Integrated J5 Planning Team Subject Matter Expert Workshop Series #1

Informing the Development of the IMAGE V3 methodology

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In conducting the research described in this report, the investigators adhered to the policies and procedures set out in the Tri-Council Policy Statement: Ethical conduct for research involving humans, National Council on Ethics in Human Research, Ottawa, 1998 as issued jointly by the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council of Canada and the Social Sciences and Humanities Research Council of Canada.

Abstract

DRDC has undertaken project 12om to support collaboration and the development of a common understanding of a situation within a multidisciplinary civil-military planning team. This project will develop the IMAGE V3 methodology that will consist of a suite of tools and processes to achieve this goal. The research team planned a series of Subject Matter Expert (SME) workshops in order to inform the development of the methodology. The present report describes the results of the first series of these workshops held in December, 2012. The first series of workshops allowed the research team to align the project direction with the support needs of the whole-of-government planning team. The feedback from the SMEs also allowed identifying a short list of methodology elements that have the greatest potential to impact on the team's performance while maintaining high likelihood of operational adoption. Using the feedback from the first series of SME workshops, the project will focus on the development of the selected methodology elements and will examine their utility in greater detail in the next series of SME workshops.

Résumé

RDDC a entrepris le projet 12om afin de soutenir la collaboration et le développement d'une compréhension commune d'une situation au sein d'une équipe de planification multidisciplinaire et civilo-militaire. Ce projet permettra d'élaborer la méthodologie IMAGE V3 comprenant un ensemble d'outils et de processus pour atteindre ce but. L'équipe de recherche a planifié une série d'ateliers regroupant des experts en la matière (EM) afin de guider l'évolution de la méthodologie. Le présent rapport décrit les résultats de la première série d'ateliers tenue en décembre 2012. Ces ateliers visaient à orienter le projet en fonction des besoins exprimés par les EM. En particulier, la rétroaction des participants a permis de déterminer une courte liste d'éléments de méthodologie pouvant avoir le plus d'impact sur le rendement de l'équipe et une bonne probabilité d'être adoptée. En se basant sur les résultats de cette première série d'ateliers, les responsables du projet se pencheront principalement sur l'élaboration des éléments de méthodologie et examineront leur utilité plus en détail au cours de la prochaine série d'ateliers avec les EM.

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Executive summary

Integrated J5 Planning Team Subject Matter Expert Workshop Series #1: Informing the Development of the IMAGE V3 methodology

Natalia Derbentseva; Michel Lizotte; Claire Lalancette; Mustapha Zaraket; Francois Bernier; DRDC Toronto TM 2013-113; Defence R&D Canada – Toronto; November 2013.

Introduction and background: Contemporary military operations are unlikely to succeed through the use of military power alone. The nature of modern conflicts calls for a comprehensive approach to the stabilization efforts, which means employing and aligning diplomatic, defence and development resources from several agencies, and coordinating these efforts through an integrated campaign plan. The development of an integrated campaign plan requires collaboration among several organizations in order to ensure coordination of their efforts and objectives.

The 12om project, entitled "Collaborative Understanding of Complex Situations", aims at developing the IMAGE V3 methodology consisting of a suite of tools and processes to support collaboration and the development of a common understanding of a situation within a multidisciplinary civil-military planning team. In order to inform the development of the IMAGE V3 methodology and to ensure that the project's objectives are aligned with the operational requirements, the research team planned a series of Subject Matter Expert (SME) workshops. The present report describes the results of the first series of these workshops held in December, 2012.

Results: SME workshop series #1 allowed the 12om research team to achieve three main goals: i) validate the identified sensemaking challenges in a multidisciplinary team environment; ii) identify current gaps to support such an environment; and iii) evaluate preliminary methodology components to derive a short list of tools and processes for further development.

Based on the results of SME workshop series #1, six methodology elements were selected for further development and integration into the IMAGE V3 methodology: 1) Whole-of-government mission analysis briefing template; 2) Team building and handover procedure; 3) Decisive point analysis; 4) Interactive common glossary; 5) Collaborative knowledge representation; and 6) What-if simulation. The discussions with the SMEs provided useful feedback with respect to the specific requirements to improving utility and implementation likelihood of the components.

Significance: The research team was able to identify methodology development priorities and to ensure that the tools developed are in line with the operational requirements. On-going interaction with clients and potential users of the IMAGE V3 methodology will ensure its utility and likelihood of adoption in the operational environment.

Future plans: The next stage of the project should focus on further development of the selected solution components. The second stage of the SME workshops will be held when these components will be sufficiently developed to be piloted. The purpose of the second stage of the

SME workshops will be on providing the SMEs with the hands-on experience with the methodology and collecting more focused feedback on its usability and desirable improvements.

Sommaire

Integrated J5 Planning Team Subject Matter Expert Workshop Series #1: Informing the Development of the IMAGE V3 methodology

Natalia Derbentseva; Michel Lizotte; Claire Lalancette; Mustapha Zaraket; Francois Bernier ; DRDC Toronto TM 2013-113 ; R & D pour la défense Canada – Toronto; novembre 2013.

Introduction et contexte : Les opérations militaires contemporaines ont peu de chance de réussir si on ne se limite qu'à la force militaire. La nature des conflits modernes demande une approche globale des efforts de stabilisation. Il faut employer et harmoniser les ressources venant d'organisations diplomatique, militaire et de développement de même que coordonner ces opérations de stabilisation par l'entremise d'un plan de campagne intégré. La collaboration entre différentes organisations civiles et militaires est au centre de l'élaboration d'un plan de campagne intégré afin d'assurer la coordination des efforts et des objectifs.

Le projet 12om intitulé « Compréhension collaborative de situations complexes » vise à élaborer la méthodologie IMAGE V3 qui consiste en une suite d'outils et de processus pour soutenir la collaboration et le développement d'une compréhension commune par une équipe de planification multidisciplinaire civilo-militaire. Afin d'orienter l'évolution de la méthodologie IMAGE V3 et de veiller à ce que les objectifs du projet s'harmonisent aux exigences opérationnelles, l'équipe de recherche a planifié une série d'ateliers regroupant des experts en la matière (EM). Le présent rapport décrit les résultats de la première série d'ateliers tenue en décembre 2012.

Résultats : La première série d'ateliers avec les EM a permis d'atteindre trois objectifs principaux : 1) valider les enjeux de compréhension dans un environnement multi-disciplinaire; 2) définir les problèmes actuels dans le soutien d'une telle compréhension, et 3) évaluer les éléments de méthodologie proposés par l'équipe de recherche afin de dresser une courte liste d'outils et de processus à développer.

Suite à la première série d'ateliers avec les EM, six éléments de méthodologie ont été identifiés et seront élaborés d'ici la fin du projet: 1) un modèle de livrable civilo-militaire; 2) une procédure de démarrage et de développement d'équipe; 3) un processus de cadrage de solutions; 4) une bibliothèque de vocabulaire; 5) un outil de représentation pour partager les connaissances d'une situation; 6) un outil de modélisation situationnelle partageable. Les discussions avec les EM ont permis d'identifier les exigences spécifiques pour améliorer l'utilité et la possibilité de mise en œuvre des livrables.

Importance : L'équipe de recherche a été en mesure de déterminer des priorités pour l'élaboration de la méthodologie et de veiller à ce que les outils élaborés répondent aux exigences opérationnelles. L'interaction constante avec les clients et les utilisateurs potentiels de la méthodologie IMAGE V3 assurera son utilité et augmentera les chances d'adoption dans un contexte opérationnel.

Plans à venir : La prochaine étape du projet visera à développer les éléments identifiés lors de la première série d'ateliers. La deuxième série d'ateliers avec les EM aura lieu lorsque ces éléments seront suffisamment développés pour organiser des tests pilotes. L'objectif de la deuxième série d'ateliers sera de fournir une expérience pratique de ces outils aux EM et de recueillir des commentaires sur la convivialité et les modifications souhaitables pour les améliorer.

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Acknowledgements

We, the research team, would like to express our sincere gratitude to the civilian and military subject matter experts who volunteered to participate in the workshop sessions. We greatly appreciate experts' genuine enthusiasm about our work and their eagerness to help us in our efforts to support the comprehensive approach. The numerous candid discussions we had about the various issues they faced in the operational environment were very insightful and informative.

We also would like to thank Daniel Lafond, Jean Francois Gagnon and Sebastien Tremblay for their assistance with organizing the workshops, collecting and analysing data.

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1 Introduction

1.1 Context

The nature of modern conflicts in volatile regions calls for a multifaceted approach to the stabilization efforts. Sustainable stability depends not only on a secure environment, but also on functional and comprehensive governance and a solid foundation for continuous social and economic development. Achieving these goals requires a coordinated effort from a number of players, including various government departments, which all bring their unique perspective to the issue. The Canadian Armed Forces (CAF) does not act in isolation, but in collaboration and in support of other government departments like the Department of Foreign Affairs, Trade and Development (DFAIT) and the Canadian International Development Agency (CIDA). Coordination of effort begins with the development of a whole-of-government (WoG) strategy and subsequent development of plans for operations.

In order to support a WoG approach to Canadian stabilization efforts and to facilitate departmental integration, an integrated planning team is formed to carry out mission planning for operations (Turnbull & Ulrich, in press). In deployment context, an integrated planning team is CAF-driven, and its activities closely follow CAF Operational Planning Process (OPP, *The Canadian Forces Operational Planning Process*, 2008). CAF OPP is a well-developed and rigorous process, which is firmly embedded within the CAF culture. CAF OPP is an essential part of planning for operations at strategic and operational levels, and it is executed by a CAF planning team, which becomes a joint planning team (J5 team) in joint operations. In situations that require a multi-pronged approach, a J5 team also integrates advisors from other government departments and non-government organizations, who contribute to the plan development, ensuring a coordinated effort of Canadian resources.

An integrated J5 team is a multidisciplinary team representing different departments and their objectives. Although all of the players aim to achieve the same high-level goal, often they employ different means to achieving it and use different indicators of success; therefore the more immediate individual objectives may differ. The development of a comprehensive understanding of the situation that encompasses different perspectives is not only important but necessary in such an environment. Such comprehensive understanding will ensure that the developed plan for operations integrates different lines of operations and takes into account potential implications. The Government of Canada's recent experience in Afghanistan revealed that there is room for improvement in the integration and alignment of different departmental priorities and the development and execution of a coordinated effort (Turnbull & Ulrich, in press).

