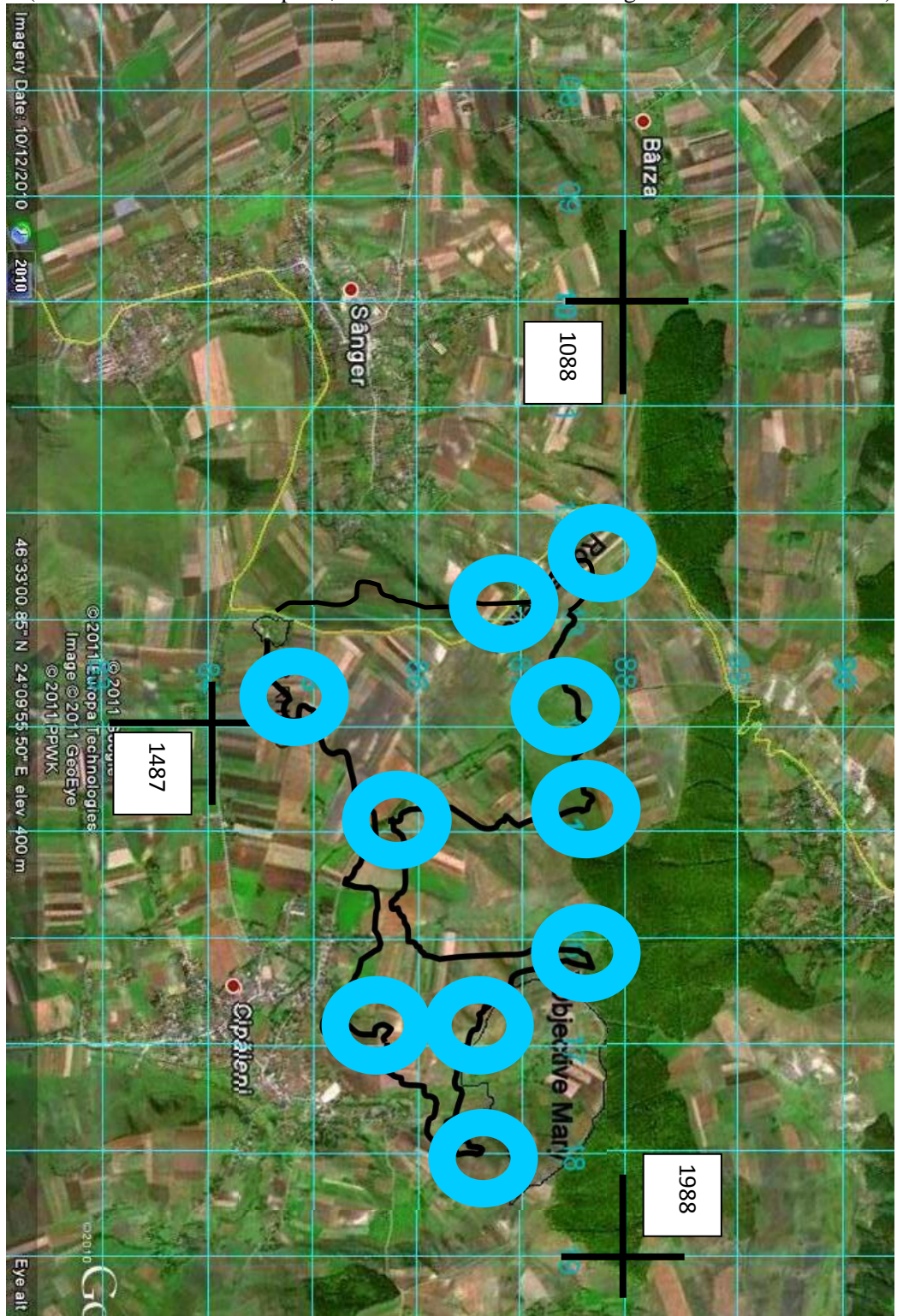
The short answer questions require an analysis of the commander's assessments as compared to the Situation Brief provided. Each answer is worth a maximum of five marks, which will be determined based on accuracy and the ability to extend the information provided in the report to more general deductions about this area of operations.

3.1.   Has there been a change to the most likely enemy threat: deliberate IEDs?

Yes, presence of possible CBRN agent.
OP with observation on CF activities indicates
recent use and may correlate with increased
surv. activities, may indicate return of Fighters
in short term
→ stock piles of wpn, including HMG may
indicate intent for offensive ops (capable
of lethal effects on CF)
        → stocking of ~~Food stuffs~~ cbt supplies
            (Food, water)
→ implication of Farmer may indicate higher level
of LN sp for INS activities

                                                    / 5

1.2.   Are the following statements true or false (circle the correct answer)?

a.   The patrol left through the west gate (**True** / False)

b.   The patrol observed opium crops en route to Objective Mary (True / **False**)

c.   The most common vehicles on ROUTE YELLOW were pick-up trucks   (True / **False**)

d.   The most common weapon seized was the AK47 (**True** / False)

e.   The patrol did not recommend any map corrections (True / **False**)

                                                    / 5

1.3.   What time of day did the patrol return?

     a.   Morning
     b.   Afternoon
     c.   **Evening**
     d.   Night

/ 2

2.2.   Center a dot anywhere in the grid square where the caches were found.
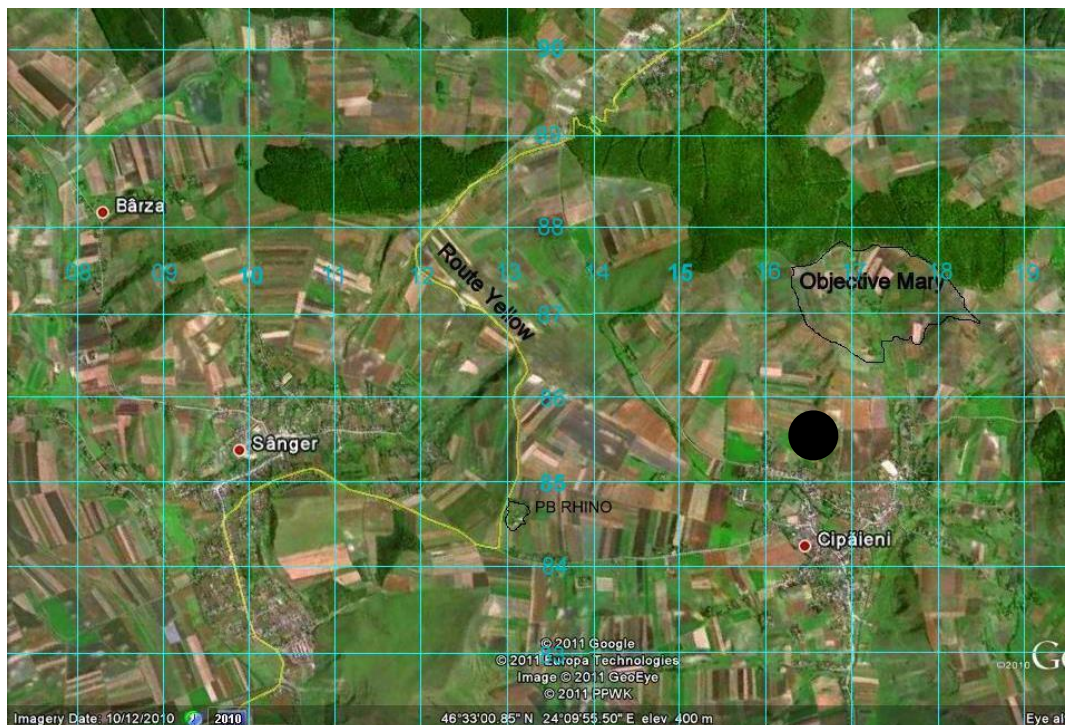
GR 16 85

/ 5

3.2.   The enemy habit was assessed to be one of moving in, emplacing, observing and leaving, is this still valid?

3.2.   The enemy habit was assessed to be one of moving in, emplacing, observing and leaving, is this still valid?

No. A cache of weapons ↗ & food would indicate a habit preparing for an extended period of ~~time~~ time in location. ~~Observation~~ Suspected observation post was found though.

/ 5

1.4.   How many vehicles were observed on ROUTE YELLOW

     a.   5 to 10
     b.   10 to 15
     `c.`   `15 to 20`
     d.   20 to 25

/ 2

1.5.   In total how many weapons were seized?

     a.   5 to 10
     b.   10 to 15
     `c.`   `15 to 20`
     d.   20 to 25

/ 2

1.6.   What was the mechanism of the Corporal's injury?

     `a.`   `Chemical Burn`
     b.   Gun Shot
     c.   Heat Rash / Chaffing
     d.   Shrapnel

/ 2

2.3.   Center a dot on the suspected enemy OP.

GR 13 84
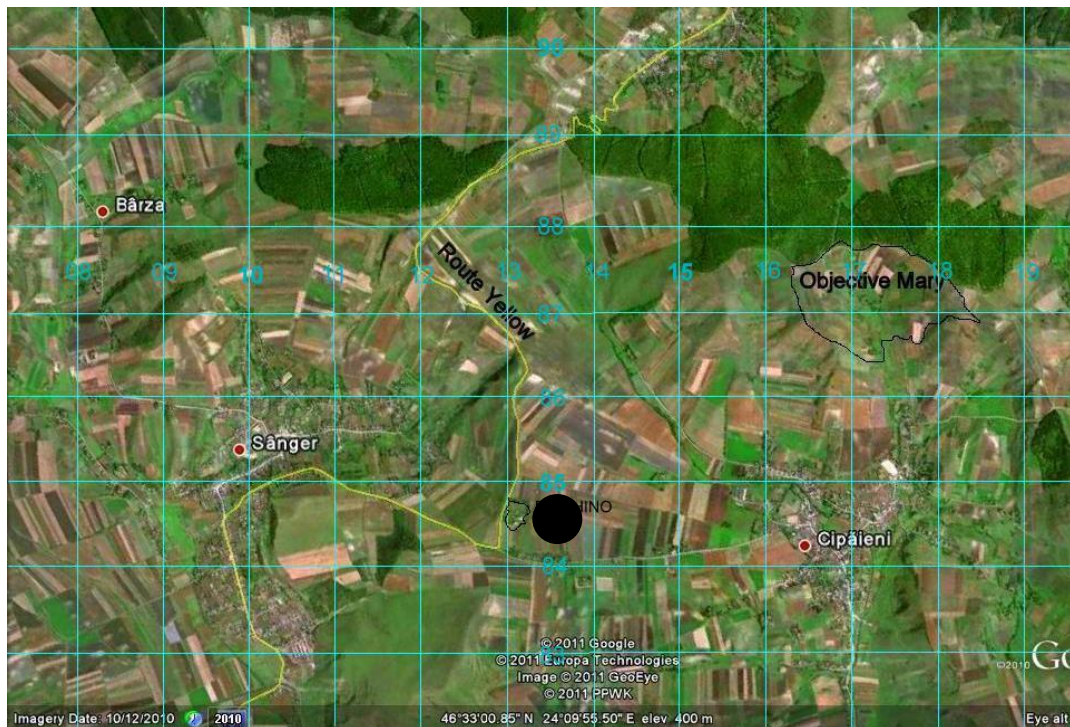
/ 5

1.7.   What type of building was the first cache located in?

a.   Barn
b.   School
c.   House
d.   Garage

/ 2

3.3.   Could a military cargo vehicle be driven from the suspected IED location to OBJ MARY along roughly the same in-route as the patrol?

No. creek was deep, with steep rocky sides on both banks. further recce of creek may find suitable crossing / fording locations, or even a bridge. Since Area is heavily farmed, there is likely to be crossing points that tractors & other farming eqpt has used in the past.

/ 5

3.4.   What follow-on missions would you recommend based on this patrol for 32?

1. OP's to observe two x cache locs

2. OP to observe OP loc East of

3. OP to observe Rhino IED/culvert loc.

4. Visit the local police to interview Capt A. Vladimiescu
    - confirm what happened to wpns
    - confirm what happened to detainee.

5. Cordon & Search of both cache locs & Random in Sangr & Cipalene

/ 5

1.8.   How many individuals were found in the residence adjacent to the cache?

a.   0
b.   1
c.   2
d.   3

/ 2

1.9.   What town was skirted en route to the suspected IED?

a.   ALKIR
b.   CIPAIENI
c.   IERNUT
d.   SANGER

/ 2

2.4.   Center a dot at the point the patrol crossed the river.
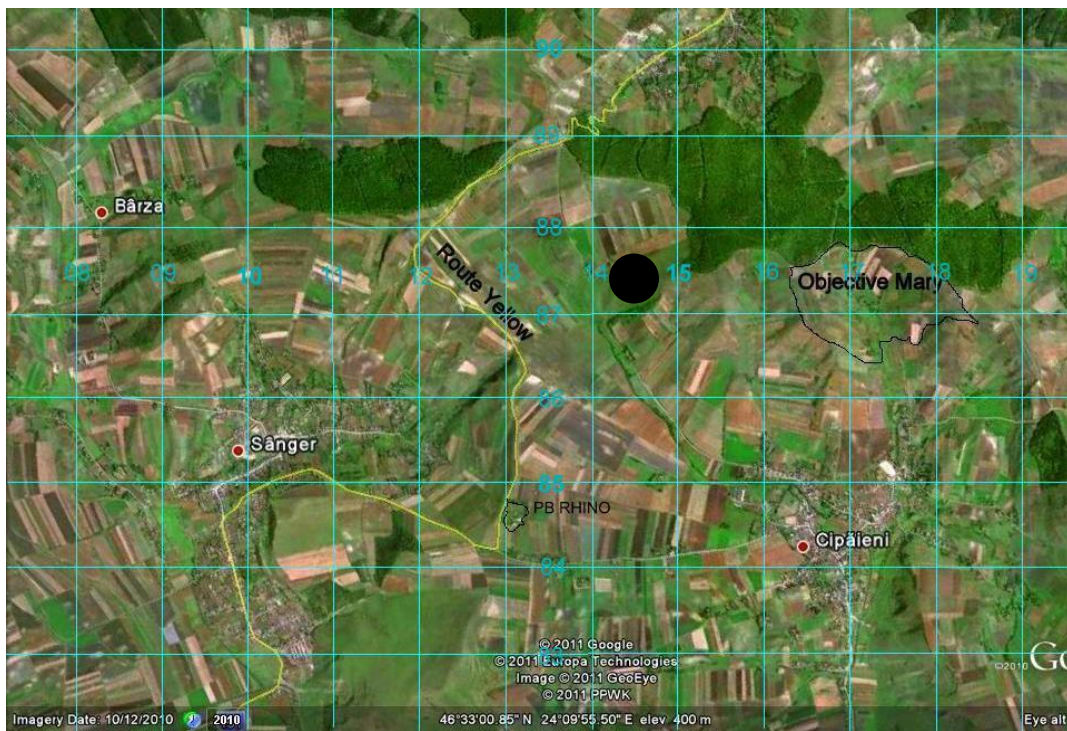
GR 14 87

/ 5

3.5.   Which weapon system should be of the greatest concern from the first cache?

Mortar bipod, as this would indicate ability of enemy to achieve their most dangerous COA of engaging Tactical Infrastructure w Light Indirect Fire.

