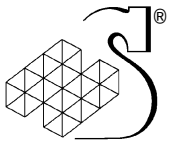

DRDC Toronto CR 2006-215

TBCS/CHAMELEON UTILITY TRIAL REPORT

by:

Michael L. Matthews, Jeremy E. Brooks, Harold A. Angel

Human*systems*® Incorporated
111 Farquhar St., 2nd floor
Guelph, ON N1H 3N4

Project Manager:
Kim Iwasa-Madge, P.Eng., CHFP
(519) 836 5911

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On behalf of
DEPARTMENT OF NATIONAL DEFENCE

as represented by
Defence Research and Development Canada - Toronto
1133 Sheppard Avenue West
Toronto, Ontario, Canada
M3M 3B9

DRDC Toronto Scientific Authorities
Maj Linda Bossi
(416) 635-2197

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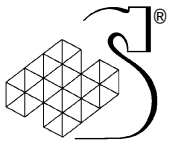


Abstract

This study evaluated the utility and ease of use of features of the Tactical Battlefield Command Systems (TBCS)/Chameleon using participants representing command elements of a combat team. Seven participants role-played an advance to contact scenario developed by Joint Command Staff Training Centre (JCSTC) in 13 segments. Following each segment, participants provided user feedback on 25 key features and tools of the software.

The overall results indicated that the features and tools in TBCS/Chameleon are seen to be generally useful by the combat team across a range of activities. Many specific features currently in the software, as well as future features, were seen to have particularly high utility and have the potential to improve situation awareness, reduce workload, improve communication effectiveness and support decision-making.

However, there are a number of areas in which the utility of features can be improved. Specific recommendations are made to support these improvements across a range of features including: map use, communication tools, production of orders and access to information.

These recommendations concentrate on utility issues with a secondary focus on increasing the ease of use of some features.

The user review process should continue at each major build of the TBCS/Chameleon. As the development moves from a concept based development to a fieldable system the user reviews should move from utility based to usability based. Tabletop user reviews of concepts will also assist with design decisions between major builds.

Résumé

Cette étude a évalué l'utilité et la convivialité des fonctions du Système tactique de commandement sur le champ de bataille (STCCB)/Chameleon en faisant appel à des participants représentant les éléments de commandement d'une équipe de combat. Sept participants ont simulé un scénario de marche à l'ennemi mise au point par le Centre de formation de commandement et d'état-major interarmées (CFCEMI) en 13 segments. Après chaque segment, les participants ont fourni une rétroaction sur 25 caractéristiques et outils principaux du logiciel.

Les résultats globaux ont indiqué que les caractéristiques et outils du STCCB/Chameleon sont considérés comme généralement utiles par l'équipe de combat, et ce, dans différents champs d'activité. De nombreuses caractéristiques actuelles du logiciel, de même que des caractéristiques envisagées, sont perçues comme étant particulièrement utiles et comme ayant le potentiel d'améliorer la connaissance de la situation, de réduire la charge de travail, d'accroître l'efficacité des communications et de soutenir la prise de décisions.

Cependant, il y a un certain nombre des caractéristiques qui pourraient être améliorées. Des recommandations spécifiques sont formulées en vue d'opérer ces améliorations à diverses caractéristiques : utilisation de cartes, outils de communication, production d'ordres et accès à l'information.

Ces recommandations sont axées sur des questions utilitaires et ont pour deuxième centre d'intérêt la convivialité accrue de certaines fonctions.

Le processus d'examen par les utilisateurs devrait se poursuivre avec chacune des nouvelles versions importantes du STCCB/Chameleon. À mesure que le système passe de l'étape conceptuelle à l'étape de l'utilisation sur le terrain, les examens par les utilisateurs devraient être de moins en moins axés sur l'utilité du système et de plus en plus sur sa convivialité. L'examen de concepts par les utilisateurs au moyen de simulations facilitera également la prise de décisions conceptuelles entre les principales versions.

Executive Summary

This report details the purpose, method, results and conclusions of the Tactical Battlefield Command Systems (TBCS)/Chameleon Utility Trial. Participants representing a combat team evaluated the utility and ease of use of features present in Version 3.1 of the software.

The purpose of this trial was to provide systematic, useful and timely user feedback to the design team, in order to enhance the utility and functionality of the TBCS/Chameleon system and to assist with the direction of future system developments. The specific objectives of the trial were to:

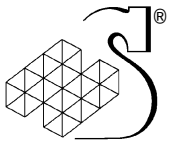
- Provide user feedback on the utility of the features in TBCS/Chameleon as they apply to various combat team levels of command, and
- Provide user feedback on the ease of use of the system's interface and functionality.

Seven participants representing command elements of a cross section of a combat team were trained for five hours on how to use the basic features of TBCS/Chameleon software. They then role-played an advance to contact scenario developed by Joint Command Staff Training Centre (JCSTC) in 13 segments. Rating data for the key features and tools of the software were provided by participants following each segment. Other data were obtained through focus groups following each stage, as well as through observations by the trial administrators. A final focus group discussion was held at the conclusion of the 3 day trial to review overall impressions of the system functionality and to discuss problem areas.

The overall results indicated that the features and tools in TBCS/Chameleon are seen to be generally useful by the combat team across a range of activities. Many specific features currently in the software, as well as future features, were seen to have particularly high utility and have the potential to improve situation awareness, reduce workload, improve communication effectiveness and support decision-making. Some of the most positive aspects of the system were:

- The enhancement to situation awareness provided by the ability to plot unit locations, contacts and other similar information (including GPS data) directly on the map.
- Improved effectiveness and accuracy with which orders can be received, prepared and transmitted.
- The streamlining of tasks associated with the collation and integration of information concerning resources.
- The enhanced maintenance of situation awareness and communication effectiveness if the user is required to change command and control systems for example switching vehicles.
- Enhanced situation awareness in planning operations.
- The potential for reducing voice communication and allowing audio channels to be reserved for the most critical information.
- The potential for reducing a number of error sources in the communication process.
- The potential to enhance situation awareness by providing access to unit level information concerning capability/status.
- Considerable potential for a variety of TBCS/Chameleon based decision aids to support tactical planning tasks.

However, there are a number of issues in which the utility of features can be improved. Thirty three specific recommendations are made to support these improvements across a range of features including: map use, communication tools, production of orders and access to information.



Major issues revealed during the trial were the need to:

- Develop appropriate features and associated interfaces to address the specific needs of different combat team members.
- Develop appropriate features and associated interfaces to address the requirements of different operational contexts.
- Increase the speed of task execution across all features.
- Improve the system interface to enhance situation awareness of new information.
- Provide support for the improved integration of global and local situation awareness.
- Address potentially serious areas where the system may impair situation awareness.
- Enhance the ability of the user to integrate text-based communication with map information.

The general impression obtained from the trial results is that the current feature set does not match the specific features needed to support the most critical and frequent tasks done by different combat team positions.

The major limitations in generalising the trial data resulted from two sources: (i) the low level of applicable combat experience in the trial participants for the roles required to be played, and (ii) the lack of stability of the system software which may have resulted in user frustration and response bias.

Sommaire

Ce rapport décrit le but, la méthode, les résultats et les conclusions de l'essai d'utilité du Système tactique de commandement sur le champ de bataille (STCCB)/Chameleon. Des participants représentant une équipe de combat ont évalué l'utilité et la convivialité des caractéristiques de la version 3.1 du logiciel.

Le but de cet essai était de fournir à l'équipe de conception une rétroaction systématique, utile et opportune de la part des utilisateurs afin d'améliorer l'utilité et la fonctionnalité du STCCB/Chameleon et d'orienter les futurs développements de système. Les objectifs précis de l'essai étaient :

- de fournir une rétroaction de la part des utilisateurs sur l'utilité des caractéristiques du STCCB/Chameleon pour les différents niveaux de commandement d'une équipe de combat;
- de fournir une rétroaction de la part des utilisateurs sur la convivialité de l'interface et des fonctions du système.

Sept participants représentant les éléments de commandement d'un groupe représentatif d'une équipe de combat ont été entraînés pendant cinq heures à utiliser les fonctionnalités de base du logiciel du STCCB/Chameleon. Ils ont ensuite simulé un scénario de marche à l'ennemi mise au point par le Centre de formation de commandement et d'état-major interarmées (CFCEMI) en 13 segments. Des scores pour les principaux outils et caractéristiques du logiciel ont été fournis par les participants après chaque segment. D'autres données ont été recueillies au moyen de groupes de discussion après chacun des stades, ainsi qu'au moyen des observations des administrateurs de l'essai. Une dernière séance de discussion a été organisée au terme de l'essai de trois jours pour passer en revue les impressions générales quant à la fonctionnalité du système et pour discuter des questions qui posent problème.

Les résultats globaux ont indiqué que les caractéristiques et outils du STCCB/Chameleon sont considérés comme généralement utiles par l'équipe de combat, et ce, dans différents champs d'activité. De nombreuses caractéristiques actuelles du logiciel, de même que des caractéristiques envisagées, sont perçues comme étant particulièrement utiles et comme ayant le potentiel d'améliorer la connaissance de la situation, de réduire la charge de travail, d'accroître l'efficacité des communications et de soutenir la prise de décisions. Parmi les aspects les plus positifs du système, mentionnons les suivants :

- L'amélioration de la connaissance de la situation assurée par la capacité de pointer l'emplacement des unités, les contacts et d'autres renseignements analogues (y compris des données GPS) directement sur une carte.
- L'amélioration de l'efficacité et de l'exactitude avec lesquelles des ordres peuvent être reçues, préparés et transmis.
- La rationalisation des tâches associées au regroupement et à l'intégration des renseignements concernant les ressources.
- La facilitation du maintien d'une connaissance de la situation et d'une communication efficace si l'utilisateur doit changer de système de commandement et de contrôle, en changeant de véhicule par exemple.
- Une connaissance de la situation accrue lors de la planification des opérations.
- Le potentiel de réduire le recours à la communication en phonie et de permettre aux canaux audio d'être réservés à la communication des renseignements essentiels.

- Le potentiel de réduire un certain nombre de sources d'erreurs dans le processus de communication.
- Le potentiel d'améliorer la connaissance de la situation en donnant accès à de l'information des unités concernant les capacités et le statut.
- Un potentiel considérable pour que divers outils d'aide à la décision du STCCB/Chameleon appuient les tâches de planification tactique.

Cependant, il y a un certain nombre de caractéristiques qui pourraient être améliorées. Trente-trois recommandations spécifiques sont formulées en vue d'opérer ces améliorations à diverses caractéristiques : utilisation de cartes, outils de communication, production d'ordres et accès à l'information.

Parmi les principales améliorations proposées, mentionnons la nécessité :

- de mettre au point des caractéristiques et des interfaces adaptées pour répondre aux besoins particuliers des différents membres de l'équipe de combat.
- de mettre au point des caractéristiques et des interfaces adaptées pour répondre aux besoins de différents contextes opérationnels.
- d'accroître la vitesse d'exécution des tâches pour l'ensemble des caractéristiques.
- d'améliorer l'interface système de manière à accroître la connaissance de la situation relativement aux nouveaux renseignements.
- de fournir du soutien en vue de l'intégration accrue de la connaissance de la situation globale et locale.
- de corriger les problèmes potentiellement sérieux qui pourraient nuire à la connaissance de la situation.
- d'accroître la capacité de l'utilisateur d'intégrer la communication textuelle et les données cartographiques.

L'impression générale obtenue des résultats de l'essai est que la série actuelle de caractéristiques ne coïncide pas avec les caractéristiques spécifiques requises pour soutenir les tâches critiques et fréquentes exécutées par les différents membres de l'équipe de combat.

Les principales limitations à la généralisation des résultats de l'essai sont dues à deux facteurs : (i) le peu d'expérience de combat applicable des participants pour les rôles qu'ils étaient appelés à jouer, et (ii) le manque de stabilité du logiciel de base, ce qui aurait pu se traduire par de la frustration chez les utilisateurs et par une déviation systématique des réponses.

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1. Introduction

This report details the purpose, method, and results of a Utility Trial of the Tactical Battlefield Command System (TBCS) / Chameleon software. The trial was conducted by Human*systems*® Incorporated (HSI®) under original contract to the Defense and Civil Institute of Environmental Medicine (DCIEM), now Defence Research and Development Canada, Toronto (DRDC Toronto) on behalf of the Director of Land Requirements 4-5 (DLR 4-5) in partial fulfilment of contract #W7711-6-7286/01-SRV.

1.1. Report Format

The report format is based on, and customised from, MIL-STD-46855B Human Engineering Requirements for Military Systems, Equipment and Facilities and related DID-DI-HFAC-80744 Human Engineering Test Report.

1.2. Purpose

The purpose of this trial was to provide systematic, useful and timely user feedback to the design team, in order to enhance the utility and functionality of the TBCS/Chameleon system and to assist with the direction of future developments of the system.

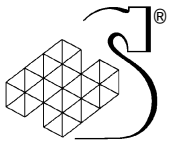
1.3. Objectives

The objectives of this trial were to:

- Provide user feedback on the utility of the features in TBCS/Chameleon as they apply to various combat team levels of command, and
- Provide user feedback on the ease of use of the system's interface and functionality.

1.4. Equipment/Concept Tested

The aim of the TBCS/Chameleon project is to capture requirements for the development of a Combat Team Level command and control system. The concept of TBCS is to provide a vehicle-based, semi-automated command and control software system to fit within the series of battlefield management systems: Land Force Command System (LFCS) at the Brigade Group level and Integrated Personal Clothing & Equipment (IPCE) at the individual soldier level.



Version 3.1 of TBCS/Chameleon was used during the Utility Trial. Sections of each of the key features were in a functional state, and the non-functional components were demonstrated at the concept level. Future versions may contain more features, which have not yet been developed to the point where they can be included in the software as non-functional components. These were reviewed at the concept level to determine initial user perception of utility. The key areas of functionality available for this utility trial included:

- Overlays
- Messaging
- Symbols
- Map features
- Unit Information
- TO&E
- Operation
- Status Displays
- Vetronics
- System options

1.5. Combat Team Tasks

An advance to contact, Combat Team level scenario was developed to allow users representing various levels of command (Sqn/Coy, Trp/Pl) to perform a task based utility evaluation of TBCS/Chameleon. The scenario was based on a Janus Simulator exercise used by the Joint Command Staff Training Centre (JCSTC) in Kingston. The key TBCS/Chameleon tasks users performed during the various segments of the scenario were:

- Contact Report
- Location Report
- Situation Report (Free text report)
- Plan Creation (battle procedures, drawing a trace with enemy and friendly symbols, obstacles, etc.)
- Overlay Creation (Hasty Attack Plan)
- Map Navigation
- Unit Familiarization (TO&E query, resources, etc.)

The tasks listed above were performed throughout the scenario, that was broken into several segments to allow natural break points for user evaluation. These included:

1. Gather background unit/mission information
2. Warning Order
3. Operation Order
4. Update Warning Order
5. Move to Assembly Area
6. At LD
7. Move to First Objective
8. Contacts
9. Continue Advance, Parachute Company Delayed
10. Warning Order for hasty attack/defence
11. Conduct of hasty attack/defence
12. Consolidation

1.6. Limitations

The number of participants available for the trial limits the ability to generalise the data and to perform inferential statistical analysis of the results. The trial participants represent a cross section of combat team personnel, who each have potentially very different needs of the software. Therefore, when group means have been calculated, we have been careful in each case to ensure that the mean was indeed representative of the group as a whole, and, if not, to point out individual variations in responses.

The use of a single scenario may be a limitation, since this does not capture the full range of mission contexts and tasks associated with the full spectrum of combat team operations.

Further limitations experienced during the trial will be discussed in the method and discussion sections.

1.7. List of Acronyms

AFV	Armoured Fighting Vehicle
BG	Battle Group
BDE	Brigade
BMS	Battlefield Management System
CAPT	Captain
CAS EVAC	Casualty Evacuation
CF	Canadian Forces
CP	Command Post
C2	Command & Control
CEOI	Communication Electronic Operating Instructions
CGI	Software Developer
CMBG	Canadian Mechanized Brigade Group
COY	Company
CTA	Cognitive Task Analysis
DCIEM	Defence and Civil Institute of Environmental medicine
EN	Enemy
FOO	Forward Artillery Observer
FR	Friendly
GPS	Global Positioning System
G3	Operations Staff Officer
G4	Logistics Staff Officer
HCI	Human Computer Interface
HSI®	Human*systems*® Incorporated

IPCE	Integrated Personal Clothing & Equipment
JCSTC	Joint Command Staff Training Center
LAV	Light Armoured Vehicle
LT	Lieutenant
LD	Line of Departure
LFCS	Land Force Command System
MAJ	Major
MASH	Armour Ammunition Resupply Report
NATO	North Atlantic Treaty Organization
O Group	Orders Group
OC	Officer Commanding
ORBAT	Order of Battle
OVLAY	Overlay
PARA	Parachute
PC	Personal Computer
PL	Platoon
PMO	Project Management Office
RCD	The Royal Canadian Dragoons
3 RCR	The 3rd Battalion, The Royal Canadian Regiment
RECCE	Reconnaissance
SA	Situation Awareness
SGT	Sergeant
SQN	Squadron
TBCS	Tactical Battlefield Command System
TO&E	Technical ORBAT and Equipment
TOWUA	Tow Under Armour
TP	Troop
WNG O	Warning Order
WO	Warrant Officer
ZT	Designated Artillery Target
2I/C	Second in Command

1.8. Applicable Documents

MIL-STD-46855B Human Engineering Requirements for Military Systems, Equipment and Facilities; DID DI-HFAC-80743 (Human Engineering Test Plan); and DID DI-HFAC-80744 (Human Engineering Test Report).

Humansystems Incorporated, Preliminary Cognitive Task Analysis (CTA) Conducted With Combat Team Commanders, Report to DCIEM, January 1998.