1.2 Aims of the project

The 12om project, under the Applied Research Program (ARP) of Defence R&D Canada (DRDC), aims at developing a methodology to support the development of a common understanding of a complex situation in a multidisciplinary team environment. More specifically, the IMAGE V3 methodology has been developed to support an integrated planning team, such as

a J5 team, consisting of military and civilian personnel from different government departments working towards a common mission. In its activities, a J5 team normally follows the CAF OPP. The J5 team analyses the current situation and develops the operation's mission statement during the second stage of the OPP – Mission Analysis. At this stage, input from various stakeholders is important for generating the most accurate situational understanding. IMAGE V3 aims to design a suite of tools and processes that will support the team during the Mission Analysis stage of the OPP and will facilitate team collaboration, sensemaking and the integration of different perspectives.

1.3 IMAGE V3 methodology

The IMAGE V3 methodology builds upon IMAGE V2 suite (Lizotte, Bernier, Mokhtari, & Boivin, 2012) that was developed to support individual sensemaking of a complex situation.

IMAGE V2 is an integrated suite of tools that facilitates incremental and iterative understanding of a complex situation through a systematic analysis. IMAGE V2 consists of four modules:

- **Representation** module enables the user to create a graphical representation of his or her understanding of the situation with conceptual graphs (CG, Sowa, 2008). CGs use two types of elements – concepts and relationships – and impose certain semantic and syntactic constraints. The design of a representation helps the user to externalise and decompose his or her view of the problem.
- **Scenarization** module enables the user to articulate his or her representation further and it leads to the construction of a simulation model. At this stage, the user identifies relevant simulation elements in the representation, that is, agents, properties, attributes, actions and reactions, etc.
- **Simulation** module is a visual and interactive system that enables the user to compile and execute the simulation code conceptualised in the previous step (i.e., scenarization). Simulation allows the user to ask what-if questions by running simulation with different parameters and to compare results of different simulations.
- **Exploration** module helps the user to navigate the data generated during the simulation runs. It enables visualising the data from different perspectives and in two or three dimensions and allows manual manipulation of the data in virtual environment with the use of virtual reality data gloves and goggles.

In light of the data exploration, the user can go back to his or her original representation and make necessary adjustments to refine it, edit the scenarization model and adjust and re-run a new simulation. This iterative process encourages the user to actively re-evaluate his or her understanding, which helps to deepen the user's appreciation of the complexity and fundamental properties of the situation.

The IMAGE V3 methodology extends IMAGE V2 suite to the team environment and focuses on the collaborative aspect of the sensemaking process. The tools and processes that will be developed in the context of IMAGE V3 will address such issues as:

- Team building;

- Individual and common knowledge representation and sharing;
- Systematic and collaborative analysis of a situation;
- Disambiguation of multi-disciplinary communication;
- Compatibility of disciplinary outputs and products.

The research team planned a number of activities to inform the development of the IMAGE V3 methodology, which are summarised in Figure 1. These activities include interviews and consultations with civilian and military Subject Matter Experts (SMEs, HREC Protocol L-818, 2011), design and careful examination of a baseline case study that simulated activities of an integrated multi-disciplinary planning team (Thales-Canada, 2012), and a series of workshops with SMEs designed to:

- Validate the identified sensemaking challenges in a multidisciplinary team environment;
- Identify priorities for developing tool and process support;
- Evaluate methodology components at various stages of their development.

The purpose of this report is to document the methodology, results and recommendations that arose from the first series of SME workshops.

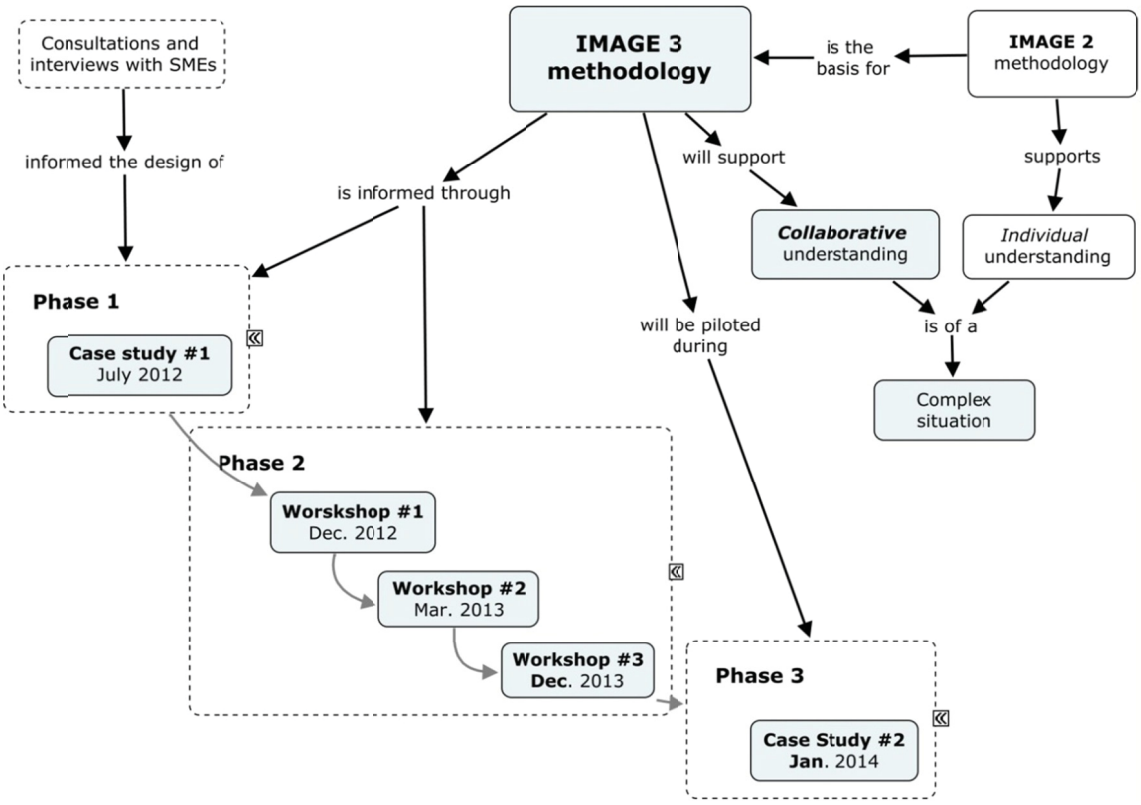

Figure 1: The development of the IMAGE V3 methodology

2 Methodology and aim

Two SME workshops were conducted in December, 2012, with four and five participants in each session respectively. One session was conducted with civilian participants only and the other session had only military participants. The relatively small number of participants in each session allowed for sufficient opportunity for everyone to participate and contribute to the discussion.

Three of the five civilian participants had worked on joint civilian-military planning missions for between one and four years in different roles. The remaining two civilian participants did not have any joint civilian-military planning experience.

All four military participants had between three and five joint civilian-military planning roles, each working alongside civilians between 2.5 to over 12 years.

Each workshop session was one day long. Both workshops followed the same structure with two main parts:

- Presentation and discussion of the results from previous studies (the first case study, SME interviews and consultations) including the evaluation of themes of issues identified;
- Presentation, discussion and evaluation of a tentative set of solutions designed to mitigate the issues identified.

The aim of the first series of workshops was three-fold:

1. To validate the findings gathered from the SME consultations, interviews and the baseline case study;

2. To identify current support gaps;

3. To solicit feedback on and prioritize the tentative set of proposed solutions.

The workshop methodology was reviewed and approved by the DRDC Human Research Ethics Committee (DRDC HREC Protocol 2012-051, 2012).

In the first part of each workshop, the research team presented to the participants a summary of the results from the baseline case study described in Thales Canada report (2012) and engaged the participants in a discussion of these findings. The first part of the workshop concluded with the participants evaluating the themes of issues that can inhibit an integrated team's performance during the mission analysis stage of the OPP that were identified during the case study and previous interviews and consultations.

The second part of each workshop consisted of two activities: a task-to-tool mapping exercise and a discussion and evaluation of the 11 tentative solution components designed to mitigate some of the issues identified in the baseline case study. The results of these evaluations along with a summary of the discussions are reported in the following sections.

3 Validation of findings from the baseline study

The SMEs generally concurred with the presented results from the baseline case study and the research team's observations, which provided a certain degree of indirect validation of these results. The only result that the SMEs judged to be idiosyncratic was the level of workload that the study participants experienced. The SMEs argued that in real deployments pressure and frustration could be significantly higher due to the potential consequences of errors, while the case study data showed that these levels were not very high. The research team was aware of this limitation, as it was difficult to recreate the pressures of a combat mission in an artificial experimental set-up.

The results of the baseline case study are reported in detail elsewhere (Thales-Canada, 2012). The review of the results and observations during the workshops initiated lively discussions, the key ideas of which are summarised below.

Personalities: Personalities of team members and their compatibility play a big role in the overall team dynamics.

Team size: Mitigating personality issues is easier in smaller groups, and it becomes more difficult in larger groups.

Co-location: Co-location greatly facilitates team dynamics and overall helpfulness of team members, and, similarly, when the teams are distributed, unhelpful behaviours could become exacerbated.

Organizational objectives: Different organizational objectives and the lack of understanding of these objectives by other team members inhibit team dynamics. Understanding where the other is coming from is very helpful.

Hierarchical level of WoG: Collaboration works better at lower levels (e.g., district), but the conflict becomes more apparent at higher levels (e.g., Kandahar Airfield — home to Canada's Afghan mission)

Civilian roles: Civilians could participate in WoG planning teams as (external) advisors, or they could be embedded in the team. The embeddedness usually creates more conflict for civilians because they have to report to two superiors – their civilian superior and the military planning leader, i.e., the J5. The two superiors might have different priorities resulting in conflicting demands for the civilian advisor.

Dimensionality of the problem space: Inclusion of each additional non-military planning team member adds another dimension of complexity to the team and the problem space, because a new civilian member brings in a new set of issues and considerations that need to be taken into account.

Generational issue: It is easier to work complementarily with younger CIDA / DFAIT agents compared to senior agents.

Clear objectives and tasks: When individual team members know clearly their respective tasks and understand expectations, it facilitates team dynamics.

The role of informal interactions: Informal interactions and extra-curricular activities are great facilitators of team dynamics. They help civilians to integrate and they make them feel less isolated. Informal interactions also provide a glimpse of the culture people come from and offer an opportunity to get to know each other on a personal basis. Being on a first name basis helps to ask all sorts of "little" questions, e.g., meaning of acronyms.

