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Mapping the Relevant of Complex Decision Making to Canadian Forces Land Operations

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Abstract

Challenging decision making environments such as those experienced by the Canadian Forces are commonly being characterized as "complex" by researchers (e.g., Grisogono, 2010). The main goal of this project was to determine whether research investigating complex decision making is relevant to the decision making actually experienced by Canadian Forces personnel, and how that research might be used to improve Canadian Forces education and training related to decision making. Complex decision making environments are characterized by requiring a series of interdependent decisions in a context that changes both autonomously and as a function of the actions of the decision maker, and where timing is a key element (e.g., decision makers may have to act at particular time in order to have their intended effect). Although factors identified in the complexity literature did appear to play a strong role in Canadian Forces decision making, further research is required to determine the relative role that these factors play in increasing decision making difficulty. Research identified additional challenges faced by Canadian Forces personnel that were not noted in the complexity literature, including challenges related to collaboration and communication. Other areas which pose significant challenges to CF personnel, and that appear to require additional education and training include planning and dealing with resource challenges. Canadian Forces personnel who are engaged in domestic and expeditionary operations appear to encounter the highest level of complexity in their decision making, and initial education and training efforts should probably focus on these individuals rather than individuals engaged in domestic day-to-day functions.

Résumé

Les chercheurs (dont Grisogono, 2010) qualifient généralement de « complexes » les milieux décisionnels difficiles comme ceux dans lesquels les Forces canadiennes sont appelées à servir. Ce projet avait pour but premier de déterminer si l'étude de processus décisionnels complexes serait utile à la prise de décisions qui constitue la réalité du personnel des Forces canadiennes, et comment ces travaux pourraient servir à améliorer l'éducation et l'instruction des militaires canadiens en ce qui concerne la prise de décisions. Les milieux décisionnels difficiles exigent une série de décisions interdépendantes, dans un contexte qui change à la fois de façon autonome et en fonction des mesures que prend le décideur et dont la synchronisation est primordiale (p. ex., les décideurs peuvent devoir agir à un moment en particulier afin d'obtenir l'effet souhaité). Les facteurs relevés dans la documentation sur la complexité semblaient effectivement exercer un rôle important dans le processus décisionnel des Forces canadiennes, mais d'autres études s'imposent afin de déterminer le rôle relatif qu'exercent ces facteurs par rapport à la difficulté de la prise de décisions. Les études ont relevé d'autres défis auxquels se heurte le personnel des Forces canadiennes qui n'étaient pas mentionnés dans la documentation sur les décisions complexes, y compris des défis liés à la collaboration et à la communication. D'autres secteurs qui posent des défis importants aux membres des FC et dans lesquels une plus ample formation semble nécessaire sont notamment la planification et les difficultés liées aux ressources. Comme les membres des Forces canadiennes affectés à des opérations nationales et expéditionnaires semblent être appelés à prendre les décisions les plus complexes, les premiers efforts d'éducation et d'instruction devrait probablement viser ce groupe de personnes plutôt que les militaires qui exercent des fonctions courantes au Canada.

Executive Summary

Mapping the Relevance of Complex Decision Making to Canadian Forces Land Operations.

Lisa A. Rehak, Tamsen E. Taylor and Lora Bruyn Martin, Human*systems*® Incorporated;
DRDC Toronto CR2011-079; Defence R&D Canada – Toronto; March 2011.

Challenging decision making environments such as those experienced by the Canadian Forces (CF) are commonly being characterized as "complex" by researchers. Researchers have proposed that contemporary military operations exhibit characteristics that have been studied extensively in domains such as chemistry, physics, and biology, and research findings in these domains could be applied to the study of CF decision making. The main goal of this project was to determine whether research investigating complex decision making is relevant to the decision making actually experienced by Canadian Forces personnel, and how that research might be used to improve Canadian Forces education and training related to decision making.

Complex decision making environments are characterized by requiring a series of interdependent decisions, in a context that changes both autonomously and as a function of the actions of the decision maker, and where timing is a key element. In this project, we performed a brief review of the complexity literature, and identified components which influence the difficulty of decisions in complex environments. The project focused on five of these factors related to complexity, including:

1) Connectivity: Things in the environment influence one another in complicated and unpredictable ways,
2) Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects,
3) Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time,
4) Underspecified goals: Goals may be difficult to achieve because they are too vague,
5) Independent agents: There are independent entities in the environment that influence it (they may have different goals than the decision maker).

We interviewed CF personnel who had experiences that were intuitively identified as being complex, and then created descriptions of decision making situations they had experienced ("scenarios"). We then examined the scenarios to determine whether the five complexity factors were present; in all cases the five factors were found. This indicates that Canadian Forces personnel do indeed experience the challenges identified by complexity research.

Further research also identified many additional challenges faced by Canadian Forces personnel. The broadest and most important of these additional challenges have to do with collaborating effectively, whether within their own team, with other Canadian organizations, or with other cultures (e.g., Afghan nationals). Additional areas where decision making could be improved are planning and dealing with resource challenges. Future work should be undertaken to examine which of the complexity factors have the most impact on decision making in the Canadian Forces,

and interventions should be aimed at increasing decision making proficiency in those areas. In the scenarios we encountered, personnel who were engaged in domestic and expeditionary contingency operations appeared to encounter noticeably higher levels of complexity in their decision making than those involved in routine functions. This suggests that initial efforts to better support complex decision making should target personnel involved in contingency operations rather than routine day-to-day functions.

Sommaire

Mappage de la pertinence de la prise de décisions complexes pour les opérations terrestres des Forces canadiennes

Lisa A. Rehak, Tamsen E. Taylor and Lora Bruyn Martin, Human*systems*® Incorporated; DRDC Toronto CR2011-079; R&D pour la defense Canada – Toronto; mars 2011.

Les chercheurs qualifient généralement de « complexes » les milieux décisionnels difficiles comme ceux dans lesquels les Forces canadiennes (FC) sont appelées à servir. Ils ont avancé que les opérations militaires modernes possèdent des caractéristiques qui ont fait l'objet de vastes études dans des domaines comme la chimie, la physique et la biologie, dont les résultats pourraient s'appliquer à l'étude de la prise de décisions dans les FC. Ce projet avait pour but premier de déterminer si l'étude de processus décisionnels complexes serait utile à la prise de décisions qui constitue la réalité du personnel des Forces canadiennes, et comment ces travaux pourraient servir à améliorer l'éducation et l'instruction des militaires canadiens en ce qui concerne la prise de décisions.

Les milieux décisionnels difficiles exigent une série de décisions interdépendantes, dans un contexte qui change à la fois de façon autonome et en fonction des mesures que prend le décideur et dont la synchronisation est primordiale. Dans le cadre du projet, nous avons examiné brièvement la documentation sur la complexité et relevé des éléments qui influencent la difficulté du processus décisionnel dans des milieux complexes. Le projet a porté principalement sur cinq de ces facteurs liés à la complexité, soit :

1) La connectivité : les facteurs environnementaux s'influencent mutuellement entre eux de manière complexe et imprévisible;
2) La dynamique : le système comporte des aspects qui évoluent. Par exemple, l'environnement change avec le temps même si l'on n'intervient pas; le rythme auquel les choses évoluent peut varier; il peut y avoir un décalage entre les gestes et les conséquences,
3) Buts conflictuels multiples : il est possible que l'on ait à atteindre de nombreux objectifs qui ne sont pas tous réalisables en même temps;
4) Buts imprécis : les buts peuvent être difficiles à atteindre parce qu'ils sont trop vagues;
5) Agents indépendants : il y a dans l'environnement des entités indépendantes qui l'influencent (leurs objectifs peuvent être différents de ceux du décideur).

Nous avons interrogé des membres du personnel des FC ayant vécu des expériences qualifiées intuitivement de complexes, puis nous avons élaboré des descriptions de situations décisionnelles qu'ils avaient dû affronter (des « scénarios »). Nous avons ensuite examiné les scénarios afin de déterminer si les cinq facteurs de complexité étaient présents. Les cinq facteurs étaient présents dans tous les cas, ce qui indique que les membres des Forces canadiennes affrontent effectivement les défis mentionnés dans les études sur la complexité.

D’autres études ont permis de relever de nombreuses autres difficultés qui se posent au personnel des Forces canadiennes. Le plus répandu et le plus important de ces défis est celui d’obtenir une collaboration efficace, que ce soit au sein de sa propre équipe, avec d’autres organisations canadiennes, ou avec d’autres cultures (p. ex., les Afghans). D’autres secteurs dans lesquels on pourrait améliorer la prise de décisions sont la planification et les difficultés liées aux ressources. On devrait entreprendre d’autres études afin d’examiner lesquels des facteurs de complexité ont la plus forte incidence sur le processus décisionnel des Forces canadiennes, et les interventions devraient être axées sur la renforcement des compétences décisionnelles. Comme les membres des Forces canadiennes qui sont engagés dans des opérations nationales et expéditionnaires semblent être appelés à prendre les décisions les plus complexes, les premiers efforts d’éducation et d’instruction devrait probablement viser ces personnes plutôt que des militaires qui exercent des fonctions courantes à l’échelle nationale.

Table of Contents

List of Tables

Acknowledgements

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We would also like to thank those who agreed to be interviewed. During our interviews, some CF members found themselves reliving unpleasant memories. We were moved by the conditions that they found themselves in, humbled by their actions, and impressed by the way in which the decision makers handled their circumstances. Those who we interviewed have chosen a path full of risk and challenge – learning of their experiences continues to increase our pride in how CF members represent our country. Without their contributions this project would, obviously, not be possible.

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1. Introduction

This section contains information about the background, scope, objectives, and deliverables for the project.

1.1 Background

The Canadian Forces (CF) are interested in improving the decision making skills of commanders and their staffs in contemporary operations. The missions faced by the CF, both present and future, are made challenging by many factors. Some of these challenges include interacting with and caring for the welfare of a civilian population while dealing with a "non-conventional" adversary, the need to consider second and third-order effects of tactical actions, and the need to interact with other organizations and nations in Joint, Interagency, Multinational, and Public (JIMP) operations (Godefroy, 2007).

Challenging decision making environments such as those experienced by the CF are commonly being characterized as "complex" by researchers (e.g., Grisogono, 2010; Moffat, 2003). Researchers have proposed that contemporary military operations exhibit characteristics that have been studied extensively in domains such as chemistry, physics, and biology, and research findings in these domains could be applied to the study of CF decision making.

Although there is some debate in the literature concerning what makes decision making complex, complex decision making typically involves decision making that must take into account many interrelated factors if decisions are to have the effects intended by a Decision Maker (DM). Existing research investigating complex decision making has frequently been conducted in laboratories using "microworlds" (i.e., computer simulations of decision making environments; see Brehmer, 1992; Dörner & Brehmer, 1993). In contrast to "real-world" decision making, the use of microworlds offers certain advantages such as more control over the environment (e.g., specific effects can be examined that might not be predictable in the real world; experimenters can increase the speed of environmental change to examine more effects in a limited time). However, it is not yet clear that findings obtained in the laboratory with microworlds are relevant to decision making in environments such as those experienced by the CF.