2. Method

2.1 Participants

To evaluate the utility of a software system aimed at the Combat Team level, it is important to have representative users from the combat team involved in the evaluation, i.e. trial participants should represent a cross section of the potential user population. This population includes (although is not limited to) combat team personnel at the Squadron/Company and Troop/Platoon level from the infantry, armour, artillery, recce, engineering and anti armour. The table below shows the intended eight member cross section of the combat team for the advance to contact scenario. It should be noted that for practical and logistical reasons some users would be required to "play" more than one role during the trial. Also shown in the table are the actual characteristics of the 7 participants who were made available for the trial.

Table 1: Participant Characteristics

Requested Participants and their Characteristics			Actual Characteristics of Trial Participants	
Participant	Representation/Experience of Participant	Rank	Actual Rank	Experience Requirement Met
1. Engineering Recce Troop Leader (E11)	Engineering as well as Recce	Lt.	Sgt	Partial
2. Armour OC	Sqn comd and OC	Maj.	Capt	Partial
3. Infantry OC	Coy comd and OC	Maj	------	n/a
4. Recce Troop Leader (LAV recce experience)	Armour Troop Leader as well as Recce	Lt.	Sgt	No
5. Platoon Comd (with anti armour experience)	Platoon Comd as well as anti armour	Lt.	Sgt	No
6. Armour 2i/c (senior capt. with BC experience)	Armour comd and logistics (should have recce experience if 4 does not)	Capt.	Lt.	No
7. Infantry 2i/c	Infantry comd and logistics (should have anti armour experience if 5 does not)	Capt.	Capt.	Partial
8. Artillery Forward Observation Officer	FOO	Lt./ Capt.	WO	Partial

It can be seen from table 1 that there was a significant difference between the desired user group and the actual user group both in rank and experience. This affects the utility evaluation in many ways including:

- Lack of experience in all aspects of the position means that the participant may be unable to adequately judge the utility of system features.
- It compromises the ability to role play non current position.

- It makes it more difficult for users to separate utility from ease of use issues.
- It reduces the ability to use imagination to project and differentiate TBCS / Chameleon use to different segments of the scenario.

2.2 Schedule

The following briefly lists the schedule of events for the four day trial:

	Day 1	Day 2	Day 3	Day 4
Morning	Equipment/ Room set up	Participants arrive TBCS/Evaluation introduction to participants Participant training	Scenario Play (Data capture)	Scenario Play (Data Capture)
Afternoon	Scenario Testing	Participant training and part tasks Scenario Introduction/ Play	Scenario Play (Data Capture)	Focus Group and Wrap up Discussion

DAY 1

This was primarily intended as a set up day where software was installed and the appropriate network connections made. The set up took place in the morning followed by machine and scenario testing in the afternoon.

DAY 2

Participants were introduced to the concept of TBCS, the trial and PMO staff and the purpose and objectives of the trial during the morning of day 2. For the duration of the morning, participants were given familiarisation training with TBCS/Chameleon.

Further training was given in the afternoon, after which participants performed selected part tasks using the networked PCs and Chameleon/TBCS software. Towards the end of the afternoon participants were re-introduced to the scenario and began hands-on scenario play.

DAY 3

Each stage of scenario play was followed by a questionnaire and focus group discussions. This continued until the scenario was completed on DAY 4

DAY 4

Scenario play and data capture continued until mid afternoon. This was followed by a final focus group where key issues arising from the trial were discussed. Implementation issues and future features were also discussed.

2.3 Physical Layout and Equipment

The evaluation was conducted in a large room with enough seating/computer/trial administrator space to accommodate approximately 16 people. The details are listed below:

- a large classroom,

- overhead projector and computer screen projector,
- 8 TBCS computer workstations with desks and tables.

The configuration of the room is given below:

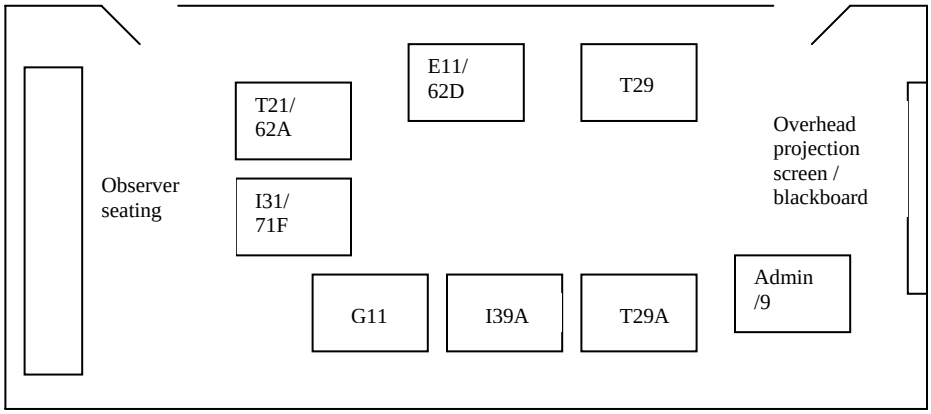


Figure 1: Utility trial room configuration.

Note: the eight rectangles represent the combat team and trial administration workstations with chairs and networked TBCS/Chameleon laptops. Please note the trial administration workstation was "Admin / 9".

2.4 Call signs

The call signs for the various units are detailed in table 2 below.

Table 2: Call sign assignments

Unit	Call sign
Armoured Engineer Troop	E11
Armour OC	T29
Infantry OC	I39
Recce Troop Detachments	62A, 62D
Infantry Platoon	I31
Armour 2i/c	T29A
Infantry 2i/c	I39A
Artillery Forward Observation Officer	G1
TOWUA	71F

2.5 Responsibilities

The responsibilities for the TBCS evaluation were shared between the software developers (CGI), the Project Management Office (PMO) and Human*systems*® Incorporated. The responsibilities were as follows:

• TBCS Introduction	PMO
• TBCS Familiarisation and Training	PMO/HSI®
• Utility Trial Introduction	HSI®
• Conduct of Scenario Play	HSI®
• Utility Evaluation Facility	PMO
• Software and Computer Equipment	CGI/PMO
• Scenario Script	HSI®
• Pre-prepared Computerized Scenario Information	CGI
• Presentation Equipment	PMO
• Questionnaire Material	HSI®
• Focus Group / Wrap Up Discussion Presentation	HSI®

2.5.1 Training of Participants

There were approximately 3 hours of familiarisation training with TBCS/Chameleon software, starting with an oral overview of the system features with no participant interaction with TBCS/Chameleon workstations. Following this feature based training, participants completed several part tasks using their workstations. This allowed them become familiar with the concepts introduced earlier in the training, and to get first-hand experience executing tasks with the system. These part tasks included:

- Map navigation
  - Find units (move map)
  - Zoom in/out
  - Change re-enter modes
- Create and send a free text and log rep message
- Symbol drawing
  - Add units
  - Move units
  - Create a minefield
  - Create designated artillery target (ZT)
- Create and send a order with trace
- Send an order with trace
- Receive an order with trace

2.6 Procedure

After familiarisation and training, participants took part in an exercise based scenario which required them to complete several tasks at networked workstations. These tasks were embedded in 13 segments of the advance to contact scenario. Each stage required the use of a range of TBCS/Chameleon functionality.

2.6.1 Scenario Description

The scenario used was a Combat Team advance to contact level scenario from an exercise used by the Joint Command Staff Training Centre (JCSTC) in Kingston for the JANUS Combat Team Commander training simulator (see Annex A for full details).

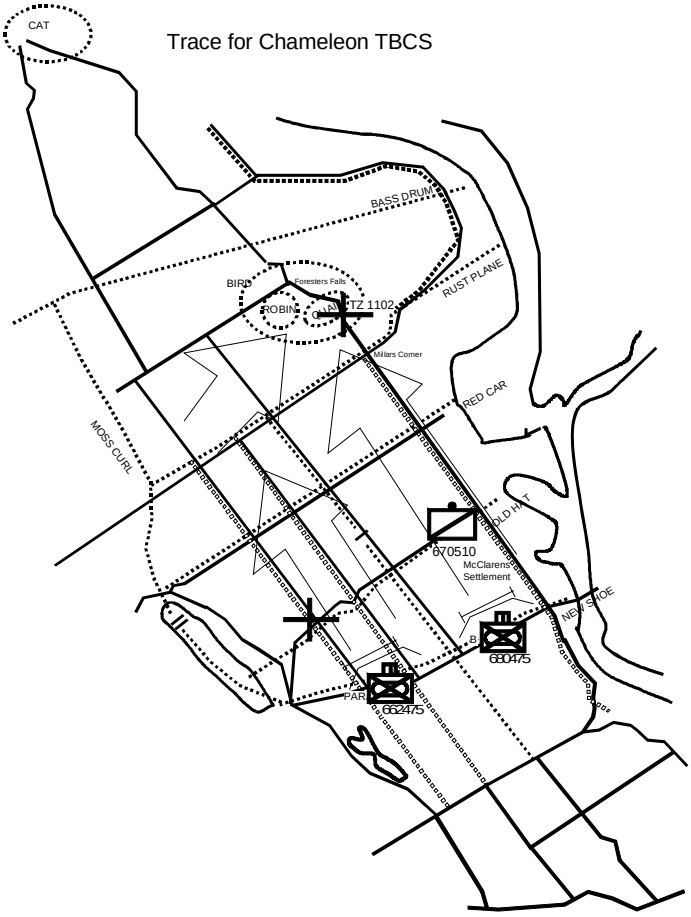
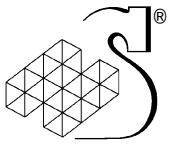


Figure 2: Initial trace showing exercise intent.



A brief summary is provided here (also see Figure 2). 2CMBG is to secure the south bank of the Petawawa River in preparation to support a crossing by 1CMBG. Three phases will be required to secure object CAT (Beachburg). (*For the purpose of the trial, only the first phase was relevant*.) In Phase 1 2CMBG will advance with two BG up with RCD left and 3 RCR right. RCD will secure object SNAKE and 3 RCR will secure object BIRD (Foresters Falls). Details of phase 1 are for PARA coy combat team left and B coy combat team right to advance with O coy combat team in reserve using CLUB route etc. (*The trial user group represented B coy combat team on the right.)* The full Operation Order can be found in Annex B.

Following hands on training, participants were instructed to take positions at specific Chameleon/TBCS networked workstations, which comprised the various elements of the combat team e.g. T29, I39, T29A, I39A, T21, I31, G1, 71F, 62A, 62D, E11. Participants were re-briefed as to the purpose of the trial, use of questionnaires and scenario evaluation framework. Particular attention was given to instructing users to "play out" the scenario, to concentrate on providing feedback for their assigned position, and to focus on the utility of the features as opposed to the ease of use of the system. As some participants were required to play the role of more than one player, they were instructed to change their log-in name to reflect the position they were playing, when necessary, e.g. for sending messages.

Participants used a custom feature of the software to load pre-defined traces that display different segments of the advance to contact. Every trace contained the basic Cobden map (1:50 000, Sheet 31 F/10, Edition 4) and some details such as map position, unit positions, trace information, and enemy contacts were shown on each of these scenarios. After loading the trace, participants received instruction from the facilitators (by voice or using TBCS/Chameleon messaging) or from other participants e.g. orders, and were required to "play out" a certain part of the scenario. Instructions included suggestions to participants of which software items would help in particular task executions.

The scenario was broken into segments to allow natural break points for user evaluation (see below). The full details of the scenario and the individual events and tasks that were planned to occur can be found in Annex C. Due to the fact that participants were expected to "play" during the scenario, flexibility in administration and timing was required during each stage. Where software items or situations were not covered or omitted by users in one stage, or where technical difficulties prevented task completion, the scenario was modified in real-time to capture these in later segments.

The scenario segments were as follows,

1. Gather background unit/mission information
Participants loaded trace 1 containing combat team positions and "0" position, a paper copy of the overall intelligence picture (text and sketch) and instructions for the software use and tasks.

2. Warning Order
Using trace 1, participants received a paper copy of the Warning Order. They were required to follow the order and conduct battle procedures appropriate to their position.

3. Operation Order
Participants loaded trace 2 and received an electronic copy of an Operations order. They were then required to follow the order and conduct battle procedures appropriate to their position.

4. Update Own Warning Order
Using trace 2, participants were instructed to make final preparations as necessary in preparation for H-hr.

5. Move to Assembly Area
Participants loaded trace 3 and moved their units along specified routes at a realistic pace to the assembly area in preparation for crossing the LD. The test administrator initiated a Situation Report,

which indicated a vehicle hitting a mine along the route; this required messaging among the combat team to maintain traffic flow.

6. At Line of Departure (LD)

Using trace 3, the combat team commanders were required to order their units to specific positions for crossing the LD at H-hr.

7. Move to First Objective

Using trace 3, the combat team moved each of their own units across the LD to the first report line, while being vigilant for enemy forces.

8. Contacts

Participants loaded trace 4 and, while advancing, were prompted by the facilitators (by paper or voice) of the presence of enemy. Users were expected to create, send and receive several contact reports as a result of prompting.

9. Continue Advance, PARA Delayed

Participants loaded trace 5. Participants used the appropriate TBCS/Chameleon tools to orient themselves to the current situation on the battlefield. The left-hand combat team was shown to be delayed by messaging and by map indication.

10. Warning Order for hasty attack

Participants loaded trace 6. Sufficient contacts were indicated to demonstrate the need for a Hasty Attack at Millars Corners. The combat team commanders were prompted to create and distribute a hasty attack plan as an electronic text and electronic sketch Other members of the combat team received this order and carried out the necessary steps to prepare to execute it.

11. Warning Order for hasty defence

Participants loaded trace 7 containing their combat teams positions for the conduct of the hasty attack. The combat team commanders were alerted by a Situation Report about an enemy advance, this prompted the need for the planning and conduct of a hasty defence using the software.

12. Conduct of hasty defence / Conduct of attack

Participants loaded trace 8 showing the results of the defence and were required to move into position to execute the hasty attack. Participants were prompted about the features of TBCS that could assist them in the conduct of an attack.

13. Consolidation

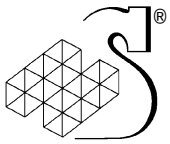
Participants were required to conduct consolidation activities using trace 8.

In summary, the key tasks expected of the user during the various segments of the scenario were:

- Unit Familiarization (TO&E query, resources, etc.)
- Contact Report
- Location Report
- Situation Report (Free text report)
- Plan Creation (Drawing a trace, enemy and friendly symbols, obstacles, etc.)
- Overlay Creation (Hasty Attack Plan)
- Map Navigation

2.6.2 Data Recording

During scenario segments data were captured through questionnaires and direct observation. Following each segment of the scenario, participants were asked to complete a questionnaire and then participate in a focus group discussion of the key components used in the segment. After the final



scenario segment, participants participated in a final focus group session to review TBCS/Chameleon on key issues relating to utility, ease-of-use and problem areas.

2.6.2.1 Questionnaires

A task based questionnaire was administered after completion of each scenario segment (see Annex C) to elicit information about how well the TBCS/Chameleon system allowed users to perform identified tasks that were done during each mission segment. The questionnaire focused on three areas of utility and two aspects of ease of use of the major TBCS/Chameleon functions. The utility questions addressed the overall usefulness of the feature in question, how it would impact on operational effectiveness and whether it represented an improvement over current capabilities. The ease of use questions focussed on ease of use in the trial setting and projected ease of use for typical field conditions.

2.6.2.2 Direct Observation

Test personnel also observed participants as they completed the various scenario segments and recorded ongoing participants' comments. The observations and information gathered served to prompt the discussion in the focus group debriefings at the end of each segment.

2.6.2.3 Focus Group De-briefings

Following each scenario segment, structured open-ended questions were asked by the trial administrators. The specific questions evolved as the scenarios were played out and reflected areas of TBCS/Chameleon that participants appeared to have had significant problems or felt were particularly easy/useful. Participants were also encouraged to discuss any other aspect of the system they felt relevant.

3. Results

3.1 Outline

The results of the utility trial are presented in this section. For each major section of TBCS/Chameleon functionality participants mean ratings are followed by integrated participant comments and HF team observations.

3.2 Reliability and Validity

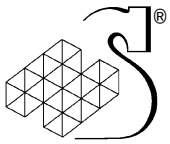
Before analysing the results of the trial, we briefly review some important issues concerning the reliability and validity of the data obtained. The concepts of reliability and validity are central to most scientific research undertakings and must also be applied to evaluations and field assessments. In research involving human performance, care in the design of studies becomes the most critical element in ensuring that the study achieves its objectives. The numbers generated by poorly designed studies look no different from those obtained from well-designed studies. The key is to ensure that the numbers reflect the measurement objectives of the study, rather than being the result of intrusions of artefacts and unstable measuring instruments.

3.2.1 Reliability

The underlying principle of *reliability* concerns the stability of the data and the confidence that one has that it is representative of the behaviour in question. The key to establishing reliability is repetition. That is, if the evaluation were to be repeated on successive occasions the same or similar outcomes would ensue.

Critical factors that influence reliability in the context of most field evaluations are outlined below together with a brief assessment of how well the objective of each factor was achieved during the evaluation trial.

- The precision with which procedures are defined prior to testing: a poorly considered trial script will allow significant variations to creep in each time the scenario is conducted. For example, if explicit instruction concerning how subjects are to perform a task are not given, then high variability in the way subjects approach the task may occur. *(Comment: these aspects were adequately controlled during the trial, given that some flexibility and range of behaviours was desired)*
- The extent to which independent variables are tightly controlled. (*Comment: factors such as unreliability of the software and network served to undermine reliability)*
- The consistency in application of the script by test administrators *(Comment: this was reasonably well controlled during the trial)*
- The extent to which intervening variables, which could influence test outcome, are anticipated and controlled. *(Comment: intrusive comments and intervening behaviours by trial observers were clearly a problem on several occasions during the trial).*
- The collection of a sufficient number of data points to ensure that the performance of interest is sampled with adequate precision.*(Comment: across the entire combat team an adequate number of data points were collected; however, since only one individual*



provided one data point for each of the system features evaluated, the reliability is low in terms of any analysis for individual combat team positions.)