Leadership: Integrated planning teams are led by military commanders, and there is a different social process by which a leader emerges in a civilian versus a military group. The leader in the military group often (if not always) is based on rank, whereas in the civilian group, it is more based on individual personality traits.

The success of WoG integration largely depends on the team leader's attitude towards the comprehensive approach. Some commanders only pay lip service to the comprehensive approach and involve civilians minimally. Commander's leadership and endorsement of the civilian team members have a significant impact on the success of their integration in the team. For example, the manner in which the Commander introduces civilian team members to the rest of the team has a large impact on "legitimizing" civilians and their contribution.

Personnel change: Personnel change mid-way through the mission is a key disruption in the team's operation, and it was nicely replicated in the case study with somewhat similar consequences.

4 Evaluation of the proposed focus areas

The analysis of the baseline case study, interviews and consultations with SMEs allowed the research team to identify a number of various issues that can inhibit WoG team's performance during the mission analysis. Over 50 issues were identified, which were collapsed into eight general categories. Table 1 lists the resulting categories of issues (or focus areas) with examples of representative behaviours that were included in each of them.

Addressing all of the issues identified is not feasible in the context of a single project. Therefore, it is important to identify those areas that have the most impact on the team's performance and that are also the most prevalent. This will help to focus the development of IMAGE V3. The SMEs evaluated prevalence and impact of each of the themes of issues on a 5-point scale ranging from 1 being "not frequent" to 5 being "very often" for prevalence; and from 1 being "not at all" to 5 being "very significant" for impact. The evaluation form that the participants filled out is included in Annex A.

Table 1: Themes of issues occurring within an integrated planning team during the Mission Analysis stage of the OPP

Theme / Focus area	**Examples of behaviours**
Collaboration process	• Team members being passive (do not show initiative), do not provide input • Being dismissive, not listening to or acknowledging others • Stressed importance of informal interactions (smoking breaks) • Misperception of the level of frustration
Development of shared understanding	• Disagreement on the key mission factors • Difference in understanding mission factors' potential impact • Providing unclear explanations • Teammate lacking understanding
Integration of different perspectives	• Lack of understanding of the opposite culture (i.e., civilians don't understand military and vice versa) • Too much detailed vocabulary, use of acronyms • Being focused only on his or her area • Different priorities and goals of different organizations

Determining task focus and objectives	• Lack of communication at the start leading to:
	  ○ Uncertainty about the final product
	  ○ How to contribute and when
	  ○ Confusion about how team could accomplish the task
	• Knowing the commander and his requirements

Problem and situation analysis	• Missing critical information • Poor analysis of his or her area • Insufficient understanding of interrelations between factors • Location of information is not known

	• Forgetting or skipping steps under time pressure
Task constraints	• Interoperability of different systems • Organization of information – useful bits were hidden in a flood of documents • Misinterpretations of the operational planning process • Change of CIDA representative mid-way through the experiment
Individual skills and experience	• Teammates knowledge and experience (most frequently mentioned factor) • Unable to summarize, organize and use information provided • Poor analytic skills • Inability to deal with ambiguity
Final product format	• The mission analysis template is not adapted for collaborative work • The OPP template is not adequate for humanitarian and political issues • Frustrations with constraints imposed by PowerPoint • Spending a lot of time on formatting

Prevalence and impact evaluations that the participants gave to each theme of issues were combined into a single score, assigning a 75% weighting factor to the impact evaluation and a 25% weighting factor to the frequency evaluation. Because different participants used the scale differently, the combined scores were converted into ranks: the theme that received the highest combined prevalence and impact score was assigned the rank of 1, and the theme that received the lowest combined prevalence and impact score was assigned the rank of 8. Table 2 reports the average ranks for civilian and military groups separately, the final combined rank for the two groups, and the research team's priority level (primary, secondary, or tertiary) for each theme.

Table 2: Results of the focus areas' evaluation

Theme / Focus area	Average Military rank	Average Civilian rank	Average total rank	Final rank	Research teams' priority
Determining task focus and objectives	1	2	1.5	1	Secondary
Collaboration process	3	3	3	2	Primary
Problem and situation analysis	5	1	3	2	Secondary
Development of shared understanding	5	3	4	4	Primary
Individual skills and experience	2	6	4	4	Tertiary
Task constraints	4	7	5.5	6	Secondary

Integration of different perspectives	7	5	6	7	Primary
Final product format	8	8	8	8	Tertiary

Both the civilian and military SMEs agreed on the importance of defining task focus and objectives and the collaboration process for the planning team. Similarly, both groups of SMEs agreed on the relative insignificance of the final product format impact on the planning team's performance.

Two themes – "Problem and situation analysis" and "Individual skills and experience" – received the largest rank difference among the remaining themes – rank difference of 4 – between the civilian and military groups. The civilians perceived higher impact of poor problem and situation analysis than the military SMEs; and the military participants perceived higher impact of poor individual skills and lack of experience on the planning group's performance.

Overall, there was a reasonable overlap between the relative impact of different themes expressed by the SMEs and the research team's priority level. A surprising result was the fairly low ranking of "Integration of different perspectives" theme by both military and civilian groups, which is seen as one of the primary focus areas of the project.

The above results should be taken with caution, however, keeping in mind the rather small sample size of nine participants in the two groups.

5 Task-to-tool mapping

The task-to-tool mapping exercise was conducted to identify existing gaps in the available tool support for various tasks during the mission analysis phase of the OPP. Participants were given a list of the mission analysis tasks and a list of available tools that were known to the research team. The participants' task was, first of all, to modify the two lists to reflect their knowledge of both the existing tasks and tools. Then, the participants were asked to draw connections between each tool and those tasks, for which they used the tool.

The participants identified the following additional activities:

- Information gathering:
  - Establishing credibility;
  - Maintaining record over time;
  - Getting information from past reporting;
  - Conducting social analysis (tribes/conflict).
- Stakeholder analysis;
- Project management;
- Collaboration;
- Integration;
- Planning, including financial and other;
- Developing a common operating picture (COP), shared understanding.

Participants also identified several additional tools that were not included in the original list:

- Communications : Outlook, Skype, Adobe conference, telephone/cell (including text messaging);
- Media: Television news, newspapers, social media, such as Twitter and Facebook;
- Network: Defence Wide Area Network (DWAN), Sharepoint;
- Hardware (tablets);
- Analysis tools: I2/iBase, Visio, MindManager;
- Other information sources: human memory, task force, situation reports.

Figure 2 illustrates the resulting mapping between the tasks and the tools from both workshop sessions. The list of tasks is on the left and the list of tools is on the right.

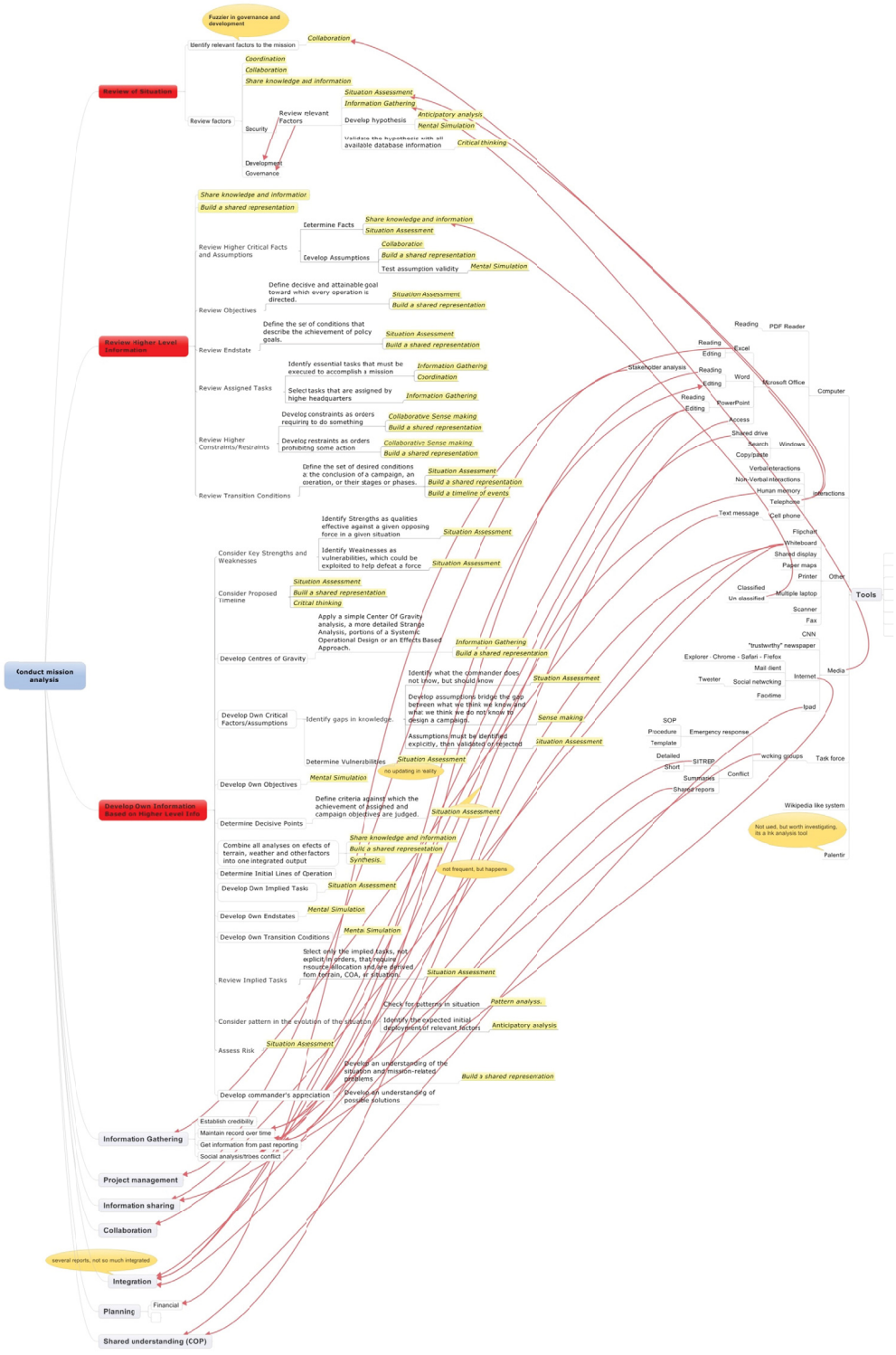

Figure 2: The results of the task-to-tool mapping exercise

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According to the results of the mapping exercise, the tools that are used during mission analysis are:

- Computer workstations, classified and unclassified, including laptops and tablets;
- Computer networks, including access to shared drive;
- Microsoft (MS) Office Suite, including MS PowerPoint, MS Word, MS Excel, and MS Access;
- Interactions with others via phone, text messaging, and e-mail;
- Information coming from various media sources and task force reports;
- Whiteboards used for information gathering and sharing, and the development of COP.