This project is intended to find similarities between the results from existing research investigating complex decision making and the decision making performed by CF personnel. The main reason for identifying these similarities is to determine the extent to which the existing research can be applied in order to facilitate and improve the CF education and training processes with respect to decision making. Establishing a link between existing complex decision making research findings and the actual decision making experienced by CF personnel is a logical and necessary first step toward applying complex decision making research to improving CF education and training related to decision making.

1.2 Objectives, Scope, and Deliverables

The overall objective of this project was to determine the usefulness of existing research in complex decision making (in particular, findings from research using microworlds) for enhancing military education and training related to decision making. To achieve this overall objective, first, a brief literature review was performed to determine the main components of complex decision making as described in the research literature. Second, a workshop was held with the project team,

some of whom had experience in complexity research and some who had military experience. The objectives of the workshop were to review the complexity components summarized in the literature review, determine which of the identified complexity components to focus on during data collection and data analysis, and to determine an appropriate approach for data collection (e.g., who should be interviewed). Third, data were collected through knowledge elicitation sessions with SMEs identified in the workshop as having appropriate experiences. Fourth, several sets of analyses were conducted to describe the actual experiences of the CF personnel and to map these experiences onto the selected complexity components. Finally, recommendations and conclusions were produced based on the analyses, and included a discussion of whether the mapping was sufficient to recommend that complexity research can be logically extended to CF education, and training as well as to determine the main challenge areas actually experienced by CF personnel to guide future changes in the CF education and training processes.

The scope of this project was land force focused (rather than focused on air force or naval operations), and included contingency operations (both domestic and expeditionary) and day-to-day functions. It was beyond the scope of this project to validate the findings of complexity research. Rather, we assessed the usefulness of complexity research findings for military decision-making education and training based on the assumption that the findings in the existing research literature were correct (although we noted some cases in which the research findings appeared incomplete).

Deliverables included:

1) A Mind Map containing a summary of the characteristics of complex decision making;
2) Descriptions of CF scenarios which were anticipated to qualify as complex decision making contexts;
3) A mapping of selected main ideas in complexity theory to the scenario descriptions;
4) A ranking of the relative contribution of the main complexity ideas to the overall challenges present in the scenario;
5) A summary of the main challenges present in the scenarios; and
6) Possible education and training interventions/enhancements.

1.3 Outline of report

The first chapter of this report contains a brief background and discussion of the objectives, scope, and deliverables. The second chapter describes the methodology used for the literature review, the workshop, the knowledge elicitation, and the analyses. The third chapter describes the results of the literature review, workshop, and analyses, and the fourth chapter contains the conclusions and recommendations suggested by the analyses.

2. Methodology

In this section, we review the methodologies used for the literature review, the workshop, the knowledge elicitation sessions, as well as the processes followed during the data analysis. Results are not included here, but can be found in next section (Section 3).

2.1 Review of complexity literature

This was not intended to be a complete review of the complexity literature, but was instead a guided review to gain an overview of the characteristics of complex decision making and factors that were thought to make decision making complex. The Scientific Authority (SA) provided several documents to review, including:

- Brehmer, B. & Dörner, D. (1993). Experiments with computer-simulated microworlds: Escaping both the narrow straits of the laboratory and the deep blue sea of the field study. Computers in Human Behavior, 9, 171-184.
- Department of Defence (2009). Adaptive campaigning 09: Army's future land operating concept, Australian Army, Canberra.
- Dörner, D. (1996). The logic of failure. New York, Metropolitan Books.
- Funke, J. (2001). Dynamic systems as tools for analysing human judgement. Thinking and Reasoning, 7, 69-89.
- Grisogono, A. M. (2010). Overview of Complex Decision-Making (CxDM) program (draft).
- Grisogono, A. M. (2006). The implications of complex adaptive systems theory for C2. Paper presented at CCRTS: The State of the Art and the State of the Practice.
- Moffat, J. (2003). Complexity theory and network centric warfare. CCRP Publication Series, available for download at www.dodccrp.org.

Previous research conducted by HSI® which investigated dynamic decision making was also reviewed (Brown, Karthaus, Rehak, & Adams, 2009). It is unclear what if anything separates complex decision making from dynamic decision making, as they share many of the same characteristics (e.g., they both involve interrelated decisions). That is, dynamic decision making and complex decision making appear to be very similar phenomena called two different things by different sets of researchers. For the remainder of this report we will refer to the type of decision making we are focussing on as complex, although we will still use some of the findings from the dynamic decision making literature for background.

The definitions of complex decision making are varied and complex themselves. The approach taken to define complex decision making was to compile a list of components that can be found in the complex decision making literature, and see which components separate complex decisions from decisions which are difficult for other reasons (i.e., "complex" vs. "complicated" decision making). This factor list was then presented in mind map format and used as a basis for discussion in the workshop (see Section 3.1 for a detailed description of the results of the literature review).

2.2 Workshop

The goals of the workshop were to review the findings of the literature review, and to finalize the scope of the project, particularly with respect to the complexity concepts that would be focused on in the knowledge elicitation sessions. Specifically, more information was required about which aspects of complexity to focus on (as it was unlikely that they could all be covered easily in each interview) and to determine which CF environments and decision making contexts were of major interest so that SMEs could be recruited to be interviewed for the project.

The workshop took place on Thursday, August 26, 2010, at Defence Research and Development Canada (DRDC) – Toronto, from approximately 10am to 3pm. The workshop was attended by the project team, including the Scientific Authority and the HSI® project team. As well, a few other researchers from DRDC Toronto attended part of the workshop as they were available.

2.2.1 Prioritization and definition of complexity factors

The mind map produced from the literature review (see Annex A) was reviewed by the workshop participants, and minor edits were suggested.

Once the results from the literature review had been agreed upon a discussion was held to determine which of the complexity factors identified in the literature review were of primary interest. Once main complexity factors were selected (Connectivity, Dynamics, Multiple conflicting goals, Under-specified goals, and Independent agents – a full description can be found in Section 3.2), the definitions of those factors were re-examined to ensure agreement.

2.2.2 Potential scenarios and SMEs

Once primary complexity factors had been selected for the knowledge elicitation sessions, potential CF operation types were discussed to determine overall areas which should be considered in scope (e.g., were we interested in domestic operations, expeditionary operations, or should both be in scope?). Once these main types of CF operations were discussed, specific examples that would likely contain the complexity factors of primary interest were listed, and possible Points of Contact (PoCs) were identified. Based on who had previous knowledge of the potential SMEs or PoCs, workshop members were assigned to follow up with the identified SMEs and PoCs to recruit participants (full description of scenarios and SMEs can be found in Section 3.2.2).

2.3 Knowledge elicitation

The goal of the knowledge elicitation sessions was to obtain information about the decision making actually experienced by CF personnel, both to allow the creation of descriptions of those experiences and to facilitate a comparison between the selected complex decision making factors and those CF experiences.

Knowledge elicitation involved interviewing SMEs who had experience in the decision making contexts intuitively identified during the workshop as complex. The interview technique used was semi-structured, individual interviews based on the Critical Decision Method (CDM) technique. The interviews were performed according to DRDC ethics guidelines, under Protocol L-763 (Jarmasz, J., Rehak, L., Taylor, T., Bruyn Martin, L., Karthaus, C., 2011). The phases of the interviews are described in the sections that follow.

2.3.1 Phase 1: Introduction of interview participants and demographics

This phase consisted of introducing the interviewers to the SME and vice versa, to facilitate the discussion. Each SME was asked to answer demographic questions at the beginning of the interview to provide a record of their experience. Demographic questions which were asked included[1]:

- *What is your rank?*
- *How long have you been in the military?*
- *What is your current position?*
- *How long have you held your current position?*
- *What other positions have you held?*

In general, the decision-making context that had previously been identified was reviewed during the discussion of demographic details to ensure that the SME actually had the anticipated experience, and that they understood the decision making context that we thought was complex. In most cases, the interviewer also indicated that other decision making contexts would be considered for further discussion if the SME thought that another of their experiences was more complex than the one we identified.

2.3.2 Phase 2: Project introduction and background

Phase 2 introduced the project background and goals to the SME. The SME had some level of knowledge about the project and its goals which he or she was given when they were recruited to participate. However, due to the time which elapsed since the SME agreed to be interviewed, it was considered beneficial to refresh his or her memory. As well, this face-to-face discussion of the project purpose allowed the SME to ask the interviewers questions about the project in general before he or she began to answer questions.

The specific goals of the project were stated, something similar to:

This project is intended to find similarities between the results of existing laboratory-based research in complex, dynamic decision making and the decision making performed by CF personnel. The main advantage of identifying these similarities would be to extend the research results in order to facilitate and improve the CF educational process.

It should be noted that if the SME had questions about the nature of complex decision making at this time, we mentioned that we would shortly be discussing five main factors involved in complex decision making which would give the SME a clearer understanding of what we meant by the term.

After the SME indicated that he or she understood the general reason for the interview, and any questions that the SME had had been answered, a brief overview of the anticipated interview timeline was provided:

- Demographic questions and general introduction (intro and Phase 1): 5-10 minutes
- Project context and key complexity factors (Phase 2): 15 minutes
- Scenario selection and general scenario details (Phase 3, Step 1): 15 minutes

[1] Note that in this and following sections, italicized text indicates things that were actually said to the SME.

- Scenario timelines and critical decisions (Phase 3, Step 2): 15 minutes
- Scenario challenges and errors (Phase 3, Step 3): 30 minutes
- Scenario strategies and learning (Phase 3, Step 4): 30 minutes

After the timeline was discussed with the SME, the interviewer introduced the five main complexity factors and defined them one at a time, and asked the SME to provide examples from his or her own experience that seemed to show the factors. The key complex decision making factors discussed with the SME, along with the definitions provided, were as follows:

Key factors related to complexity that we are looking for include:

- *Connectivity: Things in the environment influence one another in complicated and unexpected ways*
- *Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects*
- *Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time*
- *Under-specified goals: Goals may be difficult to achieve because they are too vague*
- *Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)*

Once the discussion of the key factors was complete, the SME was handed a sheet containing the factors and their definitions (the material in italics above), and the interview proceeded onto Phase 3.

2.3.3 Phase 3: Description and discussion of scenario

The majority of the data was collected during this phase. The goal was to obtain enough information about a specific complex decision making context experienced by the SME to create a scenario description and map the five key complexity factors onto the scenario description as closely as possible.

The interview format was a modified CDM technique. This technique has proven to be effective in drawing out details of SME's experiences related to decision making. The components of the CDM as we used them are as follows:

Step 1: Scenarios to explore further were identified. At this point, a brief discussion was held with the SME to determine which of the potential decisions they discussed earlier was the most promising to use as a complex decision making scenario. In general, there were usually several options, and the one that appeared to contain as many of the five key complexity factors as possible was chosen and discussed further.

As an example context, the following was developed related to the Liaison Officer, Afghanistan interview, with the assumption that the SME being interviewed was deployed to HQ Afghanistan as a liaison officer:

You have been deployed to HQ Afghanistan as the Canadian Commander's Liaison Officer. The situation in Afghanistan is complex, and included issues such as determining the validity of

information and making decisions about what to recommend. This was a complex problem about how to decide what needs to be done.