However, it was not a complete weapon (no mortar tube) and looked to be in rough shape. Therefore RPK would be most imminent threat

/ 5

1.10.   What best describes the terrain to the west of OBJECTIVE MARY ?

      a.   Dense Forest
      b.   Open Fields
      c.   Intermittent Swamp
      d.   Rolling Hills

/ 2

1.11.   What was the largest calibre weapon found?

      a.   Soviet Medium Mortar
      b.   DShK Heavy Machine Gun
      c.   .338 Calibre American Sniper Rifle
      d.   40mm Grenade Launcher

/ 2

2.5.   Which individual is the detainee?

A.

B.

C.

D.   correct

/ 5

1.12.   What was the name of the detainee ?

a.   Alexandru Vladimerscu
b.   Drago Fedorev
c.   Karlos Minkov
d.   Unknown

/ 2

3.6   Would you consider this a successful patrol?

YES — BASED ON THE AMOUNT OF
INFORMATION OBTAINED CONCERNING

- NON THREAT IED
→ TERRAIN / APPROACHES OBT MANY
→ WEAPONS CACHE / FOOD CACHE
→ DETAINEE
→ DISCOVER UNKNOWN CHEMICAL SUBSTANCE
→ SUSPECT ENE VANTAGE POINT OF
   PB RHINO
→ CHANGE IN ENE TACTICS / DOCTRINE
→ INTELLIGENCE

/ 5

<u>END OF TEST</u>

APPENDIX I
SCENARIO 2 TEST WITH SOLUTIONS

1.1   Were any of the following things observed during the patrol (circle yes or no)?

    a.   Improvised Explosive Devices (IED) (Yes / No)

    b.   Drug Crops (Yes / No)

    c.   POL Cache (Yes / No)

    d.   Farming (Yes / No)

    e.   Fertilizer (Yes / No)

                                                                                    / 5

2.1   Centre a dot in the grid where the second foot bridge is located.
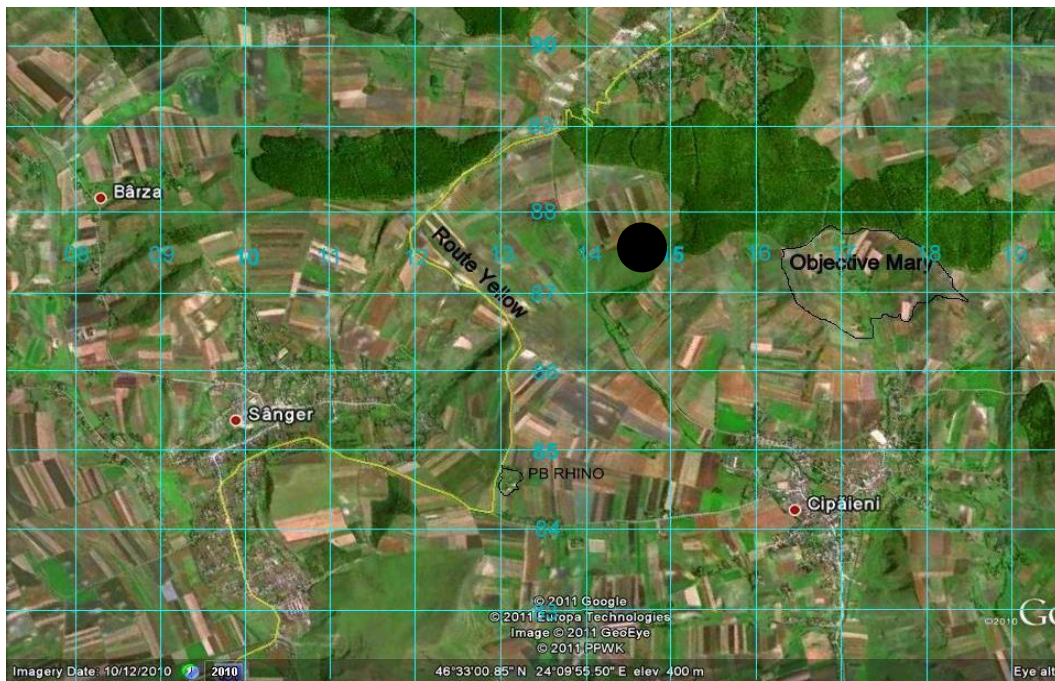
GR 14 87

/ 5 (full points for the correct grid square;
3 points for any of the adjacent grid squares / 2 for any diagonal square)

2.6   Using the marker provided, sketch the patrol's route from the patrol base to the objective area and back to the patrol base.

Solution for Traces as it Appears in Scenario 2 Blended Format

Solution for Traces without Arrows and Markings
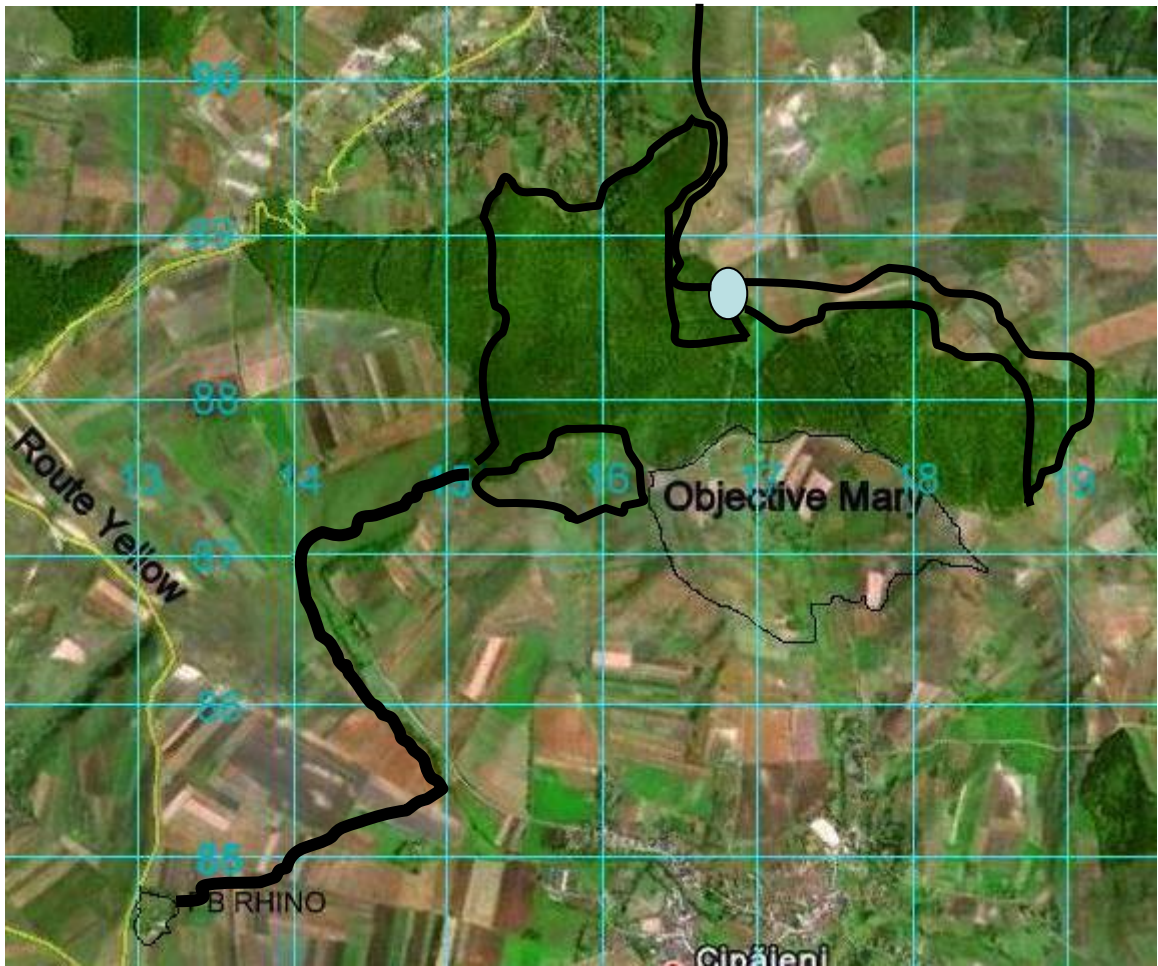
The short answer questions require an analysis of the commander's assessments and the details his report provides. Each answer is worth a maximum of five marks, which will be determined based on accuracy and the ability to extend the information provided in the report to more general deductions about this area of operations. Aim to fill all of the space provided.

3.1   Which of M2, M3, M4 and M5 affords the best balance between ease of movement and stealth?

M2 - GOOD DISMOUNTED APPROACHES
M3 - HEAVILY USED - FOOT VEHICLE, CAMPING, GRAZING
       MOUNTED TROOPS OK
M4 - FORMER CUT LINE (AS WAS M2 + M3)
M5 - NORTHW END STARTS AT A SWAMP
M4 - REQUIRES ENGINEERS OR TRACKS TO CLEAR
       OBSTACLES
M2 - HARD FOR B VEHICLES TO NEGOTIATE
M5 - NOT USEABLE

/ 5
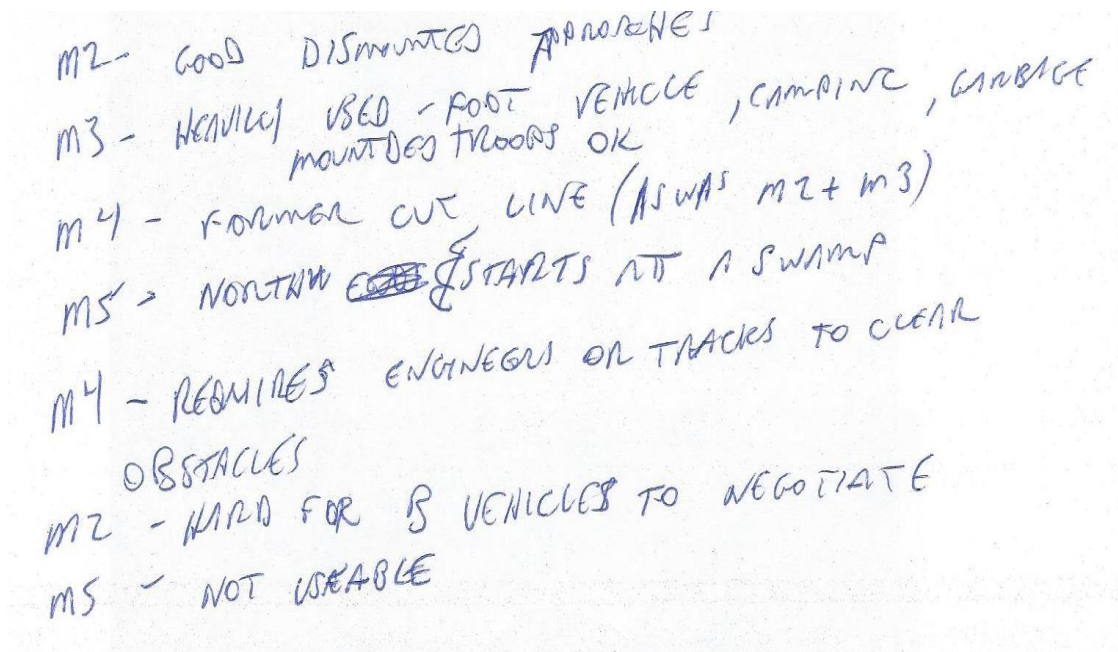
1.2   Are the following statements true or false (circle the correct answer)?

f.   The patrol consisted of less than 15 soldiers (True / False)

g.   The patrol returned to the patrol base on foot (True / False)

h.   The patrol's main effort was definition of the buildings in the objective
         area   (True / False)

i.   The patrol departed at night (True / False)

j.   The patrol agreed with 32's assessment of the terrain west of the objective
         area   (True / False)

/ 5

1.3   Which of the following weapon system was observed?

     a.   AK 47
     b.   PKM
     c.   82mm Recoilless Rifle
     d.   None of the Above

/ 2

2.2   Center a dot in the grid square of the ORV.
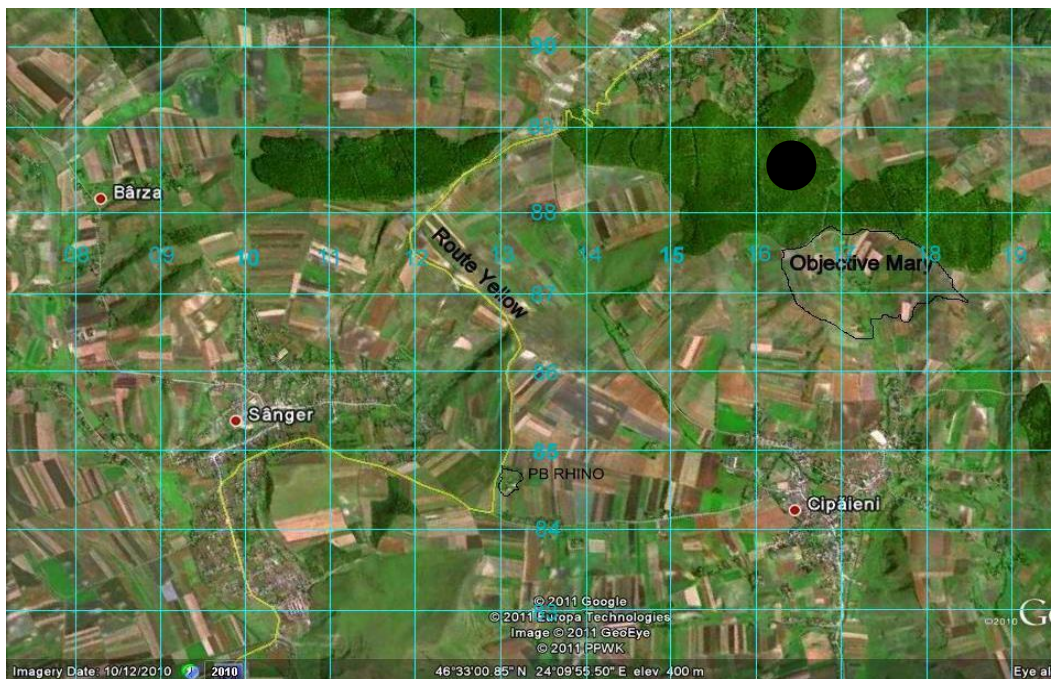
GR 16 88

/ 5

3.2   Which of the three COAs would you support and why?

COA 3 because the Attack element could move effectively to the east of Obj Mary and dismounted troops could cut off M2, M3, M4, M5. It would also push fleeing enemy to the west towards the river and the choke points (crossing sites)

/ 5

1.4   Which of the named approaches was recce'd by 61A?

    a.   M2
    b.   M3
    c.   M4
    d.   M6

                                                                        / 2

1.5   What best describes the terrain north of M1?

    a.   Swamp
    b.   Hills
    c.   Fields
    d.   Brush

                                                                        / 2

1.6   Which lane is described as follows: approximately 30m wide throughout ... clear and flat and hardened and has recently seen a large amount of foot, bike and vehicle traffic. This is being used as a major route in and out of OBJECTIVE MARY?