The results of the mapping exercise revealed that the planning team often employs some tools for most of the tasks. However, the vast majority of the tools currently used are very generic (such as MS Word or PowerPoint) and are used for many different tasks. These tools often lack features that can support specific task requirements and are often cumbersome. The planning team does not have at its disposal specialized tools that are explicitly designed to support most of its tasks.

More specifically, during the discussion the SMEs commented on the lack of tools for:

- Conducting mental simulation;
- Developing commander appreciation;
- Synchronizing different factors pertaining to time, space and tasks;
- Developing a comprehensive timeline.

The task-to-tool mapping exercise confirmed that the IMAGE V3 methodology targets current gaps in specialised tool support for mission analysis stage of the OPP. Of course, the project will not be able to address all of the gaps, but it will strive to focus on the ones that will have the most impact on the team.

6 Evaluation of proposed solutions

6.1 Identifying candidate solutions

In preparation for the workshop, the research team generated a list of over 30 potential solutions that can mitigate one or several of the issues identified. Some of these solutions were suggested by the baseline case study participants. It is not feasible to implement all of the proposed solutions in the scope of this project, therefore the research team needed to identify a short list of solutions that best fit the objectives of the project and have a potential to have the most impact on the planning team. Two sets of criteria were used to evaluate each solution:

- Four mandatory criteria that a successful solution candidate must meet in order to be selected for further consideration. Each solution was assigned a score of either 1 or 0 on each of these criteria. The mandatory criteria were:
  - Implementation falls within the scope of the project;
  - Feasibility of implementing is within the project's human resources;
  - Feasibility of implementing is within the project's financial resources;
  - Feasibility of implementing in time for case study 2.
- Each solution was also assigned a score between 1 (does not mitigate) to 5 (mitigates to a great extent) for each of the eight themes of issues discussed in section 4 and prioritised by the research team as follows:
  - Primary focus areas:
    - Improving shared understanding;
    - Improving integration of different perspectives;
    - Improving collaboration process.
  - Secondary focus areas:
    - Defining task focus and objectives;
    - Mitigating task constraints;
    - Improving problem and situation analysis.
  - Tertiary focus areas:
    - Improving individual skills;
    - Improving the final product format.

Each team research member evaluated each solution. Differences of opinion were resolved either through discussion and reaching a consensus or by averaging the different scores if consensus could not be reached. The final score for each solution was calculated in the following manner:

$$S_i = \prod_j M_j \left(\sum_k w_k V_k \right)$$

where:

- S_i is the final score calculated for the i^{th} solution, $1 \leq i \leq 33$;
- M_j is the score assigned to the solution on the j^{th} mandatory criteria (either 1 or 0), $1 \leq j \leq 4$;
- V_k is the score assigned to the solution on the k^{th} theme of issues, $1 \leq k \leq 8$; $1 \leq V_k \leq 5$;
- w_k is the weighting factor of the k^{th} theme of issues, with the following values: 1 for primary, 0.5 for secondary, and 0.25 for tertiary, $1 \leq k \leq 8$.

Eleven solutions that received the highest score were selected for the presentation to the SMEs during the workshops. These solutions and their evaluation by the SMEs are discussed in the following section.

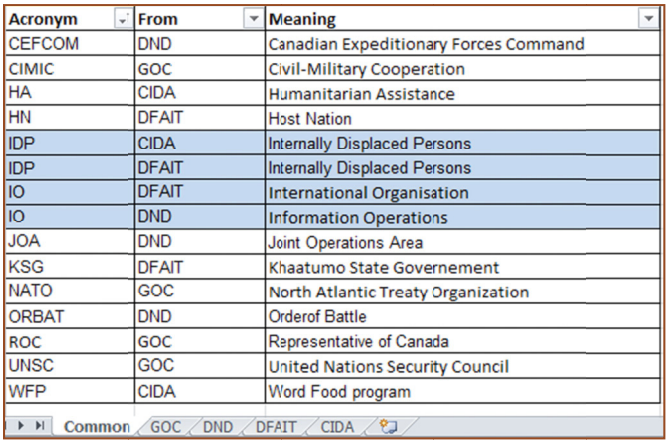
6.2 Solutions and their evaluation

During the second half of the workshop, the research team presented 11 potential solutions to the SMEs that were designed to mitigate one or several of the issues identified. Participants were presented with one solution at a time, starting with a brief description of the rationale and the envisioned process or tool followed by one or several examples of possible implementations of the solution. After presenting the implementation examples, the participants filled out the solution evaluation form (Annex B), identifying the preferred implementation of the solution and rating its value and feasibility of implementation in a WoG team on a 5-point scale ranging from 1 (Negligible) to 5 (Very high) with 3 representing a "moderate" level of value/feasibility. The solution evaluation form is included in Annex B. The SMEs discussed each solution following the completion of its numeric evaluation.

Each solution is described briefly below, including the summary of its numeric evaluation and key discussion points raised by the SMEs. Table 14 reports the summary of all 11 solutions' evaluation. Similar to the analysis of the themes of issues analysis, weighted evaluation scores were converted into ranks to differentiate among the solutions, with rank 1 being the most valuable and feasible and rank 11 being the least valuable and feasible.

6.2.1 Acronym library

When fully developed, the acronym library will be an electronic searchable collection of all the acronyms and terms used by different departments. The library will include the term and all its definitions, indicating where each definition is used. This tool will require team members to actively discuss and update the library as needed. Such a tool will reduce ambiguity in a WoG team's communication and will facilitate collaboration within the group. Figure 3 illustrates an example of such a tool's output.



Acronym	From	Meaning
CEFCOM	DND	Canadian Expeditionary Forces Command
CIMIC	GOC	Civil-Military Cooperation
HA	CIDA	Humanitarian Assistance
HN	DFAIT	Host Nation
IDP	CIDA	Internally Displaced Persons
IDP	DFAIT	Internally Displaced Persons
IO	DFAIT	International Organisation
IO	DND	Information Operations
JOA	DND	Joint Operations Area
KSG	DFAIT	Khaatumo State Governement
NATO	GOC	North Atlantic Treaty Organization
ORBAT	DND	Orderof Battle
ROC	GOC	Representative of Canada
UNSC	GOC	United Nations Security Council
WFP	CIDA	Word Food program

Common GOC DND DFAIT CIDA

Figure 3: Example of an acronym library tool

Feedback and evaluation

Table 3 reports the results of the SMEs' evaluation of the acronym library tool.

Table 3: SMEs' evaluations of the Acronym library tool

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	4.00	4.25	4.06
Average Civilian rating	3.50	4.50	3.75
Average combined weighted final rank		4 (out of 11)	

Summary of comments

- There exists a defence terminology data base, "Defence Terminology Bank" (DTB), which could be used as a starting point for developing such a tool. DTB is only available on the DWAN, hence, other government departments do not have access to it unless they are granted access to DWAN. DTB does not indicate the source of the terms it contains, and different terms are still used differently depending on the context. A "completely common" glossary does not exist; therefore it would be useful to have a common, interdepartmental terminology resource.
- The SMEs suggested two complementary implementations for such resource:
  - as a wiki on a network with some editorial oversight;

- as a database with a MS Word plug-in that would show existing definitions on mouse-over.

- The dictionary needs to be maintained in both English and French. A link between English and French versions would be useful, and a link between acronyms with the same spelling in both languages would be useful also.
- Systems' interoperability is seen as a potential implementation issue.

6.2.2 Brain-storming procedure

Two brainstorming procedures were proposed for the inclusion at the early stages of the mission analysis in a WoG team:

i) Topic-centered idea generation, and

ii) Topic-centered question generation.

A more formal brainstorming session at the beginning of mission analysis will encourage all team members to contribute their ideas (or questions), which will help to promote contribution and openness among the group members. This could be especially beneficial for teams with shy or quiet members, or in teams where civilians feel overwhelmed with the unfamiliarity of the military style of the planning team environment.

Feedback and evaluation

Table 4 reports the results of the SMEs' evaluation of the brain-storming procedure.

Table 4: SMEs' evaluations of the brain-storming procedure

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	3.00	2.25	2.81
Average Civilian rating	2.75	4.00	3.06
Average combined weighted final rank		10 (out of 11)	

Summary of comments

- At times, brain-storming results in more uncertainty than there was before, because it is not clear how to process all of the ideas generated during the session. Therefore, brain-storming technique needs to be facilitated, and requires:
  - a skillful facilitator with a good understanding of the group and a strong control;
  - a well-defined process with a good structure;
  - a clear goal of what to do with all the generated ideas.

All of these are not always present in an operational environment.

- Brain-storming is not productive in small groups and there is a danger of losing focus in a large group as more topical branches emerge.
- Brain-storming might even undermine group cohesion.
- The military SMEs also pointed out that brain-storming would not work well in a new planning team, because civilians are always outnumbered by military, and civilian personnel are often too shy to intervene freely.
- Overall, the SMEs were not overly enthusiastic about the utility and potential effectiveness of brain-storming technique in a WoG planning group.
- An open atmosphere in a group depends on inter-personal relationships, which are built through social and informal interactions. The SMEs emphasised the importance of relationship building (in a social and informal setting) for the overall team dynamics and performance.

6.2.3 Digital collaborative workspace

Digital collaborative workspace is a shared electronic network-dependent workspace that allows for interaction among team members and also serves as a repository for documents, such as all mission-critical files, summary of the kick-off information, team member bios, templates, tasking and schedule of deliverables. This resource would facilitate everyone's access to critical information and would ensure mutual awareness of the progress. It would also be valuable to newcomers helping them to get up-to-speed more quickly. Figure 4 shows an example of a digital collaborative workspace as a Sharepoint site.