- Consideration and control of temporal order effects which may influence performance, for example, increasing familiarity with the task, or the converse increasing boredom.*(Comment: because of time, budgetary and logistical constraints, it was not possible to control for potential order effects).*

Overall, in the case of the present evaluation, practical constraints on the sample size and the time available to conduct the trial are major concerns for the reliability of the data obtained. Hence the results of the trial should be seen as **suggestive rather than definitive**, particularly from the point of view of trying to capture potential differences in evaluation across different combat team positions.

3.2.2 Validity

The concept of *validity* deals with whether the measurements obtained are consistent with principle or evidence. Thus, an experiment or evaluation can be reliable, but its conclusions invalid for a host of reasons. The reverse is not true, however, an evaluation could not be valid if the results were unreliable. Of primary concern is the issue of construct validity, which can be characterised as the development of sound operational measures for the material or concepts being studied. Good construct validity means that we measure that, and only that, we want to be measuring. The key to controlling threats to construct validity is to be aware and continuously vigilant of variables that may contaminate an evaluation. In the case of the present trial, we have attempted to increase construct validity by addressing three separate aspects of system utility, rather than using just a single measure. Further, we attempt to increase validity by measuring usability issues separately from utility issues. Annex D provides a more detailed analysis of issues relating to the validity of the trial.

3.2.3 Data Quality

One final aspect of the data to be considered is the extent of missing or questionable data. The whole data set comprised twenty five system features rated on five questions by the seven trial participants to yield a potential total of 875 data points. Over this entire set, there were eleven missing data points; these resulted from the Engineering Recce and Battle Captain each failing to rate one system feature entirely, in addition, the Battle Captain failed to provide a rating for two other questions. There was no consistent evidence of questionable data, for example where a trial participant just provides the same rating for every question. However when the entire data set is examined across different combat team positions, the individuals playing the Battle Captain and Engineering frequently generated ratings which were inconsistent with the other trial participants.

3.3 Participant Characteristics

The seven participants' mean experience in the Canadian Forces was 13.5 years. There was a discrepancy between the characteristics of the requested and actual user group both in rank and experience (see Method section Table 1).

In general, participants reported having good familiarity with computers. When asked about the frequency of use of computer related issues, participants reported frequent use of keyboards, desktop PCs and Windows 95, and between occasional and frequent use of Laptop PC and Windows 3.1. The subjects also reported infrequent use (between never and occasional) of Mac/Apple products.

3.4 Network system stability

For most TBCS/Chameleon operations performed at individual participant workstations in stand-alone mode, the software performed as expected. Participants explored much of the software and tried many features that worked or did not work. The non-functioning feature gave a message saying it was not available in the current system, or required an explanation from the trial administrators, or revealed an unanticipated bug in the software.

The networked TBCS/Chameleon system was not as stable as expected and resulted in several system crashes. Crashes occurred more frequently with increased message traffic, and as a result the pace of the trial was slowed. The software developers (CGI) were monitoring when and where system crashes occurred and their cause will be reported in their after action report. It should be noted that the crashes in the system did not affect the utility evaluation of the TBCS and that all the participants were briefed that the aim of the trial was to test the utility of the information provided and not to focus on the reliability of the program.

3.5 Trial Controls

Conditions of the trial were controlled to the highest extent possible with the exception of observers. The presence of software personnel (2 people) was required in order to maintain a functioning network. However, at one point during the trial there were 6 observers, 2 software personnel and 2 trial administrators and only 7 trial participants. The observers included Majors from DCIEM and the trial units as well as Captains from the PMO and trials units. The presence of observers can have several effects on trial participants and ultimately has the potential to affect the overall results of the trial. Simply by their presence, observers put pressure on participants to behave or perform in a manner they would not, had the observer not been there. Second, some observers cannot help but get involved in the trial and interact with participants. This can interrupt the scenario, waste time and stem the flow of data from the users. For the most part, observers did not take part in the latter activity but no doubt affected the participants by their presence.

3.6 Analysis of Results

In this section of the report, a narrative description of the utility data integrated with the usability data is provided on a feature by feature basis. The questionnaire data are presented as mean rating scores for each individual question for each of the major features of the system, and are presented in the form of inset thumbnail graphs. In addition to the three individual utility questions, a composite utility rating based on the mean of these three questions was calculated.

In the cases where there are deviations in individual ratings from the overall group tendency, such differences across the seven positions are noted for the utility data only. For each of the system functions, the numerical questionnaire data are integrated with a summary of the comments provided by the test participants.

As a guide to interpreting the numerical data, the following conventions have been adopted.

UTILITY

- <3 = less than acceptable
- 3–3.9 = moderate utility
- 4-5 = strong utility.

USABILITY

- 1-1.9 = clearly unacceptable
- 2-2.8 = unacceptable
- 2.8-3.2 = marginally acceptable
- 3.2-3.9 = acceptable.
- 4-5 = clearly acceptable

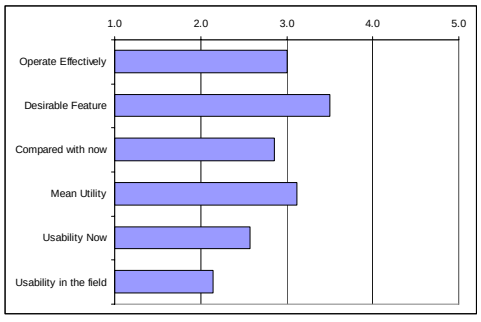
3.6.1. Overlays

3.6.1.1 Overlays: control measures

Terminology in the overlay section seemed to cause confusion among users. Some of the terms seemed to be "computer speak" and others were part military/part computer. The task flow also caused some confusion i.e. tasks available under the overlay buttons were not expected to be there by users.

Ratings suggest that users feel that this feature:

1. Was borderline in terms of allowing them to operate effectively (3.0).
2. Was moderately desirable (3.5).
3. Was about the same as the current capability (2.9).
4. Was of moderate utility (3.1).
5. Usability in the test bed was unacceptable (2.6).
6. Usability in the field would be clearly unacceptable (2.1).



Ratings on question 1 were inconsistent across the group; the feature received strong ratings from the FOO, the 2i/c Infantry and the Combat Team Commander, but ratings of "1" from the Engineering/Recce and the Battle Captain. Ratings were also inconsistent on question 2 where the feature was rated somewhat better by the FOO and the 2i/c Infantry, but worse by the Platoon Commander.

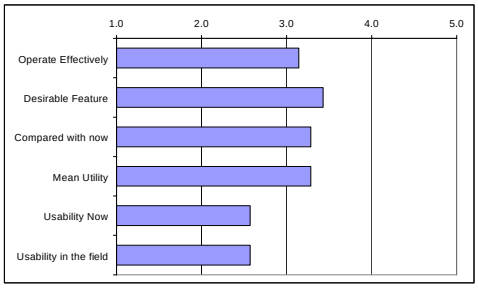
- **Participant Comments**

The ability to toggle on and off the various layers was seen as very useful as it could clear up clutter and detail could be quickly accessed.

3.6.1.2 Co-ordinate plans

Ratings suggest that users feel that this feature:

1. Was somewhat helpful in terms of allowing them to operate effectively (3.1).
2. Was a moderately desirable feature (3.4).
3. Was slightly better than the current capability (3.3).
4. Was of moderate utility (3.3).
5. Usability in the test bed was unacceptable (2.6).
6. Usability in the field would be unacceptable (2.6).



On questions 1and 2 the Engineering/Recce provided much lower ratings than the other combat team members.

- **Participant Comments**

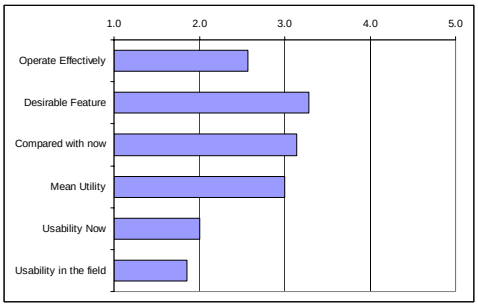
The FOO found these features to be especially useful but as with others had difficulty with the ease of use.

The Coy 2i/c stated that flanking unit information might be useful here i.e. the ability to turn on flanking units could help planning.

3.6.1.3 Orders

Ratings suggest that users feel that this feature:

1. Was not very helpful in terms of allowing them to operate effectively (2.6).
2. Was a moderately desirable feature (3.3).
3. Was about the same as the current capability (3.1).
4. Was of moderate utility (3.0).
5. Usability in the test bed was unacceptable (2.0).
6. Usability in the field would be clearly unacceptable (1.9).



This feature received inconsistent ratings across the group on all three utility questions. For question 1, the feature was generally not seen as allowing the user to operate effectively, with the exception of the Combat Team Commander who gave the feature a five rating. On question 3, this feature was not rated as being an improvement over the current capability, except for the Combat Team Commander, who again gave a five rating. The consistently low ratings for usability suggest that the feature is somewhat difficult to use in its present format.

- **Participant Comments**

Users had major problems using orders. "This feature seems time consuming and complicated to use and may take time away from battle procedure at higher levels." (Note the representatives of Trp and Pl were not able to state whether or not they should have this feature). The other big issue noted by users was that they did not want an order to take the place of an O Group. They said this would be a useful compliment to existing procedures but would not allow the commander to express command intent or feel confident that subordinates understand the plan.

A recurring issue is seeing text orders and the map at the same time. Users stated that the text order should be at the side of the map and trace or appear in a resizable window allowing both to be efficiently viewed at the same time.

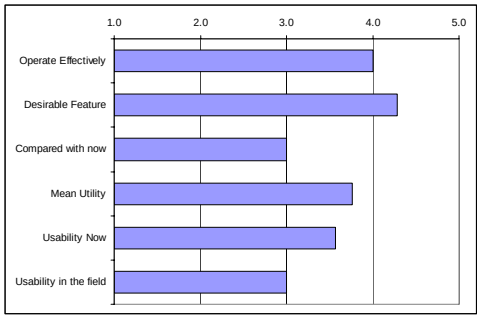
3.6.2 Messaging

The messaging aspect of TBCS is a very powerful and complex feature, not all aspects of which could be assessed in the utility trial. The evaluation concentrated upon the overall utility of the feature as well as three specific forms commonly used, namely, contact reports, warning orders and sending an overlay.

3.6.2.1 Messaging general

Ratings suggest that users feel that this feature:

1. Was helpful in terms of allowing them to operate effectively (4.0).
2. Was a desirable feature (4.3).
3. Was about the same as than the current capability (3.0).
4. Was of moderate utility (3.8).
5. Usability in the test bed was acceptable (3.6).
6. Usability in the field would be marginally acceptable (3.0).



On question 3 opinions were divided, with the Engineering/Recce, FOO and the 2i/c Infantry rating it as somewhat better than now, and the Battle Captain and Platoon Commander rating it as worse than now. As presently configured, this feature provides acceptable usability both for desk based and field operations.

- **Participant Comments**

There was consensus among users that time to make reports should be minimised, information clutter should be reduced and message information needs to be integrated with map information (requiring simultaneous access to messaging text and map display/navigation). Users commented that creating and sending messages could be streamlined by taking advantage of the automation available (pre-formatting and default recipient lists). Loc and move reps should not be automatically sent on movement, as GPS will indicate position on map. This information currently fills up in baskets too quickly. Users expressed concern that they would be spending too much time sorting through mail instead of commanding vehicle/troops. When deleting messages, users could only select one message at a time and commented that multiple message selection would be helpful.

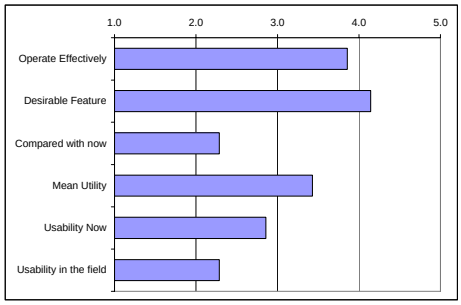
During focus groups participants commented that the “preferred reports” message feature was useful. They thought this provided them with the flexibility they need to customize the message display to access the most frequently used messages more frequently.

The overall comments following administration of the “overall” questionnaire were that speed and ease of creating, sending and receiving messages must be worked on. This will enhance the ease of use of a potential useful tool. One user suggested that there needs to be standardisation of message formats across all arms to fully use this system. Users suggested that they should be able to see map and messages at the same time, indicate new messages more prominently, and need more pre-set features.

3.6.2.2 Contact reports

Ratings suggest that users feel that this feature:

1. Was helpful in terms of allowing them to operate effectively (3.9).
2. Was a desirable feature (4.1).
3. Was worse than the current capability (2.3).
4. Was of moderate utility (3.4).
5. Usability in the test bed was marginally acceptable (2.9).
6. Usability in the field would be unacceptable (2.3).



- **Participant Comments**

Although users saw high potential utility for the contact report, they found the contact report somewhat cumbersome and time consuming. Major benefits were seen with this feature if the following provisions are implemented:

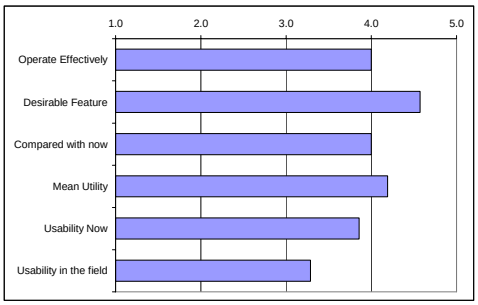
- integration with a laser range finder,
- indication of off screen contacts,
- rapid situation awareness of direction of movement (visual indicator),
- contact wait out feature (one click for contact wait out and possible one click to indicate position or direction of contact)
- new contact reports should flash on screen
- any information about the contact should be available by clicking on the vehicle on the map,
- indication if the contact has been destroyed (one user suggested greying out the symbol; question as to who is allowed to indicate this),
- a pick list of vehicle set up for the expected enemy Orbat

Some users still felt that the contact report should not and will not ever replace voice contact reports.

3.6.2.3 Warning order

Ratings suggest that users feel that this feature:

1. Was helpful in terms of allowing them to operate effectively (4.0).
2. Was a highly desirable feature (4.6).
3. Was better than the current capability (4.0).
4. Was of strong utility (4.2).
5. Usability in the test bed was acceptable (3.9).
6. Usability in the field would be acceptable (3.3).



This feature received consistently high ratings for all utility questions from all except the 2i/c Infantry and the Troop Leader, who did not rate the feature as allowing them to operate effectively.

- **Participant Comments**

Improvements to this highly useful feature mainly concerned screen space. Users could not relate the text message (order, routes, etc) to the map and wrote down much of the information and then related it to the map. The forwarding feature is good ("…will eliminate inaccuracies of speech and be so much faster…") as long as the order can be edited. However it is too slow in current implementation i.e. copy and paste into each section is cumbersome. Some users suggested that a hard copy print out would be better if the display format will not support efficient viewing of the map and the order.

The comment was made that the user should be able to select a default group in the recipient list.

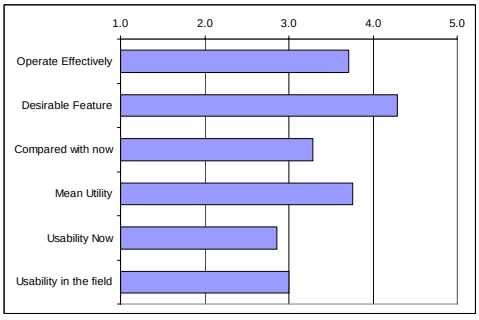
The "Orders in minutes" alert should indicate when the orders will be delivered in case you do not receive the order exactly when it is sent.

One user commented that it is critical that the warning order (and other orders such as hasty attack) be acknowledged i.e. it is not enough to just send a reply that the message has been received but that it has been read and understood.

3.6.2.4 Send overlay

Ratings suggest that users feel that this feature:

1. Was helpful in terms of allowing them to operate effectively (3.7).
2. Was a desirable feature (4.3).
3. Was a little better than the current capability (3.3).
4. Was of moderate utility (3.8).
5. Usability in the test bed was marginally acceptable (2.9).
6. Usability in the field would be marginally acceptable (3.0).



The Engineering/Recce and the Platoon Commander, who rated the feature as being somewhat worse than the existing capability, provided the only negative ratings.

- **Participant Comments**

The concept of this feature appears to be more useful than the ratings indicate. That is, users commented that sending a sketch with a warning order would be useful as everyone would have the same information and radio traffic would be reduced. However in its current implementation, users found this process of creating, sending and receiving, as with orders, to be far too complicated. Users said they would use this feature for a deliberate attack but not for a hasty attack as it would take longer than a radio order. One user commented that for the OC and above it would be a useful feature for deliberate attack and similar planning but is too time consuming otherwise. Another user said sending an overlay is, "… a desirable feature however too time consuming and rigid. It needs…quick freehand drawing… so as not to steal time from the battle."

Engineering commented that this feature would receive little use. Artillery said they need the ability to enter target numbers on the overlays.

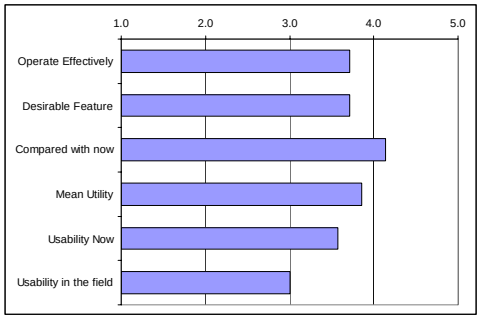
Comments made at the end of the trial in the overall section rating section of the questionnaire were unanimous :

- the concept of sending an overlay is good,
- many hours will be saved (no more trace copying),
- overlays must be able to be sent quickly,
- users need more flexibility in drawing tools.