    a.   M1

    b.   M2

    c.   M3

    d.   M4

                                                                        / 2

2.3   Center a dot in the grid square of the Horn.
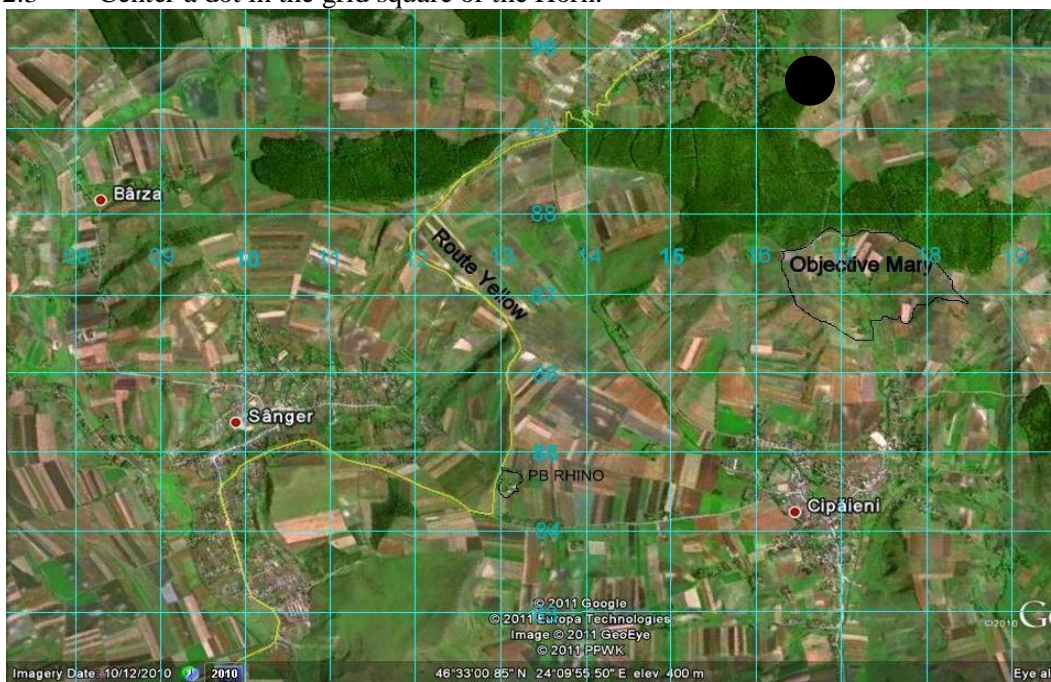
GR 16 89

                                                                        / 5

1.7   Which approach to OBJECTIVE MARY was not recce'd at some point the patrol?

    a.   North
    b.   West
    c.   South
    d.   East

/ 2

3.3   Suggest three Requests for Information (RFIs) that you would like Charlie Company to pursue in this area?

Attack position ORV

Z-lov harbour

Time required to move from ORV to Attack position.

/ 5

3.4   What is your assessment of the items found in the clearing north of M2?

Diesel Fuel + FERTILIZERS = OKLAHOMA City Truck Bomb.

A farmer may leave Fertilizers near his fields, but the area N of the woods is swampy. Very unlikely that fuel would be left somewhere unattended, esp in an area with problems such as this. Diesel is usually precious & in short supply, so would never be left alone to be stolen.

This site needs more observation in future.

/ 5

1.8   During what time of day was observation maintained on the buildings in OBJECTIVE MARY?

     a.   Late Morning

     b.   Early Afternoon

     c.   Evening

     d.   Night

/ 2

1.9   What Call Sign was the lead for this patrol?

     a.   E21B

     b.   61A

     c.   39

     d.   32C

/ 2

2.4   Center a dot where the patrol started its movement through M5
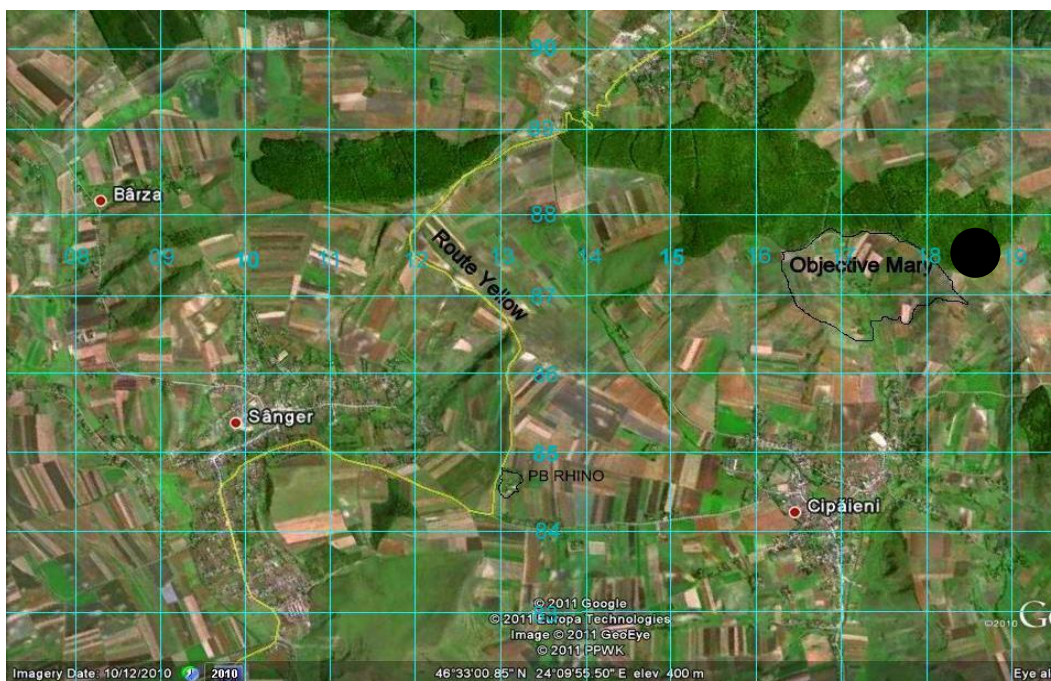
GR 18 87

/ 5

3.5   What kind of engineering support would be useful for Charlie Company's eventual exploitation of OBJECTIVE MARY?

C-IED assets based on equip found.
Bridging elements (rope, hasty dismounted)
Chainsaw

/ 5

1.10   Which approach was not observed both during the day and at night?

    a.   M2
    b.   M3
    c.   M4
    d.   M5

/ 2

1.11   How many crossing points did the patrol identify prior to moving into M1?

    a.   2
    b.   4
    c.   6
    d.   8

/ 2

2.5 Which picture shows the buildings observed in OBJECTIVE MARY?

A.

B. correct

C.

D.
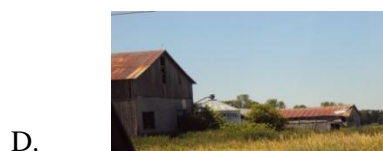
/ 5

1.12 Which statement about not stated about the southern edge of the woods?

a. Dense canopy provides cover from aerial observation
b. Edge of woods are relatively light with limited undergrowth
c. Relatively easy movement with good cover from the roll of the ground.
d. Platoon-sized element would be able to skirt the southern edge of the woods

/ 2

3.6   Would you consider this a successful patrol?

YES - GOOD RECCE OF TOALS
    → GOOD DETAIL OF EACH APPROACH
    → ENGINEERING ASSESSMENT OF OBSTACLE
      ID FROM 32
    → POL OF OBJ MARY
    → UNDERSTANDING OF APPROACH TO.
      STAGING AREA / OBJ

    →

/ 5

<u>END OF TEST</u>
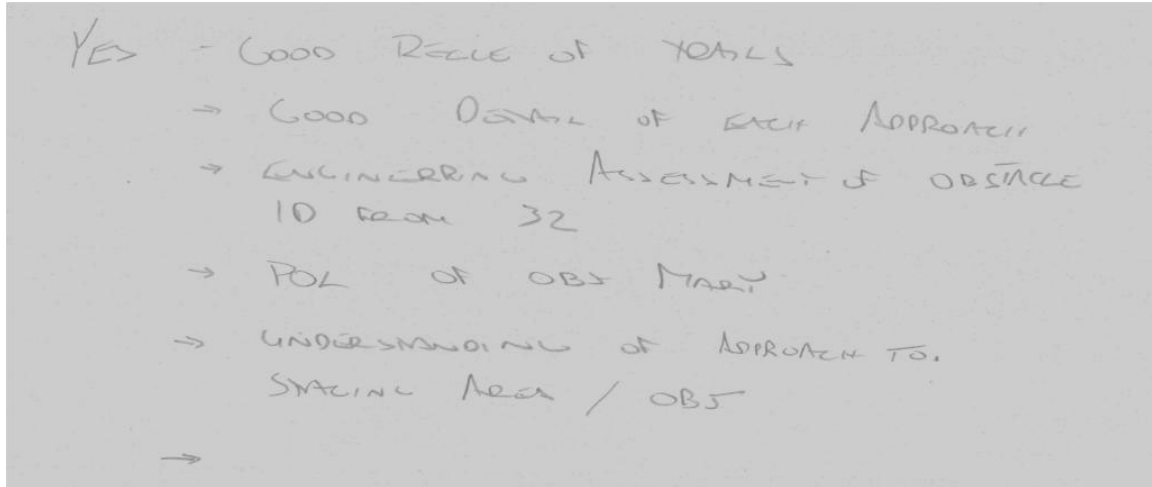
APPENDIX J
GENERAL SURVEY ANALYSIS

The final element of the experiment was a questionnaire designed to tease out which features of the blended report were preferred by the participants. The first section of this document asked them to "Rate the value of the inclusion of the following elements":

1.1.   The use of a GPS trace as opposed to the route card

1.2   The side-by-side placement of imagery and text as opposed to one large block of text followed by a picture section at the end.

1.3   The **bolding** of certain words and phrases.

1.4   The inclusion of a mission overview block describing the situation, mission and scheme of manoeuvre as opposed to placement of these elements somewhere in the text block.

1.5   Repetition of corresponding map segments as opposed to inclusion of the map simply at the end.

1.6   The de-condensing of print through the use of more white space as opposed to conventional staffing.

1.7   The inclusion of directional arrows on the different map segments as opposed to textually describing the direction of travel.

1.8   The use of color in both templates as opposed to black-and-white.

1.9   The use of GPS track segments as opposed to the textual description in a route card.

The figure below shows the rating scale as it appeared under each of these questions and the method used to convert these scores for further analysis:

Significant Detraction   = -5
Detraction   = -3
Mild Detraction   = -1
Neutral   = 0
Mild Improvement   = 1
Improvement   = 3
Significant Improvement = 5

Figure J1: General Survey Rating Scale and Scoring Criteria

Using a positive and negative rating scale has the advantage that it allows for a general deduction about the overall utility of the features by color coding the responses. The below table shows the full set of responses, shrunken to the point that individual data is difficult to decipher but that a full picture of the trend of the results should be clear. Positive scores are colored green, neutral scores and those marked as 'I Don't Know' (which for scoring purposes were ignored) are marked in yellow, and negative scores are highlighted in red.

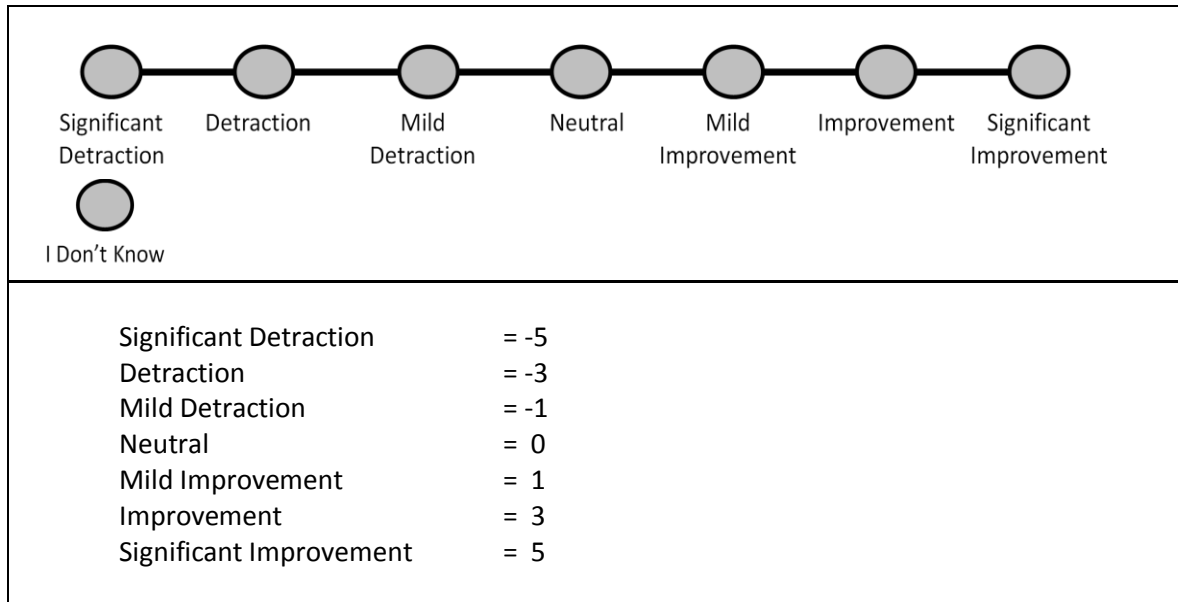|								
5	5	0	3	1	5	5	5	5
5	5	3	3	5	3	5	5	5
3	1	3	3	3	I Don't	1	5	3
5	5	3	0	5	1	5	5	5
5	5	3	3	5	3	5	3	5
3	3	3	3	1	3	3	3	3
5	5	1	3	5	3	5	5	5
0	3	3	3	-3	1	5	3	1
0	5	0	-1	-1	0	0	5	0
5	5	3	5	5	3	5	5	5
5	3	1	3	5	0	3	5	5
3	5	1	1	3	5	5	5	5
3	3	3	3	3	3	3	3	3
5	3	3	5	3	3	5	3	5
3	3	3	0	3	0	5	3	3
1	1	3	3	-1	1	5	5	0
3	3	0	1	3	1	3	3	1
5	5	-1	3	5	0	5	5	3
0	5	3	3	-1	-3	5	5	3
5	5	1	1	5	1	5	5	5
I Don't	3	1	1	1	3	5	3	1
5	5	0	1	3	3	5	5	5
0	5	3	5	5	-5	5	0	5
5	3	0	3	3	5	5	5	3
1	0	0	-1	3	0	3	3	3
5	5	1	3	5	3	5	5	5
1	3	3	3	3	3	5	3	3
5	5	5	3	5	1	5	5	5
5	5	5	5	5	5	5	3	5
5	-5	3	5	5	5	5	1	3
3	5	3	3	5	5	5	3	5
5	5	0	0	3	1	5	3	5
3	-3	0	0	1	1	0	-1	1
3	5	1	3	5	5	5	3	5
3	5	1	-1	5	I Don't	5	5	3
5	5	5	5	5	3	5	5	5
5	5	1	5	5	5	3	0	5
5	3	3	3	1	0	5	5	5
5	5	5	5	5	5	5	5	5
0	1	3	0	I Don't	1	-1	3	3
3	5	-3	3	3	1	3	3	5
-1	1	3	5	-3	1	5	5	5
5	5	0	1	0	3	5	3	5
3	-3	3	3	1	3	5	1	5
3	5	-3	1	3	-1	3	3	5
5	5	3	3	5	0	5	5	5
5	5	-5	-1	-5	-3	5	5	5
3	5	1	0	3	5	5	3	3
5	3	0	3	3	0	3	0	5
3	5	1	1	3	3	3	3	3
0	5	3	I Don't	5	5	3	3	3
5	5	5	5	5	5	5	3	5
3	5	1	5	3	0	3	5	3
I Don't	5	3	1	5	3	5	3	I Don't
5	3	3	0	0	3	3	3	5
3	5	I Don't	3	3	I Don't	3	0	3
3	5	0	3	3	5	5	5	5

Figure J2: General Survey Coloured Response Matrix (Scored from -5 to 5)

The 57 participants each provided responses to 9 questions for a total of 513 scores. Of these 24 (4.7%) were negative, 44 (8.6%) were neutral, 9 (1.8%) were undecided, and 436 (85.0%) were positive.