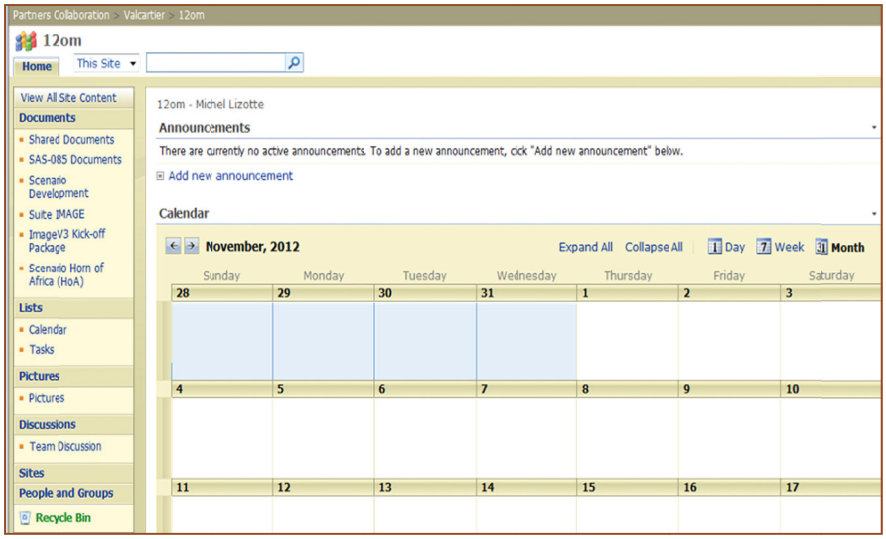


Figure 4: Example of a digital collaborative workspace (Sharepoint site)

Feedback and evaluation

Table 5 reports the results of the SMEs' evaluation of the digital collaborative workspace solution.

Table 5: SMEs' evaluations of the digital collaborative workspace solution

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	4.00	2.50	3.63
Average Civilian rating	3.50	2.25	3.19
Average combined weighted final rank		8 (out of 11)	

Summary of comments

- Different departments are using different networks, and their interoperability is a big issue for the implementation of digital collaborative workspace.
- The military uses Sharepoint. In Afghanistan civilian counterparts were given access to it as well. However, providing Sharepoint access to other departments is more problematic for domestic operations, because of incompatibility of the departmental networks.

- Other departments use unclassified solutions such as Google Docs and Apple cloud computing, which are not acceptable to the Department of National Defence (DND).
- DND relies on MS Office suite, which constrains the possibility of implementing other solutions.
- Participants could not identify and evaluate alternative systems because they were not familiar with the available alternatives.
- Information sharing is one of the major challenges not just among the departments, but also within the departments, and digital collaborative workspace will be difficult to implement and is unlikely to solve the problem of information sharing.
- Building relationships among the team members is the most important factor to ensure information sharing.

6.2.4 Comment capability to digital team outputs

Comment capability functionality will allow inserting digital comments on shared or co-created documents, which will serve as a complementary (to face-to-face) way to express ideas and offer critiques. This functionality may improve team member contribution, exchange of ideas and their capture; it will provide more reserved team members with an alternative opportunity to contribute and it will keep an electronic record of contributions. An example of comment capability is shown in Figure 5.

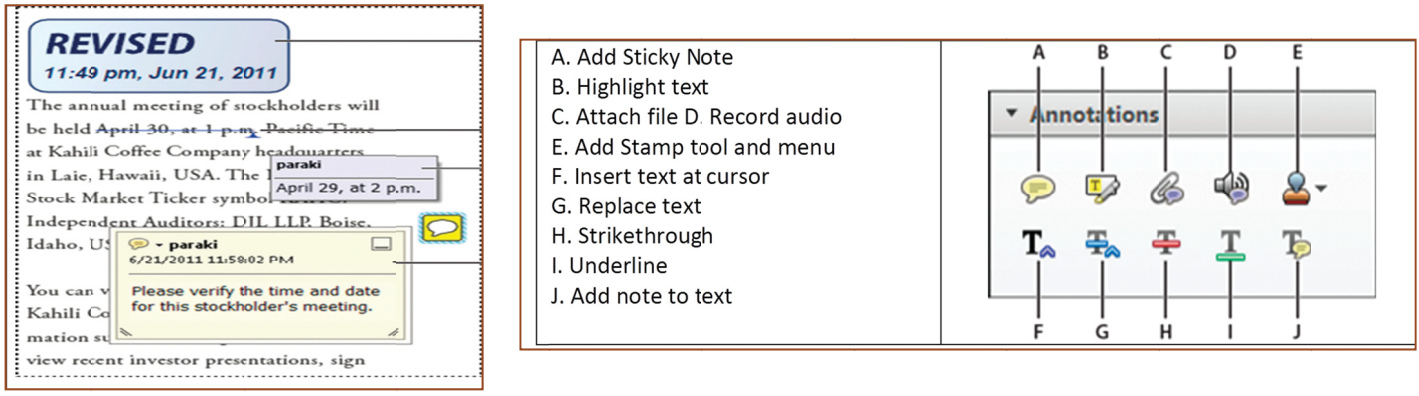


Figure 5: Example of comment capability to digital team outputs

Feedback and evaluation

Table 6 reports the results of the SMEs' evaluation of the comment capability to digital team outputs solution.

Table 6: SMEs' evaluations of the comment capability to digital team outputs solution

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	2.50	3.50	2.75
Average Civilian rating	3.75	4.50	3.94
Average combined weighted final rank		9 (out of 11)	

Summary of comments

- Comment feature and track of changes in MS Word and Excel are used and are generally found to be helpful. However, Power Point – the main briefing software used by the military – does not have this feature and it would be nice to implement it.
- The SMEs raised several issues with digital commenting:
  - Document editing becomes cumbersome when there are several reviewers of a document;
  - The ease of digital editing encourages people to make minute changes, especially because there is no need to explain the proposed changes in the digital format;
  - Electronic commenting will not work as a way to encourage reserved members to contribute, because in the military environment, only those ideas that were presented out loud to the group have weight.
- Participants also commented on a general inability to reach interdepartmental (i.e., military-civilian) agreement on a joint document. They pointed out that achieving agreement on a written document is quite difficult, that the choice of words makes a difference, "a 3-letter word can make or break the product." This lack of agreement is not an issue in the OPP context, because there is an individual who is responsible to report to the commander, and this individual will make a decision on the final wording and will edit the final document.

6.2.5 WoG mission analysis briefing template

This solution proposes to develop and incorporate civilian-friendly templates and formats into the final team outputs. This solution aims to:

- Clarify the nature of the output required by each team member;

- Provide templates that are suitable for civilian content;
- Reduce formatting work for the mission analysis brief.

The development of the briefing template will require active contribution and collaboration from SMEs from different departments. Figure 6 shows an example of potential content of a mission analysis brief template.

1. **Introduction**
   - Aim of Brief
   - Outline
2. **Review of the situation**
   - General
     - Political, military and historical background
     - Current Situation (PMESII : Political, Military, Economic, Social, Infrastructure, Information)
   - Opposing Force Situation
     - Intent
     - Capabilities
     - Assessment (brief description of likely actions – not COAs)
   - Higher Commander's/ROC's Direction and Guidance
     - Mission
     - Intent
     - Objectives (Governance, development, security)
     - Transition Conditions
     - Assumptions (Governance, development, security)
     - Limitations (Governance, development, security)
     - Assigned Tasks to Your Command
     - Implied Tasks to Your Command
   - Operations Design
   - Key factors and deductions
     - Governance
     - Development
     - Security
   - Constraints/ Restraints (Governance, development, security)
   - Key Strengths and Weaknesses
     - Opposing Force
     - Own Force
     - Relevant Other Forces, as necessary
   - Decisive Points (own level) (Governance, development, security)
   - Objectives
   - Critical Risks and Vulnerability (Governance, development, security)
   - End State and Criteria for Success (Governance, development, security)

Figure 6: Example of a WoG product template

Feedback and evaluation

Table 7 reports the results of the SMEs' evaluation of the WoG product template.

Table 7: SMEs' evaluations of the WoG product template

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	4.50	4.50	4.50
Average Civilian rating	4.50	3.25	4.19
Average combined weighted final rank		1 (out of 11)	

Summary of comments

- The SMEs agreed that having a common briefing template would be beneficial for the WoG team. It will make it easier to include civilian input.
- There was also consensus that for the development of the common template, the OPP template would be a good starting point, and the final product will be an adjusted OPP template.
- Each WoG team's composition depends on the problem being addressed. Each additional department represented on the team adds another dimension not only to the problem space but to the final product that will be created by the team. In light of this, creating a template suitable for every situation is impossible. However, it is possible to create a generic template with built-in civilian inputs that will be adjusted depending on the WoG team composition.
- The level of detail required on military OPP template is not always available for civilian input. It is often the case because civilians do not have the manpower to have representatives on the ground to collect information necessary to gain sufficient understanding of the situation for policy and development implications on operational and tactical levels.

6.2.6 Team building and handover procedure

The next proposed solution is a structured team building procedure that is to be conducted at the beginning of the mission analysis stage. This procedure is designed to also facilitate the handover when team members change midway through the mission. The proposed activities for the team building procedure are designed to ensure:

- Familiarity of team members with each other;
- Understanding of the mission, process and expected product;
- Understanding how each team member is expected to contribute to the final product, and how team efforts will be coordinated.

The activities include a few focused roundtable discussions designed for each team member to present his or her point of view individually followed by a group discussion. The expected outcomes of this procedure include clarity regarding team members' background, experience, roles, and constraints, team's work plan, task allocation, individual deliverables and their schedule, communication plan, and defined desired output.

Feedback and evaluation

Table 8 reports the results of the SMEs' evaluation of the team building and handover procedure.

Table 8: SMEs' evaluations of the team building and handover procedure

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	5.00	2.75	4.44
Average Civilian rating	4.00	3.75	3.94
Average combined weighted final rank	2 (out of 11)		

Summary of comments

- For the team building and handover procedure, an important issue to consider is how the team is formed:
  - If everyone arrives at the same time – then a team building procedure is absolutely necessary, and should be designed to bring a new team together;
  - However, often individuals join the team after it's been functioning for some time. In this case, proper introductions by J5 are necessary, and a modified version of the team building procedure is needed to integrate the new team member.
- For newly arriving people, it would be helpful if there was a way to capture a common sense of understanding of the situation. Some of the products of the team building procedure may help with that.
- Handover notes may exist but there is no formal process, and often there is no overlap between the departing and the incoming individuals. Passing on a list of contacts, specific terms of reference, and ongoing tasks would be very helpful to get up to speed for a newcomer.