3.6.3 Symbols

3.6.3.1 Friendly units Orbat

Ratings suggest that users feel that this feature:
1. Was helpful in terms of allowing them to operate effectively (3.7).
2. Was a desirable feature (3.7).
3. Was better than the current capability (4.1).
4. Was of moderate utility (3.9).
5. Usability in the test bed was acceptable (3.6).
6. Usability in the field would be marginally acceptable (3.0).



- **Participant Comments**

Users had some confusion between the "ideal" Orbat under TO&E and the Orbat under symbols. They wanted much of the information under TO&E resources to be current information for their own combat team or unit, so they could use one feature for both planning and drawing.

Most users commented that this feature has potential to be very useful for a planning tool for Sqn/Coy level commanders but would not generally be used below this level. Suggested improvements to the utility of this feature were to include the status of each unit such as vehicle and weapon status, weapon symbol, weapon range, daily battle loss.

Users also commented that the status of a unit could be graphically displayed here to give the commander a quick summary of the capability of the unit. The commander could then "expand" the Orbat at will to see further detail and status/capability information.

With regard to friendly symbols on the map, users commented that the option to filter units and show different aggregations was good but must be simple to use. Also the ability to select how units are show e.g. weapons, Tac or call sign, is very useful.

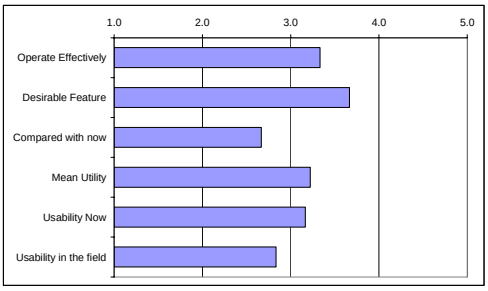
The video clip feature was seen as having considerable potential. Users suggested that the window be resizable to enhance its utility.

Overall comments were favourable, with one user stating that he preferred to see call signs on the map instead of Tac signs. This indicates that the options are a good idea. However, improvements could be made by "clicking" on a unit for a small identification information box rather than it popping up by itself with information useful for logistics only.

3.6.3.2 Enemy units editor

Ratings suggest that users feel that this feature:

1. Was somewhat helpful in terms of allowing them to operate effectively (3.3).
2. Was a desirable feature (3.7).
3. Was somewhat worse than the current capability (2.7).
4. Was of moderate utility (3.2).
5. Usability in the test bed was marginally acceptable (3.2).
6. Usability in the field would be marginally acceptable (2.8).



- **Participant Comments**

This feature was seen as having low utility for combat operations. Users said that it would be , "Good for planning or in the intelligence shop or CP, I don't think I would use it in the field.". Users said that symbols should be created and sent from "higher" and just allow them to pick from the list in contact reports and from the editor. A suggestion was made to include dismounted enemy units.

3.6.4 Map functions

Three aspects of the map and related capabilities were evaluated:

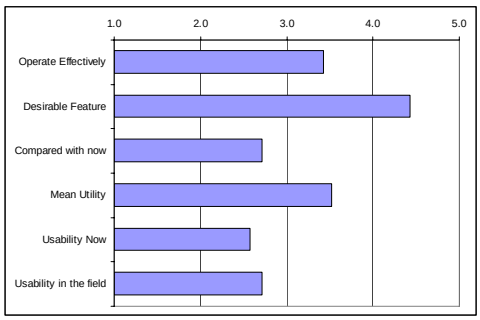
- the basic map format which included aspects such as scale and detail
- map navigation, that is the user's ability to move around within the current window and between the presently viewed section of the map and other areas currently lying outside of the present window
- map drawing and annotation**,** which involves such tasks as drawing lines, placing symbology.

3.6.4.1 Map format

- **Questionnaire Ratings**

Ratings suggest that users feel that the map format:

1. Was somewhat helpful in terms of allowing them to operate effectively (3.3).
2. Was a desirable feature (4.3).
3. Was somewhat worse than the current capability (2.8).
4. Would be useful (3.4).
5. Usability in the test bed was unacceptable (2.5).
6. Usability in the field would be unacceptable (2.6).



Responses for items 1 and 2 varied considerably between participants. In particular, on question 1 both the Combat Team Commander and the 2i/c Infantry differed from the other five participants and rated this feature as being somewhat ineffective. On question 3 users were even more divided over whether this feature was seen as being an improvement over the current capability. Both the Combat Team Commander and the Engineering/Recce rated this as being much better than now, the Troop Leader about the same as now, and the remaining four positions as being worse to much worse than now. These lower ratings may have been due to contamination of this utility rating by usability concerns, since both for the test use and anticipated usability in the field, ratings were less than acceptable

- **Participant Comments**

Comments concerning map format were lengthier and more insightful than for any other feature.

Some users (senior combat team personnel) expressed general concerns over the size of the map display. They had difficult imagining how they would function with the limited view i.e. being able to zoom in sufficiently to see detail while still trying to maintain the "larger picture". These users suggested they would rely on a paper map essentially because the utility of the current implementation of the map on a laptop size display was too small.

Some users were concerned with the lack of sufficient detail on the map due to the resolution of the screen, and suggested that the paper map would be more useful for infantry. One user said the colour between the trees and water was too close. At the same time, they saw the benefits of current and future features such as GPS integration and intervisibility, and suggested adding a bearing and distance tool i.e. pick two points and automatically calculate bearing and distance. However, the comment was made that most of the planning tools associated with the map (orders and overly creation, intervisibility etc.) are just for planning and there is, "…no requirement for Pl Commander to use TBCS for detailed movement planning and the Pl essentially follows along in combat team until deployed for an attack."

Users commented that grid reference display around the map might prove helpful. This could help to convey the scale of the "zoom" of the display as well as help navigation.

Additional information desired for the map display is map identification such as sheet number.

The options for map orientation were generally seen as useful. Users did not agree on which option was "the best" hence the requirement for the options.

One user gave requirements for map format from an engineering perspective:

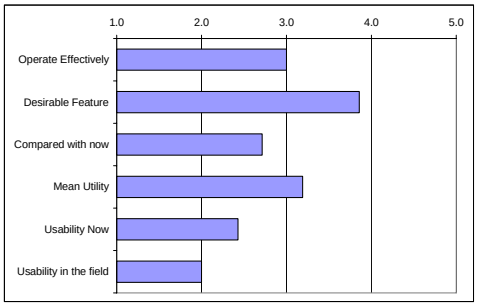
- "Engineer requires 3 different maps:
  - regular topo 1:50,000
  - 1:50,000 cross country movement
  - 1:50,000 road and bridge
  Special zoom required for bridges to include R&B data
  Special zoom for terrain to show passibility, sustainability
  Engineer icons for building material, heavy equipment, local utilities, power lines, water treatment, etc.
  Feature to update road maintenance work, tactical bridge symbols etc.
  Scale should remain at 1:50,000 to compare accurately to paper maps
  Display points of intervisibility"

The comments following administration of the final "overall" questionnaire reiterated points raised during the trial i.e. improved map navigation and manipulation is required.

3.6.4.2 Map navigation

Note that map navigation refers to the user moving the point of interest around different areas of the map, not using the map to navigate the vehicle.
For all three aspects of utility, ratings were consistently lower than for map formats.
Ratings suggest that users feel that map navigation:

1. Was somewhat helpful in terms of allowing them to operate effectively (3.0).
2. Was a desirable feature (3.8).
3. Was somewhat worse than the current capability (2.7).
4. Was of moderate utility (3.1).
5. Usability in the test bed was unacceptable (2.3).
6. Usability in the field would be unacceptable (2.0).



- **Participant Comments**

Several issues were identified as causing difficulties. The major problem identified was the inability to smoothly scroll the map display across the display window, since the current functionality would only allow the adjacent map regions to be displayed with no common topography with the previously displayed area. As a result, users reported a loss of situational awareness resulting from considerable difficulty in integrating the newly displayed map region with the one they were previously looking at. Users also reported frustration in being unable to move the map in small increments. The predefined view option was seen as being useful.

All users had significant problems with map navigation. User frustration continued throughout the trial, "Map navigation – difficult to use". Difficulties were related to time (refresh), movement distance and "scroll" method. The time problem caused frustration but most users seemed to understand the technological limitation. More importantly users wanted a better way of moving the map and suggested scroll bars or a drag feature. They thought a feature like this would help them with the problem of losing their situational awareness due to "jumps" of the map with current navigation techniques. They said they need to keep track of location of the current map view in relation to their or other unit positions. The current method of map movement was not generally well received. A pan, scroll or drag feature was preferred. The need for simple, effective navigation is

very important. Many users commented they need to quickly move away from the immediate area of the combat team to see either other areas of interest or the big picture (with more detail than the current overview provides) and quickly move back.

The map enlarge feature was seen as very useful ("…great piece of kit…keep this option...") by almost all users, but should be made resizable so that it takes up less space. However, they also expressed the need to see more detail on this map when required. One user suggested this could be done with full size view of the "enlarge" view and the zoomed in view by toggling between the two as long as both maps indicated your own position.

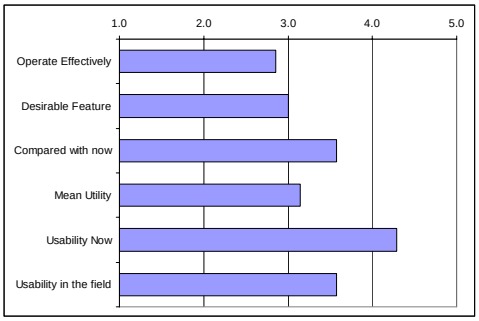
3.6.4.3 Map drawing

This feature was not evaluated because of consistent problems with the system software.

3.6.5 Unit information

Ratings suggest that users feel that this feature:

1. Was somewhat helpful in terms of allowing them to operate effectively (2.9).
2. Was a somewhat desirable feature (3.0).
3. Was better than the current capability (3.6).
4. Was of moderate utility (3.1).
5. Usability in the test bed was clearly acceptable (4.3)
6. Usability in the field would be acceptable (3.6).



On question 1, opinion was completely split on whether this feature would allow users to operate effectively; the 2i/c Infantry and Battle Captain both provided strongly positive ratings, however the Engineering/Recce, FOO and Platoon Commander gave ratings of 2 or lower. On question 2, this feature was seen to be highly desirable by only the 2i/c Infantry and received only moderate ratings by the remaining members of the group.

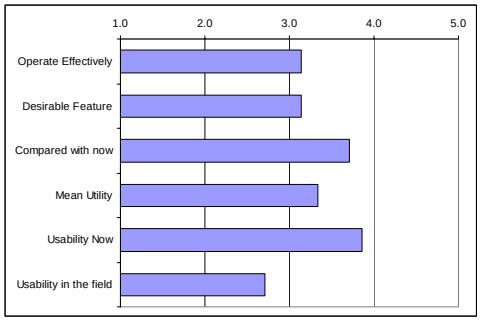
- **Participant Comments**

In agreement with the ratings only the Coy 2i/c commented that this information would assist with his daily collation of logistics information. All other comments suggested this information would be useful "at higher level only", useful at Battle Group (BG) or Brigade (Bde) level, e.g. "G3 or G4" etc. It appears that the most useful information is contained in "resources" if it can be updated in near real time. One user commented that he could not envision any use of this feature.

3.6.6 TO&E

This feature comprises three components that were evaluated separately: Orbat, resources and information query builder.

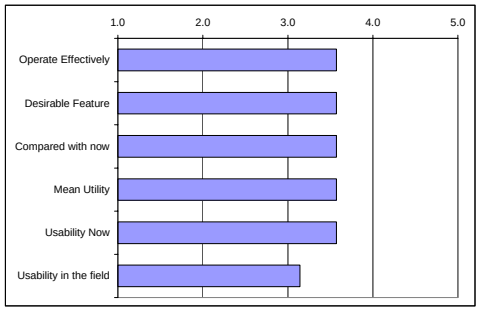
3.6.6.1 Orbat



Ratings suggest that users feel that this feature:
1. Was somewhat helpful in terms of allowing them to operate effectively (3.1).
2. Was a somewhat desirable feature (3.1).
3. Was better than the current capability (3.7).
4. Was of moderate utility (3.3).
5. Usability in the test bed was acceptable (3.9).
6. Usability in the field would be unacceptable (2.7).

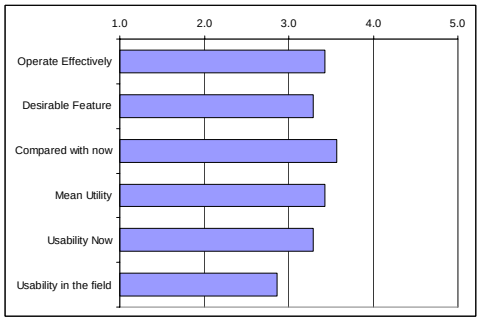
The strongest ratings for this feature were provided consistently by the Engineering/Recce for all three questions.

3.6.6.2 Resources



Ratings suggest that users feel that this feature:
1. Was helpful in terms of allowing them to operate effectively (3.6).
2. Was a desirable feature (3.6).
3. Was better than the current capability (3.6).
4. Was of moderate utility (3.6).
5. Usability in the test bed was acceptable (3.6).
6. Usability in the field would be marginally acceptable (3.1).

3.6.6.3 Information query builder



Ratings suggest that users feel that this feature:
1. Was somewhat helpful in terms of allowing them to operate effectively (3.4).
2. Was a somewhat desirable feature (3.3).
3. Was better than the current capability (3.6).
4. Was of moderate utility (3.4).
5. Usability in the test bed was acceptable (3.3).
6. Usability in the field would be marginally acceptable (2.9).

- **Participant Comments**

Comments regarding the ORBAT and Resources ranged from “Excellent tool for easy access to staff data that may be used in plan operations.”, to, “ORBATS not really required.” These types of comments came from different senior people in the trial combat team. Within this range of comments there was a consensus that real information was preferred to ideal information because it would be more useful in the field. Ideal staff planning information would be useful for planning above the combat team level. Also the resource information (if real and updated every ½ hour) was deemed as

being very useful. Suggestions of information to be added to enhance the resources were: daily battle losses, vehicle status, weapon range, and combat effectiveness.

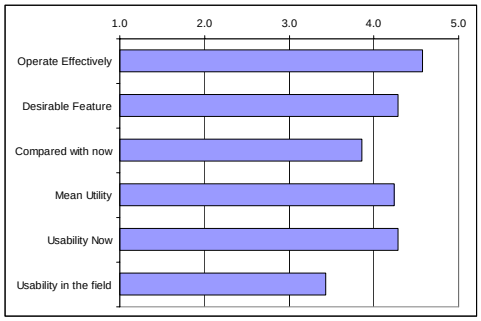
The OC commented that the information query builder was "…a very good feature." However, the other team members generally suggested that it would be a useful tool for combat team commanders at the very lowest.

Overall comments stated that in general this feature is for combat team command level and planning use only.

3.6.7 Operation CEOI

Ratings suggest that users feel that this feature:

1. Was major benefit in terms of allowing them to operate effectively (4.6).
2. Was a desirable feature (4.3).
3. Was better than the current capability (3.9).
4. Was of strong utility (4.2).
5. Usability in the test bed was clearly acceptable (4.3).
6. Usability in the field would be acceptable (3.4).



- **Participant Comments**

All comments were favourable. CEOI was deemed to be a very useful feature. Improvements were to make it more accessible and more secure than the current implementation. Also to add more information such as : "freqs, codeword, nicknames, light recognition sigs", "..Needs all information represented in NATO orders format under heading command and signals".

3.6.8 Status Bar

The next series of items probed the various status indicators within the bar along the bottom of the display window. For the most part responses to these features were very similar, with the exception of the map re-centring mode and Vetronics, the responses for which are broken out separately.

All of these features were judged to have strong utility and acceptable usability. (see composite figures below).

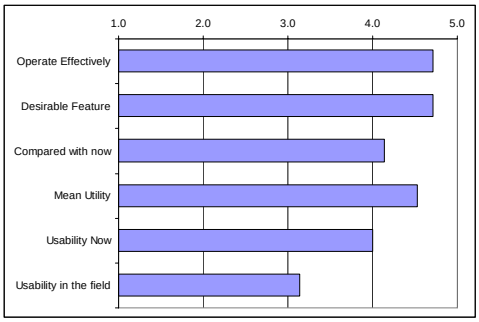


Figure 3A: Composite ratings Message Status

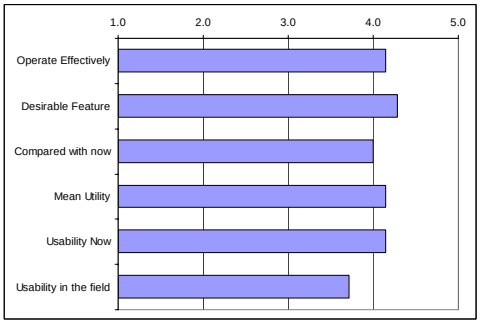


Figure 3B: Composite ratings Cursor Status

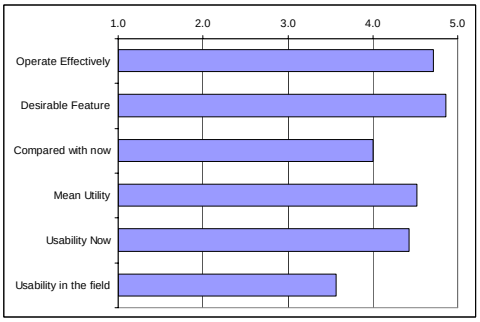


Figure 3C: Composite ratings Cursor Position Indicator

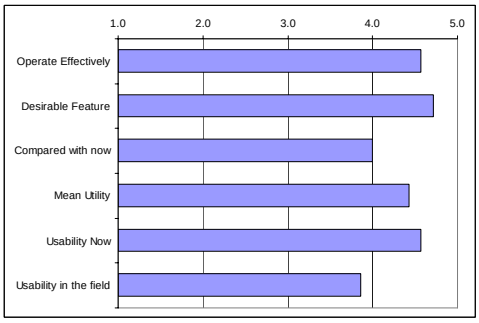


Figure 3D: Composite ratings Active Unit Position

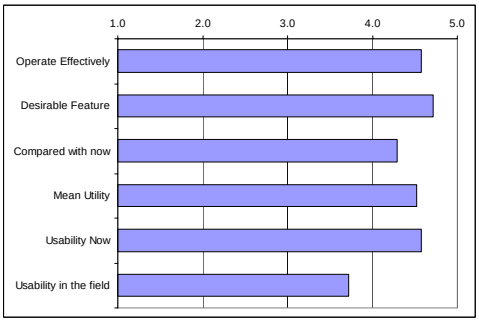


Figure 3E: Composite ratings Date Time Indicator

3.6.8.1 Message Status

- **Participant Comments**

The message status bar is quite small and users commented that it is difficult to see, especially when in a vehicle. An indication is required to alert users to "immediate" messages. Also a better indication of priority messages is needed.