- *Can you begin to list out the factors increasing the complexity of the situation? Specific issues may include* (to be used as examples if the DM has difficulty)*:*
    - *How to determine what factors should be given most weight when making recommendations*
    - *How to determine whom to trust and what information to trust*
    - *How to communicate effectively with members of a different culture*
    - *How to determine mentoring needs*
    - *How to determine which activities best support achievement of Canada's goals in theatre.*
- *Can you describe a specific scenario that took place over weeks or months that you found challenging?*
- *What was your role during this scenario?*
- *At what point did you become involved in the context under discussion (e.g., acting as a liaison officer)?*
- *What was your decision making authority in this scenario?*
- *What factors made this particular scenario challenging?*
- *Who were the original stakeholders in this scenario, and did other stakeholders emerge over time?*
- *Did the stakeholders agree about what was important?*
- *Did the stakeholders influence the scenario? Were these influences anticipated?*
- *What was your perception of what was involved in this situation originally? D id your perception of what was involved in this situation change over time? (E.g., were there a set of factors you knew were involved when you first started, and then you realized that additional factors were at play later on?)*
- *During this scenario, were there times when your decisions would have no effects (i.e. there appeared to be strong factors maintaining status quo)? Or a time when your actions would start to have an effect, but then the scenario returned back to status quo?*
- *Can you think of any examples where there was a long trend of no change, and then suddenly there was a dramatic increase or decrease in some scenario aspect? ("aspect" here could be thought of as higher level interest, change in funding, change in manning, etc.)*
- *Do you have any examples of a 2 sided escalation where Blue Forces do X, Red Forces do Y; Blue Forces increase X, Red Forces increase Y continuously?*
- *How you ever had a scenario where the same action had different effects? Difference effects may be immediate, second, or third-order, etc.*

- *Or when there were delays between your actions and the desired effects? [Note: Some further questioning may be desired to verify the link between the action and the effect – for example, what if the action actually had no bearing on the desired effect, but the desired effect was achieved regardless?)*
- *Any examples of actions having the opposite effect than what was intended or anticipated?*

Once a more detailed scenario was agreed upon, the interviewers followed up with questions intended to uncover critical points and additional desired information in Step 2.

Step 2: Once a detailed scenario was agreed upon, the goals, decisions that are made, information used, and situational features that affected performance during the scenario were identified and the timeline of critical points was verified. The goal of this step was to identify all the critical points so complexity behaviours around those critical points could be focused on during Step 3. Questions similar to the following were asked:

- *What were the critical points which happened during this scenario (in sequence)?*
- *At each critical point, what decision(s) or assessment(s) did you have to make?*

The interviewers reviewed the scenario and each critical point that occurred during the decision situation with the interviewee to ensure a common understanding. The procedure in this step varied depending on the thought processes of the SME. Sometimes the SME preferred to review all of the critical points and then think about related decisions, and sometimes the SME moved back and forth between critical points and decisions. However the SME seemed to wish to proceed was accommodated by the interviewer.

During this portion of the interview, a timeline was created on a blank sheet of paper to act as a memory cue for both the SME and the interviewers. Critical points and decisions were written on post-it notes and added to the timeline. The use of post-it notes enabled order changes and spacing changes along the timeline as required.

Once the SME indicated that the critical points and related decisions had been noted satisfactorily, the interviewer moved on to Step 3.

Step 3: Issues which needed to be elaborated were discussed. The main pieces of information we wished to get out of this step included challenges and potential errors.

Let's focus on the decisions made at the first critical point…

- *What made the decision challenging?*
- *Were your goals understood?*
- *Did you have to achieve more than one goal at a time?*
- *Did you have a clear understanding or mental model of the issues involved?*
- *Did you consult others for their input?*
- *What did you NOT know that you really needed to know?*
    - *Was there any way you could you have gotten that information?*
- *What else (besides more information from last question) would have made this decision easier for you?*

- *Were you able to think through the 2nd and 3rd order effects of your decision options?*
- *Were there any unanticipated consequences of your decision?*
- *If you could make this decision again, what would you do differently?*
- *Did you modify your approach to decision making (e.g., level of risk aversion)?*

Each critical point and related decision was discussed using the questions above. After each decision had been reviewed, the interviewers moved on to Step 4.

Step 4: During this step, alternatives were identified and elaborated. Different strategies for performing tasks were discussed and factors that influenced the choice and usefulness of strategies were identified. Ways in which errors might have been prevented were discussed.

- *What were important factors that you feel affected your performance during the scenario?*
- *Was there a time during this or a similar scenario that someone did something and you would have acted differently?*
- *Did you get feedback about how your actions were affecting the scenario?*
- *What would have made this scenario easier for you?*
- *Are there any other types of behaviours that should be taught to people who are likely to experience similar types of scenarios and decisions?*
- *What did you learn from this scenario that your training didn't teach you?*
- *Did the decisions made in this scenario follow the mission command philosophy – if not, why not?*

Near the end of the interview, SMEs were explicitly asked if there were any ideas they had about how education or training could be improved so that other people would be better prepared to deal with the challenges they faced in this scenario, or if they had any other education or training suggestions.

2.4 Analysis methodology

There were several analyses performed on the data acquired in the knowledge elicitation sessions. The first was a description of the scenario, involving the creation of a description of the complex decision making situation described by each SME. The second analysis involved a mapping of the five complexity factors to each scenario, with a rating of the relative contribution of the five key complexity factors to the general difficulty of the scenario. The third analysis was a compilation of the main decision making challenges experienced by the SMEs.

2.4.1 Scenarios

The scenarios were created to provide a description of complex decision making situations actually experienced by CF personnel. For the purposes of this project they serve to illustrate CF experiences and they provide a basis for determining whether the key complexity factors identified from microworld research are relevant to the actual experiences of CF personnel. In future work, it may be that these scenarios can be used to facilitate education and training in complex decision making in the CF.

The information gathered from the interviews was examined to create a summary of the information provided by the SMEs. The scenarios contain a general description of the role of the DM, and a list of the factors that were mentioned by the DM as playing a large role in his or her decision making. Factors that unfolded over time were pointed out as dynamic events are fundamental to complex decision making. Each scenario was submitted to the appropriate SME for review, and scenarios were revised according to the SMEs' suggestions. The scenarios were as descriptive as possible, although the individual SME is not named in them. The SMEs removed any identifying details that they did not wish to be included.

2.4.2 Mapping of five complexity factors to scenarios

One of the main goals of this project was to determine whether five main factors identified from the complexity literature can be mapped to the operational experiences of members of the CF. To facilitate this, an explicit mapping from the scenarios to the five key complexity factors was performed. These are presented in tabular format using the following template:

Table 1: Template for complexity factor mapping to scenarios

Complexity Factor and Definition	Factor Examples	Importance of Factor for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included:	
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: There were subsystems which had their own dynamics in this context. These included:	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included:	
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included:	
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included:	

Because it rapidly became obvious that examples of the complexity factors could be found in the scenarios, a more quantitative approach was attempted to determine the relative importance of the different complexity factors to each of the scenarios. That is, rather than just a yes/no assessment

that the complexity factor was or was not present in the scenario, it was desirable that an assessment be made about which complexity factors were primarily responsible for the complexity of a particular decision making scenario. Because there were not resources available to create an objective complexity rating system, the rating system was relative and only considered the extent to which the complexity factors were present to different degrees in the final 10 scenarios created for this project. That is, a complexity factor was rated as HIGH for a scenario if it was present in that scenario more than in others, and LOW for a scenario if it was present less in that scenario compared to the other 9. It should be noted that these comparisons can only take into account the information provided by the SMEs about their experiences, and it is likely that the relative ratings are profoundly affected by the SMEs' own interpretations and understanding of their experience, as well as their ability to communicate to the interviewers.

There were several steps used to create a rating for the five complexity factors. First, general criteria were created based on the definitions of the five complexity factors examined in the project. For example, the Connectivity factor was defined as "Things in the environment influence one another in complicated and unpredictable ways". From this, two criteria were created, one being "How many interrelated factors have to be considered when making decisions?" and the other was "How many 2nd and 3rd order effects were noted?"

Once these general criteria were determined, each of the 10 scenarios was examined to assess the extent to which the general criteria applied to that scenario. For example, the scenarios were examined to determine the maximum number of interrelated factors that had to be considered when making a single decision. Once these assessments were made, they were compiled and compared to determine what should be considered as "HIGH", "MEDIUM", and "LOW" ratings for each of the criteria. This assessment was based on the overall range present across the scenarios (e.g., all of the counts of maximum number of interrelated factors related to a single decision were compiled). As well, an attempt was made to put approximately equal numbers of scenarios into the three rating categories (i.e., HIGH, MEDIUM, and LOW) so that there would be a range of ratings and differences could be detected (e.g., avoid floor or ceiling effects).

For the template used to create the complexity rating criteria, see Table 2: Template for creating complexity rating criteria. Note that all "General Criteria" (found in the middle column of Table 2 below) were centred on the decision maker (e.g., "Are there many goals?" is asking whether the decision maker had many goals).

Table 2: Template for creating complexity rating criteria

Factor and Definition	General Criteria	Rating (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	How many interrelated factors have to be considered when making decisions? How many 2nd and 3rd order effects were noted?	High <Criteria>
		Medium <Criteria>
		Low <Criteria>
Dynamics:	Were there examples of situations	High

Factor and Definition	General Criteria	Rating (High, Medium, Low) and Justification
The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	that unfolded over time that profoundly affected decision making? How many subsystems impacted the decision-making context? Were there subsystems that had hierarchical aspects (e.g., their own dynamics)?	<Criteria>
		Medium <Criteria>
		Low <Criteria>
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	Are there many goals? Are there problems with goal prioritization? Do these goals necessarily conflict? Are there situations where the goals conflict even if they wouldn't necessarily have to?	High <Criteria>
		Medium <Criteria>
		Low <Criteria>
Under-specified goals: Goals may be difficult to achieve because they are too vague	Are there goals that are vague? To what extent did the vagueness of goals complicate decision making?	High <Criteria>
		Medium <Criteria>
		Low <Criteria>
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Were there independent agents who impact decision making? Did independent agents have goals that conflicted with the DM's goals? Did independent agents have goals that conflicted with one another in such a way that the DM's decision making was affected?	High <Criteria>
		Medium <Criteria>
		Low <Criteria>

Once these ratings were complete, they provided an overview of the relative complexity of the 10 scenarios. These ratings were also used in the top-down challenges analysis (the full list of ratings is provided in Section 3.4).