- It is important to form the complete team at the beginning of the process; and it is likewise important for all team members to be present at all of the planning stages in order to understand the objectives.
- Team bonding is important for an effective functioning of a planning team. The (formal) team building procedure allows for some of that bonding to happen, however, the development of interpersonal relationships is largely an informal process, and it needs to take place before the team leaves on a mission.
- Social relationship building among the team members cannot be formalised. Therefore, the team building procedure cannot replace informal interactions.

6.2.7 Problem framing process

The problem framing process is an activity designed to engage the team into understanding the many dimensions and factors relevant to a mission. The problem framing is about systematically developing the shared context for the mission analysis. Problem framing process specifically serves to define the situation as a system and it creates the backdrop and boundaries on which to focus team deliberations. Problem framing is a component of Systemic Operations Design paradigm, which is sometimes seen as an alternative method to the OPP (Lauder, 2009).

Feedback and evaluation

Table 9 reports the results of the SMEs' evaluation of the problem framing process.

Table 9: SMEs' evaluations of the problem framing process

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	3.75	2.50	3.44
Average Civilian rating	4.00	2.67	3.67
Average combined weighted final rank		7 (out of 11)	

Summary of comments

- The SMEs agreed that a common understanding of the problem is important; however the process itself was unclear to them.
- Problem framing is part of SOD, and the adoption of this solution was seen as problematic without adopting the entire SOD process. Implementing the entire SOD process to replace OPP is not a viable option.
- Some SMEs had experience applying the system analysis approach to analysing a problem and found it quite useful. However, this approach might not be suitable for all problems and for every OPP. Also, it is important that everyone involved in the analysis understands the process well.
- As part of the problem framing process, Operational Design (OP design) could be quite useful as well. OP design focuses on the problem in a certain way, however if the perspective is wrong, then the entire analysis will also be wrong. Identifying a problem upfront runs a risk of identifying the wrong problem.

6.2.8 Collaborative knowledge representation

The development of collaborative common situation representation is one of the first steps in the development of the team's common understanding of the situation. The creation of such representation will increase team members' awareness of each other's perspectives, differences in emphasis, and it might help to expose underlying assumptions that the team members hold. Such common representation will help to collaboratively assess the state of elements in the situation in relation to goals (e.g., Political, Military, Economic, Social, Information and Infrastructure (PMESII) assessment). Collaborative knowledge representation can be created with several existing knowledge representation techniques that require varying degree of precision. Three potential implementations were presented to the SMEs – Mind Maps (Buzan & Buzan, 1994), Concept Maps (CMaps, Novak, 1998) and Conceptual Graphs (CG, Sowa, 2008). Figure 7 shows an example of a common collaborative knowledge representation in the form of a CMap.

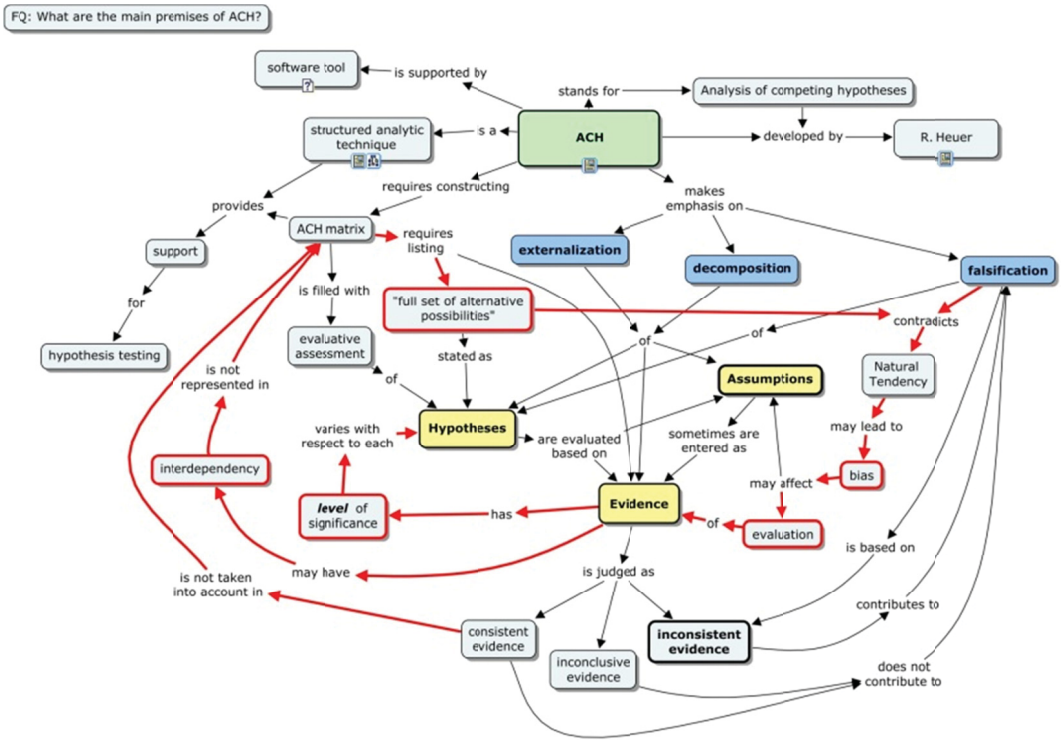


Figure 7: Example of a common collaborative knowledge representation in the form of a CMap

Feedback and evaluation

Table 10 reports the results of the SMEs' evaluation of the collaborative knowledge representation.

Table 10: SMEs' evaluations of the collaborative knowledge representation

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	4.00	3.00	3.75
Average Civilian rating	3.67	2.67	3.42
Average combined weighted final rank		5 (out of 11)	

Summary of comments

- Developing such representation has an advantage of being concise and generating a discussion on the topic; the discussion is important.
- A more visual presentation could help, but it should be used with caution.
- Using such representation tools runs the risk of over specifying and overcomplicating the problem.
- Such tools might be more suitable for personal use, i.e., as a thinking tool, or for generating a discussion, and maybe not as much for communication, because people to whom the information is presented may be unfamiliar with these formalisms.
- Some civilian departments, such as DFAIT, are very much word-driven and are not visually focused. The use of visual representations is not in their culture, and visual representation tools would seem foreign to them. However, the participants from DFAIT commented that it would be helpful if DND shared their "picture" of the situation, because it would help DFAIT to know how the problem is understood outside of DFAIT.
- The emphasis with this solution should be on the process and not as much on the final product; therefore the solution should be process-driven rather than tool-driven.
- There is a need to have flexibility in manipulating the representation and simplicity of the tools is important: the more emphasis is put on a tool and its use, the more will be taken away from the analysis and the planning process.

6.2.9 What-if simulation: A process and tool to develop a shared model of the situation

The development of a shared model of the situation is another level in formalising and developing shared understanding of the problem. During this process, the team is encouraged to discuss, elaborate and integrate their external common representation into a causal model of how the team believes the environment works. Shared model is different from the common representation in the level of precision of the elements and their relationships. An understanding of the causal relationships within the system that the team is seeking to influence is key to addressing the root causes of observed problems. Shared causal model can take several different forms, such as influence diagrams (Howard & Matheson, 1981), system dynamics stock-and-flow diagrams (Sterman, 2000)), or what-if simulation models. Figure 8 illustrates an example of a shared model of a situation in a form of a stock-and-flow diagram.

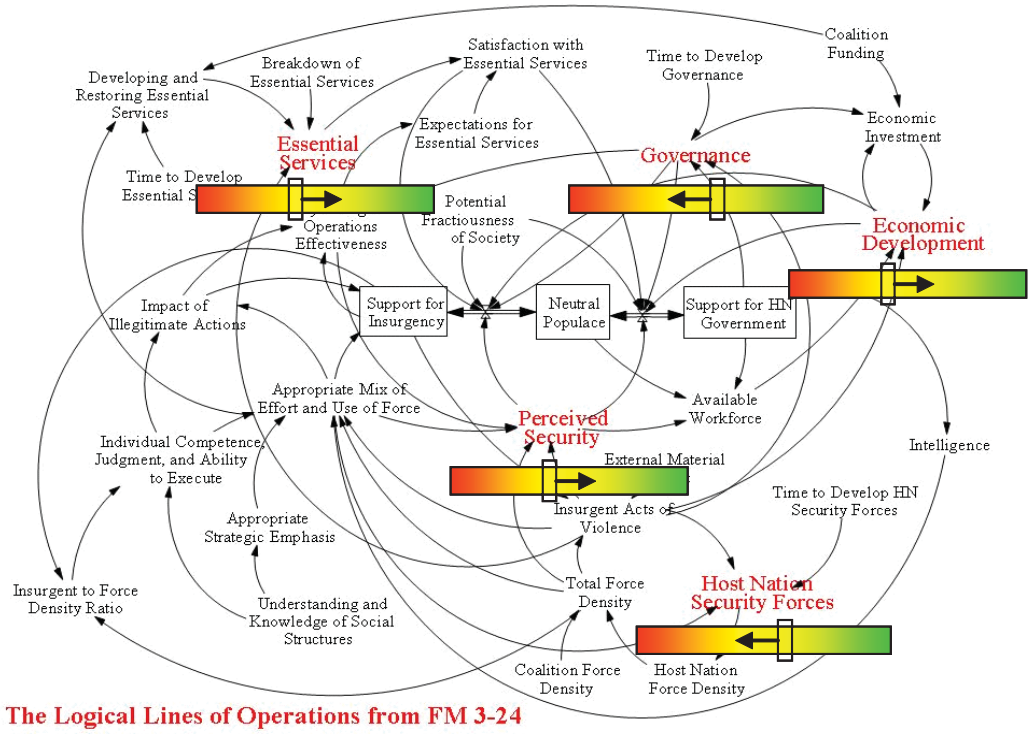


Figure 8: Example of a stock-and-flow shared model representation

Feedback and evaluation

Table 11 reports the results of the SMEs' evaluation of the shared model tool.