3.6.8.2 Cursor Position Indicator

- **Participant Comments**

Comments were related to size and the fact that it is difficult to see. This would be relied on less if a grid indication were provided around the map.

3.6.8.3 Date and Time Indicator

One user commented that this was too small. Another commented that the clocks must be synchronised to the nearest second with all other units otherwise it should not be displayed. Another users commented that there were too many options.

3.6.8.4 Active Unit Position

Users generally commented that having the grid references instantly available was a desirable feature.

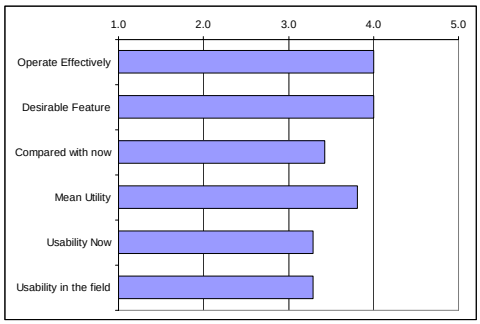
3.6.8.5 Cursor Status

Cursor position indicator choices were seen as being helpful to combined options.

3.6.8.6 Map Re-centring Mode

Ratings suggest that users feel that this feature:

1. Was helpful in terms of allowing them to operate effectively (4.0).
2. Was a desirable feature (4.0).
3. Was somewhat better than the current capability (3.4).
4. Was of moderate utility (3.8).
5. Usability in the test bed was acceptable (3.3).
6. Usability in the field would be marginally acceptable (3.1).



- **Participant Comments**

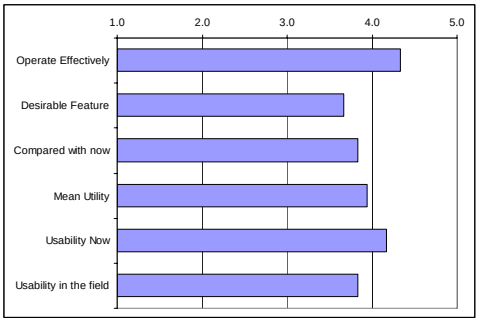
Re-centre was helpful to users once they understood the various options. Users commented that re-centre on own position should not occur on every move as it takes too much time to update.

Users commented that they did not want to rely on map re-centring alone and would prefer "…more flexible map browsing", (this relates to previous comments on map scrolling or panning.)

3.6.8.7 Vetronics

Ratings suggest that users feel that this feature:

1. Was helpful in terms of allowing them to operate effectively (4.3).
2. Was a desirable feature (3.7).
3. Was better than the current capability (3.8).
4. Was of moderate utility (3.9).
5. Usability in the test bed was clearly acceptable (4.2).
6. Usability in the field would be acceptable (3.8).



For question 2, only the Combat Team Commander saw this as being worse than the current capability. In general, participants' ratings for this feature tended to be higher than might be expected from the comments indicated below.

- **Participant Comments**

Users viewed this feature with some scepticism i.e. they didn't believe it would be implemented in the CF. However, some users mentioned that a warning of an impending vehicle system failure would be helpful especially if integrated with all vehicle systems for units and higher (i.e. a logistics function). Other users said they had a driver to take care of the vehicle and did not need the feature.

3.6.9 System Options

Participants were required to use individual segments of "system options" features i.e. "messaging" and "viewer". Each of these features was not systematically evaluated during the trial. In general, participants were surprised by the amount of custom configuration available to them and although they did not have lengthy experience reviewing their effects, they found the utility very promising.

3.7 Post Scenario Focus Group Discussion

3.7.1 Overall Ratings of Major System Features

Prior to the general focus group discussion, participants provided an overall questionnaire rating for six of the most frequently used individual features in terms of utility and ease of use. Mean data are shown below and give a general impression of participant perception following the trial.

Table 3: Mean Overall Ratings for Selected Features across all participants.

Feature	Utility	Ease of Use
Overlays	4.1	2.9
Messaging	4.2	3.2
Symbols	4.2	3.4
Map	3.1	2.9
Unit Info.	4.2	4.0
TO&E	2.9	3.9
Mean	3.8	3.4

While the overlay, messaging, symbols and unit information are generally seen as having strong utility, the map and TO&E features were rated as having moderate to less than acceptable utility. Only unit information and TO&E were clearly seen as having acceptable ease of use.

It should be noted that the combat team commander had consistently higher ratings than those of other combat team members and therefore distorted somewhat the mean values. Without this data the mean utility and ease of use values drop to 3.2 and 2.7 respectively. These data suggest that neither the overall utility nor ease of use of the principal system features were viewed with much favour by most of the combat team.

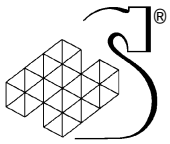
3.7.2 Review of Major TBCS/Chameleon Issues

Following the last stage of the scenario, a general focus group discussion was conducted to review the high utility features of TBCS/Chameleon (based on the trial administrators' observations and participants' comments), as well as users' initial perception of future TBCS/Chameleon features. After 2½ days exposure to the software, users made the following positive comments about system features/functions.

- The map, overlays, symbols and TO&E (including the playback of moves) features combine to form effective planning and training tool.
- The video clip option will provide useful recce information *(users suggest this should be resizable).*
- CEOI decreases workload in gathering and recalling this information (*users assumed this would be filled with all the relevant information they have access to now*).
- GPS integration with map will increase situation awareness.
- The Automation capability provided by messaging e.g. logistics, MASH, Cas evac. will reduce workload.
- Alarm on approach of mine field will increase safety and situation awareness.
- Messaging allows for an increase in accuracy (everyone receives the same information with no transcription errors).
- Message pre-formatting reduces the workload associated with preparing messages.

3.7.3 Future Issues

Major future issues included in the discussion were interface implementation and decision aids. The concepts of integrating features such as touch screen, stylus and voice recognition interaction were generally well received. Participants were generally familiar with these features in some form or another (e.g. bank machines) and saw high utility in these modes of interface. However, the concept



of a head up display was not well understood due to lack of familiarity. No comment can be made on the potential utility of this feature.

Decision aids were mentioned as having high utility throughout the trial, and this theme was picked up during the final focus group discussions. In particular decision aids were seen to be most useful in the context of planning activities and include:

- weapon range indicator,
- bearing and range tool,
- integration of GPS and laser range finder,
- intervisibiliy tool, and
- route planning tools.

3.8 Rating differences across positions

With only one individual to provide a rating for each position, any interpretation of rating data for a position must be treated with caution. The data could reflect either true differences resulting from different needs and perceptions across positions, or could just be the result of differences among individuals. Notwithstanding this limitation, mean data for all three utility questions and both usability questions have been compiled over all system features and are shown in Table 4 below. These data show that the utility of the current TBCS feature set is seen as moderately positive across the entire combat team.

Table 4: Overall Utility and Usability Ratings for each combat team position

	Mean Utility Rating	**Mean Usability Rating**
Combat Team Commander	3.9	4.5
Battle Captain	3.8	3.4
Troop Leader	3.7	2.9
2i/c Infantry	3.8	3.5
Platoon Commander	3.7	3.6
Engineering Recce	3.7	2.4
Artillery FOO	3.6	3.2

With respect to usability issues, there is much less agreement across the team. The Troop Leader and Engineering positions, on average, rate the system ease-of-use as unacceptable. At the other extreme, the Combat Team Commander rated all features on average as being easy to use. The remaining team members fell somewhere between these extremes.

3.9 Desirability of system features

The following Table provides a further breakdown of the desirability of system features (question 2 Annex C – Utility Trial Questionnaire) across combat team positions, and contains only those features which received a rating of four or higher (shaded cells). This information may be of some assistance in future development of the system when trade-offs have to be made between system features (and their overall utility across the team) against other constraints. These data may also be of use if there is

some consideration given to matching the specific system functionality to the different needs of different combat team positions.

Table 5: Features rated as being moderately desirable or higher for a future system.

	Combat Team Comd	Battle Captain	2i/c Infantry	Platoon Comd	Troop Leader	Eng Recce	Artillery FOO
Overlay: Control measures		Not Rated					
Overlay: Co-ord plans							
Overlay: Orders							
Mess: General							
Mess: Contact Rep							
Mess: Wng O							
Mess: Send overlay							
Symbols: Fr unit		Not Rated					
Symbols: En unit editor							
Map: Format							
Map: Navigation							
Unit information							
TO&E: Orbat							
TO&E: Resources							
TO&E: Info query							
Op: CEOI							
Mess. Status							
Cursor position							
Date time indicator							
Active unit position							
Cursor mode							
Map recentre mode							
Vetronics						Not Rated	

3.10 Summary

In this summary, the composite data, collapsed over all combat team positions, will be considered from a variety of perspectives in order to better understand the overall trends. Since the primary purpose of the trial was on the utility of TBCS as a requirements capture tool, the rating data on the three utility questions will be the major area of focus.

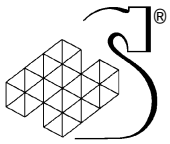


Table 6 Utility of System Features (mean of Questions 1, 2, 3)

System Feature	Mean Rating
Cursor Position	4.9
Message Status	4.7
Date/time indicator	4.7
Active Unit position	4.7
Message: Wng O	4.6
Map:Format	4.4
Op: CEOI	4.3
Cursor Status	4.3
Messaging: General	4.3
Messaging: Send overlay	4.3
Messaging: ConRep	4.1
Map re-centre	4.0
Map: Navigation	3.9
Symbols: Fr unit	3.7
Vetronics	3.7
Symbols: En unit ed	3.6
TO&E: Resources	3.5
Overlay :Con measures	3.5
Overlay: Coord plans	3.4
TO&E: Info query	3.2
Overlay: Orders	3.2
TO&E: Orbat	3.1
Unit info	3.0

In terms of gross measures of utility, taken across all system features, the mean rating on question 1 of Annex C – Utility Trial Questionnaire, was 3.8, which suggests that participants overall judged that the system features would provide a moderately positive benefit to their operational effectiveness. For question 2, the mean rating was 4.0 which would indicate that across all features were seen to be moderately desirable in a future system. For question 3, the mean response of 3.5 suggests that the system features were not seen to be much of an improvement over present capability. This judgement may have been influenced by usability concerns, since ratings on the ease of use questions were overall lower for most system features than for the utility questions

To further summarise the utility data, an overall rating of utility for each system feature has been calculated across all three questions and all trial participants. These data are shown in table 6, with the system features ranked in descending order of utility.

It is interesting to note that many of the elements which appear in the TBCS status bar are ranked towards the top of the list. It should be noted that for the most part, these features (which provide a convenient summary of status information) contribute more to general situational awareness than they do to the actual execution of specific tasks. Further, these features also received moderate to moderately high ratings on usability, and there is a strong possibility that the trial participants were unable to set aside their impressions of ease-of-use when making judgements about the utility of a feature. Notwithstanding this possibility, it should be noted that no system feature was rated below 3 in terms of average utility, *suggesting that all features were seen to be useful for including in the final system*

One further, useful method of summarising all of the data, is to organise the system features into four broad categories of utility: moderate (mean rating 3-3.9) or high (mean rating 4+) and acceptable usability (mean rating >3) or unacceptable (mean rating <3). For the utility categorization, only the responses to the question on ease-of-use in the field were considered (question 5), since these provide more meaningful feedback for system development purposes than the ratings on ease-of-use in the test environment

The results of this classification are shown in Table 7 below.

Table 7: System Features classified by utility and ease of use.

	High Utility	**Moderate Utility**
Acceptable Usability	Messaging: general Messaging: warning order Operation: CEOI Message status indicator Date/time indicator Active unit position Map recentre mode Vetronics	Symbols: friendly units Unit information TO&E: Resources Vetronics Map drawing
Unacceptable Usability	Messaging: contact report Map format Map navigation	Overlays: control measures Overlays: co-ordinate plans Overlays: orders Symbols: enemy units editor TO&E: Orbat TO&E: Information query builder

This table provides useful directions for guiding short term system development priorities if future user trials are contemplated. For example, features which are shown to have high or moderate utility and low usability could be carefully reviewed with the intention of developing a much improved interface and/or functionality.

4. Discussion

This section draws together some of the major issues which emerged from the utility trial. The topics to be covered are:

- trial participants
- map usage
- communication issues
- access to resource information
- TBCS/Chameleon
- utility versus ease-of-use.

Where possible, utility related issues are followed by design recommendations. Please note that recommendations have been numbered consecutively across all topics for ease of reference.

4.1 Trial participants

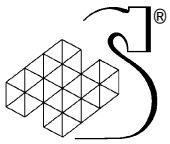
At the start of the Results section we reviewed the characteristics of the participants for the utility trial and showed how they fell short in many ways, compared with the desired sample requested. We now outline some concerns about the test participants based upon a general subjective evaluation from watching their performance in the more structured aspects of the trial, and from interpreting their comments in the trial discussion sessions. While such a subjective evaluation has potentially low reliability, the two test administrators have significant field experience in working with military personnel in a wide range of trial environments. Hence, we have a reasonable knowledge base against which we can compare the present trial participants.

We believe that there are five main issues relating to the trial participants that give rise to concerns. These are:

1. The degree to which they are a representative sample,
2. Their ability to play the role in question,
3. Their ability to play two different roles during the trial,
4. Their ability to use their imagination to evaluate the role the system could play in other contexts, and
5. Their ability to imagine how additional functionality might be suitable for certain operational tasks.

We now consider each of these points in turn.

Given the limited experience of many of the participants, particularly in the roles which they were scheduled to play, we have strong reservations concerning the degree to which the participants actually are representative of typical combat teams. Our conclusion is that their knowledge base was shallow and in many cases they had limited experiences in performing a range of tasks under operational or exercise conditions. While this lack of experience is unlikely to bias the evaluations in any systematic way, it does suggest that caution should be applied in considering the results to be representative of the army population who are likely future users of TBCS/Chameleon. That is, unless the actual army population itself is equally low in experience. If this is the case, then it makes this and future evaluations of the system more problematic, since potential users may have so little knowledge about



the tasks done under operational conditions that evaluating the system without this contextual experience represents a major risk for identification of the appropriate suite of functions required.

The lack of experience among the trial participants also impacted upon the test participants' ability to play the role expected in the execution of the scenario. They frequently needed to be prompted to go beyond the basic tasks that formed the core of the scenario segments. In some cases, other members of the team, whose own task performance was dependent on tasks perform by others, prompted the team member in question to do the task that was missed. The result is that the software did not get the full shakeout that one might have hoped for.

In retrospect, it appears that the idea of having some participants play two different roles (in order to economise on the number of users required) was not successful. We found that we had to constantly remind those playing two roles to switch to the alternate role and carry out the mission-appropriate tasks. This conclusion is reinforced by the fact that for those mission segments where the participant had to assume two roles, no separate post-segment ratings for each of the individual roles were obtained.

Although one or two of the trial participants showed a lot of imagination, this was not true of the majority. This expressed itself in two ways. First, they could not go beyond the immediate limited range of tasks and existing procedures to speculate on how the system might support other tasks, or how other tasks could be potentially served by a BMS. Second, if some aspect of the system interface or functionality was giving them problems in performing a specific task, they seemed unable to set aside this aspect in evaluating how the system might effectively support other tasks and activities.

In conclusion, these limitations of the trial participants probably result in an underestimation of both the potential utility and general applicability of TBCS/Chameleon, since they have had sufficient experience to extrapolate to mission contexts and where the system may be able to play a significant role.

4.2 Networked system stability

As discussed in the Results section, the networked TBCS/Chameleon software system crashed more frequently than expected. The software designers worked very hard throughout the trial to increase the stability of the system by creating and installing software patches half way through the utility trial. This increased the stability somewhat but still resulted in some residual instability.

This instability of the networked TBCS/Chameleon system affected the users ability to objectively assess the utility of the software. It was anticipated that many of the features would be non functional and that there would be some "glitches" in the software. However, considerable time was used in rebooting the network and users became frustrated by the constant interruptions that resulted. While users were generally able to separate utility issues from ease of use there is a potential for considerable system instability to affect system utility ratings. Therefore, it is likely that there was a slight underestimation of system utility as a result.

4.3 Map issues

Given the centrality of map use for many combat team activities, it is not surprising that this area of system functionality generated some of the most extensive comments and discussions. Three major areas relating to map use emerged: size, navigation and content.

4.3.1 Map size

At the most general level the greatest concern was the small size of the viewable area. This was the particular concern for the senior combat team personnel who believed that the format reduced their ability to integrate a more local view of the area of interest with the more global picture. It appeared that the capability for providing a scalable window insert to show other areas of the map, was not an effective solution for providing the necessary integration of situation awareness. These users believed that they would still need a paper map to provide the more global view. Some users also expressed concern over the total size of the map in that it did not match the size that they were used to having for combat team operations.

A related issue to map size, is the immediate loss of part of the map visible area that occurs when a message is received and occludes part of the underlying map area. Users suffer a major loss, or disruption, in situation awareness when this happens. Additional workload is created and there is a loss of effectiveness, as the user has to restore situation awareness once the message has been removed from the screen.