Presentation of the average scores is simpler when the range is changed from a range -5 to 5 to a range of zero to 10. This sees the conversion changed to follow equivalency:

Significant Detraction	= 0
Detraction	= 2
Mild Detraction	= 4
Neutral	= 5
Mild Improvement	= 6
Improvement	= 8
Significant Improvement	= 10

This change makes it easier to see which of the various elements was preferred and by what margin. These results – shown in descending order of preference – are as follows:

Table J1: Preferred Blended Template Elements based on General Survey Responses

	Average Rating	Rating Range	Question Number
Inclusion of Directional Arrows	**9.2**	Improvement to Significant Improvement	S1.7
Use of GPS Track Segments vice Textual Description	**8.9**	Improvement to Significant Improvement	S1.9
Side-by-side placement of imagery and text	**8.7**	Improvement to Significant Improvement	S1.2
Use of Colour	**8.6**	Improvement to Significant Improvement	S1.8
GPS Trace as Opposed to Route Card	**8.5**	Improvement to Significant Improvement	S1.1
Use of Map Segments Throughout	**7.9**	Mild Improvement to Improvement	S1.5
Mission Overview Block	**7.4**	Mild Improvement to Improvement	S1.4
Use of White Space to De-Condense Text	**7.1**	Mild Improvement to Improvement	S1.6
Bolding	**6.7**	Mild Improvement to Improvement	S1.3

All of the elements included were seen as an improvement on average. The inclusion of directional arrows rated highest and was in the upper half of the improvement to significant improvement range. The use of global positioning system (GPS) track segments as opposed to textual desriptions, the side-by-side placement of imagery and text, the use of color, and the GPS trace as opposed to the route card were all in this same, highest range of user satisfaction. The

other four elements queried were all in the next highest range as a mild improvement to an improvement, with the use of map segments, the mission overview block and the use of white space all being in the upper half of this range, with only bolding in the lower half.

In the second section of this document, the participants rated the overall utility of the doctrinal templates and the blended templates using the following questions:

2.1   You were given two templates. One was designed around a standard report format and contained a large section of text broken into number and titled sections, followed by a large section of pictures, which were numbered to correspond with the text.

Segment of Text Section   Segment of Imagery Section

We established an ORV just NE in some low ground at GR 1221 8771. Density of this strip of foliage between unharvested fields allowed for undisturbed observation from a hastily established vantage point for approximately two hours. UAV observations from the previous 24 hours saw multiple vehicles cross over the suspected area so pressure plate was not considered likely mechanism. We established a vantage point to try to determine likely firing position and observe pattern of life. This was maintained for approximately two hours.

Rate this template's overall utility for capturing information out of 10 using the following scale.

10 — Optimal

9

8 — Strong

7

6 — Satisfactory

5

4 — Weak

3

2 — Limited to No Value

1

0

2.2 The second template started with a mission overview that graphically and textually described the context of the patrol. The patrol was presented chronologically through the use of combinations of map segments, overlays, pictures and descriptions.

Patrol moved back to ORV at 1700hrs then skirted treeline to the horn.

(this edge was recce'd by patrol – as with the rest of the woods it provides covered movement through light, tall vegetation to a depth of about 40m and is flanked by open fields, most of which have recently been tilled, also no drug crops were observed on this patrol).

Remained in location until 2200hrs.

Rate this template's overall utility for capturing information out of 10 using the following scale.

10 Optimal

9

8 Strong

7

6 Satisfactory

5

4 Weak

3

2 Limited to No Value

1

0
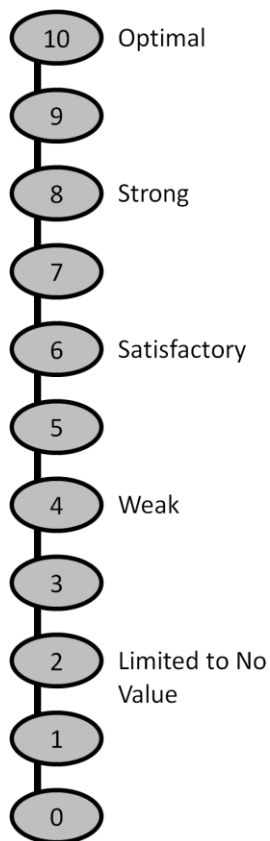
There were few differences in terms of preference for any of the elements queried in the General Survey when viewed by green and blue grouping (see Annex T for further details) and in the case of their assessment of the utility of the two templates both groups rated the blended template as average of 8.3 / 10, indicating that there was no difference in satisfaction with the Scenario 1 and Scenario 2 versions of the blended template. There was a minor difference between the green and blue responses for the doctrinal template, with the green grouping which used the doctrinal template in Scenario 1 rating it on average as 5.6 / 10, while the blue group rated the Scenario 2 doctrinal template as 5.2 / 10. Overall the doctrinal templates were rated as 5.4 / 10 compared to the significantly higher level of satisfaction for the blended template, which averaged 8.3 / 10.

	S2.1 -- Control Template	S2.2 -- Experimental Template
Max Score	10	10
Green Group Average	5.6	8.3
Green Group SD	1.8	0.8
Blue Group Average	5.2	8.3
Blue Group SD	1.4	1.1
Overall Average	5.4	8.3
Overall SD	1.6	0.9

Table J2: Preferred Template based on General Survey Responses

APPENDIX K
MARKING METHODOLOGY AND RESULTS

Marking – Part 1

As described earlier the 1.1 to 1.12 series questions (henceforth referred to as Part 1) consisted of the following multiple choice questions (for the full range of questions, refer to Annexes I and L, with the solutions and attempts included in the appendices):

1.1.   Were any of the following found throughout the patrol (circle yes or no)?

    a.   Canned Food (**Yes** / No)

    b.   Unexploded Ordnance (UXO) (Yes / **No**)

    c.   Improvised Explosive Devices (IED) (Yes / **No**)

    d.   Empty Shell Casings (Yes / **No**)

    e.   Alcohol (**Yes** / No)

        / 5

1.2   Are the following statements true or false (circle the correct answer)?

    k.   The patrol consisted of less than 15 soldiers (**True** / False)

    l.   The patrol returned to the patrol base on foot (True / **False**)

    m.   The patrol's main effort was definition of the buildings in the objective area (True / **False**)

    n.   The patrol departed at night (**True** / False)

    o.   The patrol agreed with 32's assessment of the terrain west of the objective **area** (True / False)

        / 5

Both of the above sets of questions were based on factual information drawn directly from the reports and were in no way ambiguous.

1.5. In total how many weapons were seized?

    a.   5 to 10
    b.   10 to 15
    c.   15 to 20
    d.   20 to 25

/ 2

1.6. What was the mechanism of the Corporal's injury?

    e.   Chemical Burn
    f.   Gun Shot
    g.   Heat Rash / Chaffing
    h.   Shrapnel

/ 2

These questions were again based solely on factual, non-subjective information presented in the reports, but generally required some slightly deeper analysis. In the above examples, Question 1.5 required that a subject was able to recall the general number of weapons found. This information was not explicitly written in the text, so it was necessary for the participant to visualize the weapons caches, determine a rough number, and select the appropriate range. For Question 1.6, the participant would have been able to eliminate options b. and d. as there was no enemy action during the patrol, and would have had to select a. based on the circumstances in which the injury occurred, without its exact mechanism being spelled out. Other questions required participants to note the time of day, i.e. evening having instead been given the time; determined the total number of soldiers on the patrol, having only being given a list of which call signs and attachments participated; or identified which approach had not been attempted, based on the information they had about the ones that were. As these questions were more difficult, they were more heavily weighted than those that required a simple yes or no.

Part 1 include five points for the five yes / no questions, five points for five true / false questions and 20 points for 10 multiple choice questions for a total of 30 marks. The individual scores for each participant for each question, along with the total and percentage scores for each participant for this section, as well as for the other two question types (Parts 2 and 3, described in subsequent sections) can be found along with information on the differences between the control / experimental and blue / green groups in Annexes O (Scenario 1) and P (Scenario 2).

Marking – Part 2

The 2.1 to 2.4 series involved identifying where a given event occurred. This information was available via the textual descriptions included in either of the templates. Neither template showed any of the locations requested as a point on the map, but in the case of the control version this information could be more accurately determine in conjunction with the route card provided; in the experimental template, this information enhanced through the various route segments or the traces included.

Start GR	End GR	Bearing	Straight-line Distance	Comment
1302 8475	1265 8482	5200	350	Depart PB
1265 8482	1295 8780	0200	2900	Turn North
1295 8780	1221 8771	5100	750	ORV
1261 8723	1299 8759	0400	450	Departed from 2 Sect Block
1299 8759	1338 8739	2500	400	Nil
1338 8739	1380 8760	0700	700	Long Halt
1380 8760	1472 8771	1500	1000	Nil
1472 8771	1484 8579	3000	1900	Nil
1484 8579	1569 8577	1600	900	Nil
1569 8577	1621 8607	0900	700	Nil
1621 8607	1611 8761	0200	1500	From hear began cloverleaf of objective along its southern boundary until the 1805 easting
1805 8652	1690 8580	4200	1300	OP Location
1690 8580	1681 8576	6400	300	First Cache
1692 8219	1606 8564	5600	900	First Leg Route Back (39C COMMENT GRID SHOULD READ 1692 8519)
1606 8564	1550 8561	4800	500	Old Treeline
1550 8561	1548 8534	6400	300	Start skirt road
1548 8534	1495 8551	5200	600	Crossed river
1495 8551	1371 8490	4300	1200	Suspected OP
1371 8490	1328 8471	4100	700	East gate

All four questions on both tests used the same map at the same scale
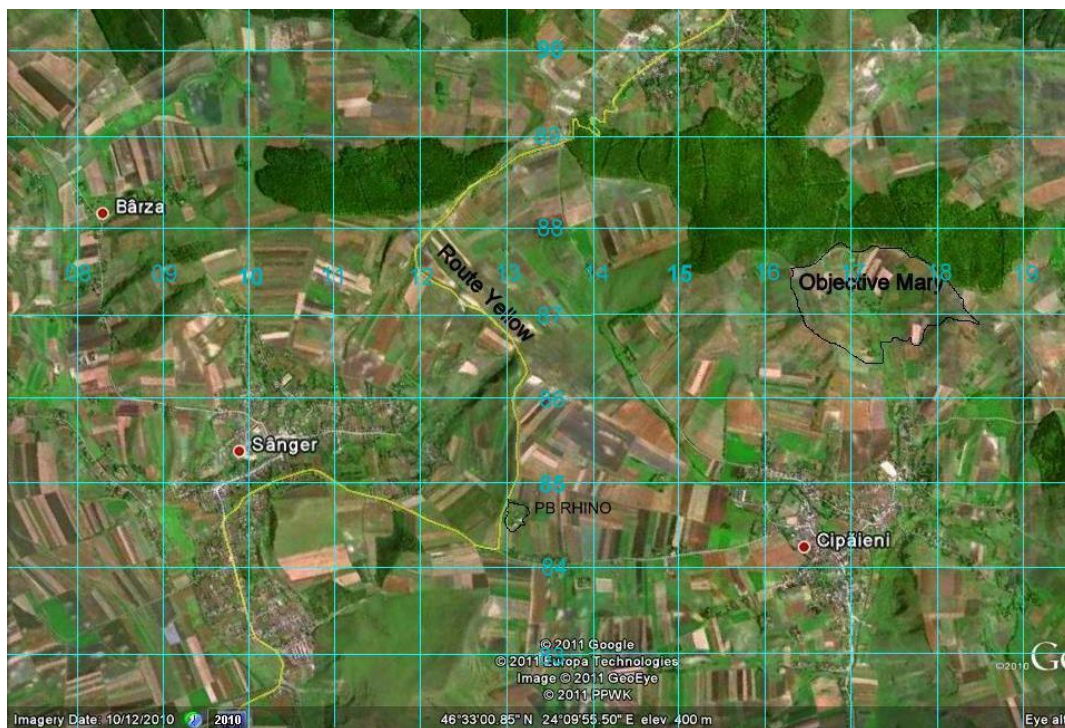
The marking breakdown for these was described with Question 2.1 for each test in both versions:

/ 5 (full points for the correct grid square;
3 points for any of the adjacent grid squares / 2 for any diagonal square)

Markings in all other squares were marked as zero, thus a total of 20 possible marks was available for these four questions in either test.