Summary of comments

Although the participants agreed that this solution has high potential value, they raised a number of issues with its application in an operational environment:

- The solution seems to be time consuming, therefore the likelihood of its application in an operational environment is very low;
- Output of the model will need to be considerably simplified for presentation;
- To be useful, the creation of a shared model requires sustained development effort and updating over time and through handovers;

Table 11: SMEs' evaluations of the shared model tool

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	3.67	2.67	3.42
Average Civilian rating	4.00	2.75	3.69
Average combined weighted final rank		6 (out of 11)	

- The model itself and its output seem to be complicated, which will also reduce the likelihood of its application.
- The development and maintenance of the model require a dedicated person knowledgeable in the model development and the current situational dynamics. Such personnel are not always available, and operational environment priorities could dictate other uses of their time.
- With more tools added to the OPP, there is a danger that tools will overrun the process, and that the tools will take away from the actual analysis of the problem, potentially resulting in goal displacement (i.e., the new goal becoming focused on applying the tools as opposed to analysing the problem).
- The simulation aspect of the shared model solution is more appropriate at the course of action (COA) stage of the OPP; and it seems to be premature during the mission analysis stage.

6.2.10 Cross-impact method

Cross-impact method is an analytic method that focuses on the identification of interdependencies among variables in the system. It requires the identification of key factors and systematic assessment of their mutual impact, i.e., an increase or decrease. The process requires the user to examine each variable in relation to every other variable identified and to assign a numerical value indicating its impact on each of the other variables. The impact is assigned on a fixed scale, e.g., from "-5" to "+5". The row and column totals for each variable allow identifying the most volatile and the most influential variables in the system. The cross-impact method is used in forecasting, intelligence analysis and business for assessing and comparing the overall systemic effects of a variable on a system. The results of this analysis can be used in the development of the shared model discussed above. Figure 9 shows an example of a cross-impact analysis matrix.

	HG	LM	SW	I	PA	CS	CU	LF	IS	Total	Weight
Host Nation Governance (HG)	0.00	4.00	5.00	2.00	6.00			2.00		19.00	0.18
Local Media (LM)					6.00					6.00	0.06
Socio-Economic Welfare (SW)		4.00			5.00	3.00			0.00	12.00	0.11
Infrastructures (I)			4.00	0.00	4.00					8.00	0.07
Population Allegiance (PA)		4.00			2.00	3.00		2.00	5.00	16.00	0.15
Criminality Suppression (CS)		6.00	3.00		3.00				2.00	14.00	0.13
Cultural Understanding (CU)	1.00	1.00			3.00	1.00		1.00	1.00	8.00	0.07
Local Forces (LF)					5.00	2.00		0.00	2.00	9.00	0.08
Insurgency Suppression (IS)	2.00	2.00		2.00	2.00	2.00		3.00	2.50	15.50	0.14
Total	3.00	21.00	12.00	4.00	36.00	11.00	0.00	8.00	12.50	107.50	1.00

Figure 9: Example of cross-impact analysis output

Feedback and evaluation

Table 12 reports the results of the SMEs' evaluation of the cross-impact method.

Table 12: SMEs' evaluations of the cross-impact method

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	2.00	3.75	2.44
Average Civilian rating	3.00	2.75	2.94
Average combined weighted final rank		11 (out of 11)	

Summary of comments

- The process is very subjective, and it is difficult to quantify the perceived potential impact, which has a qualitative nature.
- Substantial differences of opinion in assigning weights to variables' impacts are very likely. Resolving these differences through convergence of opinion would not work in the military environment where the opinion of the senior officer dominates the outcome.

- This analysis could potentially be valuable in challenging existing assumptions; however it should not be used as a causal model.
- Numbers provide a false sense of precision. There is a danger of (intentionally or unintentionally) skewing the results to achieve the desired outcomes and then assuming the totals to be true indicators. This could lead to misconceptions that would be difficult to uproot, because they are seemingly based on the results of the analysis.

6.2.11 Solution framing process

Solution framing process is designed to help the team to frame the solution that will help to conceptualize the outline of an operation or strategy. Solution framing does not equate to course of action development but rather to the generation of a 'solution frame' that helps structure the conclusions of the sensemaking process. A solution frame refers to a representation or a hypothetical scenario on how the problem situation may be resolved. It is hypothesized that this process will help reveal discrepancies in the understanding of team members. Similar to problem framing, solution framing is also a step in the SOD process.

Feedback and evaluation

Table 13 reports the results of the SMEs' evaluation of the solution framing process.

Table 13: SMEs' evaluations of the solution framing process

	Value to the team	Feasibility of implementation	Combined weighted rating
Average Military rating	4.50	4.75	4.56
Average Civilian rating	3.75	3.00	3.56
Average combined weighted final rank		3 (out of 11)	

Summary of comments

- The military SMEs saw a considerable similarity between the proposed solution framing process and the Operations Design (OP design) procedure conducted at the orientation phase of the OPP, in particular the decisive point analysis (DP analysis). OP design requires defining objectives, strategies, and COAs.
- OP design and its DP analysis component are very time consuming, but could be very useful if they are done properly.

- Currently OP design lacks any tool support, and diagrams for briefings are done with drawing tool in MS Power Point.

6.2.12 Evaluation summary

Table 14 provides summary of the numeric evaluations of the 11 solutions presented to the participants, reporting average military and civilian ranks separately and the combined rank for each solution component.

Table 14: Summary of the solution evaluation

#	Solution	Average Military rank	Average Civilian rank	Combined final rank
1	Acronym library	4	4	4
2	Brain-storming procedure	9	10	10
3	Digital collaborative workspace	6	9	8
4	Comment capability to digital team outputs	10	2	9
5	WoG mission analysis briefing template	2	1	1
6	Team building and handover procedure	3	2	2
7	Problem framing process	7	6	7
8	Collaborative knowledge representation	5	8	5
9	What-if simulation: Process/Tool to develop shared model of the situation	8	5	6
10	Cross-impact method	11	11	11
11	Solution framing process	1	7	3

According to the SMEs, each of the presented solutions has a potential to bring value given it is applied in the right context. Naturally, some solutions have greater expected value and feasibility of implementation at the mission analysis stage of the OPP than others. The SMEs emphasized that any solution selected for further development must not be too abstract, too complex, too quantitative, too "simple" or time consuming.

7 Recommendations for IMAGE V3 development

Following the analysis of the workshop discussions and evaluations of the proposed solutions, the research team identified a short list of solutions deemed to be most suitable for further development in the context of IMAGE V3. The six solutions proposed for further development represent a rounded toolset to support a WoG team in its efforts. This set addresses many issues: team building; role definition; clarifying task focus, objectives and output; improving communication; knowledge sharing; integration of different perspectives and the development of common understanding.

The solutions proposed for further development are listed below including the suggested modifications or comments offered by the participants or observations made by the research team. The solutions are presented in the order of their combined final ranks (see Table 14) starting with the solution that received the highest rating, and therefore was ranked as number 1 – the WoG mission analysis briefing template.

1. WoG mission analysis briefing template

The common WoG mission analysis briefing template solution received the highest rating from the SMEs. The SMEs agreed that taking the OPP template as the basis is a good starting point with subsequent additions and adjustments depending on specific requirements of potential civilian products.

The key aspect in developing the WoG mission analysis briefing template is to ensure adequate contribution and participation from departments concerned. This process will be conducive to mutual interdepartmental education about the product, information requirements and potential constraints that different departments' experience – a process beneficial in itself.

The major challenge in developing the briefing template would be to create it in a general enough form, such that it would be applicable to the majority of the situations without placing too many constraints. The SMEs pointed out that each additional civilian representative on the team adds another dimension to the problem space and, most likely, requires a placeholder and a specific format in the briefing template. A solution to this could be the development of various potential placeholders for different types of outputs that could be removed when they are not needed.

2. Team building and handover procedure

The team building and handover procedure also received relatively high ratings from the SMEs as a potential solution. The team building procedure is designed to build rapport and familiarity within the group, to set the team's expectations, goals and a roadmap for achieving them. This procedure ideally takes place at the beginning of the OPP iteration. The procedure will need to be adjusted depending on the group composition, the task at hand, and the stage of the process.

To support successful handovers, the procedure needs to ensure that the following information is captured and maintained:

- Important contact information;

- Terms of reference;
- Objectives, ongoing tasks, and schedule.

Additional interventions need to be developed to ensure smooth integration of team members arriving mid-way through a mission.

The importance of team building for the overall performance and success of WoG planning teams dominated the workshop discussions. The SMEs believe that interpersonal relationships within the team play the most important role in how well the team operates, on its ability to develop shared understanding and to integrate different perspectives in their final product. A proper team building procedure can considerably improve the overall group's focus and coordination. However, the SMEs questioned the possibility of formalising the development of interpersonal relationships with prescribed procedures.

The SMEs emphasised that the development of interpersonal relationships most naturally happens in the informal, outside the office setting, for example, through social gatherings after work, during lunches and breaks. The SMEs observed that it is the most beneficial if the team that is being deployed undergoes the pre-deployment training in its full strength with all the team members present for the entire duration of the training. The training environment has a relatively low-stakes atmosphere and it is usually held in such a location that requires all of the trainees to stay nearby the training site for the duration of the training. This arrangement provides personnel with ample opportunities for socializing with their teammates after hours and getting to know each other socially – the key ingredients to developing interpersonal relationships.

In addition to the development of a rounded team building and handover procedure in the context of 12OM project several additional measures (that fall outside the 12OM scope) could be implemented to facilitate adequate team building. These may include:

- Ensuring a complete team presence during the pre-deployment training;
- Educating the command staff on the importance of social interactions after hours;
- Encouraging these interactions by creating opportunities for such gatherings through providing funds, venue, and/or time off work;
- Creating a workspace layout that encourages:
  - On-the-job interactions, for example, collocation in the same room without dividers to encourage open interactions; and
  - Social interactions during breaks, for example, common lunch area and designated "smoking" area.

3. Decisive point analysis

The SMEs highly regarded the potential for tool-support for a solution framing process in the form of DP analysis of the OP design. They pointed out that DP analysis diagrams are currently done on a whiteboard and then redrawn with the drawing tool in MS PowerPoint for presentation. It would be more efficient if there was a designated and easy-to-use tool that will facilitate both the construction and presentation of the DP analysis diagrams.

DRDC Valcartier has developed tools for supporting centers of gravity analysis and DP analysis as part of COPLANS suite (Belanger, Guitouni, & Pageau, 2009). It is worthwhile to investigate the possibility of using the DP analysis component of COPLANS before developing any new tools.