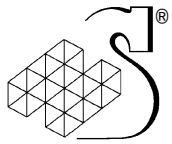
4.3.2 Map navigation

This area produced significant problems and comments from all users. While we discount some of the difficulties users encountered, which we ascribe to limitations in the current speed of the system, there is no doubt that the ability to navigate smoothly and quickly around the map is a major ease-of-use issue. Because of the difficulties users encountered in map navigation, the perceived utility of the map was probably underestimated. Smooth map navigation is at the heart of the user's ability to maintain situation awareness. That is, to provide the appropriate mental picture users need to be able to quickly integrate information within the existing map window with information from either immediately adjacent areas, or areas that are more distal. Time is of the essence in achieving this integration, as the user must mentally maintain one spatial perspective while supplementing or integrating with it other spatial information. Users provide several examples of how the current system fails to support the various types of map navigation activity that are needed to support and enhance situation awareness; these were outlined in more detail in the results section.

4.3.3 Map content and drawing features

In general, users were satisfied that TBCS/Chameleon was able to show existing map formats in more or less the level of detail and rendering that is found in the existing paper map format. It was clear that users saw a significant potential for improving map functionality with the advent of computer based map technology. The major theme to emerge was the need for differential map detail for different mission contexts, different mission tasks, different time pressures and different team roles. For example, the levels of detail to support planning before an advance, while on the move, conducting a hasty attack, and consolidation were all quite different. Users also expressed a strong desire to see certain types of information available on a map that could not be made currently available in existing formats. The specific information required varied across combat team position, for example, infantry wanted to see more detail concerning the terrain and buildings, whereas engineering was more concerned over issues relating to bridges, roads and utilities.

The display of friendly symbols on the map seemed to be useful, however the associated information in the pop-up box was seen to be more useful for logistics activities than for combat operations. Users were positive about several aspects of the functionality that enhanced their situation awareness. These included the option to filter units and show aggregations and the type of unit information displayed (e.g. weapons, Tac or call sign). Users made several suggestions for enhancements to the utility and



implementation of this feature to further enhance its overall effectiveness for use in the field. In contrast, the enemy units editor was not seen to be useful or usable for combat operations.

The general conclusion that must be drawn is that to fully support all combat team members and all aspects or combat team operations, a flexible map format is required. This would allow the user to select the appropriate level of detail symbology and tools for the immediate mission task at hand.

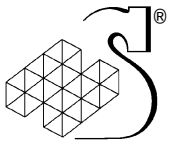
4.3.4 Map tools

Users were generally enthusiastic about the potential implementation of several map tools and features that might be expected in a future evolution of the TBCS/Chameleon concept. These included intervisibility, calculation of bearing and distance between points and GPS integration with a laser range finder.

Overall, the conclusion that must be drawn from the utility trial is that users place a high priority on map usage to create and maintain both local and global situation awareness. They are used to a paper map format, which they have learned to use effectively to integrate these two aspects of situation awareness. While they see the electronic map format as having strong potential to improve situational awareness over the paper map, many aspects of the TBCS/Chameleon implementation of map functionality produce a lower-level of situation awareness than exists with their present interaction with the paper format. Without major changes in features to support the required utility, and a parallel improvement in the interface to support usability, the likely result of fielding a system with the current capability is that users will probably continue to use a traditional map format in conjunction with TBCS Chameleon, with no guaranty of any improvement to their situation awareness. It is also possible that such a hybrid approach could actually impair situation awareness, increase workload and decreased combat team effectiveness.

4.3.5 Recommendations

1) Increase the size of the viewing area of the map display.
2) Reduce the amount of map area that is obscured by interface elements.
3) Provide appropriate map formats and drawing tools which are better matched to the requirements of combat team members (e.g. engineering requires different map content from artillery).
4) Allow users to more easily integrate map/trace information and message text information. Users need to simultaneously view map features and message information.
5) Modify map “pan” feature to allow smooth movement of the map without the current “jumps” (e.g. allow the user the capability to drag or scroll the map as little as ¼” in any direction, or as much as one complete screen width while allowing the user to see the map throughout the movement).
6) Allow quick method of alternating between two map views (i.e. in both location and zoom factor).
7) Provide the enlarge view feature with a resizable window capability.
8) Provide a capability to select an area within the enlarge view window to become the current map display view.
9) Provide a tool that allows users to select two points and automatically calculate bearing and distance.



10) Allow users the option to display major grid reference marks (i.e. eastings and northings) at the edge of the map without compromising recommendation 2.

11) Provide more flexible drawing tools to allow rapid annotation of drawings such as quick sketches for a hasty attack.

12) Provide a readily accessible count down clock feature with user selectable alarm increments (e.g. a warning 5 minutes before time equals H-hr).

4.4 Communication issues

Like map usage, communication is a major component of combat team operations. Users place great stress on having fast and accurate communication achieved with the minimum of effort and mental workload. The specific topics we will comment upon include general utility, contact reports, orders and sending overlays.

4.4.1 General utility

While users generally saw significant potential for this form of communication, simply executed with a few quick and over-learned spoken words, a major area of concern expressed was the time it takes to create many basic messages. Users wanted to see the message creation interface made much simpler and wanted to use pre-formatted generic content as much as possible.

A second issue of concern was message reception, where two problem areas emerged. First, users did not believe that they were receiving sufficient situation awareness of new messages, in that an increment in the number displayed in the message in-tray status bar could be easily missed if their attention were elsewhere. In particular, users felt that they should be alerted in particular to high priority incoming messages, and the way this was currently implemented failed to meet this need. Secondly, the accessed messages covered too much of the underlying map area with the result that it was often difficult to do the necessary integration between the message content and what was happening on the map.

4.4.2 Recommendations

13) Change the “three tab” message format to one window.

14) Allow the user to define a default recipient list for all messages.

15) Allow messages to be sent with incomplete information. For example a contact report could be sent by making the following clicks: message – contact – send (results in an automatic contact wait out) or message – contact – location on map – send (results in contact wait out with grid reference information).

16) Provide better means of rapid situation awareness of reception of priority message through visual cues (while maintaining the auditory cue option). The default mode for reception of priority messages should be set to “on”.

17) Improve the editing capability of messaging to support order production to reduce the number of steps involved in numerous cut and paste operations.

18) Provide the capability for message forwarding.

19) Continue to develop preformatted messages matched to the needs of high frequency tasks performed by different team members.

20) For messages that rely on a common time base (e.g. “orders in x minutes”), provide a reference time stamp integrated with preformatted messages.

21) Provide a capability to allow the sender of the certain message to check an easily referenced list, which shows who received, reviewed and understood messages.

4.4.3 Contact reports

The analysis of contact report issues can be centred on two areas, sending and receiving. Users expressed considerable concern over the time it would take in TBCS/Chameleon to send a contact report, compared with how quickly this can be accomplished with voice communication. In general, users would prefer fewer steps, fewer options and more pre-formatted, easily accessible forms, for example, having available a quick pick list of expected enemy units. However, users also saw considerable potential for quickly sending certain types of information if data derived from laser range finding could be integrated into the TBCS/Chameleon system.

In terms of message reception, users saw great potential for having some of the contact report information appear directly on the map, as currently implemented in TBCS/Chameleon. They typically saw this feature as reducing workload and communication errors, enhancing situation awareness for new information and integrating that information into their mental picture. The enhancements to situation awareness include: immediate comprehension of the nature of the contact, the exact location and its movement. There were two aspects relating to the reception of contact reports that produced some concerns and negative comments. First, the user is totally unaware of contact reports that appear outside of the map area that is currently displayed, even though they may be of critical importance. Second, even within the map area displayed, a new contact report may fail to attract the necessary attention and can be easily overlooked. This becomes more critical as the amount of information displayed on the map increases and as the user narrows attention to focus intently on a task.

Users believed that the symbol information plotted on the map should be as simple as possible and allow them to quickly interrogate additional information with a simple button click. There is a further need to support situation awareness by reducing display clutter arising from multiple contacts as a mission unfolds by allowing changes in unit status to be reflected in the displayed symbology, for example in the case of contacts which have been destroyed.

The final central area of major concern that relates to both message transmission and reception is the perceived time it would take for a "contact wait out". Some users believed that it was necessary to continue to circulate this information by voice because of the ease in which it can be accomplished, the potential expression of urgency by voice intonation and the alerting effect this has upon the recipient, particularly if attention was concentrated elsewhere. On the other hand other users believed that some of these needs could be addressed in a well-designed, visual-spatial format, which would also have the advantage of providing immediate situation awareness of the contact location.

4.4.4 Recommendations:

22) Provide the capability to flag the user that off screen contact reports have occurred.

23) Visually alert the user to a new contact reports plotted on the map.

24) Provide the capability to alter the appearance/status of enemy symbols (e.g. to show enemy destroyed).

25) Provide the capability to quickly interrogate by way of clicking an enemy unit symbol for information in the original contact report (e.g. who made the report, at what time, what was the enemy doing etc).

4.4.5 Orders

The perceived utility of the TBCS/Chameleon functionality which supports order production and transmission depended to a large extent on the specific mission activity and associated time pressure. In general, the capability was seen to be more suited to slower paced phases of missions than to operations such as a warning order for a hasty attack and counter attack. The general ability to receive, edit and transmit a warning order using TBCS/Chameleon was seen as having high utility and having the strong potential for reducing workload and eliminating error. Major improvements to the actual implementation of this feature were seen to be necessary as users reported that editing functions were too slow and cumbersome.

Considerable potential was seen for having a standard overlay accompany the order, in that all recipients would have identical information, thereby reducing transcription errors and workload. Again, users found the actual implementation of the TBCS/Chameleon functions which supports overlay production to be cumbersome and complicated, a view which we would support based on our observations of individual trial participants as they struggled to use this aspect of the software. While some of this difficulty could be attributed to insufficient training, this would not account for much of the difficulties encountered.

Moreover, and perhaps more intractable, users reported that under time pressure a number of difficulties associated with order production and transmission arise. Users believed that while the existing HCI and functionality would support order production for a planned attack, it would be too slow to implement in a hasty attack environment. We believe that these comments derive more from the time it would take to create the necessary overlay rather than the belief that the system features have potentially low utility in this context.

One further missing element from the order production and distribution process that should probably be addressed as TBCS/Chameleon evolves is the need to incorporate some form of acknowledgement that orders have been received, reviewed and comprehend.

4.4.6 Recommendations

26) Reorganise system features that support creating an order into a simpler integrated function (i.e. the plan creation process should not be executed through "overlays"). This will help to decrease in the large number of steps now required.

27) Simplify the "overlay" feature. Combine control measures, co-ordinate plans and orders. Allow the user to select from one list of available layers.

28) Provide the capability to show the "flanking unit picture" in the overlay menu. This provides the user (OC) with the option to the co-ordinate plans with other members of the battle group (e.g. turn on/off other combat team commanders' battlefield picture).

29) Allow users to send overlays within messages more quickly and easily by decreasing the task steps. Integrate this with recommendation 13.

4.5 Access to resource information

A number of system features can be grouped into this category including friendly units Orbat, unit information TO&E, operation CEOI and Vetronics.

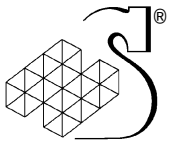
The consensus of the group was that the friendly units Orbat feature had good utility but would only be used by limited number of members of the combat team, most notably squadron and company level commanders. For these individuals the tool was seen to be most useful for planning activities. A number of suggestions were received concerning improvements that could be made both to the utility of the feature and its ease-of-use. There was some confusion between resource information to be found under this feature and that found under friendly unit symbols. It appears that one access point to draw or place friendly units on a plan and access information about their status and capabilities would be more useful.

The unit information feature was seen to be desirable only by the 2I/C to assist in the daily collection of logistics information. The balance of the combat team believed the feature to be more useful to higher levels of command. Again, limited use was seen for the TO&E features across the combat team, and users believed that it would be a suitable and needed tool for only combat team commanders and higher. The ability to build queries was thought to be useful for the OC. The most desirable improvement to the current functionality was seen to be in enhancing the database to reflect actual resources and to have this information updated at regular intervals.

The operation CEOI feature received consistently positive ratings from all team members who thought that this was not only very useful, but usable right now in its existing implementation assuming that additional information (see user comments in results section 3.5.9) and security features were added.

4.5.1 Vetronics

There was little agreement on the usefulness of the Vetronics capability across the combat team members. In spite of some general scepticism, some users could see the future use for such a capability in its ability to provide quick situation awareness to higher units of capabilities or problems across groups of vehicles of interest. Users believe that this capability would be greatly enhanced if Vetronics were integrated with all vehicle systems. At the level of the individual vehicle, Vetronics was seen to be more useful for providing an early warning of an impending problem, rather than for providing the current ongoing status of vehicle systems.



4.5.2 Recommendations

30) Orbat database should reflect current unit/personnel/weapon status.

31) Combine Orbat drawing symbols (currently under symbols, friendly units) and resource information (currently in TO&E in VIPER). Maximum utility will be achieved through providing one place for friendly and enemy Orbat selection for status information or for selecting the symbol to be draw on the map.

32) Provide rapid situation awareness of aggregated resource status through graphic means. Provide the option to expand this information down to progressive levels of detail,. e.g. provide a graphic which shows the operational effectiveness of a Company level unit – the user could expand one level down to rapidly determine the status of the Platoons, which again should be represented in graphical format. The user could then expand one level further to see text based detailed such as AFV state or other operational status information (weapon status, weapon symbol, weapon range, daily battle loss etc.).

33) Provide online capability to reference the "Junior General Kit" with appropriate hypertext links.

4.6 System Options

The number of user options is significant and provides the user with flexibility in setting up their preferred configuration. However, it is not clear how the options map onto the specific needs for different tasks and different combat team personnel. Because this feature is used less often than many others (and therefore the functions are more quickly forgotten) emphasis should be placed in making the option selections self-explanatory to all users.

Users should be provided with the ability to rapidly select among a standard set of pre-configured modes of operation based upon an analysis of user requirements and context. For example, an interface and tool set which supports combat team commander level planning with no time pressure in a hide, would not be suitable in the context of a section/crew commander in a hasty attack. Within the pre-configured modes, some degree of user customisation may be provided.

5. Conclusions

Overall, the current functionality of TBCS/Chameleon and the feature set employed is seen to serve the needs at a very general level of the combat team across the range of combat team activities required for the trial scenario. However, for individual members of the combat team, the match between perceived utility and individual need varies greatly.

The utility trial has shown that there are a number of major problems in the current functionality and these are addressed in point form below. The points listed below concentrate mostly on utility issues. There is some crossover with ease-of-use issues as they impact upon the potential utility of some system features.

5.1 Meeting the requirements of different combat team positions

- At present, the system makes no attempt to provide the appropriate functionality according to the frequently performed tasks associated with the unique role of different combat team members.
- The risk in providing a comprehensive feature set is that the implementation of the feature does not necessarily address the specific way tasks may be performed differently by different combat team members.

5.2 Meeting the requirements of different operational and mission contexts

- Similar tasks performed in different mission contexts may require different system features to support effective task execution. The specific features and tools provided and means of user interaction need to be tuned to the specific context in which they are performed.
- A simplified tool set needs to be provided for tasks conducted under time pressure.
- Consideration needs to be given for the specific information requirements associated with dismounted activities.
- Map features need to be implemented selectively to meet the local task requirements.

5.3 Speed of use

- The system features need to be organised and integrated in a manner which minimises the number of steps required to be taken to perform a task.
- The actions required by the software should match the normal sequence and logical order in which tasks are done.
- The interface should be enhanced to allow time sensitive tasks (e.g. sending a contact report) to be performed rapidly and simply.
- The implementation of drawing tools needs to be improved to allow them to be more effectively used to support rapid planning and order production.

5.4 Supporting situation awareness

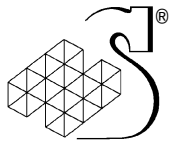
- The functionality of the general map capability, which is the critical core component of combat team tasks, is consistently judged to be worse than the existing capability. Hence, improvements in the design of this feature will go a long way to improving system effectiveness.
- The system provides little support for rapid awareness for new information.
- The system impairs the integration of local and global perspectives and spatial integration of information (compared with what can be achieved now).
- Users find it difficult to maintain appropriate map situation awareness because of a variety of difficulties associated with map navigation.
- The system needs to provide greater support for visualising future event status.
- Selective and additional map elements will need to be added to support situation awareness of terrain.
- The system has the potential for detracting from the user's ability to operate in a head-up mode.
- The system fails to provide the specific support (in terms of the appropriate feature and tool-set) for the various forms of situation awareness which arise in different mission contexts

5.5 Supporting communication

- The system fails to convey the urgency currently associated with certain voice messages.
- There is a lack of feedback on whether messages have been received and understood.
- The system provides insufficient tools to support effective message management and has the potential for increasing the workload associated with this.

5.6 Beneficial features of the system

- The provision to plot unit locations, contacts and other similar information (including GPS data) directly on the map provides a major enhancement to situation awareness and has the potential for a decrease in workload, transcription errors and communication traffic.
- At the command level, the system enhances the effectiveness and accuracy with which orders can be received, prepared and transmitted.
- The system has the potential for streamlining tasks associated with the collation and integration of information concerning resources.
- The system enhances the maintenance of situation awareness and communication effectiveness when the user is required to change command and control systems, for example switching vehicles.
- The system provides good support for enhanced situation awareness in planning operations.
- The system has demonstrated potential for reducing voice communication and allowing audio channels to be reserved for the most critical information.



- The system has the potential for reducing a number of error sources in the communication process.
- The system has the potential to enhance situation awareness by providing access to unit level information concerning capability/status.
- Users can see considerable potential for a variety of TBCS/Chameleon based decision aids to support tactical planning tasks.