2.4.3 Challenges analysis

The goal of the challenges analysis was to determine the types of challenges experienced by CF personnel in operations, with the goal of guiding future CF education and training related to complex decision making. There were two components to this analysis: one approach was top-down, the other was bottom-up. The top-down challenges analysis examined the challenges

identified via the mapping from the complexity literature to the scenarios, and the ratings used to assess the relative contribution of the five main complexity factors to the difficulty of each scenario. That is, this approach was top-down as it was guided by previously identified factors that were expected to play a role in making decision-making complex. The bottom-up challenges analysis examined the decision making challenges mentioned by the SMEs during their interviews, and examined them to determine if there were any categories or themes that emerged which represent broad challenge areas that could be addressed in CF education. That is, this approach was bottom-up as it was driven by the data provided by the SMEs during the interviews, rather than preconceived ideas about what would make decision making challenging. The results from these two types of identified challenges were then compared to determine whether the complexity literature seemed to provide an adequate understanding of the difficulties faced by CF personnel when they are making decisions during operations.

Another goal was to determine if different types of challenges were present in different types of scenarios. Challenge ratings and challenge categories were examined across scenario type to determine if there was a distinguishable pattern of challenges. The idea was that, if different types of challenges occur in different types of scenarios, then specialization in decision making instruction might be required so that personnel are educated and trained to deal with the challenges that they are likely to face.

2.4.3.1 Top-down challenges analysis

The top-down challenges analysis was based upon the ratings created for the mapping of complexity factors onto the scenarios. See Section 2.4.2 for a description of the procedure used to create these ratings. Another important question that can be addressed by this analysis is whether different scenario types appeared to differ on their overall level of complexity or complexity components. To determine this, the complexity of the scenarios were scored for each factor ("HIGH" = 2, "MEDIUM" = 1, and "LOW" = 0), the scores were totalled to get an overall complexity score, and then the scenarios were ordered based on their overall complexity and patterns were noted (e.g., what types of scenarios appeared to be highest in complexity). Each complexity factor was examined in the same way to determine if there were patterns in the degree to which each factor manifested in the different types of scenarios.

Once it was determined which scenarios rated as "HIGH" on different complexity factors, they were examined to determine if there were any common characteristics which might distinguish scenarios which were likely to contain that particular complexity factor.

2.4.3.2 Bottom-up challenges analysis

The bottom-up challenges analysis was based upon things that the SMEs explicitly mentioned as being challenging about the decisions they had to make in the scenario they were describing. The information gathered during the knowledge elicitation sessions was examined and challenges were compiled from them. Also included in this list are specific education and training suggestions offered by the SMEs. The list of challenges and education and training suggestions were compiled into a spreadsheet using the format presented in Table 3. Once the list was compiled, the challenges were examined to determine if there were broader themes and subthemes present. These themes were then summarized in the table. Note that descriptions of the general themes are provided in the themes analysis (e.g., see Table 5 in Section 2.4.4.1).

Table 3: Bottom-up challenges template

Scenario	Recommendation	Challenge or Education/Training?	General theme	Subtheme

Once these analyses were performed, they were compared and examined to form conclusions to support education and training initiatives.

2.4.3.3 Bottom-up education and training suggestions

Because one of the key goals of this project is to support CF education and training, once the bottom-up challenge analysis was complete, the list was examined and the number of education and training suggestions for each general theme was identified. The specific suggestions were examined, and general suggestions were derived from them. These general suggestions were entered in the template presented in Table 4.

Table 4: Bottom-up education and training suggestions template

General Theme	Description	General Education/Training Suggestions	Number of Specific Education/Training Suggestions

2.4.4 Collective analysis

Mapping the five main complexity factors to the scenarios showed that the complexity factors appear to be relevant to the experiences of the SMEs. The collective analyses (an overlap and a gap analysis) was performed to integrate the previous analyses and answer several remaining important questions. These questions were:

1. What is the degree of overlap between the challenges identified by SMEs and the five main challenges that we examined from the complexity literature?
2. What are the gaps in the complexity literature that have to be addressed in CF education and training supporting decision making?

2.4.4.1 Examining overlap between complexity research and SME experience

Once the bottom-up challenges analysis was performed, the general themes were examined to determine the extent to which they contained components of the five main complexity factors identified from the complexity literature review. This was done to determine whether the actual experience of CF personnel can be effectively described using complexity ideas, or whether additional ways of presenting information about challenges would be required to facilitate education and training.

To determine whether the general theme overlapped with the complexity category, the specific examples related to each theme were examined. If an example could be found which appeared to be related to one of the five main complexity factors, it was provided and taken as evidence for overlap between the general them and the complexity factor. If no example could be found that was obviously related to one of the five complexity factors, then that general theme was considered to not overlap with the complexity factor. See Table 5 for the template used for this analysis.

Table 5: General themes, definitions, overlap, and gap analysis template

General Theme	Theme Description	Subcomponents	Overlap	Gap Analysis

2.4.4.2 Gap analysis

One of the important pieces of information required from this comparison of the complexity literature and the actual experience of CF personnel is a determination of what important challenges to the decision making of CF personnel are not well captured in the complexity literature. These gaps need to be identified and investigated further if the CF education and training processes are to be adequately supported.

To determine if there were gaps, the general themes and related examples generated from the bottom-up challenges analysis were examined and anything not apparently represented in the complexity literature was identified and included in the general themes analyses (i.e., see Table 5).

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3. Results

3.1 Review of complexity literature

To understand the nature of complex decision making, we reviewed a number of articles. These showed that there are several important components of decision making to consider. These include what characterizes complex decision making environments, what additional factors can influence the complexity of decision making, and behaviours which can be adaptive or pathological in complex decision making situations.

According to Brown et al. (2009; also see Brehmer & Allard, 1991), there are four generic characteristics of the decision-making *task* in complex environments, they are:

1) There are a series of decisions,
2) These decisions are interdependent,
3) The environment changes both autonomously and as a function of the decision maker's actions, and
4) Timing is a key element, where decision makers have little control over exactly when dynamic decisions must be made.

If these factors are not present, then it is unlikely that the environment involves complex decision making.

A further review of the literature revealed factors that are typical of complex decision making *contexts*, and which can add to the complexity of decision making. These include:

1) Connectivity (a large number of diverse, interacting components),
2) Dynamics (constant change, even without the input of a decision maker),
3) Intransparency (opaque relationships between variables),
4) Information overload (i.e., a large amount of data),
5) Independent agents,
6) Multiple goals which might conflict,
7) Underspecified goals, and
8) Challenges with self-reflection.

Collectively, these main 12 factors related to complexity were used to create the skeleton of a Mind Map.

Grisogono (2010) lists behaviours which are supposed to be related to positive outcomes ("good actor behaviours") or related to negative outcomes ("poor actor behaviours") in complex decision making environments. These behaviours were examined and, to eliminate redundancy, similar behaviours were combined (e.g., "extremely interested in information contradicting own view of the world" and "challenges own concepts and beliefs, entertains alternatives" were combined into "challenge own concepts and beliefs, entertains alternatives". These good and bad decision making behaviours were added to the Mind Map and associated with the related complexity factor.

Originally it was hoped that we could gather information about good actor and poor actor behaviours related to complex decision making, and determine which of these should be taught so that CF personnel would be better able to handle complex decision making situations. Unfortunately, many of the good and poor actor behaviours are very difficult to empirically assess. For example, Grisogono (2010) lists "able to judge how much planning is enough" as a good actor behaviour, and "over-planning" (i.e., too much planning) and "bang-bang-decisions" (i.e., too little planning) as poor actor behaviours. Unfortunately, there is no guidance as to how to assess how much planning is actually "enough". By its nature, complex decision making is difficult and unpredictable, and even the best decision makers will not always have a successful outcome, and a successful outcome could be the result of chance even with poor decision making. Therefore, whether behaviours are good or poor cannot reasonably be assessed by examining outcomes only.

Note that, due to resource limitations, the literature review performed for this project was extremely limited. There are two aspects of the complex decision making literature that could not adequately be investigated here, but are worthy of mention. The first is the team component of the complex decision making literature (e.g., Artman, 1999; Clancy, Elliott, Ley, Omodei, Wearing, McLennan, & Thorsteinsson, 2003; and McLennan, Omodei, Holgate, and Wearing, 2003). Although team decision making was beyond the scope of the current work, it is likely highly that this research will be relevant for understanding some of the challenges facing decision makers in the CF. The second aspect of complex decision making research that could not be reviewed here is the role of emotional and motivational factors in complex decision making. This has only recently been examined by researchers, specifically Dörner who is in the process of creating a framework integrating personality and motivational elements with good/poor actor behaviours. Unfortunately, as of the writing of this report that literature is not readily available in English, and so is not cited or reviewed here. Hopefully future work can take advantage of these two areas of research into complex decision making and integrate those findings with the findings reported here.

The complexity terms used in the Mind Map were double checked with the terms used in Funke (2001), and where possible the terms used in that article were used in the mind map and noted. In addition, a preliminary review of operational terminology was performed (largely from the Australian Department of Defence (2009) campaign manual) and some terms were mapped to the related complexity factors to show that these factors likely are relevant to the military domain.

This Mind Map was then used during the Workshop as a basis for discussion. See Annex A for the Mind Map. One thing to note is that, during this review, we found that human limitations are critical for understanding what makes something complex, as it is characteristics and limitations of the decision maker that makes things difficult. However, it was not possible to cleanly map challenges onto human limitations; for example, working memory limitations played a role in most challenges. Thus, human limitations are not explicitly a component of the Mind Map.

3.2 Workshop

During the workshop, the goals were to narrow the scope of the investigation to the components of complexity that the SA thought were most important (due to time and resource considerations it was thought that not all factors could be given equal weight), and to determine which CF environments and decision making contexts were of major interest so that SMEs could be recruited for the knowledge elicitation sessions.

3.2.1 Prioritization and definition of complexity factors

The Mind Map was reviewed and the participants suggested a few minor changes. The revised Mind Map is presented in Annex A.

After discussion, the workshop participants agreed that this project should focus on five main factors related to complexity. These five factors were:

1) Connectivity
2) Dynamics
3) Multiple conflicting goals
4) Under-specified goals
5) Independent agents

These five factors were chosen as they were thought to be most characteristic of complex environments (e.g., not just information overload that can occur in complicated as well as complex decisions) and also what CF personnel seem to talk about when discussing what makes their decisions difficult (e.g., dealing with civilians).

Once these five main factors were chosen, there was further discussion to ensure that everyone had the same understanding of these factors, and definitions were created. The definitions of five key complexity factors were:

1) Connectivity: Things in the environment influence one another in complicated and unpredictable ways,
2) Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects,
3) Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time,
4) Underspecified goals: Goals may be difficult to achieve because they are too vague,
5) Independent agents: There are independent entities in the environment that influence it (they may have different goals than the decision maker).

3.2.2 Potential scenarios and SMEs

Once the five complexity factors had been chosen, potential CF operation types were discussed to determine overall areas that should be considered in scope. Domestic operations and expeditionary operations were both considered to be within scope. It was determined that, when examining expeditionary operations, we should try not to focus only on Afghanistan, if possible. Land force operations, rather than air force or naval operations, were to be the focus of the project.

After discussion, four main CF contexts were considered to be within scope: domestic operations, domestic day-to-day functions, expeditionary offensive operations, and expeditionary humanitarian operations. Several examples that were likely to be complex and fit each of these contexts were noted by workshop participants (see Table 6).