The figure below illustrates how marks were allocated. In the top right is the correct location; the top left shows four locations that would have also received full marks; the bottom left shows fours locations that would have been marked as 3 / 5; the bottom right shows four locations that would have been marked as 2 / 5.

| 2.2 | Centre a dot in the grid where the second foot bridge is located. |

Exact Location (5/5)

Same Grid Square (5/5)

Adjacent Square (3/5)

Diagonally Adjacent Square (0/5)
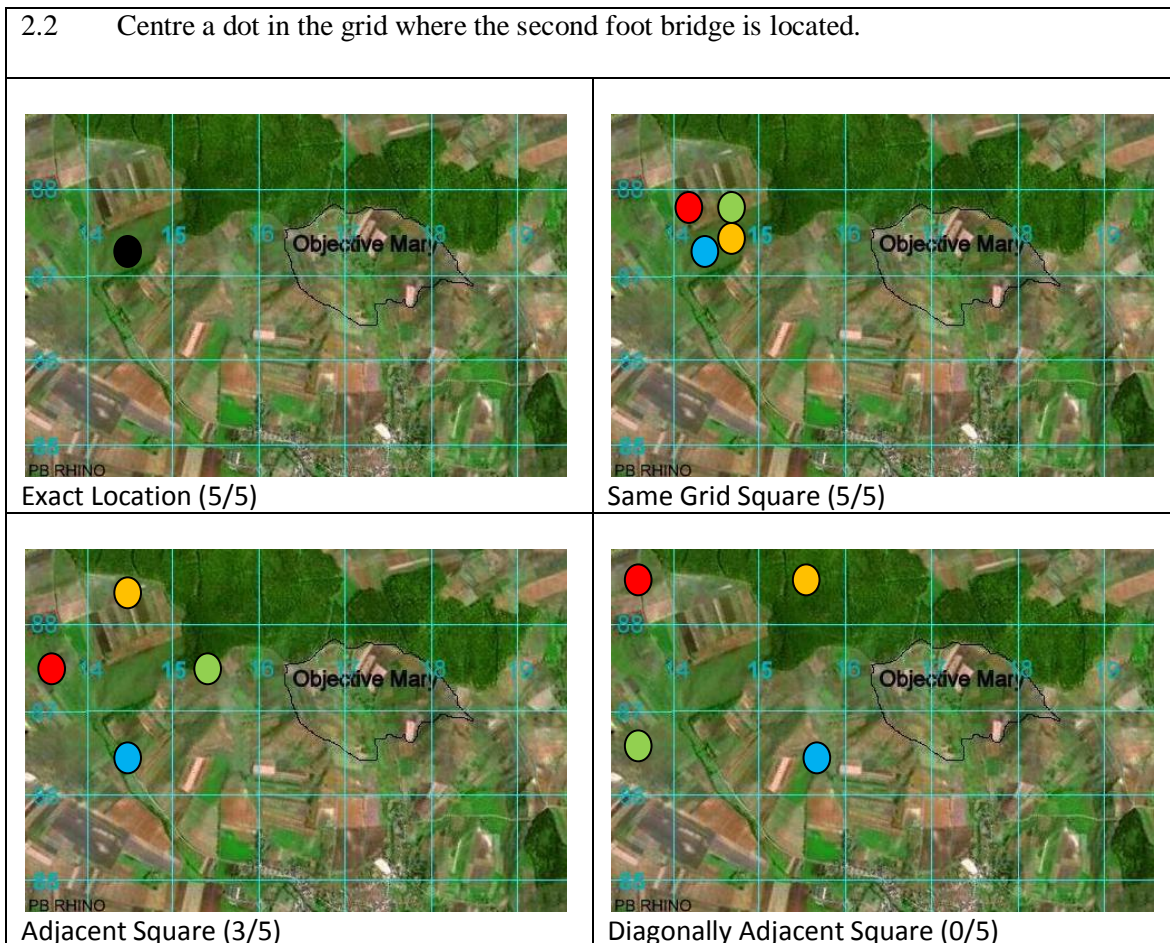
This series of questions was designed to determine a subject's ability to recall specific events of major significance. In the Scenario 1 test this included:

- Identifying the location of a suspected IED, which spoke to the initial threat in the area, the absence of which should have prompted deductions about the reliability of local informants and the validity of that threat, and was the start point for a more consequential secondary mission.

- Identifying the location of weapons caches, which should have prompted deductions about the accuracy of the enemy and local sections of the situation and potential changes to the enemy's most likely and most dangerous actions.

- Identifying the location of a suspected enemy OP, which should prompted deductions about enemy habits and movements as well as the security of their own tactical infrastructure.

- Identifying the location of a river crossing, which with the exception of the crossing points representations a major obstacle to easterly mounted and dismounted movement.

In addition to the sample question in the above figure, the Scenario 2 test the questions asked the participant to:

- Identify the location of the patrol's objective-rendezvous to demonstrate understanding of the patrols general movement and conduct.

- Identifying the location of an area designated as the 'Horn', a frequently referred to reference and their point of departure from the treed area surrounding the objective area toward their eventual pick-up point.

- Identifying where the patrol began its movement through the gap designated as 'M5', the final line of advance through the northern wood-line searched by the patrol This was the only one of the four lines reconnoitred from south to north, as this occurred after the patrol had completed a leg to clover-leaf the extreme east of the treed area, followed by a east to west approach of the start of this gap, which allowed for an assessment of the viability of an eastern approach to the objective area.

Question 2.5 similarly involved visual recall, but was specific to key image rather than location identification. Given the significance of these images with respect to each patrol, they were given the same weighting as the location identification questions. The questions for Scenario 1 and 2 were as follows:

2.5.   Which individual is the detainee?

A.

B.

C.

D.

/ 5

2.5   Which picture shows the buildings observed in OBJECTIVE MARY?

A.

B.

C.

D.
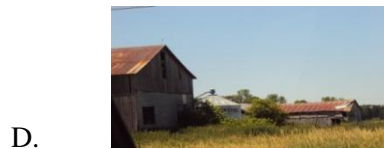
/ 5

The third component of part 2 was the tracing of the patrol's route. Given the importance of understanding where and how the patrol traversed the ground this was the single most heavily weighted question of the test at 20 marks. Using the map below, participants were instructed simply to trace out the route (as best as they could remember it):
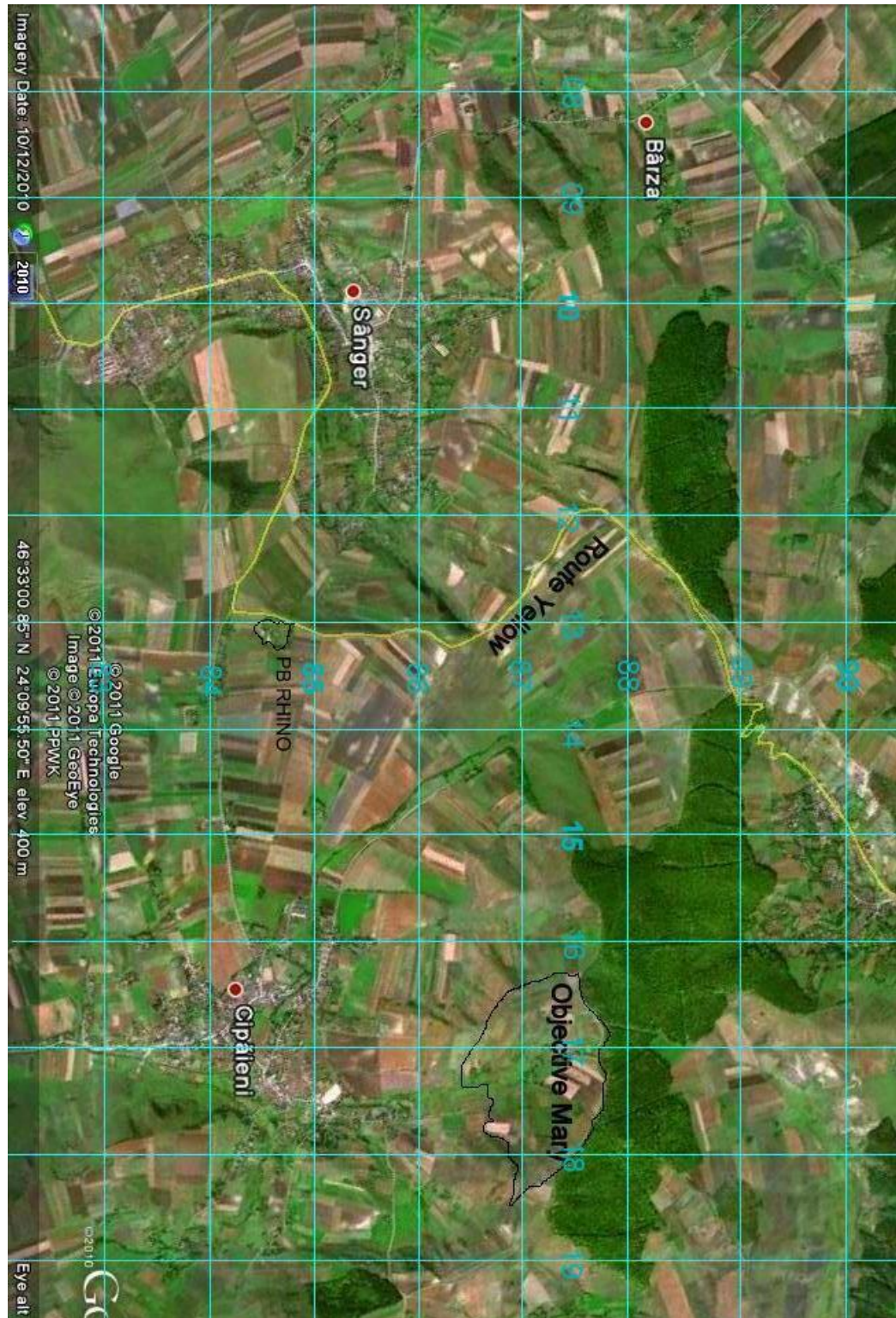
There was no requirement for any other markings or indication of direction, simply the requirement to draw the path. On the following page (to retain scale) is an example of such a trace, in this case a route built out of approximation of route to the initial objective and the stitching-together of route segments directly from Scenario 1 Experimental Template.

Given the almost limitless variety of potential traces, fairly and accurately marking such an exercise can be challenging. Rather than trying to mark the accuracy of the path or the fit of the shape, it was decided that marking would focus on whether or not the path included certain points. To determine this, an overlay was produced for each test (these overlays can be found as Appendix 2 to both Annexes I and L).

1088

1487

1988
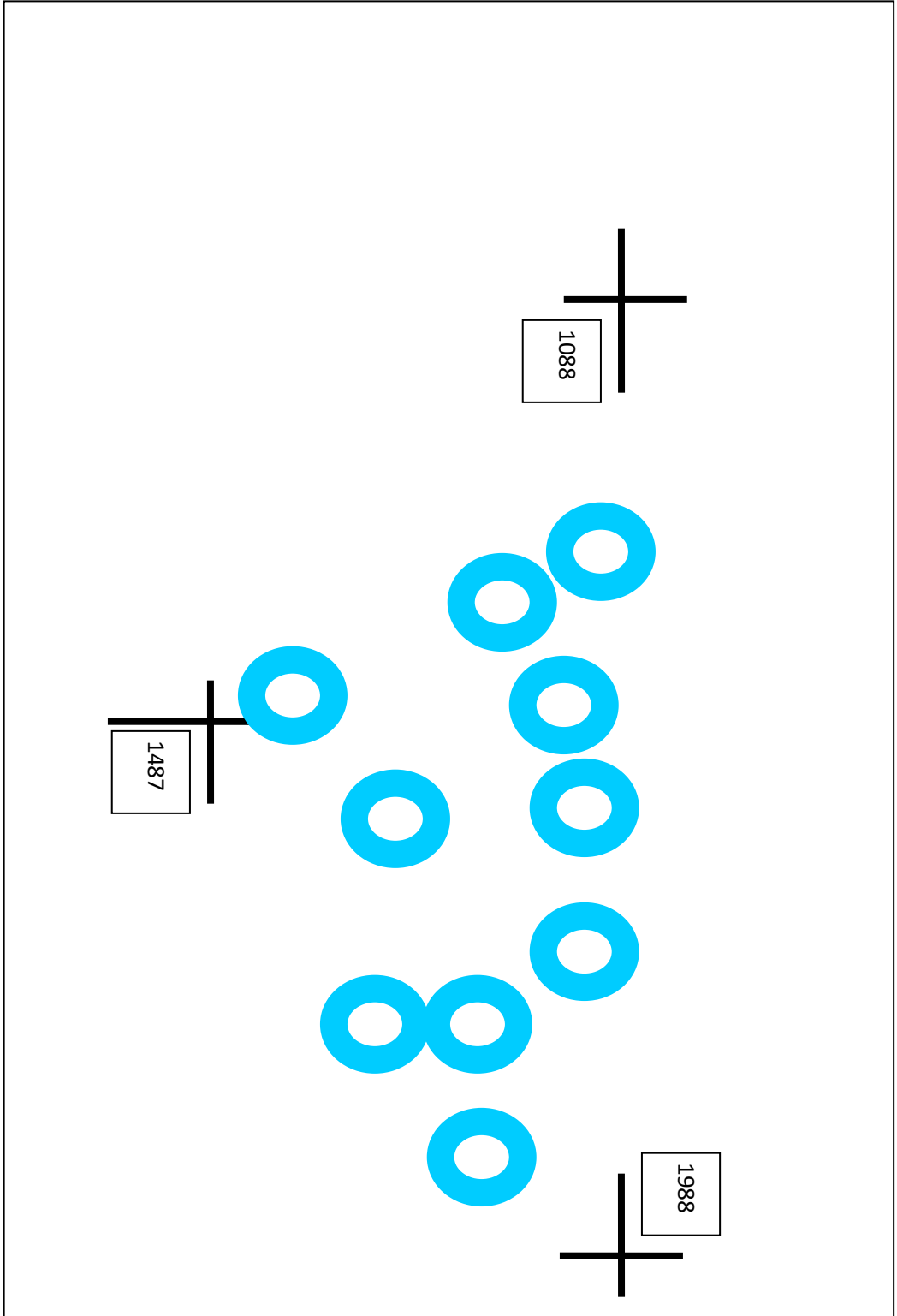
The overlay, which was printed off on transparency paper to the identical scale of the map, was place on top of each response. Lining up the grid intersection points – the 4-digit numbers next to the three crosses – allows for a quick initial assessment of the similarity between the overlay and the trace.
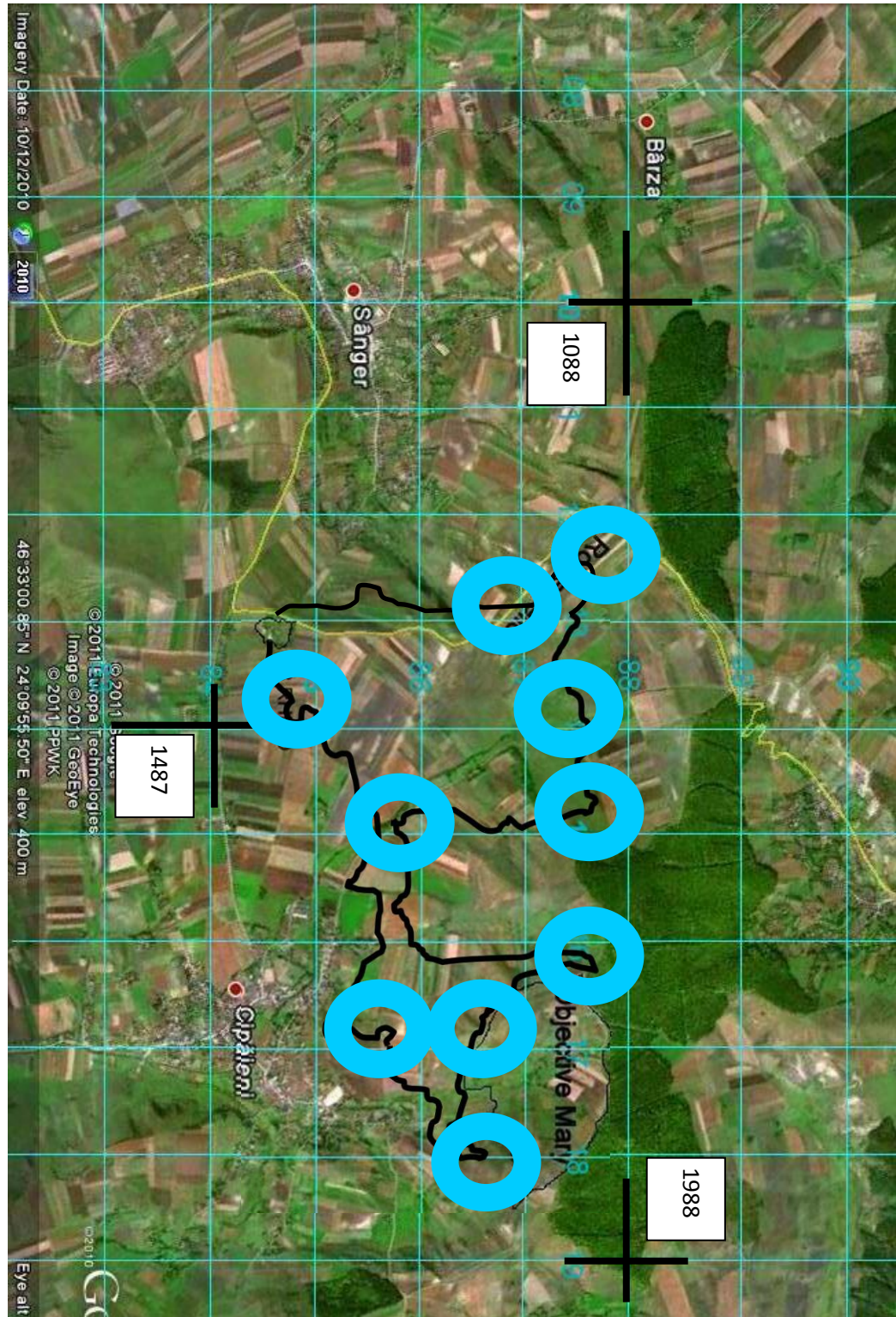
Each blue bull's-eye is centred on an exact point the patrol moved across. The inner circle has a diameter of roughly 400m, the outer circle formed from the inner (transparent) circle and the outer (blue) halo, has a diameter of 800m. Full marks (2 / 2) were given for any lines or markings that were found within the inner circle as this indicates an accuracy specific to that point of +/- 200m. If no lines or markings were found in this inner circle, any line or marking found within the blue halo would yield one mark, as this would mean an accuracy of +/- 400m.