5.7 Which combat team positions does TBCS/Chameleon serve.

- The current feature set appears to support most directly the requirements of the OC and possibly 2I/C. This conclusion is tempered by the fact that the trial participant who played the role of the OC represented an armour perspective only. Hence the utility of TBCS/Chameleon to support senior command level needs from an infantry perspective remains unanswered by the present trial.
- All members of the combat team believed that some of the TBCS/Chameleon features would enhance the performance of some of their tasks.
- As currently implemented, the feature set within TBCS/Chameleon has progressively lower utility as one moves down the chain of command from the combat team commander to crew/section commander.

5.8 Summary

The process of performing a concept stage, field context, design review of TBCS with end users has proven successful. Recommendations resulting from this trial can be implemented in to the next version of TBCS/Chameleon software. These recommendations concentrate on utility issues with a secondary focus on increasing the ease of use of some features.

The following factors limit the predictive value of the results.

- the low level of experience in the personnel who played combat team roles in the trial
- a single participant at each combat team position was used to represent the entire user population
- the scope of the scenario does not capture all aspects of combat team operations

The user review process should continue at each major build of the TBCS/Chameleon. As the development moves from a concept based development to a fieldable system the user reviews should move from utility based to usability based. Tabletop user reviews of concepts will also assist with design decisions between major builds.

Annex A – Scenario Description

This table describes the details of the Advance to Contact scenario used as a framework for conducting the Chameleon/TBCS Utility Trial. Explicit details for every action of each position cannot be provided because participants are expected to role-play during each stage using the features they feel are most helpful. Consequently every action cannot be predicted. Message modes used by participants depend on the features in messaging and the order/plan/overlay sending capability available in the version of the software at the time of the trial. The contents of the four columns contain the following information:

1. Stage of scenario and electronic trace loaded by participants.
2. Grid position for each of the combat team participants (T29, I39, T29A, I39A, T21, I31, G1, 71F, 62A, 62D, E11) and notional combat team members for 7 different traces using the Cobden map (1:50 000, Sheet 31 F/10, Edition 4).
3. General instructions, prompts, and cues for participants.
4. Expected Chameleon/TBCS actions of participants.

Scenario Segment	Unit Grid Positions	General Instruction to Participants	Expected Participant Actions
1. Background (trace #1)	39 687432 PARA company combat team at 651407. O Company combat team at 675482 using text "O" 9 at 702408.	Participants are told they are "dropped" into area in their position, know nothing about their unit or combat team. It is suggest they use the logistic function, map, friendly Orbat, message in their tray or query builder, CEOI under Operation, Vetronics…to find out as much information about their unit (subordinates and higher) as they can. To begin the are told to load trace 1.	Participants load trace1 containing combat team positions and "0" position. They read a paper copy of the overall intelligence picture (text and sketch). They read the information and use features such as ORBAT to uncover information about units under command. Participant will also use the map to try to understand the ground and general tactical situation.
2. Wng O (trace #1)	As above.	Participants are sent an electronic message with a Wng O. They are told to expect a Wng O and are expected to respond as they would normally by going through battle procedures (using TBCS) to help e.g. detailed map study and time appreciation etc. Prompts may be required to have participants who wouldn't normally send a Wng O do so to exercise the system feature.	Participants receive a message containing a Wng O. They read the Wng O, conduct battle procedures and then create and send own Wng O.
3. Op O (trace #2)	62A at 670510 PARA 662475 (same as above for naming this symbol) 39 at 680475	Participants will load the trace and will receive an electronic Op O. They are told they will receive the CO's Op O and are expected to create their own as they might in the field and then get to the position where they would send this out using a text message and trace.	Participant opens trace with CO's intentions and then creates own Op O. Participant creates own Op O using trace and messaging. May create new order or may change current map.
4. Update Wng O (trace #2)	As above.	Participants are told they are getting close to H-hr and may want to check last minute details of logistics or plans and then make an update to their Wng O or Op O. They should take a couple of minutes and use TBCS to do last minute checks.	Participant use TBCS messaging to update Wng O or Op O if required and may need to search for any last minute update of logistics or unit locations.

Scenario Segment	Unit Grid Positions	General Instruction to Participants	Expected Participant Actions
5. Move to Assembly Area (trace #3)	21 at 691448 22 at 689447 23 at 688445 T29 At 687444 T29A 686443 24 at 685442 31 at 682440 32 at 680438 33 at 678434 39 at 679433 G1 at 678436 39A at 680432 E11 at 658516 71F at 695455 62A 670510	Participants are told that H-Hr is really close and they are now going to move to the assembly area/attack position. To do this they should take about 10-15 minutes to move their own unit(s) along the road (slightly north of their position bearing east northeast then north northwest) in small increments – they may get ahead of other units or get mixed up but try to maintain a realistic pace – keep an eye out for messaging. They are told to take about 15 min. to get to the attack position. A cue is given to T21 - T21B damaged by mine while moving to LD – at Gr 695456 (stream) T21B loses track and blocking road. *Note this cue should be give before the advancing column crosses the stream at the above grid reference point.*	Participants will move their units along the road. They may perform map navigation and will certainly study the map in detail to discriminate units. T21 will receive cue card and will initiate messaging indicating the current situation.
6. At LD (trace #3)	As above.	The OC is instructed to place units i.e. indicate to the combat team where they should locate at the LD, by way of message. Other participants are told they're close to the LD and wait for final message instructions. When they receive the OC's message, move to the required position and wait for a verbal indication of h-hr. While the OCs are planning the attack formation, participant are told to try the options (if they haven't already) at the bottom of their screen for message waiting, current cursor position, current date, active unit position, current cursor state and current map recenter state.	The OC should work out positions for attack using paper or the current map and send out messages to the combat team indicating the desired formation for the advance. Participants will exercise status display options at the bottom of the screen. Participants then move themselves into position.
7. Move to first objective, location awareness. (trace #3)	As above.	H-Hr is indicated and participants are instructed to advance their unit/vehicles at a realistic pace up to the first report line and be prepared for contacts. Participants will be queried about their own position and of everyone else. A cue is given to a participant to indicate that they have hit a minefield. [1]	Participants move symbols and wait for contacts. Messaging will take place to indicate to the combat team the locations. Messaging will take place to indicate to the details of a minefield.

[1] Details of the cue i.e. time, grid reference and individual participant depend on the circumstances of the free play scenario.

Scenario Segment	Unit Grid Positions	General Instruction to Participants	Expected Participant Actions
8a. First Set of Contacts (trace #4)	21 at 656520 22 at 661523 23 at 667528 T29 at 666524 T29A 668523 24 at 670524 31 at 661519 32 at 674522 33 at 676520 39 at 660518 G1 at 669521 39A at 658516 E11 at 661541 71F at 653518 62A 656545 62D 660545 PARA coy at 635497	Participants are told to load up trace 4 and are asked to continue their advance. They should expect an encounter with the enemy. They are asked to respond to contacts as they normally would using TBCS. They are asked to try to move their units in a tactically realistic fashion. They should take about 20 minutes to go to the next report line. Provide five contact cues to various participants examples are: 1) …you can see 2x BRDM's-2 moving southeast along spade route at high speed at and are observing. 2) …you see a section minus with BMP 2 dug in at defile at Gr 656545 and you are moving northeast etc.	Participants load new trace and move symbols and wait for contacts. When they receive a cue they will make contact reports similar to below: 1) 62A - Gr 624540 2x brdm's-2 moving southeast along spade route at high speed – observing. 2) 62D - Gr 651550, section minus with BMP-2 dug in at defile. Moving northeast. 3) 71F – Gr 624541 2x brdm's-2 moving southeast along spade route – observing 4) T29A - Gr 625541 3x brdm's-2 moving south along spade route at high speed – observing 5) G1 – Gr 626541 1x BMP moving south along spade route – observing The contacts above should appear to be multiple reports of the same enemy causing the OC to make some contact report consolidation decisions.
9. Show contacts destroyed, Show PARA is falling behind. (trace #5)	21 at 631540 22 at 636542 23 at 643554 T29 at 632542 T29A at 650560 24 at 648558 31 at 635540 32 at 647555 33 at 650553 39 at 637541 G1 at 650551 39A at 644553 E11 at 647576 71F at 630538 62A 646577 62D 646578 PARA coy at 635497	Participants are told to load up trace 5. They are told they will be experiencing typical battlefield situations and report traffic. They should try to respond to the situations in a typical fashion but using TBCS. If a particular type of message is not available, use text message. Keep moving units at a real battlefield pace and take 15 min. to get to the next report. Prompt a team member to report destroyed enemy in previous contacts.[1] Prompt to T21 to report T21C destroyed. Send a message from 9 requesting a sit rep. Prompt 71F to give contact rep. (BMP-2 moving NW Gr 622522 at high speed along diamond route). A cue will be given to show PARA Coy, a flanking unit, is falling behind e.g. 29, this is 9, call sign 4 (para coy) is delayed dealing with difficult with enemy at position Gr 630504	Participant will load the new trace that shows new positions of the combat team. A participant will send a message to indicated the enemy destroyed (reece and destroyed section). A participant will report the loss of 21C. 29 this 71F contact… The OC may send messaging after he or she sees PARA Coy is falling behind.

[1] Details of the cue i.e. time, grid reference and individual participant depend on the circumstances of the free play scenario.

Scenario Segment	Unit Grid Positions	General Instruction to Participants	Expected Participant Actions
10. More contacts leading to the necessity of a Hasty Attack plan. (trace #6)	21 at 613569 22 at 615572 23 at 622578 T29 at 624580 T29A at 612567 24 at 630573 31 at 615567 32 at 632578 33 at 633574 39 at 627581 G1 at 605566 39A at 613568 E11 at 632588 71F at 610567 62A at 632588 62D at 633589	Participants are told to load trace 6. Participants are asked to keep moving their units as they think they would on the battlefield and go to the next report line in the next 15 minutes. They can expect some more serious problems regarding enemy during this and the next couple of segments. Prompt 62A (recce) to make a contact report of dug in enemy Pl along north bank of stream Gr 613593, (quail) trying to work to n along railroad track. Prompt 62A (recce) to reference last, can observe 2xBMP-2s and 1xT72s and a BRDM-2. Prompt OCs to provide sit rep. The OC may need a prompt to create a hasty attack plan. All participants are asked to create their own hasty attack plan using send overlay feature to exercise the feature.	Participant will load new trace. 62A will make a contact report. 62A will follow up the previous contact report. This should indicate to the OC the need for a hasty attack. OC should provide a sit rep. All should realize the need for a hasty attack and will create a plan for this.
11. Distribute the plan for the Hasty Attack, preparation and counter attack. Plan and move to defensive (trace #7)	21 at 595589 22 at 600583 23 at 592585 T29 at 595586 T29A at 622588 24 at 619588 31 at 597585 32 at 595583 33 at 594582 39 at 597583 G1 at 622593 39A at 593583 E11 at 636567 71F at 589582 62A 630590 62D 631592 PARA coy at 585542	Participants are told to load trace 7 that shows everyone in position for the hasty attack. They will be asked to prepare to conduct this attack. All participants receive a message from 9 e.g. 2 this is 9er, from H6, enemy column detected moving south long diamond route. Lead element just passing Gr 617646. Column contains 6xT72. *Note this cue should be given before participants begin the hasty attack i.e. within the first few minutes of loading the trace*. This should cause OC to want to reorient units to face present threat prior to conducting the hasty attack. All participants are cued into the situation and everyone will be asked to create a hasty defense plan and send to the person opposite to them in the room to exercise the feature.	Participant will load the plan for the hasty attack and use TBCS to perform any preparation they have. All receive the contact/sit rep indicating the counter attack. All participants will create and send plans for a hasty defense.
12. Executed defensive plan and conduct of hasty attkack. Employment of engineering resources. (trace #8)	21 at 625581 22 at 626580 23 at 635579 T29 at 639579 T29A at 627578 24 at 640583 31 at 637580 32 at 630576 33 at 631573 39 at 641580 G1 at 633572 39A at 625576 E11 at 636576 71F at 624581 62A 623584 62D 623585	Participants are told to load trace 8. Participants will be told the defensive was successful and that they will have to conduct the hasty attack. They should move their units and expect more messaging. As they move into position and conduct the attack they should think about how they would use TBCS in a real situation. For example, when the infantry dismounts, should every section commander have a portable TBCS, every Pl commander, every coy commander etc… A participant is prompted to give a sit rep for destroyed enemy e.g. you can see 5xt72 destroyed by fire on road to the north.[1] A participant is prompted to give indication of railway bridge at 622595 destroyed.	Participant loads new trace to see new positions of all. Participants re-conduct the attack on Foresters Falls. Participants send update message of the enemy situation to all. The message sent with the bridge destroyed information should cause some assessment of engineering resources by the OC. e.g. 29 this is E11A (eng Recce) Brooms Creek is unfordable, good bridge site at Gr 596582 in the low ground.

[1] Details of the cue i.e. time, grid reference and individual participant depend on the circumstances of the free play scenario.

Scenario Segment	Unit Grid Positions	General Instruction to Participants	Expected Participant Actions
13. Consolidation (trace #8)	As above.	Participants are told they are going to a consolidation phase. They should follow SOP and move into the positions they think they would adopt and conduct the normal routines. They should pay special attention to logistics features and where they think the potential benefits of TBCS are for this activity.	Participants use messaging and resource features to create post battle and daily logistic reports.

Annex B – Operation order

OP Order for Chameleon TBCS Utility Trial

24 Nov 97

CFM NOTES TO 00S GIVEN BY CO RCR AT 24 0900R NOV 97
Refs: A. CANADA Sheet 31 F/10 (COBDEN) Edn 4, 1:50,000

Time Zone: Romeo (local)

SITUATION

En Forces. As per Int Brief.
Friendly Forces.

Div Comd's Intent.
1) Purpose. To support the Corps Comd's plan of destroying the cbt capability of the KRASNOVIAN forces in BH; thereby removing the KRASNOVIAN military threat and creating conditions for a lasting peace.

2) Method. 1 Can Div is currently deployed with 1 CMBG fwd, the remainder of the Div indepth with 2 CMBG RIGHT and 5 CMBG LEFT. 1(CA) Div will adv to the KRASNOVIAN Border in three Ph:

Ph 1. 2CMBG will adv to the Petawawa River while 5 GMBC will secure the Div LEFT flank by occupying the CONSTANT-CLEAR-GOLDEN and DORE LAKES region.
Ph 2. 1CMBG will conduct an aslt river crossing of the PEAWAWA River to destroy the remnants of 31 and 37 MRR.
Ph 3. 5 GBMC will pass through 2 CMBG and 1 CMBG and exploit to the KRASNOVIAN border.

3) End State. To have destroyed all elements of the KRASNOVIAN military in 1 (CA) Div sector up to the KRANOVIAN Border.

Comd 2 CMBG's Intent.
1) Purpose. To secure the SOUTH bank (or both banks) of the PETAWAWA river in preparation to sup crossing by 1 CMBG.

2) Method. Through rapid, aggressive action of fr forces 190 MRR and 491 Indep TB will be destr and the SOUTH bank of the PETAWAWA River will be secured. Deep and close battles will be fought concurrently through the aggressive use of ARTY, CAS and AH fires; thus keeping the en off-balance throughout. 2 CMBG will advance to the PETAWAWA River in three phs with the KRH BG in res throughout:

Ph 1. 2CMBG will adv with two BG up with RCD LEFT and 3 RCR RIGHT. RCD will secure Obj SNAKE and 3 RCR will secure Obj BIRD.
Ph 2. On order advance and secure Obj CAT with 3 RCR or RCD.

Ph 3.1 RCR will pass through the RCD and 3 RCR and secure Obj DOG.

3) End State. 2 CMBG End State will see 1 RCR secure on the SOUTH bank of the PETAWAWA River prepared to sp 1 CMBG Assault Water Crossing. The three remaining BGs will remain in depth prepared to sp the fwd passage of 1 CMBG and 5 GBMC. All en within the 2 CMBG sector will have been destroyed or captured.

Six CAS sorties have been alloc to 2 CMBG daily from 0700 hrs 25.

Atts and Dets. See Gp and Task Matrix

MISSION

TO SECURE Obj CAT by 2000 hrs 25 Nov.

EXECUTION

CO's Intent.
Purpose. To seize Obj BIRD with a view to either effecting adv to secure Obj CAT, or sp adv of RCD to Obj CAT; then, deploy for sp of subsequent adv of 1 RCR to Obj DOG.

Method. 3 RCR will sp the Comd's plan as follows:

Ph 1. We will adv with two cbt tms up PARA Coy Cbt tm LEFT and B Sqn cbt tm RIGHT as the main effort with O Coy Cbt Tm in Reserve clearing CLUB Rte and securing the LD. Recce Pl well fwd and our right flank covered by TUA. We will destroy all enemy encountered. We will cut off escape rtes so that we don not face the same en twice. We must maintain momentum throughout and, therefore, be careful not to allow the enemy to force us to deploy our forces at every encounter and thus, delay our advance. The end state for Ph 1 will see PARA Coy Cbt Tm secure on Obj ROBIN; B Sqn Cbt Tm secure on Obj QUAIL; O Coy Cbt Tm will secure LD and be prepared to continue the adv on order; Recce conducting area recce of peninsula to N of BIRD.

Ph 2. On order, O Coy Cbt Tm as the main effort will continue to adv to Obj CAT. O Coy Cbt Tm will estb The Bridgehead into PEMBROKE and B Sqn Cbt Tm will pass through O Coy Cbt Tm and continue the FIBUA Battle as the BG Main Effort. PARA Coy Cbt Tm will move to the Northwest of CAT and act as Cut Off and Flank Security. O Coy Cbt Tm will then remain in res.

Ph 3. All elements prepared to support the fwd passage of 1 RCR onto Obj DOG. O Coy Cbt Tm will be the Main Effort for Reorg/Reconstitution in anticipation of being brought fwd to sp 1 RCR.
End State. B Sqn Cbt Tm secure on Obj CAT, PARA Coy Cbt Tm estb to the NORTH WEST of CAT, and O Coy Cbt Tm in res. All elements prepared to assist 1 RCR adv and atk onto Obj DOG.