Table 6: Potential CF contexts for knowledge elicitation

Scenario Categories	Potential Scenarios
Domestic, Day-to-day	Personnel
	Capital Acquisition
	Army of Tomorrow - 2021
	Increasing size of CF
	Canadian Forces Leadership Institute
	Directorate of Land Concepts and Designs
	Directorate Doctrine & Training
	Peace Support Training Centre
	Intelligence
	Canadian Land Force Command and Staff College (CLFCSC) – Centre of Excellence (CoE)
Domestic Operations	Olympics
	Arctic Sovereignty
Overseas – Humanitarian	Haiti
	Disaster Assistance Response Team
	Civil Military Cooperation (CIMIC)
Overseas – Offensive	Leaving Afghanistan
	Intel
	"Attacking the network" (counter-improvised explosive device)
	CIMIC
	Reintegration
	Combat Logistics
	Force Generation
	Pre-deployment Task Force Training

Recruitment of SMEs was done with the goal of obtaining interviewees who had experience with specific contexts that involve complex decision making.

3.3 Knowledge elicitation

The knowledge elicitations sessions were intended to obtain information about the actual decision making experienced by CF personnel, to allow the creation of descriptions of those experiences as well as to facilitate a comparison between the five selected complex decision making factors and those experiences.

The knowledge elicitation sessions involved interviewing SMEs who had experience in the decision making contexts which were identified in the workshops as likely representing complex decision making environments. The interview technique used was semi-structured interviews based on the CDM technique. See the Method Section (Section 2.3) for an in-depth overview of the interview structure used.

SMEs were recruited via workshop members and their networks of contacts. There were a total of 12 SMEs interviewed; of these, two interviews were not analysed as the SME had difficulty providing examples of specific situations which involved the complex decision making factors we were concentrating on (either because they could not remember examples or because they were reluctant to discuss examples that could be sensitive). Of the final list of 10 SMEs, the roles discussed are listed below in Table 7. Note that no SMEs with humanitarian experience were on the final list of SMEs recruited for this project.

Table 7: SME roles described in knowledge elicitation sessions

Scenario Category	Context (Role)
Domestic, Day-to-Day	CoE Training Development Supervisor
	CoE Training Developer
	HF Engineer, Capital Acquisition
	Professional Military Education (PME) Revitalization Supervisor
	PME Revitalization Staff Member
	Psychological Operations (PSYOPS) Training Program Developer
Domestic Ops	Military Liaison and Advisor, International Event
Expeditionary - Offensive	Liaison Officer, Afghanistan
	National Support Element (NSE) Officer, Afghanistan
	Chief of Staff, Strategic Advisory Team, Afghanistan

3.4 Analysis

3.4.1 Scenarios

The scenarios were created from the data collected during the SME interviews. The scenarios contain a general description of the role of the SME (referred to as the DM) and a list of the factors which were mentioned by the DM as playing a large role in his or her decision making. Factors that unfolded over time were pointed out as dynamic events are fundamental to complex decision making.

Note that the scenarios were reviewed several times to ensure that details provided were appropriate, both in terms of accuracy and that they did not compromise sensitive information. The scenarios were reviewed by the SME who was the interviewee, one SME who was sensitive to the issues reviewed all scenarios, and the scenarios were also reviewed by the Scientific Authority. Because some of the details provided were considered potentially sensitive, some details were omitted from the scenarios themselves (and the report as a whole), but were still counted as factors that were considered during decision making. For example, when a large number of factors were

listed as being considered in decision making, but those factors would reveal too much about the identity of the DM or the situation, then the number of factors were listed but the factors themselves were not.

Below is a segment of the Liaison Officer, Afghanistan scenario description, to illustrate what is provided in the scenarios in terms of the general description of the DM's role and examples of the factors provided.

3.4.1.1 Example scenario: Liaison Officer, Afghanistan

The DM was assigned to act as a liaison officer in the operations coordination centre in Kandahar, Afghanistan. It was the responsibility of the DM to act as a liaison between the Canadian Forces (CF) and the Afghanistan National Army (ANA), Afghanistan National Police (ANP), Kandahar Prison, Border Security, and the National Directorate of Security (NDS; the Afghanistan Secret Service). At the beginning of the DM's deployment, there was a massive escape from the Kandahar prison. This created an atmosphere of uncertainty about the level of security present in Kandahar, and part of the DM's role was to facilitate an increase in security. In particular, the DM was required to liaise with the relevant parties to increase security in preparation for voter registration which was to occur approximately 8 months later. The DM was to create a "Kandahar city security network"; he had to convince the relevant stakeholders that it was necessary, persuade them to take part, and oversee the process.

Factors which influenced the ability of the DM to manage these processes included:

- The prison break was believed to be facilitated by assistance from inside the prison. Many of the senior leadership at the prison were either arrested or fired. This caused a massive change in personnel and a huge loss of confidence in the prison system and personnel, as well as a re-evaluation of many assumptions held by CF personnel about security in Kandahar;
- There was a quick turnover in Afghan personnel; for example, within 9 months there were 3 governors of Kandahar.

Factors that unfolded over time:

- The prison break led to a process of information gathering. This process gradually revealed that there was no Common Operating Picture (COP) among Afghan security agencies; that the ANP could not effectively get information about threats; that the ANP had difficulty responding to threats; that the ANP could not effectively ask for assistance from other security organizations; and that Afghan security organizations typically work at a tactical level and are not used to working at an operational or strategic level. These pieces of information changed how the DM saw his goals and how they could be accomplished;
- The DM attempted to get the relevant stakeholders to install, maintain, train on, and use communication equipment provided by the U.S. He found this very difficult for many reasons (e.g., cultural differences), and felt that any intervention he tried did not result in change (i.e., there seemed to be a "set point" in the environment that was highly resistant to change). This became more and more frustrating as time went on and the DM grew increasingly hopeless that the C2 infrastructure would be adequate to maintain security.

The full scenario descriptions can be found in Annex B: Operational Scenarios that Contain Complexity.

3.4.2 Mapping of five complexity factors to scenarios

One of the main goals of this project was to determine whether factors from the complexity literature can be mapped to experiences of members of the CF. To facilitate this, an explicit mapping from the scenarios to the five key complexity factors was performed. Examples from the scenarios were provided for each of the factors (for more about the development of this analysis process, see details in Section 2.4.2).

Recall that, due to the relative rating scheme used, a rating of "HIGH" means that this factor occurred in this scenario to a relatively large extent (i.e., relative to the other scenarios), a rating of "MEDIUM" means that this factor occurred in this scenario to an intermediate extent, and a rating of "LOW" means that this factor occurred in this scenario to a relatively small extent; however, any absolute conclusions must be interpreted cautiously as ratings are only relative to the 10 scenarios discussed here. These general criteria and ratings can be found in Table 8, an example mapping of scenario components onto the five complexity factors (for the Liaison Officer, Afghanistan scenario) can be found in Table 9. All of the scenario mappings can be found in Annex C.

Table 8: Complexity rating criteria

Complexity Factor and Definition	Criteria	Rating (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	How many interrelated factors have to be considered when making decisions? How many 2nd and 3rd order effects?	High At least 1 example with 10 or more factors that have to be considered for a single decision At least 1 example with 10 or more 2nd and 3rd order effects (or potential effects) that could result from a single decision
		Medium At least 1 example with between 5 and 9 factors that have to be considered for a single decision At least 1 example with between 5 and 9 2nd and 3rd order effects (or potential effects) that could result from a single decision OR Criteria for high and low categories are not met (e.g., any scenario that meets one but not both high criteria)
		Low No example with more than 4 factors that have to be considered for a single decision No examples with more than 4 2nd and 3rd order effects (or potential effects) that could result from a single decision
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be	Were there examples of situations that unfolded over time that profoundly affected decision making? How many subsystems impacted the decision-making	High Seven or more specific examples of situations that unfolded over time that profoundly affected decision making At least 10 subsystems which impacted decision making and can be shown to have different dynamics (timelines, processes, cultures, rates of change)
		Medium Five or 6 specific examples of situations that unfolded over time

Complexity Factor and Definition	Criteria	Rating (High, Medium, Low) and Justification
delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	context? Were there subsystems that had hierarchical aspects (e.g., their own dynamics)?	that profoundly affected decision making Five to 9 subsystems which impacted decision making that can be shown to have different dynamics OR Criteria for high and low categories are not met (e.g., any scenario that meets one but not both high criteria)
		Low Four or fewer examples of situations that unfolded over time that profoundly affected decision making Four or fewer subsystems which impacted decision making that can be shown to have different dynamics
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	Are there many goals? Are there problems with goal prioritization? Do these goals necessarily conflict? Are there situations where the goals conflict even if they wouldn't necessarily have to?	High At least 6 distinct goals At least 3 cases where there was goal conflict or goal prioritization issues which influenced decision making
		Medium Four or 5 distinct goals Two cases where there was goal conflict or goal prioritization issues which influenced decision making OR Criteria for high and low categories are not met (e.g., any scenario that meets one but not both high criteria)
		Low Three or fewer distinct goals One or no cases where goal conflict or goal prioritization issues influenced decision making
Under-specified goals: Goals may be difficult to achieve because they are too vague	Are there goals that are vague? To what extent did the vagueness of goals complicate decision making?	High Three or more goals that were vague, where the vagueness impacted the ability of the DM to make decisions
		Medium One or 2 goals that were vague, where the vagueness impacted the ability of the DM to make decisions
		Low Goals were generally clear (at least at a high level), and vagueness did not appear to impact the ability of the DM to make decisions
Independent agents: There are independent entities in the environment who influence it (they may	Were there independent agents who impact decision making? Did independent	High Eight or more groups of independent agents who impacted decision making Six or more examples of independent agents with goals that conflicted or could interfere with the DM's goals

Complexity Factor and Definition	Criteria	Rating (High, Medium, Low) and Justification
have different goals than the decision maker)	agents have goals that conflicted with the DM's goals? Did independent agents have goals that conflicted with one another in such a way that the DM's decision making was affected?	Medium Five to 7 groups of independent agents who impacted decision making Three to 5 examples of independent agents with goals that conflicted with or could interfere with the DM's goals OR Criteria for high and low categories are not met (e.g., any scenario that meets one but not both high criteria)
		Low Less than 5 groups of independent agents who impacted decision making Two or fewer examples of independent agents with goals that conflicted with or could interfere with the DM's goals

Table 9: Example scenario mapping onto the five complexity factors (Liaison Officer, Afghanistan)