2/2	1/2	0/2
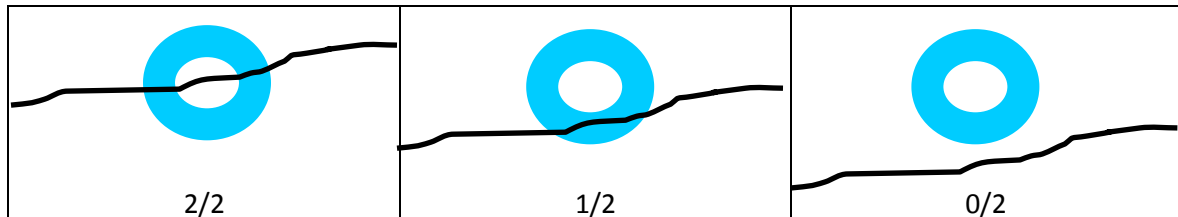
There is a potential argument that there was some inherent advantage in terms of information availability between the control and experiment group with respect to the route. Both were provided identical textual descriptions of the route; these simply appeared in different sequence. The potential difference was that the experimental group was show a traced path that showed the exact path of the patrol across the ground (a GPS trace), while the control group was provided with a route card. This route card does not show the meandering of the patrol across the terrain, but instead shows only the start and end points of various legs along with bearing and distance of each straight-line approximation between the two points. This said all of the blue bull's-eyes used for marking were placed on locations that were specifically referred to in this text. Textual information alone (had it been perfectly retained in memory) would have been sufficient (with a good understanding of map use) to determine a general route that the patrol took through each of these points.

This application of disparate textual chunks to route re-call is, however, unrealistic. This said, the route card still had sufficiently information to determine an optimal solution. Had a participant simply plotted each of the grid points identified in the route card onto the blank map provided, he would have generate a solution that would have seen a mark in 9 of the ten bull's-eyes. Had he simply added a rudimentary cloverleaf of the objective (as described several times in the report), he would have – without bothering to connect any dots or drawing a single other line – generated an optimal solution.
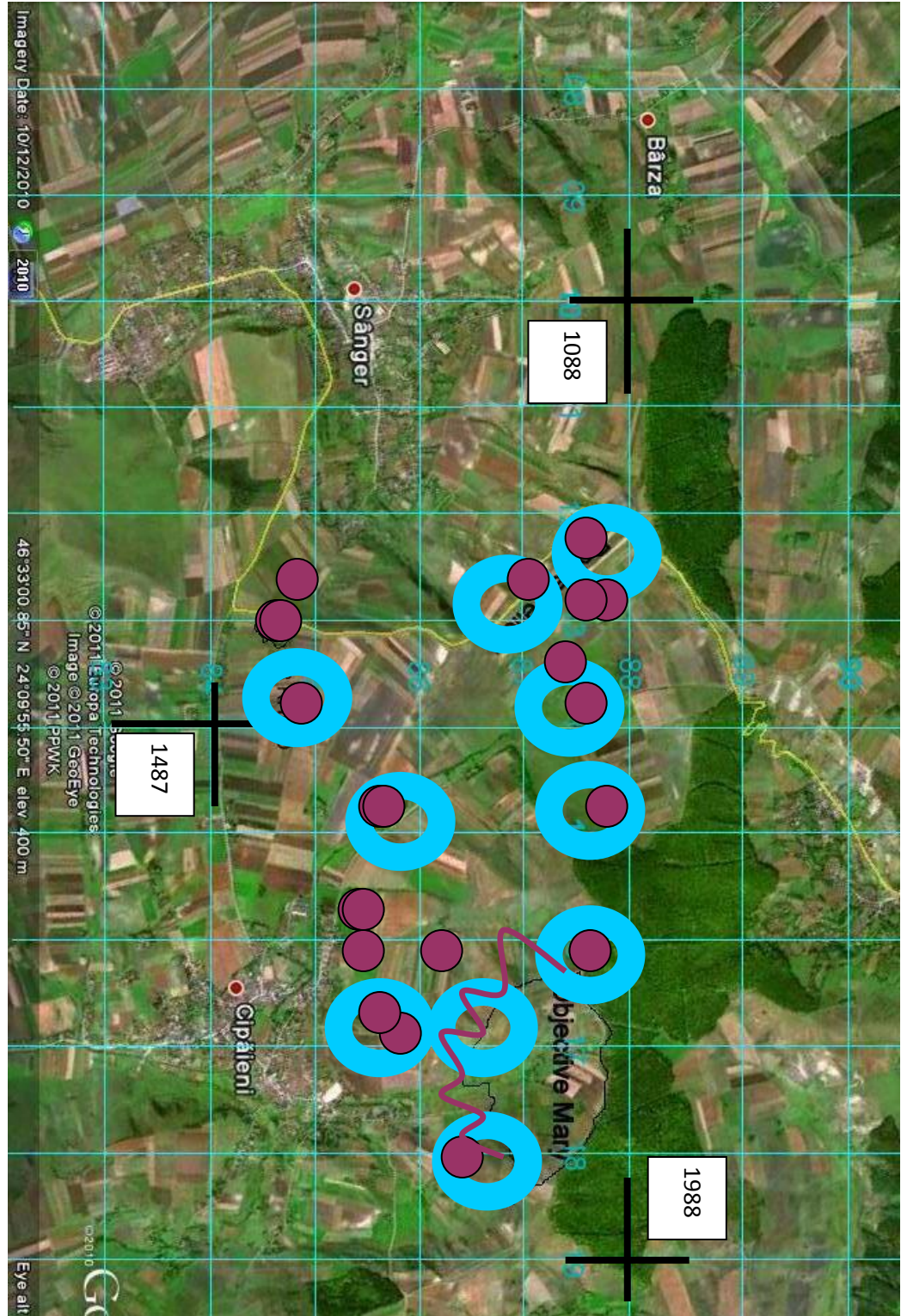
Now in fairness, to develop such a solution, he would have had to remember all of the points or have had to create this overlay during the time assigned for reading the report and then attempted to replicate. This additional effort under time pressure is unlikely and is less efficient than the

information being provided in a more appropriate manner to begin with, but that is, of course, the point that this research is aiming at.

The following examples from Scenario 1, copied from scanned tests, should serve to both demonstrate the variety of answers received and provide a general feel for what kinds of shapes yielded which range of marks.

5 / 20

In the above case, simply applying a curved line from the patrol base to the objective area hit enough of the bull's eyes in the areas of the caches and along the out route to garner five out of the twenty possible points. The sample below is a substantial improvement. It captures the general movement to the initial objective, more or less accurate shows the easterly movement toward the objective area, and covers part of the out route. It falls short, missing the dog leg to crossing the river on the move to Objective Mary, not showing the cloverleaf of the objective area, and failing to capture the movement in the vicinity of the caches.

10 / 20

15 / 20

The sample above is a further improvement its replication of the movement to and around the first objective along with the movement to Objective Mary is more accurate, and it includes some of the movement around the objective area, though it too represents this as a half circle around the southern boundary rather than as a cloverleaf and also misses the dog leg. It does capture generally capture the out route and the movement around the caches but not with a superb degree of accuracy. Nonetheless this was a generally strong response that captured 3/4's of the possible marks. The example below, the highest scoring sample for Scenario 1, is a further refinement of the in route, shows a more accurate depiction of the movement around Objective Mary and the cache site and is a good fit with the out route, including the movement past the suspected enemy observation post.

17 / 20

Scenario 2 saw a comparable range of response.
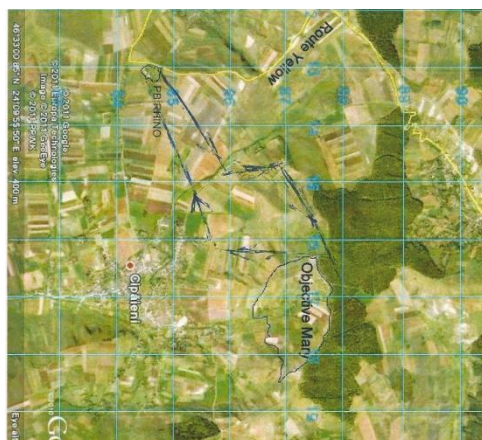
In the above case, only the movement to the western most gap was capture along with some of the ground covered by the reconnaissance detachment, but no further movement to the objective rendezvous (ORV) is included and the out route is completely inaccurate. The example below does better. It is a decent representation of the movement from the patrol base to the ORV, so effectively captures the first of a three phase patrol. Unfortunately, the author of this test stopped without completing these other two / thirds of the patrols movement (though because of the overlap between in and out routes, still achieved a score of 50%).
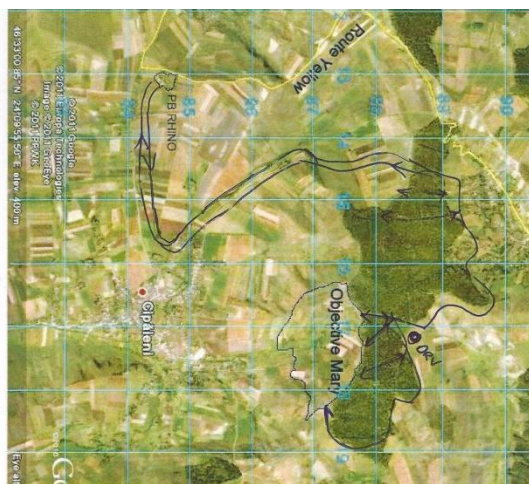
The sample does cover these other phases, accurately in the case of the action at the objective, inaccurately with respect to the route back to the patrol base. It shows the entrance to all four of the lanes reconnoitred after the ORV, but does not show the movement through the easternmost gap and the ORV is labelled incorrectly, though the trace sketched is relatively close to its actual location. The most significant errors, besides tracing the out route as a mirror of the in route, is showing the western most movement through the wooded area about 1000m too far to the west and missing 61A's probe along the southern edge. The sample below does not include these same errors – it captures the movement to the first gaps and situates it in the correct location, it shows 61A's circuit, then the patrol's movement through the gap, along the northern edge of the forest, passed the Horn, and into the ORV. It then shows the pattern of movement from the ORV to the four lanes into the objective area and finally the patrol's link-up and northerly movement toward the pick-up point on Route Yellow.

Marking – Part 3

Short answer test were meant to draw together disparate pieces of information from throughout the report and see the participant produce a response based on a more unified understanding of this information and its context within the situation provided with a view to its utility for future operations. In the case of both tests, the participant was given a specific role as a lens through which to view the report; in the case of the markers, they were told to mark the responses as though they were the Commanding Officer of a unit and had received these assessments from one of their immediate subordinates.

Marking such general questions carries with it a great risk of subjective bias. Four experts were selected to mark all responses. All of these markers were experienced soldiers that had previously participated in pilot testing and were given significant time to familiarize themselves with the material. Two of the experts were master snipers – one serving and one retired – that by virtue of training are well-acquainted with reporting procedures and when queried during pilot testing reported having read 100+ patrol reports (the highest range available) and written 50+ (also the highest) range. In addition both have completed multiple tours as a sniper where they would have been required to complete extensive reporting of this type and had both been employed as a Unit Master Sniper in Kandahar were they would have read several hundred such reports from their own soldiers, from the reconnaissance platoon, and from the rifle companies that they supported. The third marker was a senior officer with multiple tours as a platoon commander in the former Yugoslavia; with the insight of a variety of senior positions, staff and technical training; and over twenty-five years of service in the infantry. This expert had previously been employed as the infantry technical advisor and a company commander at the infantry school and is currently holding the office of primary interest for all unique operations requirements including those of infantry reconnaissance and snipers. He also reported to have read and written the highest ranges of patrol reports when surveyed during pilot testing. To balance out this group, an experienced artillery officer, also employed in requirements development with staff and technical training that had the benefit of a tour in Kandahar with the fire support co-ordination centre was add to provide a more all-arms perspective.

Only whole numbers were used by markers (0, 1, 2, 3, 4, 5). The final mark assigned for any response to any question was the average mark of the four provided by the markers. Each test contained six short answer questions, spread throughout the document, worth five marks each for a total of 30 out of the 105 marks allocated for the entire test. What follows is the complete list of questions from both tests with a sampling of responses (high, medium, and low) for each question.

3.1.	Has there been a change to the most likely enemy threat: deliberate IEDs?

Scenario 1, Question 3.1 – High Score Example (L107)

Yes, presence of possible CBRN agent.
OP with observation on CF activities indicates
recent use and may correlate with increased
surv. activities, may indicate return of Fighters
in short term
→ stock piles of wpn, including HMG may
indicate intent for offensive ops (capable
of lethal effects on CF)
  → stocking of ~~Food stuff~~ cbt supplies
      (Food, water)
→ implication of Farmer may indicate higher level
of LN sp for INS activities)

D	I	C	M	Overall
5	5	5	4	4.75

Scenario 1, Question 3.1 – Medium Score Example (L115)

NONE WERE OBSERVED BUT FIELDS COULD
BE USED AS CACHES — MORE INFO AFTER
CROPS HARVESTED

D	I	C	M	Overall
2	3	3	2	2.50

Scenario 1, Question 3.1 – Low Score Example (A128)

NO, remains very low.