4. Interactive common glossary

The use of acronyms and unfamiliar terminology was one of the most frequently mentioned challenges in the WoG context. The existence and use of a common reference library can facilitate communication within the team and improve their shared awareness of each other's perspectives. A glossary of terms and relationships as an integral part of IMAGE suite could be the starting point to suit SMEs' recommendations. Below is a list of features desirable in such a glossary tool:

- Each term needs to have a list of definitions linked to their source (i.e., the department where it is used);
- English and French versions need to be maintained;
- The library needs to be searchable and sortable based on the source, language or term;
- The library needs to be hosted on a shared drive of the local network to allow for easy access;
- It is desirable to develop an MS Word and Power Point plug-in that will provide tool-tips like help pop-up on mouse over;
- The updates to the library should be easy-to-make, and will improve its usability. For example, the procedure for updating the dictionary can be simplified by allowing the user to add a term to the dictionary directly from a Word or PDF document by highlighting the word and selecting a corresponding item from the right mouse click menu;
- Import and export capability between the IMAGE suite and MS Excel is also desirable;
- A procedure for updating and version oversight needs to be developed.

5. Collaborative knowledge representation tool.

A tool for sharing knowledge representations has the potential to significantly facilitate the mission analysis process. It allows externalising individuals' understanding of the problem space and it can serve as a good catalyst for a discussion. The IMAGE suite has a representation capability implemented through Conceptual Graphs (CGs). CGs offer many advantages, such as a formalized syntax and computational possibilities. However, these advantages come at a cost of simplicity: using CGs efficiently requires knowledge of their particular syntax, and creation of a vocabulary, which might be a tedious process. Without a certain degree of experience with CGs, they may be difficult to construct and to read, which can significantly inhibit their adoption.

Following the SMEs' observations that the tools for OPP have to be simple to use, the recommendation is to introduce Concept Mapping (CMapping) as an initial knowledge representation tool for developing shared situational awareness representations. CMapping does not impose any syntactical or semantic constraints on the representation, and its structures follow

natural language. These features make CMaps – the output of CMapping – much easier to construct and to read than CGs.

If a more formalized representation is desirable to query or filter cluttered representations, to merge perspectives or to build a simulation model, a CMap can be converted into a CG, which can be then converted into a simulation model. This step-wise process can simplify the causal model development and increase its usability.

6. What-if simulation

The last solution included in the short list of tools for further development is the process and tool support for creating a shared executable model of the situation. Although this solution has several implementation challenges, it has a potential to improve situational awareness of the team, especially if SMEs' suggestions for its implementation are taken into account.

One of the major implementation challenges is the need for a dedicated analyst for the model development and maintenance. In an operational environment, a defence scientist deployed with the WoG team can fill this role, or it can be facilitated through a reach-back capability.

In developing this solution, measures should be taken to ensure that the model and its results are used for exploration purposes only, to question the team's current understanding of the situation and assumptions. The outputs of such simulation are only as good as the model itself; therefore the model's main purpose is to improve the team's understanding, rather than to provide answers or fill information gaps.

Simplified and visual output formats for presenting the model itself and the simulation results will improve its usability.

8 Summary

SME workshop series #1 allowed the 12om research team to further align the IMAGE V3 methodology direction with the support needs of the WoG planning team in the operational environment and to further focus the project effort.

The task-to-tool mapping exercise confirmed that the project targets current gaps in tool support for the mission analysis stage of the OPP. Discussions with the SMEs of the 11 proposed solutions allowed the research team to identify a short list of six solution components for further development. Moreover, these discussions provided useful feedback with respect to some of the specific requirements to improve the utility and implementation likelihood of these processes and tools. In particular, as emphasised by the SMEs, it is important to remember that any solution selected for further development must not be too abstract, too complex, too quantitative, too "simple" or time consuming.

While some of the feedback on the proposed solutions was somewhat expected, some comments were not anticipated. More specifically, two solutions designed to improve team member contribution and exchange of ideas were not well received. The civilian as well as the military participants were both very reluctant to brainstorming procedures. Usually, they do not find such sessions productive. They also expressed many reservations regarding a comment capability to digital team outputs (e.g. track of changes in MS Word). In particular, the military do not usually consider ideas that are not presented out loud to the group.

The next stage of the 12om project should focus on further development of the selected solution components. It would be useful to hold the second stage of the SME workshops when these components will be sufficiently developed to be piloted. The purpose of the second stage of the SME workshops should be on providing a hands-on experience with these tools to SMEs and collecting more focused feedback on their usability and desirable improvements.

Annex A Focus Area Evaluation Form

12om Domain expert workshop #1 **Session # ___**

Participant code: _____

Evaluation of focus areas
From your experience working in multidisciplinary teams, for each of the following issues please rate:

- How often you have encountered the issue
- How much of an impact it has on the team's performance

Issue	How often have you encountered the issue? 1 = not frequently 2 = some of the time 3 = half of the time 4 = often 5 = very often	How much of an impact does it have on the team's performance? 1 = not at all 2 = somewhat 3 = moderately 4 = significantly 5 = very significantly
Lack of shared understanding	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
Lack of integration of different perspectives	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
Poor collaboration process	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
Poorly defined task focus and objectives	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
Task constraints (e.g., time constraints, interoperability of different systems, access to information, etc.)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
Poor problem and situation analysis	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
Poor individual skills and lack of experience	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
Inadequate final product format	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
Other (specify):	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)

Annex B Solution Evaluation Form

Participant:

Rate the value and feasibility of the suggested solution

1=Negligible Value/Feasibility
2=Low Value/Feasibility
3=Moderate Value/Feasibility
4=High Value/Feasibility
5=Very High Value/Feasibility

"Acronym library, shared dictionary, common terminology tool/process" preferred implementation (If applicable):

	1	2	3	4	5
Value:					
Feasibility:					

"Brain-storming procedure promoting contribution /openness" preferred implementation (If applicable):

	1	2	3	4	5
Value:					
Feasibility:					

"Digital collaborative workspace" preferred implementation (If applicable):

	1	2	3	4	5
Value:					
Feasibility:					

Participant:

Rate the value and feasibility of the suggested solution 1=Negligible Value/Feasibility 2=Low Value/Feasibility 3=Moderate Value/Feasibility 4=High Value/Feasibility 5=Very High Value/Feasibility

"Comment capability to digital team outputs" preferred implementation (If applicable):		
	Value:	1 2 3 4 5
	Feasibility:	1 2 3 4 5

"Product template/format co-designed by a WoG team" preferred implementation (If applicable):		
	Value:	1 2 3 4 5
	Feasibility:	1 2 3 4 5

Participant:

Rate the value and feasibility of the suggested solution 1=Negligible Value/Feasibility 2=Low Value/Feasibility 3=Moderate Value/Feasibility 4=High Value/Feasibility 5=Very High Value/Feasibility

"Kickoff procedure" preferred implementation (If applicable):		
	Value:	1 2 3 4 5
	Feasibility:	1 2 3 4 5

"Problem framing process" preferred implementation (If applicable):		
	Value:	1 2 3 4 5
	Feasibility:	1 2 3 4 5

"Shared situation awareness representation process/tool" preferred implementation (If applicable):		
	Value:	1 2 3 4 5
	Feasibility:	1 2 3 4 5

Participant:

Rate the value and feasibility of the suggested solution

1=Negligible Value/Feasibility
2=Low Value/Feasibility
3=Moderate Value/Feasibility
4=High Value/Feasibility
5=Very High Value/Feasibility

"Process/Tool to develop a shared model of the situation" preferred implementation (If applicable):

	1	2	3	4	5
Value:					
Feasibility:					

"Cross-impact method" preferred implementation (If applicable):

	1	2	3	4	5
Value:					
Feasibility:					

"Solution framing process" preferred implementation (If applicable):

	1	2	3	4	5
Value:					
Feasibility:					

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List of acronyms

ARP	Applied Research Program
CAF	Canadian Armed Forces
CG	Conceptual Graph
CIDA	Canadian International Development Agency
CMap	Concept Map
CMapping	Concept Mapping
COA	Course of Action
COP	Common Operating Picture
DFAIT	Department of Foreign Affairs and International Trade
DND	Department of National Defence
DP analysis	Decisive Point analysis
DRDC	Defence Research & Development Canada
DRDKIM	Director Research and Development Knowledge and Information Management
DTB	Defence terminology Bank
DWAN	Defence Wide Area Network
J5	Joint Plans
MS	Microsoft
R&D	Research & Development
OP Design	Operational Design
OPP	Operational Planning Process
PMESII	Political, Military, Economic, Social, Infrastructure and Information systems
SA	Situational Awareness
SME	Subject Matter Expert
SOD	Systemic Operations Design
WoG	Whole of Government

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DRDC has undertaken project 12om to support collaboration and the development of a common understanding of a situation within a multidisciplinary civil-military planning team. This project will develop the IMAGE V3 methodology that will consist of a suite of tools and processes to achieve this goal. The research team planned a series of Subject Matter Expert (SME) workshops in order to inform the development of the methodology. The present report describes the results of the first series of these workshops held in December, 2012. The first series of workshops allowed the research team to align the project direction with the support needs of the whole-of-government planning team. The feedback from the SMEs also allowed identifying a short list of methodology elements that have the greatest potential to impact on the team's performance while maintaining high likelihood of operational adoption. Using the feedback from the first series of SME workshops, the project will focus on the development of the selected methodology elements and will examine their utility in greater detail in the next series of SME workshops.

RDDC a entrepris le projet 12om afin de soutenir la collaboration et le développement d'une compréhension commune d'une situation au sein d'une équipe de planification multidisciplinaire et civilo-militaire. Ce projet permettra d'élaborer la méthodologie IMAGE V3 comprenant un ensemble d'outils et de processus pour atteindre ce but. L'équipe de recherche a planifié une série d'ateliers regroupant des experts en la matière (EM) afin de guider l'évolution de la méthodologie. Le présent rapport décrit les résultats de la première série d'ateliers tenue en décembre 2012. Ces ateliers visaient à orienter le projet en fonction des besoins exprimés par les EM. En particulier, la rétroaction des participants a permis de déterminer une courte liste d'éléments de méthodologie pouvant avoir le plus d'impact sur le rendement de l'équipe et une bonne probabilité d'être adoptée. En se basant sur les résultats de cette première série d'ateliers, les responsables du projet se pencheront principalement sur l'élaboration des éléments de méthodologie et examineront leur utilité plus en détail au cours de la prochaine série d'ateliers avec les EM.

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Collaborative sensemaking; situational awareness; multidisciplinary teams; shared understanding; Operational planning process; inter-government collaboration