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: The prison break led to a process of information gathering. This process gradually revealed that there was no Common Operating Picture (COP) among Afghan security agencies; that the ANP could not effectively get information about threats; that the ANP had difficulty responding to threats; that the ANP could not effectively ask for assistance from other security organizations; and that Afghan security organizations typically work at a tactical level and are not used to working at an operational or strategic level. These pieces of information changed how the DM saw his goals and how they could be accomplished; Cultural differences between Afghanistan and Canada are profound; they created a lack of trust and difficulty with coordination, affecting many of the DM's decisions. Factors included: • Extremely high emphasis on interpersonal relationships in Afghanistan (e.g., the importance of personal relationships to Afghans is paramount). This has profound implications; for example, authority based on position alone is not "real" authority to the Afghans (obedience is based on personal relationships); • Differences in the legal system and widespread corruption (e.g., people responsible for the prison break probably were not punished as they could pay to be released, which destroyed trust); • A difference in the idea of what it is to have a job and the attendant responsibility (e.g., a police officer threw away	High Many factors that are interrelated and that have to be considered when making decisions (e.g., there were 15 important cultural effects and implications which influenced the DM's decisions) Examples of 2nd and 3rd order effects (e.g., the DM having to work in a different culture involved at least 15 additional decisions or effects)

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	his phone because he was getting too many 911 calls, even though that was the only phone the calls were coming to); • The Afghans appeared to have the perspective that they had little control over events (e.g., "what Allah wills will happen"), whereas Canadians typically feel they do have control over events. This had implications; for example, the Afghans were not used to the concept of practicing for a possible event and were resistant to such training • Different social standards (e.g., the DM never met the wife of any Afghan he worked with). The DM knew that social relationships were important, but was not able to actually understand what the relationships were as he was not privy to how families were interrelated through marriage; • Literacy is so low in Afghanistan that usually no written records are kept, which means data is not available that would help assess resource and training requirements; • Lack of appreciation for resources (e.g., communications equipment was given to the relevant stakeholders; one faction of the ANA changed locations but left the equipment in the old location unattended without notifying the DM); • Age is more of a factor in creating a sense of authority in Afghanistan. The DM felt that he would have received more respect if he had been older;	
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics	Situations that unfolded over time that profoundly affected decision making included: There was a 911 system that was implemented; this was supposed to be run by the ANP but the chief of police discarded the phone that was used for the 911 calls as he found it inconvenient. The DM volunteered to take over the 911 function; this became a tool to get the ANP involved as the operations room would receive the calls but the ANP would be contacted to answer them. This created additional (an unpredictable) windows of opportunity for collaboration with the ANP, for obtaining intelligence, and for facilitating relationships with civilians; The prison break led to a process of information gathering. This process gradually revealed that there was no Common Operating Picture (COP) among Afghan security agencies; that the ANP could not effectively get information about threats; that the ANP had difficulty responding to threats; that the ANP could not effectively ask for assistance from other security organizations; and that Afghan security organizations typically work at a tactical level and are not used to working at an operational or strategic level. These pieces of information changed how the DM saw his goals and how they could be accomplished;	Medium Three specific examples of situations that unfolded over time that profoundly affected decision making Six subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
which are part of the DM context).	The DM attempted to get the relevant stakeholders to install, maintain, train on, and use communication equipment provided by the U.S. He found this very difficult for many reasons (e.g., cultural differences), and felt that any intervention he tried did not result in change (i.e., there seemed to be a "set point" in the environment that was highly resistant to change). This became more and more frustrating as time went on and the DM grew increasingly hopeless that the C2 infrastructure would be adequate to maintain security. There were subsystems which had their own dynamics in this context. These included: The ANA; The ANP Kandahar prison personnel; The CF; Civilians; The operations centre in which the DM was working. Canadian and other foreign military organizations appeared to have a relatively fast rate of change compared to the Afghan organizations (e.g., longer time to train, longer time to change procedures), with an exception being in the rate of personnel change, with higher turnover in the Afghan organizations.	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: Creating an effective Kandahar city security network Building and maintaining relationships with members of the ANA, ANP, Kandahar prison personnel, Border Security, and the NDS. There were some cases in which it was difficult to achieve all of these goals. One example was that the ANP and ANA were adversaries that the DM was trying to get to work together, and it was difficult to meet both of their needs and expectations. Another example is that the DM had to balance the feedback accuracy that he provided to trainees with allowing them to save face and remain invested (i.e., too much negative feedback would likely have resulted in stakeholders withdrawing from the training).	Medium There were a number of important goals that conflicted in different ways in different situations (6 distinct goals) Two examples of goal conflict Primary difficulty due to problems with getting stakeholder buy-in and participation rather than goals conflicting
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included: The goal of creating an effective Kandahar city security network was superficially clear but what was actually required and the poor state of the current system was only revealed over time.	Medium One example of a vague goal that impacted the ability of the DM to make decisions Goals at a high level were fairly clear, the main challenge was to determine

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
		current security situation and needs
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included: The CF; The ANA (didn't like working with the ANP and vice versa); The ANP; Kandahar prison personnel (not trusted; most were new after the prison break); Border security; NDS; IEC (Independent Electoral Commission) – required protection; Mentors. Large problems due to interpersonal conflicts between different stakeholders (e.g., ANA and ANP didn't want to work together; no one wanted to work with the Kandahar prison personnel) Large problems related to getting stakeholder buy-in and adequate participation; this partially a cultural problem (e.g., all Afghani groups didn't want to cooperate with the DM's training plans)	High Eight independent agents who impacted decision making Seven examples of independent agents with goals that conflicted or could interfere with the DM's goals

Further analyses were conducted based on these mappings, including the Challenges Analyses discussed in the next section.

3.4.3 Challenges Analyses

Both top-down and bottom-up analyses were applied to the data collected in order to identify and quantify decision making challenges.

3.4.3.1 Top-down challenges analysis

The top-down challenges analysis quantifies the mappings done (in Section 3.4.2 above). To determine whether different scenario types appeared to differ on their overall level of complexity, the complexity ratings were scored ("HIGH" = 2, "MEDIUM" = 1, and "LOW" = 0), the scores were totalled to get an overall complexity score (the higher the score, the more complex the scenario), and then the scenarios were ordered based on their overall complexity and patterns were noted (e.g., what types of scenarios appeared to be highest in complexity). Overall complexity rating scores and the ordered list of scenarios by complexity are presented in Table 10.

Table 10: Scenario complexity rating scores

Scenario	Rating Type	Rating	Complexity Total /10	Scenario Type
Military Liaison and Advisor, International	Connectivity	HIGH	10	Domestic Operations
	Dynamics	HIGH		
	Multiple conflicting goals	HIGH		
	Under-specified goals	HIGH		

Scenario	Rating Type	Rating	Complexity Total /10	Scenario Type
Event	Independent agents	HIGH		
NSE Officer, Afghanistan	Connectivity	HIGH	9	Expeditionary Operations
	Dynamics	HIGH		
	Multiple conflicting goals	HIGH		
	Under-specified goals	MEDIUM		
	Independent agents	HIGH		
Liaison Officer, Afghanistan	Connectivity	HIGH	7	Expeditionary Operations
	Dynamics	MEDIUM		
	Multiple conflicting goals	MEDIUM		
	Under-specified goals	MEDIUM		
	Independent agents	HIGH		
CoE Training Developer	Connectivity	MEDIUM	6	Domestic Day-to-Day (Training)
	Dynamics	MEDIUM		
	Multiple conflicting goals	MEDIUM		
	Under-specified goals	HIGH		
	Independent agents	MEDIUM		
Chief of Staff, Strategic Advisory Team, Afghanistan	Connectivity	MEDIUM	5	Expeditionary Operations
	Dynamics	MEDIUM		
	Multiple conflicting goals	MEDIUM		
	Under-specified goals	MEDIUM		
	Independent agents	MEDIUM		
PME Revitalization Supervisor	Connectivity	MEDIUM	4	Domestic Day-to-Day (Training)
	Dynamics	MEDIUM		
	Multiple conflicting goals	MEDIUM		
	Under-specified goals	LOW		
	Independent agents	MEDIUM		
CoE Training Development Supervisor	Connectivity	MEDIUM	4	Domestic Day-to-Day (Training)
	Dynamics	MEDIUM		
	Multiple conflicting goals	MEDIUM		
	Under-specified goals	LOW		
	Independent agents	MEDIUM		
HF Engineer, Capital Acquisition	Connectivity	LOW	2	Domestic Day-to-Day (Procurement)
	Dynamics	MEDIUM		
	Multiple conflicting goals	MEDIUM		
	Under-specified goals	LOW		
	Independent agents	LOW		
PME Revitalization Staff Member	Connectivity	LOW	2	Domestic Day-to-Day (Training)
	Dynamics	MEDIUM		
	Multiple conflicting goals	LOW		
	Under-specified goals	LOW		
	Independent agents	MEDIUM		
PSYOPS Training Program Developer	Connectivity	MEDIUM	1	Domestic Day-to-Day (Training)
	Dynamics	LOW		
	Multiple conflicting goals	LOW		
	Under-specified goals	LOW		
	Independent agents	LOW		

As can be seen from the total complexity scores presented in Table 10, the order of complexity appears to be almost completely separated by general scenario type, at least for the 10 scenarios compared here. The most complex scenario was related to domestic operations, the next most

complex scenario type appeared to be expeditionary operations, and the least complex scenario type appeared to be domestic day-to-day functions.

In addition to the overall complexity ratings of the scenarios, the scenarios were also ordered based on their scores on the five complexity factors. These ratings can be seen in Table 11 through Table 15 below.

Table 11: Scenario connectivity ratings

Scenario	Connectivity Rating	Scenario Type
Military Liaison and Advisor, International Event	HIGH	Domestic Operations
NSE Officer, Afghanistan	HIGH	Expeditionary Operations
Liaison Officer, Afghanistan	HIGH	Expeditionary Operations
CoE Training Developer	MEDIUM	Domestic Day-to-Day (Training)
Chief of Staff, Strategic Advisory Team, Afghanistan	MEDIUM	Expeditionary Operations
PME Revitalization Supervisor	MEDIUM	Domestic Day-to-Day (Training)
CoE Training Development Supervisor	MEDIUM	Domestic Day-to-Day (Training)
PSYOPS Training Program Developer	MEDIUM	Domestic Day-to-Day (Training)
HF Engineer, Capital Procurement	LOW	Domestic Day-to-Day (Equipment Procurement)
PME Revitalization Staff Member	LOW	Domestic Day-to-Day (Training)

Table 12: Scenario dynamics ratings

Scenario	Dynamics Rating	Scenario Type
Military Liaison and Advisor, International Event	HIGH	Domestic Operations
NSE Officer, Afghanistan	HIGH	Expeditionary Operations
Liaison Officer, Afghanistan	MEDIUM	Expeditionary Operations
CoE Training Developer	MEDIUM	Domestic Day-to-Day (Training)
Chief of Staff, Strategic Advisory Team, Afghanistan	MEDIUM	Expeditionary Operations
PME Revitalization Supervisor	MEDIUM	Domestic Day-to-Day (Training)
CoE Training Development Supervisor	MEDIUM	Domestic Day-to-Day (Training)
HF Engineer, Capital Procurement	MEDIUM	Domestic Day-to-Day (Equipment Procurement)
PME Revitalization Staff Member	MEDIUM	Domestic Day-to-Day (Training)
PSYOPS Training Program Developer	LOW	Domestic Day-to-Day (Training)