D	I	C	M	Overall
2	2	1	2	1.75

While there are cases where higher scores were achieved by the control group, most of the high scores came from the experimental group on either test. This can be readily noticed in the examples provided by looking at the last digit of the identification number – for Scenario 1 tests all odd identification numbers are from the experimental group, with even numbers for the control group. The A or L at the beginning of each identifier show whether a given example came from a participant from AMS or LSL. As will be discussed later, these two groups had almost identical averages for both scenarios.

3.2.   The enemy habit was assessed to be one of moving in, emplacing, observing and leaving, is this still valid?

Scenario 1, Question 3.2 – High Score Example (L111)

3.2.   The enemy habit was assessed to be one of moving in, emplacing, observing and leaving, is this still valid?

No. A cache of weapons ↑ & food would indicate a habit preparing for an extended period of ~~time~~ time in location. ~~Observation~~ Suspected observation post was found though.

D	I	C	M	Overall
4	5	4	4	4.25

Scenario 1, Question 3.2 – Medium Score Example (A257)

No seem to be planning on returning

D	I	C	M	Overall
2	3	3	2	2.50

Scenario 1, Question 3.2 – Low Score Example (A114)

~~It could be, but~~

Yes as this could have been an isolated incident

D	I	C	M	Overall
1	2	1	1	1.25

While there were numerous higher scores for other question, this question appears to have been challenging or to have been given a low priority for most respondents, as the relatively light answer provided as the high scoring example was tied as the highest scoring response.

3.3.   Could a military cargo vehicle be driven from the suspected IED location to OBJ MARY along roughly the same in-route as the patrol?

Scenario 1, Question 3.3 – High Score Example (L142)				

NO. creek was deep, with steep Rocky sides on both bAnks further reece of creek may find suitable crossing / fording locations, or even a bridge. Since the AreA is heavily farmed, there is likely to be crossing points that tractors & other farming eqpt has used in the past.

D	I	C	M	Overall
4	5	5	4	4.50

Scenario 1, Question 3.3 – Medium Score Example (A110)				

non, track veh should be used

D	I	C	M	Overall
3	4	3	3	3.25

Scenario 1, Question 3.3 – Low Score Example (L150)				

unknown

D	I	C	M	Overall
1	0	1	0	0.50

3.4.	What follow-on missions would you recommend based on this patrol for 32?

Scenario 1, Question 3.4 – High Score Example (L116)

1. OP's to observe two + cache locs

2. OP to observe OP loc East of Rhino

3. OP to observe IED/culvert loc.

4. Visit the local police to interview Capt A. Vlochremsou
   - confirm what happened to upns
   - confirm what happened to detainee.

5. Cordon & Search of both cach locs & Random in Sangr & Cipalenr

I - 7/11

/5

D	I	C	M	Overall
5	5	5	4	4.75

Scenario 1, Question 3.4 – Medium Score Example (A258)

Observe the barn and secondary cache site. As well, observe the possible EN Op position found on the rtn leg.

D	I	C	M	Overall
3	4	3	3	3.25

Scenario 1, Question 3.4 – Low Score Example (A130)

Observation
Search

D	I	C	M	Overall
2	1	2	2	1.75

All examples for Scenario 3.3 and 3.4 came from the control group.

3.5.	Which weapon system should be of the greatest concern from the first cache?

Scenario 1, Question 3.5 – High Score Example (L111)

Mortar bipod, as this would indicate ability of enemy to achieve their most dangerous COA of engaging Tactical Infrastructure w Light Indirect Fire. However, it was not a complete weapon (no mortar tube) and looked to be in rough shape. Therefore RPK would be most imminent threat

D	I	C	M	Overall
5	4	5	4	4.50

Scenario 1, Question 3.5 – Medium Score Example (L156)

RPK, Dsh-K

D	I	C	M	Overall
2	3	2	2	2.25

Scenario 1, Question 3.5 – Low Score Example (L107)

→ Dhskh – HMG, can penefrate LAV
→ mortar mount also an issue
→ AK74, prestige wpn

D	I	C	M	Overall
1	3	1	2	1.75

The assessment of the AK74 as a prestige weapon is actually a very interesting deduction. Whether or not this assessment is accurate is of less consequence than the fact that the reasoning that reached this conclusion is quite in-depth. Had the respondent included even some of this reasoning, his mark would likely have been much higher. However, as either none of the markers shared this belief about the AK74 or, even if they did, assumed that this was simply a grasping guess having rejected two other options (interestingly, either one of which could have formed the basis for a solid response), the mark granted was comparatively low.

3.6	Would you consider this a successful patrol?

<div align="center">Scenario 1, Question 3.6 – High Score Example (L141)</div>

YES – BASED ON THE AMMOUNT OF
INFORMATION OBTAINED CONCERNING

    – NON THREAT IED

    → TERRAIN / APPROACHES OBJ MARY

    → WEAPONS CACHE / FOOD CACHE

    → DISTANCE

    → DISCOVER UNKNOWN CHEMICAL SUBSTANCE

    → SUSPECT ENE VANTAGE POINT OF
      PB RHINO

    → CHANGE IN ENE TACTICS / DOCTRINE

    → INTELLIGENCE

D	I	C	M	Overall
5	5	5	4	4.75

Warrant Officer Mackenzie was less generous in his marking than any of the other three experts. This high scoring example was the only answer of the 57 provided to this question that he marked as 4 / 5. Of the 684 questions total that he marked, he rated zero of them as 5 / 5.

Scenario 1, Question 3.6 – Medium Score Example (A104)				

YES, IN TERMS OF CACHES LOCATED AND SECONDARY MISSION (APPROACHES TO OBJ MARY)

NO, IN TERMS OF IED EXPLOITATION, AS NONE FOUND

D	I	C	M	Overall
3	4	4	3	3.50

Scenario 1, Question 3.6 – Low Score Example (A257)				

yes.

D	I	C	M	Overall
1	1	1	1	1.00

A simple 'yes' was a common response to this question. Given the weighting of this question, the fact that it was allocate an entire page to allow for long answers, the depth of responses from other respondents, and the broad nature of this question, all markers identified this as a weak response and consistently scored such answers as one out of five.

3.1 Which of M2, M3, M4 and M5 affords the best balance between ease of movement and stealth?

Scenario 2, Question 3.1 – High Score Example (L115)				

D	I	C	M	Overall
5	5	5	4	4.75

The control group and experimental group were switched from the first to the second scenario, thus for the Scenario 2 tests, odd identification numbers are now part of the control group and even numbers have become the experimental group. The above example then comes from the control group. This answer was tied for top marks at 4.75 / 5 and this participant had the second highest average score for all six short answer responses in the Scenario 2 test (74%) in the control group and the fifth highest score of all 57 participants in this category (the control group average for short answer responses was 35% for Scenario 2; the experimental group was 48%). This indicates that participants could still do well in this section with a doctrinal template.

Scenario 2, Question 3.1 – Medium Score Example (L112)				
M3 → good for disrntd forces but significant protection from obsn				
D	I	C	M	Overall
4	3	3	2	3.00
Scenario 2, Question 3.1 – Low Score Example (L105)				
M2 is easiest to move. Have no idea about any other details.				
D	I	C	M	Overall
1	1	2	2	1.50

3.2	Which of the three COAs would you support and why?

Scenario 2, Question 3.2 – High Score Example (A258)

COA 3 because the Attack element could move effectively to the east of Obj Mary and dismounted troops could cut off M2, M3, M4, M5. It would also push fleeing enemy to the west towards the river and the choke points (crossing sites)

D	I	C	M	Overall
5	5	5	4	4.75

Scenario 2, Question 3.2 – Medium Score Example (A116)

The first as it is the most straightfwd and easiest to apply

D	I	C	M	Overall
3	2	2	2	2.25

Scenario 2, Question 3.2 – Low Score Example (L105)

No idea, I ran out of time trying to decipher Sgt Turner's shitty report.

D	I	C	M	Overall
0	0	1	0	0.25

Some responses, were indicative of participant's frustration with the doctrinal report, specifically during the second test as the group that had already seen and used the blended template was now working with the doctrinal alternative.

3.3   Suggest three Requests for Information (RFIs) that you would like Charlie Company to pursue in this area?

Scenario 2, Question 3.3 – High Score Example (A258)				

Attack position ORV

Z-lov harbour

Time required to move from ORV to Attack position.

D	I	C	M	Overall
3	5	5	4	4.25

Scenario 2, Question 3.3 – Medium Score Example (A115)				

– Type of vehicle can pass

– obstacle

– Cache / RV /

D	I	C	M	Overall
4	3	4	3	3.50

Scenario 2, Question 3.3 – Low Score Example (L103)				

– Assessment of fertiliser and fuel stockpile as potential IED/HME components (M2).

–

D	I	C	M	Overall
1	3	1	1	1.50

Scenario 2, Question 3.3 – Blank Score Example (L114)				

D	I	C	M	Overall
0	0	0	0	0.00

3.4	What is your assessment of the items found in the clearing north of M2?

Scenario 2, Question 3.4 – High Score Example (L142)

Diesel Fuel + Fertilizers = Oklahoma City truck bomb.

A farmer may have Fertilizers near his fields, but the area N of the woods is swampy. Very unlikely that fuel would be left somewhere unattended, esp in an area with problems such as this. Diesel is usually precious & in short supply, so would never be left alone to be stolen.
This site needs more observation in future.

D	I	C	M	Overall
5	5	5	4	4.75

Scenario 2, Question 3.4 – Medium Score Example (L106)

Full fuel cans + fertilizer could be used to construct an IED.

D	I	C	M	Overall
3	5	3	2	2.25

Scenario 2, Question 3.4 – Low Score Example (A105)

Appears to be resupply point.

D	I	C	M	Overall
0	0	2	2	1.00

3.5   What kind of engineering support would be useful for Charlie Company's eventual exploitation of OBJECTIVE MARY?

Scenario 2, Question 3.5 – High Score Example (A258)				

C-IED assets based on equip found.
Bridging elements (rope, hasty dismounted)
Chainsaw

D	I	C	M	Overall
5	5	4	3	4.25

Scenario 2, Question 3.5 – Medium Score Example (L114)				

Support to cross the river with more than a patrol. A rope bridge is possible without engineering support.

D	I	C	M	Overall
3	3	4	2	3.00

Scenario 2, Question 3.5 – Low Score Example (A129)				

Bridging equipment.

D	I	C	M	Overall
3	1	1	1	1.50

The high response for this answer was from the same participant (A258) as the high response for 3.3. This participant was from the experimental group (the green group in Scenario 2) with an average score for Part 3 of 83% and an overall score of 78% for the test complete. This was a substantial improvement over his average of 68% for Part 3 and 58% overall when he was part of the control sample for Scenario 1.

Compare this to the participant that provided this low score example for this question. When A129 (blue group) was part of the experimental group in Scenario 1 his Part 3 average marks ranged from 2.75 to 4.50 out of 5, with a Part 3 score of 73% and an overall test score of 71%. When this same individual became part of the control group for the second scenario his short answer marks went down by an even greater magnitude than his colleague in the green group

improved. A129's score for Part 3 went down by almost half to a score of only 41% and an overall score reduced to 58%, this being buoyed by his comparatively high score in Part 1 (80%).

| 3.6 | Would you consider this a successful patrol? |

Scenario 2, Question 3.6 – High Score Example (L141)

YES - GOOD RECCE of GOALS
→ GOOD DETAIL of EACH APPROACH
→ ENGINEERING ASSESSMENT of OBSTACLE
   ID FROM 32
→ POL of OBS MARY
→ UNDERSTANDING of APPROACH TO.
   STAGING AREA / OBS
→

D	I	C	M	Overall
5	5	5	4	4.75

Scenario 2, Question 3.6 – Medium Score Example (L152)

The Comd's intent to define the 'M' rtes was clearly satisfied; therefore, the patrol was successful. Information was clear and images provided a good picture.

D	I	C	M	Overall
5	3	3	3	3.50

Scenario 2, Question 3.6 – Low Score Example (L148)

Yes It gathered the bulk of info required of the Patrol.

D	I	C	M	Overall

Comparison of Markers

While there was a wide variety in the responses, the score allocated by the markers all fell along a similar trend. The most generous marker on average was Sgt (ret'd) Blake Ives with an average score granted of 2.81 / 5 for the 684 questions marked. The least generous average was from the other master sniper, Warrant Officer Dave Mackenzie, with an average score granted of 1.83 / 5 for the same set of 684 questions. Major Sean Dwyer was toward the higher end with an average score granted of 2.61 / 5. Captain Steve Chledowski averaged 2.37 / 5. As discussed the final score for each response was the average score of the four markers; the average short answer response was marked as 2.41 / 5 with a standard deviation of 1.62. The average mark for Part 3 was 14.43 out of 30 or just over 48%.[56]

Table K1: Average Score per Question Granted by Marker

Dwyer	Average Score Granted	**2.61**
	Standard Deviation	1.72
Ives	Average Score Granted	**2.81**
	Standard Deviation	1.78
Chledowski	Average Score Granted	**2.37**
	Standard Deviation	1.60
Mackenzie	Average Score Granted	**1.83**
	Standard Deviation	1.12
Overall	**Part 3 Average**	**2.41**
	Part 3 SD	1.62

Table K2: Average Scores for Part 3 by Grouping

	Average Score (/30)	Average Percent	Average SD	Average SD Percent
Scenario 1 Control	15.96	53%	3.87	13%
Scenario 1 Experimental	16.82	56%	5.36	18%
Scenario 2 Control	10.52	35%	6.70	22%
Scenario 2 Experimental	14.39	48%	6.46	22%
	14.43	**48.1%**	**5.59**	**18.7%**

While the average score varied considerably marker-to-marker, the trend in their marking was similar. All markers scored the responses for Scenario 2 as 20-29% lower than the responses for Scenario 1.

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[56] 2.41 / 5 average from the marks multiplied by the six questions in Part 3 would yield an average of 14.46 / 30. This number however is inaccurate as the 2.41 has already been rounded, in this case up. Determining this score by averaging the individual cells yields 14.43.

Table K3: Average Expert Scores for Part 3 Responses by Scenario

		Scenario 1	Scenario 2	Improvement with Scenario 2 compared to Scenario 1
Dwyer	Average Score Granted	3.06	2.17	**-29%**
	Standard Deviation	1.48	1.82	23%
Ives	Average Score Granted	3.20	2.42	**-24%**
	Standard Deviation	1.48	1.96	33%
Chledowski	Average Score Granted	2.61	2.14	**-18%**
	Standard Deviation	1.41	1.74	23%
Mackenzie	Average Score Granted	2.00	1.59	**-20%**
	Standard Deviation	0.94	1.24	32%
Overall	**Part 3 Average**	**2.73**	**2.08**	**-24%**
	Part 3 SD	**1.42**	**1.74**	23%

When the responses are grouped according to whether they were part of the control or experimental group, there is even clearer agreement between experts. On average, they scored the responses from the experimental group between 17 and 19% higher.