Gp and Tasks. IAW Gping and Task Matrix.

Coord Instr.

Timings:

Regrouping complete	2100 hrs Nov 24
Back brief to CO	2300 hrs Nov 24
H Hr	0630 hrs Nov 25
Ph 1 complete	1300 hrs Nov 25
Ph 2 commences	on order
Ph 2 complete	1700 hrs Nov 25
Ph 3 commences	on order
Ph 3 complete	2000 hrs Nov 25

Report Line, Rtes, Bdrys, Contact Pts. As per trace.

By-pass Policy. En within sector will surrender or be destr. No by-pass by BG; however, CO 3

RCR may auth lead Cbt Tms to bypass sect and smaller en.

Fire Plan. As per initial briefs, CFSP to concentrate on LD and Obj BIRD, Cbt Tm CFSP to BG FSCC NLT 2300 hrs 25 Nov. BG CFSP TBI 2100 hrs 24 Nov.

Recce. No recce fwd of NEW SHOE before 0530 25 Nov.

Engineers. OC 24 Fd Sqn to coord.

NBC. TOPP LOW.

Pri of Tgts. Comd and Con, Tanks, APC's.

Limit of Exploitation. For Ph 1 will be BASS DRUM. For Ph 2 and 3 it will be RED SANDAL.

Air and Avn. Comd 2 CMBG will be using all air and avn in the deep battle. Req of air and avn for high pri tgts are to be submitted through BG HQ.

Open Fire Pol. Prior to H-Hr self-defence only. At H Hr all ident en not in the process of surrendering are legitimate tgts. Vehs remain legitimate tgts if wdr. Tps remain legitimate tgts if wdr with wpns. En which surrenders or wdr without wpns are not legitimate tgts and will not be engaged.

SERVICE SUPPORT

Resup. No add resup until completion of Ph 3. Ea coy to maint 24 hrs cbt sup.

COMMAND AND SIGNALS

Altn Comd. DCO then OC O Coy
Locs:
3 RCR G CP Main initially at GR xxxxxx UF
2 CMBG Main at ARNPRIOR UR
CO's TAC with main effort.

Radio Silence.
Radio Silence remains in effect.
Broken on contact by cbt tms.
Lifted by 3 RCR BG HQ only
3 RCR G CP Main initially at GR UF
2 CMBG Main at ARNPRIOR UR

Frequencies. ALL TBC+

BG Comd	Pri 3010	Alt 3420
N Coy Cbt Tm Comd	Pri 3210	Alt 3610
PARA Coy Cbt Tm Comd	Pri 3360	Alt 3745
BG Fire Support Net	Pri 4490	Alt 3535

Code Words

Ser	Code Word	Meaning	Issued By
a)	b)	c)	d)
1	OAK	LD Crossed	All
2	ELM	Obj SNAKE Secure	1 RCR
3	BIRCH	Obj BIRD Secure	3 RCR HQ
4	BEECH	Obj QUAIL Secure	B Sqn Cbt Tm
5	COCONUT	Obj ROBIN Secure	PARA Coy Cbt Tm
7	HEMLOCK	Commence Ph 2	3 RCR HQ
8	MAPLE	Obj CAT Secure	3 RCR
9	PINE	Obj Commence Ph 3	3RCR HQ
10	ALDER	Obj DOG Secure	1 RCR

ACK INSTRS: Ack

Author:

LCol
Commanding Officer

Authentication

Capt
Ops O

Annexes

Annex A – Gping and Task Matrix
Annex B – Trace
Annex C – Int Brief

DISTR

PARA Coy
N Coy
O Coy
Q Coy
R Coy
HQ 2 CMBG
Recce Sqn
2 RCHA
RCD
1 RCR
2 CER
CO
OA
OB
FSCC
Spare

ANX A – GP AND TASK MATRIX – CFM NOTES OPS 01

PARA Coy	B Sqn	O Coy	Recce	Atts and Dets
Under Comd A Sqn RCD	Under Comd 3 Dets TUA N Coy 3 RCR	Under Comd Det TUA C Sqn RCD		Under Comd A Sqn RCD B Sqn RCD C Sqn RCD
In Sp Pnr Pl	In Sp Tp armd engr	In Sp Tp engr	In Sp Engr Recce Det	In Sp Armd Engr Tp Tp fd engr
Alloc G2	Alloc G1			Alloc BC/FOOs F Bty 2 RCHA

Tasks	Tasks	Tasks	Tasks	
Ph. 1 LEFT fwd Cbt Tm Destroy en between NEW SHOE and BASS DRUM Be prep to man Contact Pt CX Secure Obj ROBIN	Ph. 1 RIGHT fwd Cbt Tm Destroy en between NEW SHOE and BASS DRUM Secure Obj QUAIL	Ph. 1 Secure LD Clear CLUB rte BG Reserve	Ph. 1 Provide Recce well fwd on both axis Est Obj BIRD	Arty Tasks F Bty, 2 RCHA DS 3 RCR Tp 89 Bty DS 3 RCR Engr Tasks Mobility tasks on sp of fwd Cbt Tms Rte clearance of CLUB rte Clearance of booby traps within built up areas Recce Tasks Close fwd recce in sp of cbt tms TUA Tasks Long rge dir fire sp Cbt
Ph. 2 Be prepared to sp C Sqn Cbt Tm or RCD adv to CAT	Ph. 2 Be prepared to sp C Sqn Cbt Tm or RCD adv to CAT	Ph. 2 Be prepared to adv to CAT or sp RCD adv to CAT	Ph. 2 Be prepared to sp C Sqn Cbt Tm or RCD adv to CAT	
Ph. 3 Be prepared to sp fwd passage of 1 RCR	Ph. 3 Be prepared to sp fwd passage of 1 RCR	Ph. 3 Be prepared to sp fwd passage of 1 RCR	Ph. 3 Be prepared to sp fwd passage of 1 RCR	

ANX C – Intelligence Annex to 3RCR Ops 001

Summary of En Situation

The Krasnovian 1 CAA advance on three axis, towards parry Sound, Huntsville and Pembroke, forcing the Multi-National Bde to Wdl back to the Carlatian Border. The 1 CAA's immediate obj was to seize the Ottawa valley as far south as Arnprior, but the Zepher dominated Barrian Federation Army has been holding the Krasnovians in the Muskrat lake area since 2 Nov. We believe that their final Obj was to retake all of the BH, incorporating it into the greater Krasnovia.

The Krasnovians launched an attack on BH on 16 Oct. 1CAA of the KRA advanced on three axes. In the west, 79 MRD advanced south along Hwy 69 to Parry Sound. 94 MRD moved along Hwy 11 to Huntsville. These two Divs are holding in loc despite the lack of BH resistance.

In the east 80 MRD advanced southeast along the Ottawa valley using Hwy 17 as the main axis. 37 Tk Div is in the North Bay area and appears to be oriented t advance along Hwy 17. The assessed immediate obj is the Town of Arnprior.

The 80 MRD is deployed with two MRRs up (31st and 27st east) with the remnants of the 190 MRR and the 91 TR on a fwd screen and covering force posns as far south as Mclarens Settlement Gr UR 678519. 31st and 37th MRRs have been preparing def posns for the past 36 hrs, their strength is est to be approx 50%.

Air Superiority: The 80 MRD is capable of local A/S for up to 30 mins
NBC: The En has NBC capable and may use persistent agents to deny mobility.

Annex C – Utility Trial Questionnaire

TBCS / Chameleon — User Review

Background

The purpose of this questionnaire is to allow us to get a better understanding of how a Tactical Battlefield Command System (TBCS) will assist you to effectively conduct a range of military operational tasks . The feedback obtained from this trial will allow system designers and developers to get a better appreciation of users' needs and will contribute to the development of a product that meets user requirements and is operationally effective.

For each major TBCS feature, you are asked to provide ratings on two aspects of the system:

- **utility** - means its ***usefulness*** in assisting you to complete operational tasks, and
- **usability** - means the ***ease of use*** of the software in carrying out the steps.

INSTRUCTIONS

1. Complete the personnel information on the overleaf in boxes 1.1 – 1.4.
2. For each scenario: Circle the scenario number;
3. In box 2, enter your name and rank (only your initial are required for subsequent scenarios).
4. In box 3, check the position you played (users with two positions please complete two separate sheets where applicable).
5. In box 4, rate each feature you used in the scenario. Use the rating scale below, where applicable.

Strongly Disagree ***No Opinion*** ***Strongly Agree***

Λ Λ Λ Λ Λ

Mark boxes like this Λ/ You do not need to fill the box completely.

Complete the entire row only for the features you used. Leave all other rows blank.
If you want to change your answer but cannot erase the first mark, fill in both boxes and circle the correct one.
The five questions always asked are:

Question 1 (***Allow you to operate effectively?***): How well would this system feature let you operate effectively at this segment of the mission?
Not at All ***Helps Somewhat*** ***Major Benefit***

Question 2 (***Desirable feature in the final system?***): How desirable is it to include this feature in the final system?
Not at All Desirable ***Somewhat Desirable*** ***Highly Desirable***

Question 3 (***Improvement over the current capability?***): Is this feature likely to be an improvement over the way in which you work right now in this situation.
Much Worse Than Now ***Neither Worse nor Better*** ***Much Better Than Now***

Question 4 (***Easy to use here?***): *How easy was this feature to use for the current task*
Very Difficult ***Acceptable*** ***Very Easy***

Question 5 (***Easy to use in the vehicle / field?***): *How easy would it be to use this feature in the field (e.g. in a vehicle, under movement, at night….)*
Very Difficult ***Acceptable*** ***Very Easy***

Additional Comments:

1. If you find a feature in TBCS which you think could be useful but not in its current form – rate the feature as you see fit but let us know how it could be made useful by writing on the back of the questionnaire sheet. Please include any additional comments or ideas on the sheet provided.
2. If you find something in TBCS you really like or dislike - write it down on a post it note.

1. Personal Information

All the data you provide will be kept in confidence but we need background information to determine how different users have different requirements for system features.

1.1 Name & Rank: _____ **1.2 Years in Canadian Forces** _____

1.3 History:

History in Combat Team and Other Appointments		
Unit	Position in Cbt Tm	Time in position (yr,mo)
e.g. 12 Pl D Coy 1RCR	Pl Comd	1 yr 9 mo

1.4 Computer Experience (typical usage):

Desk top PC's	❑Never	❑Occasional	❑Frequent
Lap top PC's	❑Never	❑Occasional	❑Frequent
Windows 3.1	❑Never	❑Occasional	❑Frequent
Windows 95	❑Never	❑Occasional	❑Frequent
Mac/Apple products	❑Never	❑Occasional	❑Frequent
Keyboarding	❑Never	❑Occasional	❑Frequent

TBCS / Chameleon — User Review

2. Name and Rank

Last name _____ Initials _____ Rank _____

3. Position for this Scenario

T29 * I39 * T29A * I39A * G11 *

T21 * I31 *

62 A * 62 D * 71F *

4. TBCS Features

	Utility			Usability	
	Allow you to operate effectively ?	***Desirable feature** final system ?*	*Improvement over the current capability ?*	*Ease to use Here?*	*Ease to use in the vehicle / field ?*
	Not at All / Helps Somewhat / Major Benefit	*Not at All / Somewhat Desirable / Highly Desirable*	*Much worse / Neither worse/better / Much Better*	*Very Difficult / Acceptable / Very Easy*	*Very Difficult / Acceptable / Very Easy*
1. Overlays – control measure	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
2. Overlays – coord plans	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
3. Overlays – orders	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
4. Messaging – general	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
5. Messaging – Contact report	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
6. Messaging - Wng O	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
7. Messaging – send overlay	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
8. Symbols – fr units (Orbat)	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
9. Symbols – en unit editor	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
10. Map– format (scale, detail, etc.)	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
11. Map- navigation (pan, zoom	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
12. Map- drawing (plans, etc.)	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
13. Unit Information – (i.e. right	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
14. TO&E – Orbat	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
15. TO&E – resources	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
16. TO&E – Info query builder	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
17. Operation – CEOI	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
18. Message state (red, green,	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
19. Cursor posn indication	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
20. Date time indication (options)	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
21. Active unit posn	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
22. Cursor state (single, multi, etc.)	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
23. Map recentre mode (fixed etc.)	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
24. Vetronics	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
25. System – options	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
26.	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
27.	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
28.	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
29.	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^
30.	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^	^ ^ ^ ^ ^

Annex D - Discussion of validity issues concerning the trial

One check that can be performed to assess the validity of the questions that were asked, is to look at how they are inter-correlated. For example, when trial participants rate the utility of a system feature in terms of its desirability for the final system, one would not expect such a rating to correlate with either measure of usability, if the participants are treating these as separate dimensions to be evaluated. On the other hand, one would expect a utility judgement on whether a feature is an improvement over the current system to be somewhat influenced by its usability.

The table below shows the Pearson correlation matrix between each of the measures, derived from the average rating across all participants for all system features. Please note a perfect positive correlation is 1.0 while a perfect negative correlation is -1.0. No correlation is 0.

Table D1: Correlation of measures.

	Operate Effectively	Desirable Feature	Improvement over now	Easy to use in trial	Easy to use in the field
Operate Effectively		.82	.59	.73	.73
Desirable Feature			.29	.40	.43
Improvement over now				.78	.74
Easy to use in trial					.91

These data provide some support for the underlying validity of the measures. Feature desirability is not correlated with the utility measures, nor whether the particular feature is seen as an improvement. This suggests that the trial participants rate this aspect of utility relatively independently of other issues. The two usability measures are highly correlated as one might expect, and less well correlated with other measures. Also expected is the positive relationship between whether the perception of the feature as an improvement over current capabilities and the feature's usability. Again, because of the small size of the data set, these findings should not be over-interpreted, however, they do give encouragement to believing that what was intended to be measured was actually measured.

A second aspect of validity is external validity, which encompasses the issue of generalisability, that is the extent to which the results of an evaluation may be extended to other groups and settings. In the case of the TBCS evaluation performed in an "office-like" environment, the question would be the extent to which the results can be generalised to operational C2 settings and different personnel. A principle factor that will influence this in the present case is the *fidelity* of the test environment that is, the extent to which it captures the environment influences and critical tasks for which TBCS will be applied in the field. We have attempted to address the issue of external validity in two ways: first, all of the system features are evaluated in a scenario-based context that has high external validity. Second, we have specifically required trial participants to distinguish between their impression of the

system in the context of the trial environment, and the actual field conditions for its intended use. However, it is unlikely that this latter approach can ensure adequate validity for extrapolating the present trial data to actual field use that involves working in moving vehicles under full exercise or operational conditions. It is must also be recognised that given the small sample size, and limited experience of some of the trial participants in the role they were assigned, the data have low validity with respect to the different operational requirements of the different combat team positions

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(U) This study evaluated the utility and ease of use of features of the Tactical Battlefield Command Systems (TBCS)/Chameleon using participants representing command elements of a combat team. Seven participants role−played an advance to contact scenario developed by Joint Command Staff Training Centre (JCSTC) in 13 segments. Following each segment, participants provided user feedback on 25 key features and tools of the software.

The overall results indicated that the features and tools in TBCS/Chameleon are seen to be generally useful by the combat team across a range of activities. Many specific features currently in the software, as well as future features, were seen to have particularly high utility and have the potential to improve situation awareness, reduce workload, improve communication effectiveness and support decision−making.

However, there are a number of areas in which the utility of features can be improved. Specific recommendations are made to support these improvements across a range of features including: map use, communication tools, production of orders and access to information.

These recommendations concentrate on utility issues with a secondary focus on increasing the ease of use of some features.

The user review process should continue at each major build of the TBCS/Chameleon. As the development moves from a concept based development to a fieldable system the user reviews should move from utility based to usability based. Tabletop user reviews of concepts will also assist with design decisions between major builds.

(U) Cette étude a évalué l'utilité et la convivialité des fonctions du Système tactique de commandement sur le champ de bataille (STCCB)/Chameleon en faisant appel à des participants représentant les éléments de commandement d'une équipe de combat. Sept participants ont simulé un scénario de marche à l'ennemi mise au point par le Centre de formation de commandement et d'état major interarmées (CFCEMI) en 13 segments. Après chaque segment, les participants ont fourni une rétroaction sur 25 caractéristiques et outils principaux du logiciel.

Les résultats globaux ont indiqué que les caractéristiques et outils du STCCB/Chameleon sont considérés comme généralement utiles par l'équipe de combat, et ce, dans différents champs d'activité. De nombreuses caractéristiques actuelles du logiciel, de même que des caractéristiques envisagées, sont perçues comme étant particulièrement utiles et comme ayant le potentiel d'améliorer la connaissance de la situation, de réduire la charge de travail, d'accroître l'efficacité des communications et de soutenir la prise de décisions. Cependant, il y a un certain nombre des caractéristiques qui pourraient être améliorées. Des recommandations spécifiques sont formulées en vue d'opérer ces améliorations à diverses caractéristiques : utilisation de cartes, outils de communication, production d'ordres et accès à l'information.

Ces recommandations sont axées sur des questions utilitaires et ont pour deuxième centre d'intérêt la convivialité accrue de certaines fonctions.

Le processus d'examen par les utilisateurs devrait se poursuivre avec chacune des nouvelles versions importantes du STCCB/Chameleon. À mesure que le système passe de l'étape conceptuelle à l'étape de l'utilisation sur le terrain, les examens par les utilisateurs devraient être de moins en moins axés sur l'utilité du système et de plus en plus sur sa convivialité. L'examen de concepts par les utilisateurs au moyen de simulations facilitera également la prise de décisions conceptuelles entre les principales

versions.

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(U) Tactical Battlefield Command Systems; TBCS; CHAMELEON; combat team; role playing; mission planning; situaton awareness; decision making; digital maps