Table 13: Scenario multiple conflicting goals ratings

Scenario	Multiple Conflicting Goals Rating	Scenario Type
Military Liaison and Advisor, International Event	HIGH	Domestic Operations
NSE Officer, Afghanistan	HIGH	Expeditionary Operations
Liaison Officer, Afghanistan	MEDIUM	Expeditionary Operations
CoE Training Developer	MEDIUM	Domestic Day-to-Day (Training)
Chief of Staff, Strategic Advisory Team, Afghanistan	MEDIUM	Expeditionary Operations
PME Revitalization Supervisor	MEDIUM	Domestic Day-to-Day (Training)
CoE Training Development Supervisor	MEDIUM	Domestic Day-to-Day (Training)
HF Engineer, Capital Procurement	MEDIUM	Domestic Day-to-Day (Equipment Procurement)
PME Revitalization Staff Member	LOW	Domestic Day-to-Day (Training)
PSYOPS Training Program Developer	LOW	Domestic Day-to-Day (Training)

Table 14: Scenario under-specified goals ratings

Scenario	Under-specified Goals Rating	Scenario Type
Military Liaison and Advisor, International Event	HIGH	Domestic Operations
CoE Training Developer	HIGH	Domestic Day-to-Day (Training)
NSE Officer, Afghanistan	MEDIUM	Expeditionary Operations
Liaison Officer, Afghanistan	MEDIUM	Expeditionary Operations
Chief of Staff, Strategic Advisory Team, Afghanistan	MEDIUM	Expeditionary Operations
PME Revitalization Supervisor	LOW	Domestic Day-to-Day (Training)
CoE Training Development Supervisor	LOW	Domestic Day-to-Day (Training)
HF Engineer, Capital Procurement	LOW	Domestic Day-to-Day (Equipment Procurement)
PME Revitalization Staff Member	LOW	Domestic Day-to-Day (Training)
PSYOPS Training Program Developer	LOW	Domestic Day-to-Day (Training)

Table 15: Scenario independent agents ratings

Scenario	Independent Agents Rating	Scenario Type
Military Liaison and Advisor, International Event	HIGH	Domestic Operations
NSE Officer, Afghanistan	HIGH	Expeditionary Operations
Liaison Officer, Afghanistan	HIGH	Expeditionary Operations
CoE Training Developer	MEDIUM	Domestic Day-to-Day (Training)
Chief of Staff, Strategic Advisory Team, Afghanistan	MEDIUM	Expeditionary Operations
PME Revitalization Supervisor	MEDIUM	Domestic Day-to-Day (Training)
CoE Training Development Supervisor	MEDIUM	Domestic Day-to-Day (Training)
PME Revitalization Staff Member	MEDIUM	Domestic Day-to-Day (Training)
HF Engineer, Capital Procurement	LOW	Domestic Day-to-Day (Equipment Procurement)
PSYOPS Training Program Developer	LOW	Domestic Day-to-Day (Training)

Although this challenges analysis uses only a comparison within the set of 10 scenarios developed in this project, several conclusions can be made. Most SMEs had little trouble describing decision making contexts in which they had experienced the five complexity factors, and generally indicated that these situations were challenging. Thus, it seems reasonable to conclude that the complexity challenges noted here do indeed make decision making more difficult, and also that the complexity challenges are frequently experienced by CF personnel. Therefore, addressing these types of challenges in general could improve CF instruction related to decision making in complex domains.

Second, there does seem to be a pattern in which certain types of scenarios tend to have more complex decision making challenges than others. Operations, whether domestic or expeditionary, tend to have higher complexity than day-to-day domestic functions. Because of the limited number of scenarios (particularly that there is only one domestic operations scenario), it is difficult to justify making many conclusions about why one type of scenario is more complex than others. However, it can be noted from comparing the overall complexity scores to the complexity scores for the five factors individually that the order of the scenarios remains fairly constant. That is, the overall complexity rankings of the scenarios are not being driven by one or two of the five complexity factors. Rather, it appears that scenarios that tend to be very complex tend to be complex on all five factors, and those that tend to be less complex tend to be less complex on all five factors, adding support to the conclusion that operational scenarios tend to be more complex overall than domestic day-to-day scenarios.

3.4.3.2 Bottom-up challenges analysis

The bottom-up challenges analysis was based upon things that the SMEs explicitly mentioned as being challenging about the decisions they had to make in the scenario they were describing. The list of challenges and education and training suggestions were compiled into a spreadsheet (see Annex D). Once the list was compiled, the challenges were examined to determine if there were

broader themes and subthemes present. These themes were then summarized in the spreadsheet. Descriptions of the general themes are provided below in Table 16, along with subcomponents of the themes, the scenario types in which the challenges were found, and the number of challenges and education and training suggestions found related to the theme. Note that some challenges as stated by the SMEs had multiple components; these challenges were duplicated and entered in multiple themes as appropriate. There were a total of 304 challenges and education and training suggestions noted by the SMEs.

Table 16: Bottom-up Analysis general themes

General Theme	Description	Subcomponents	Scenario Types Represented	Number of Challenges and Education/Training Suggestions
Authority	Challenges related to the power hierarchy	Subcomponents include challenges related to when people overstep their authority, when to call upon higher authority, not having enough authority to influence a situation, and having to deal with a loss of control when passing an issue on to higher authority	Domestic only (i.e., not noted in expeditionary operations) Some operational, some day-to-day	6
Collaboration	Challenges related to having to work with others	Subcomponents include challenges related to flexibility requirements, having insufficient lead time, the requirement to have joint training, having to collaborate with people with difficult personalities, misunderstandings about the roles of collaborators, a lack of knowledge among collaborators, co-location (or lack thereof), change resistance of collaborators, distrust, hidden agendas, adversarial relationships, high turnover, low motivation, effects of collaboration difficulties on workload, challenges to credibility, need to effectively share information, knowing the team, morale and stress, maintaining leadership, a high level of interdependence with collaborators, difficulty mentoring, coordinating work, requiring high emotional intelligence, requiring good negotiation skills, having the proper people involved in work, including people with diverse experience, giving credit to collaborators, and dealing with collaborators' individual differences	All	90
Communication	Challenges related to exchanging information	Subcomponents include challenges related to inadequate communication procedures, when collaborators use different jargon, when communication is not clear and	All	17

General Theme	Description	Subcomponents	Scenario Types Represented	Number of Challenges and Education/Training Suggestions
	with others	honest, inadequate communications infrastructure, when necessary procedures for communicating information were not in place, when communication was vague, not timely, or not complete, and when communication flow was more rapid among civilians than among CF personnel		
Culture	Challenges related to cultural differences	Subcomponents include speaking different languages, lack of common understanding, differences in the legal system, corruption, different beliefs in individual control, different social standards, different literacy rates, and the need to save face	Expeditionary only	16
Direction	Challenges related to understanding command intent or other instructions	Subcomponents include getting clear direction, having an unclear chain of command, being asked to perform an impossible task, and requiring flexibility,	All	17
Evaluation	Challenges related to determining if goals have been accomplished	Subcomponents include time delays, no baseline available, objective assessment being difficult, empirical evaluation being required, a lack of feedback, and unpredictability of feedback	Domestic only Operational and day-to-day	9
Experience	Challenges related to the skills and knowledge possessed by DMs	Subcomponents include using SMEs where possible, having the right person in the right job, using intuition, and needing relevant experience	Domestic only Operational and day-to-day	5
Goal conflict	Challenges related to having multiple goals that can conflict	Subcomponents include considering multiple factors, achieving multiple conflicting objectives, and considering long-term effects	All	11
Information	Challenges related to the information available to the DM (not meant to include challenges related to communicating	Subcomponents include dealing with information overload, difficulty getting correct information, difficulty evaluating the validity of information, having insufficient information, dealing with changing information, separating interrelated factors, high workload, using first principles to generate data, collecting new data, updating information, needing lessons	All	20

General Theme	Description	Subcomponents	Scenario Types Represented	Number of Challenges and Education/Training Suggestions
	with individuals)	learned, and requiring real world information		
Location	Challenges related to where the scenario took place	Subcomponents include security requirements, harsh conditions, and lack of flexibility	All	6
Personality	Challenges related to the personality of the DM	Subcomponents include having the right person in the right job, networking, dealing with authority, effects of being Type A, and handling independence	All	5
Planning	Challenges related to creating or modifying plans	Subcomponents include insufficient planning, having the right planning tool at the right time, dealing with politics, having a lack of previous similar events, uncertainty, incorrect assumptions, scope changes, incorrect planning, procedure changes, lack of required information, interdependence of planning components, long lead times, use of trigger points, adapting plans, backup plans, high rate of change, changes dictated by outside forces, resource shifting, requiring updated information, identifying needs early, requiring flexibility, short timelines, lack of control, high stakes, using available resources, requirement for on-going planning, using go/no go criteria, being vulnerable to the unexpected, and unpredictability	All	50
Resources	Challenges related to managing or finding adequate resources	Subcomponents include budget concerns, communication infrastructure, power infrastructure, lack of equipment, timeline, planning, need to achieve multiple objectives, having a funding review, inconsistent expectations, time limitations, changes in available resources and consequences, uncertainty, roads, transportation, availability in general, scheduling, balancing, staff, location, replenishment, sleep and rest, and information	All	43
Role justification	Challenges related to having to convince others that the	No subcomponents noted	Domestic day-to-day and expeditionary	7

General Theme	Description	Subcomponents	Scenario Types Represented	Number of Challenges and Education/Training Suggestions
	DM's role or the role of trainees is important			
Strategic issues	Challenges related to the strategic level of operation (e.g., governmental directives; considering strategic implications of actions)	No subcomponents noted	Domestic day-to-day and expeditionary	3

There were several types of challenges that did not appear in all types of scenarios (domestic operations, domestic day-to-day functions, and expeditionary operations). Several challenge types appeared only in domestic scenarios ("Authority", "Evaluation", and "Experience"), "Culture" challenges appeared only in expeditionary scenarios, and some themes appeared in domestic day-to-day and expeditionary scenarios, but not in domestic operations ("Role justification" and "Strategic issues"). Because these challenges did not appear across all scenario types, this may indicate that there are different types of decision making challenges that are found in different situations, and different types of instruction may be required. Of course, it is also possible that these challenges are present to an equal extent in all scenario types, and were simply not detected.

However, although there were some challenge types that were not found across all scenario types, a large number were (Collaboration, Communication, Direction, Goal conflict, Information, Location, Personality, Planning, and Resources). This suggests that there are challenges that make decision making difficult across contexts. Therefore, decision making instruction could be utilized to improve how these challenges are handled and this instruction would be helpful in a great many situations. The importance of teamwork, collaboration and communication to CF success has been documented in previous research also (e.g., see Thomson, Adams, Hall, Brown, Flear, 2011).

3.4.3.3 Bottom-up education and training suggestions

The bottom-up analysis was examined and specific education and training suggestions were identified related to the general themes. As appropriate, specific suggestions were made a bit more general to combine closely related suggestions. For example, "Make sure communication is clear" was used to summarize the specific SME suggestions "Comes down to making sure all communication is clear" and "Need to work on getting everyone speaking the same language". See Table 17 for the list of bottom-up education and training suggestions.