Table K4: Average Expert Scores for Part 3 Responses by Control and Experimental Group

		Control Group	Experimental Group	Improvement with Experimental over Control
Dwyer	Average Score Granted	2.38	2.85	**19%**
	Standard Deviation	1.69	1.71	1%
Ives	Average Score Granted	2.60	3.01	**16%**
	Standard Deviation	1.78	1.76	-1%
Chledowski	Average Score Granted	2.18	2.57	**18%**
	Standard Deviation	1.57	1.61	3%
Mackenzie	Average Score Granted	1.70	1.96	**16%**
	Standard Deviation	1.12	1.11	-1%
Overall	**Part 3 Average**	**2.21**	**2.60**	**17%**
	Part 3 SD	**1.59**	**1.62**	**2%**

This same agreement in overall quality of response by group can be seen when comparing the blue and green groups. On average all markers agreed that the blue group provided 9 to 11% worse responses.

Table K5: Average Expert Scores for Part 3 Responses by Color Group

		Green Group	Blue Group	Improvement with Blue Group compared to Green
Dwyer	Average Score Granted	2.73	2.49	-9%
	Standard Deviation	1.61	1.81	12%
Ives	Average Score Granted	2.97	2.63	-11%
	Standard Deviation	1.71	1.83	7%
Chledowski	Average Score Granted	2.48	2.26	-9%
	Standard Deviation	1.52	1.67	10%
Mackenzie	Average Score Granted	1.93	1.72	-11%
	Standard Deviation	1.07	1.16	9%
Overall	Part 3 Average	2.53	2.28	-10%
	Part 3 SD	1.55	1.68	8%

The fourth way of grouping the sample is by whether they were part of the AMS department or were part of DLR (LSL). Given the information known about the two groups prior to the experiment, it is reasonable to expect that their achievement rates should be comparable. While a more detailed discussion of this division can be found in the subsequent section, it is worth looking at how this grouping affect the marks in Part 3.

Table K6: Average Expert Scores for Part 3 Responses by AMS / LSL Grouping

		LSL	AMS	Improvement with LSL over AMS
Dwyer	Average Score Granted	2.88	2.37	22%
	Standard Deviation	1.75	1.65	6%
Ives	Average Score Granted	3.03	2.60	17%
	Standard Deviation	1.80	1.74	4%
Chledowski	Average Score Granted	2.61	2.16	21%
	Standard Deviation	1.64	1.54	6%
Mackenzie	Average Score Granted	1.98	1.77	12%
	Standard Deviation	1.14	1.16	-2%
Overall	Part 3 Average	2.63	2.21	19%
	Part 3 SD	1.65	1.55	6%

For the fourth time, all markers agreed that one group did better than the other and though markers differed in their generosity, all scored the LSL group as providing responses that on

average were 12 to 22% better. Given this it is fair to conclude that, while all responses to the Part 3 questions were subjective, that there was general agreement from a pool of experts on the quality of each of these responses.

APPENDIX L
PROPOSED EXPERIMENTATION

A more ambitious experiment would involve a roughly two weeks of significant commitment in garrison by multiple infantry sub-sub-units (platoons). Again, an ideal sample would consist of one platoon and the reconnaissance platoon, all participating at at least three-quarters strength. This experiment would be run a kin to a short, on-base exercise and could be sold to the chain of command by virtue of not only its academic merit but also for its training value. The proposed schedule of events would be as follows:

Table L1: Proposed Experiment for an Infantry Unit

Date / Time	Grouping	Task
Week 0: Friday Afternoon	All Leadership (detachment commanders / section second-in-commands and above)	Attend generic situation brief, with follow-up reading over the weekend.
Week 1: Monday after normal Physical Training (PT) period	Section and Detachment Commanders	Attend one hour orders session, followed by six hours for three rifle section commanders, a weapons det commander and six recce det commanders to plan patrol. Tools and assets at commander's discretion and company availability.
	Non-leadership	Preparing equipment / review of Tactics, Techniques, and Procedures (TTPs) and Standard Operating Procedures (SOPs) under section section-in-commands (2ICs)
Week 1: Tuesday (no PT)	Patrol Groups Complete	Nine hours for all ten elements to execute mission, one hour to conduct debrief. Delivery method and equipment distribution at Section Commander's discretion and based on availability.
Week 1: Wednesday after PT	Patrol Commanders	Seven hours for each of the ten patrol commanders to write a patrol report using whatever format they desire.
Week 1: Thursday after PT	Patrol Commanders	Six hours of lectures on literature specific to educational psychology with a view for designing improved templates.
Week 1: Friday after PT	Patrol Commanders	A further four hours of lectures.
Week 2: Monday after PT	Patrol Commanders	Seven hours to re-write their patrol report. Again, in whatever form each chooses.

Date / Time	Grouping	Task
Week 2: Wednesday Afternoon	Test Participants from a different sub-sub-unit(s)	Testing to commence with background survey and spatial ability test. Next the sample will be split in to green and blue groups. Each group will read the same ten scenarios provided by the patrol commanders. The control group will read the patrol commander's original version; the experimental group will read his second version. The green group will be the control group for all odd numbered scenarios; the blue group will be the control group for all odd numbered scenarios. Each scenario will be followed by a test, which given time restraints will have reduced Parts 1 and 3. Timings are to be determined based on depth of reports submitted by patrol commanders.
Week 2: Friday Morning	Test Participants	All participants return and complete the same ten tests and the general assessment survey.

The logical follow-up to this would be a comparison of the best templates that the patrol commanders created compared to the templates used in this experiment, ideally at a different location or using a different sub-unit as the participants. Consideration would have to be given to the fact that the experiment would be comparing different formats specific to different scenarios and the differences in overall scores, which is why it would be preferable to have already complete the first experiment proposed for an infantry unit (as describe in Section 5.2) before executing this second one.

APPENDIX M
PROPOSED AUTOMATED TEMPLATE DESIGN

This research and the recommended follow-on experimentation is an important step in this area, but is only the first one. Ultimately, to truly increase gains in these areas, the simple blended format presented needs to be expanded upon. The ultimate form it should take will require additional study and substantial operator input, but it is fair to say that increased blending through digitization, using the approaches discussed throughout this thesis, should achieve the desired improvement in understanding and retention.

While there are numerous ways to design an animated or simply a more digitized report, the following list describes what the literature and the author's experience support as a desirable features:

a.   The entire interface as a single screen with a topographical map of the objective area as the background, upon which all icons, traces and overlays can be transposed. This map should include the standard military grid system, contours and typical map markings.

b.   There is almost universal understanding that incorporating a GPS track log is a significant improvement over a route card or hand drawn trace. A single log is insufficient and instead there should be a track log for each patrol element to ensure that the full path is mapped. Further, rather than simply showing the completed traces, the route should instead be played out so that a reader can see where the given elements of the patrol were at a given time.

c.   There is a need to represent the general situation at the time of the patrol. This is done through a combination of the trace from the commander's orders and the various overlays (IED, friendly force distribution, supporting aerial asset paths, contacts, other friendly patrol routes, etc.) that would have been available to the commander when he was writing his report and can be turned on and off by the reader to de-clutter the report as required.

d.   The patrol must be given a general context as to its purpose and its results. This is achieved by including a section that essentially captures the historically-important elements of the commander's orders (situation, mission, concept of operations, composition, etc.) and another section for his general assessment post-patrol. Inclusion of these and the other elements described ensures that all of the information currently available in the doctrinal or various theatre-specific formats is included in this interface. This would be something a kin to the Mission Overview from the blended templates and should be executable and closed through a single icon.

e.   Significant incidents need to be highlighted, thus icons for locations where pictures were taken or videos were record would appear along the trace, along with markers for events like contact reports, IED reports, ICOM interceptions, suspected OP locations, shot reps, etc.

f.   As discussed, any of the events that are represented by images or graphics need to be paired with comments to fully explain their relevance. This text is to be superimposed on the image. Normally this would either make the text

unreadable or obscure the picture or both. This can be overcome by the reader being able to fade either media or both, e.g. the scroll of the mouse could wash away the picture, making the text the primary focus; wash away the text to make the picture clearer; or, ideally, balance the two. This does two things – first, the further the text is from its associated image, the reduced likelihood of making a meaningful connection in the brain, meanwhile superimposing them reduces the distance to zero; second, it prevents the commander from having to waste time balancing every image / text combination in order to achieve the optimal effect.

g. In addition, this fading technique could be used in other areas, specifically with the trace and the map, to allow the reader to improve readability.

Digitized Build for Scenario 1

For the purpose of experimentation, a template that captures Scenario 1 would require the following features:

a. A topographical map. The one used for this interface should include the information available in this screen-capture from google maps, the reference for which appears at the bottom of the screen. It will also need to include gridlines (the lines in blue) that have been overlaid and the associated numbering (in blue), as well as the added objective area with its name (Objective Mary), the overlaid route and the patrol base (PB Rhino).

b. While it would be desirable for a tactical interface to zoom in and out, this is not required for the purpose of this experimental interface. Such a feature may give the subject access to more information than is available to the control group, which is not desired, it would likely involve significant challenges with respect to maintaining the relative position of the gridlines as these are not actual grid references but something simply stencilled in; and it may turn out that there is some piece of infrastructure or terrain that when viewed closer in contracts or distracts from the storyline created.

c. The map will be the background screen that all other functions will be overlaid upon.

d. This topographical map should be 'fade-able', i.e. there should be some function, the scroll of the mouse when the map is selected, a sliding bar on the side of the screeen, etc., that controls the brightness of the map relative the brightness of the overlays. E.g. when reduced the map would fade to transparent while the overlays remained unchanged, making the overlays more discernable; and when increased, the map would darken to a point (basically the point of saturation that it is at in this view) after which the overlays (route, objective, patrol base, grid lines, and all overlays described below) would fade to transparent.

e. In GR 18 89, there will be an icon that represents a map. Clicking on the this box will open a dialogue box. Tthe dialogue boxes will be three grid squares wide by three heigh. All dialogue boxes will have the standard x-box that when executed closes the box. Inside this dialogue box will be the area map.

f.   When executed, this map should appear in the top right of the screen. As with the background map, this area map should be 'fade-able'.

g.   Three traces, representing three elements of the patrol, will be drawn out starting in PB Rhino in GR 13 84, moving NW then E then SW, along an exact path that will be determined in consultation with the designer, ending in the same location.

h.   These traces will be associated to a timeline bar to be added to the top of the background screen, along the 90 northing. This will be similar to a standard media play bar, i.e. it will show the progression along the timeline and have play, pause, forward and back functions.. The traces will be drawn out as the bar is played forward. It will be associated with a time display that shows the relative time that the patrol was at the location using the 24-hour clock. Synchronization of where the patrol was at any given time will be done in consultation with the designer. The thickness of the line will be determined in consultation with the designer. As the line advanced arrows indicating the direction of advance should appear, staggered behind the advancing edge of the line.

i.   At the advancing tip of each trace will be a hollow, blue square icon with two black dots centred on top of the square. Inside the blocks will be the numbers 32, 32A and 32B.

j.   As the trace plays out, there will be various points where the patrol will have taken pictures, as the line moves across one of these a camera icon will appear offset from this trace, with a straight line (of different width than the trace line) connecting the icon to the trace. The exact size of this icon will probably take some experimentation to strike the balance between something that obscures important terrain information while still being large enough to be obvious. These icons will remain in view so long as that segment of the patrol trace is visible, i.e. when the trace is playing at any point in time after the picture was taken. There will be a total of 53 pictures for the patrol.

k.   When the icon is executed a dialogue box with the relevant picture should appear connected to the icon with a line (the same way that the icon is linked to the trace). This must be offset so that neither the trace nor the icon is obscured by the dialogue box or the adjoining line. Multiple boxes should be executable simultaneously, but not overlap, so there will be a maximum number that will can be open at any time under these parameters.

l.   Inside the dialogue there will be a picture with a few sentences of text overlaid on top. This box should be 'fade-able' as described elsewhere, i.e. there should be some mechanism through which the picture fades toward white in one direction while the text fades toward transparent in the other. It is important to note that the picture must fade to white rather transparent lest the text be obscured by the background map underneath.

m.   At one maximum, the text would be near-completely obscured, while at the other, the picture would be near completely faded to white. In the case of the former it would allow an unobstructed view of the image; in the latter a plain

and easily readable set of text; in between – at a different point for any combination – it would produce an optimal image that allows for the simultaneous viewing of both.

n. Along the border of these dialogue boxes, the grid reference and time of that picture should be visible.

o. There should be an icon indicating a report that would appear along the trace and have the same form and functionality as the picture icons. These dialogue boxes would consist of a white background and a textual report of less than ten lines. These will be filled with the various location and situation reports that would have been sent during the patrol as well as observation post reports and recommended map corrections. There will be less than ten of these.

p. As the user moves the mouse across the screen there should be a box next to the cursor that shows the eight figure grid reference for the point that the cursor is at.

q. There should be an icon that when executed turns on or off all of the traces on the map.

r. In GR 08 89, there will be an icon that when executed produces a text box with the general mission information for the patrol. This box would include space for the pre-patrol situation, mission, call sign and patrol leader, organization, intent, scheme of manoeuvre, area map and objective map with an anticipated general trace.

s. In GR 18 82 there should be an icon that when execute opens a dialogue box that contains the commanders general assessments. This box should have a white background and will consist of approximately four paragraphs of text and a signature block.

CURRICULUM VITAE

Captain Mike MacKillop was born in Vancouver, BC and grew-up in Calgary, AB. He joined the Calgary Highlanders in 1997. In 2003, he attained a BA in philosophy from the University of Calgary, completed the Advanced Winter Warfare Course and deployed to the forest fires in British Columbia as a section commander (Op PEREGRINE). In 2004, he transferred to the regular army as an infantry officer.

In 2006, Captain MacKillop was posted to the Third Battalion of the Princess Patricia's Canadian Light Infantry (PPCLI) as the Transport Officer; the following year he was posted to 1 PPCLI as a Rifle Platoon Commander (8 Platoon). Following his completion of the Basic Reconnaissance Patrolman Course, he assumed command of Reconnaissance Platoon, 1 PPCLI. He held this position for two years and led the platoon throughout its deployment as part of Task Force 3-09 (Afghanistan).   For his leadership during that tour he was awarded the Medal of Military Valour (MMV).

In 2010, Captain MacKillop completed the graduate stream of the Land Forces Technical Staff Program in Kingston. Following this he was employed as the requirements officer for cold weather clothing and equipment in the Directorate of Land Requirements (DLR), then the liaison officer to Applied Military Science Department of RMC, before taking over his current position as the Deputy Project Director for the Unique Operations Cell in DLR. For the last two years, his portfolio has included requirements development for infantry reconnaissance, mountain operations, parachuting including the Interim Parachute Capability Project, dismounted night vision, with most of his time dedicated to the Sniper Systems Project.