Table 17: Bottom-up training suggestions

General Theme	Description	General Education/Training Suggestions	Number of Specific Education/Training Suggestions
Authority	Challenges related to the power hierarchy	Be sure to engage your higher authority at the proper time	1
Collaboration	Challenges related to having to work with others	Bring all required people together for face-to-face meetings to solve problems, coordinate, make decisions as a team, understand people's views and needs, etc.	43
		Effective collaboration requires instruction to evolve a common understanding between organizations and to create a network of personal relationships and build trust	
		CF personnel must have good emotional intelligence, negotiation skills, interpersonal skills, and be able to build relationships	
		Know your team – who is on the team, their level and type of knowledge, their personality, whether they are team players	
		Build and use a personal network of relationships	
		Coordinate involvement of collaborators – get buy-in, notify early when you want groups involved	
		Take care of group cohesion, keep people engaged	
Communication	Challenges related to exchanging information with others	Make sure communication is clear	5
		Make sure you get all required information	
Culture	Challenges related to cultural differences	Make sure you understand the extent of cultural differences and their impact on your mission	1
Direction	Challenges related to understanding command intent or other instructions	Make sure you have clear intent and that it is recorded	8
		Need to ensure that the command structure is suitable for the task	
Evaluation	Challenges related to determining if goals have been	Need to compare plan to actual steps taken and identify what worked and whether assumptions were valid – this needs to be done in an accessible way so that it is used	4

General Theme	Description	General Education/Training Suggestions	Number of Specific Education/Training Suggestions
	accomplished	Use empirical evidence when available and don't rely on experience and intuition if you don't have to	
Experience	Challenges related to the skills and knowledge possessed by DMs	Need the right person in the right job – proper and recent experience – get people with the experience you need (e.g., SMEs)	5
Goal conflict	Challenges related to having multiple goals that can conflict	Need to carefully consider pros and cons of possible decisions with conflicting goals	2
Information	Challenges related to the information available to the DM (not meant to include challenges related to communicating with individuals)	Should ensure that you have access to recently updated information	4
		Be careful about data accuracy	
		"Real world" information is often better than instruction	
Location	Challenges related to where the scenario took place	*No education or training suggestions for this challenge.*	0
Personality	Challenges related to the personality of the DM	Need to have the right personality for the job (e.g., how you handle lack of authority, how you handle independence, ability to establish relationships)	5
Planning	Challenges related to creating or modifying plans	Need to be able to see when plans need to change	11
		Need to be flexible and able to handle ambiguity in planning	
		Need to understand how much planning is required (e.g., how much detail, how far in advance)	
		Use planning techniques as required (go/no go points, trigger points, OPP vs. IPP)	
Resources	Challenges related to managing or finding adequate resources	If possible, try to take advantage of related resource pools to achieve multiple goals	2
		Time resource acquisition properly relative to when resources can be used	

General Theme	Description	General Education/Training Suggestions	Number of Specific Education/Training Suggestions
Role justification	Challenges related to having to convince others that the DM's role or the role of trainees is important	Need to be able to justify your role	4
Strategic issues	Challenges related to the strategic level of operation (e.g., governmental directives; considering strategic implications of actions)	Try to be sensitive to potential strategic issues in all aspects of planning	1

As can be seen from Table 17, there were many (96) education and training suggestions offered by the SMEs, and much overlap (as indicated by the fact that usually there are many more Specific suggestions than General ones). Most suggestions were related to enhancing collaboration, possibly indicating that this is an area where CF instruction should be improved.

3.4.4 Collective Analyses

Mapping the five main complexity factors to the scenarios showed that the complexity factors appear to be relevant to the experiences of the SMEs. The collective analyses (overlap and gap analyses, described in Section 2.4.4) were performed to integrate the previous analyses and answer two remaining important questions. These questions were:

1. What is the degree of overlap between the challenges identified by SMEs and the five main challenges that we examined from the complexity literature?
2. What are the gaps in the complexity literature that have to be addressed in CF education and training supporting decision making?

3.4.4.1 Examining overlap between complexity research and SME experience

Once the bottom-up challenges analysis was performed, the general themes were examined to determine the extent to which they contained components of the five main complexity factors identified from the complexity literature review. This was done to determine whether the actual experience of CF personnel can be effectively described using complexity ideas, or whether additional ways of presenting information about challenges would be required to facilitate education and training.

To determine whether the general theme overlapped with the complexity category, the specific examples related to each theme were examined. If an example could be found which appeared to be related to one of the five main complexity factors, it was provided and taken as evidence for

overlap between the general theme and the complexity factor. If no example could be found that was obviously related to one of the five complexity factors, then that general theme was considered to not overlap with the complexity factor (although it could be that this information was simply not obtained in this project). The description of the overlap between the two challenge analyses is presented in Table 18.

Table 18: Overlap between challenge analyses

General Theme	Description	Subcomponents	Overlap
Authority	Challenges related to the power hierarchy	Subcomponents include challenges related to when people overstep their authority, when to call upon higher authority, not having enough authority to influence a situation, etc.	Contains elements of dynamics (e.g., making sure to engage higher authority at proper points in time), multiple conflicting goals (e.g., getting resolution by engaging higher authority vs. maintaining control of decision making), and independent agents (e.g., stakeholders were overstepping their range of authority). There were no obvious examples of connectivity or underspecified goals.
Collaboration	Challenges related to having to work with others	Subcomponents include challenges related to co-location (or lack thereof), change resistance of collaborators, distrust, hidden agendas, etc.	Contains elements of connectivity (e.g., upcoming leaders in collaborating organizations should be identified and invited to attend CF education and training. This would result in building familiarity with organizations, people, and jargon, create the possibility for on-going collaborative exercises, and create an embedded liaison), dynamics (e.g., meeting requests were responded to less favourably over time), multiple conflicting goals (e.g., delicate balance between giving accurate and helpful feedback and making people demotivated), underspecified goals (e.g., the DM tried to meet demands for requirements but stakeholders kept coming back and asking for more and for information to be presented in different ways), and independent agents (e.g., people were highly motivated to be self-protective).
Communication	Challenges related to exchanging information with others	Subcomponents include when collaborators use different jargon, when necessary procedures for communicating information were not in place, when communication was vague, etc.	Contains elements of connectivity (e.g., no nexus existed for communicating CF intelligence to other organizations (e.g., RCMP) and this was a serious problem as it was illegal to communicate information from CF assets that had to do with conducting surveillance of Canadians on Canadian soil), dynamics (e.g., news can travel quickly in the Afghan population, adding to the risk of riots), and independent agents (e.g., some team members did not appropriately communicate information to the DM in a timely way). There were no obvious examples of multiple conflicting goals or underspecified goals.

General Theme	Description	Subcomponents	Overlap
Culture	Challenges related to cultural differences	Subcomponents include speaking different languages, lack of common understanding, differences in the legal system, etc.	Contains elements of connectivity (e.g., low literacy rate in Afghanistan so there are few written records), and independent agents (e.g., there is a high level of corruption in Afghanistan). There were no obvious examples of dynamics, multiple conflicting goals, or underspecified goals.
Direction	Challenges related to understanding command intent or other instructions	Subcomponents include getting clear direction, having an unclear chain of command, being asked to perform an impossible task, etc.	Contains elements of connectivity (e.g., need to coordinate as much as possible with higher command (e.g., CANOSCOM) to get information needed to form education and training objectives), multiple conflicting goals (e.g., given instructions from higher command to do things without any funds available), underspecified goals (e.g., can be a problem that Generals don't give very concrete and clear intent), and independent agents (e.g., requests for clarification from superiors about prioritization of programs did not result in clear direction). There were no obvious examples of dynamics.
Evaluation	Challenges related to determining if goals have been accomplished	Subcomponents include time delays, no baseline available, objective assessment being difficult, etc.	Contains elements of connectivity (e.g., need to analyse steps taken, OPP used, compare plans to actual operation, identify what worked, examine assumptions), dynamics (e.g., lack of timely feedback), and independent agents (e.g., trainees respond unpredictably to events). There were no obvious examples of multiple conflicting goals or underspecified goals.
Experience	Challenges related to the skills and knowledge possessed by DMs	Subcomponents include making sure the right person is in the right job, using intuition, needing relevant experience, etc.	Contains elements of connectivity (e.g., need to know how Ottawa works, dealing with public servants, procurement, etc.), multiple conflicting goals (e.g., need to be able to "walk both sides of the fence"), and independent agents (e.g., ensure that people creating exercises have proper and recent experience). There were no obvious examples of dynamics or underspecified goals.
Goal conflict	Challenges related to having multiple goals that can conflict	Subcomponents include considering multiple factors and achieving multiple conflicting objectives	Contains elements of connectivity (e.g., users have multiple conflicting needs; making changes will almost inevitably affect multiple needs both positively and negatively), dynamics (e.g., have to balance short-term and long-term goals), multiple conflicting goals (e.g., delicate balance between giving accurate and helpful feedback and making people demotivated), and independent agents (e.g., changes to programs should involve consultation with a large number of stakeholders,

General Theme	Description	Subcomponents	Overlap
			(e.g., all elements). There were no obvious examples of underspecified goals.
Information	Challenges related to the information available to the DM (not meant to include challenges related to communicating with individuals)	Subcomponents include getting information with errors, finding it difficult to get correct information, having insufficient data, etc.	Contains elements of connectivity (e.g., proposals for funding involve many interrelated factors), dynamics (e.g., unpredictable response after information exchange (silence or many more requests)), and independent agents (e.g., there was resistance to including testing for all important interacting factors). There were no obvious examples of multiple conflicting goals or underspecified goals.
Location	Challenges related to where the scenario took place	Subcomponents include harsh conditions, security requirements, lack of flexibility, etc.	Contains elements of connectivity (e.g., the environmental effects make maintenance more frequent), dynamics (e.g., location of conflict had large impact on flexibility to replenish resources), and independent agents (e.g., demand by the training course location to not have trainees in uniform). There were no obvious examples of multiple conflicting goals or underspecified goals.
Personality	Challenges related to the personality of the DM	Subcomponents include independence, type A, having the right personality for the job, etc.	Contains elements of connectivity (e.g., need to establish relationships), and independent agents (e.g., can't have type-A personalities in full-time CoE positions because they may butt heads with the military). There were no obvious examples of dynamics, multiple conflicting goals, or underspecified goals.
Planning	Challenges related to creating or modifying plans	Subcomponents include challenging assumptions, insufficient planning, lack of control, etc.	Contains elements of connectivity (e.g., after the prison break there was a distrust of prison staff and many assumptions were reassessed), dynamics (e.g., training cannot rely on templates because the rate of change is too high), multiple conflicting goals (strategies for controlling number of bidders focussed on getting more bidders so in the end there were too many), underspecified goals (e.g., deliverables kept changing so contracting was difficult), and independent agents (true sustainment was not practiced by the BG, leading to lack of planning information).
Resources	Challenges related to managing or finding	Subcomponents include communications infrastructure, roads, budget,	Contains elements of connectivity (e.g., difficult to get travellers back to the compound due to lack of vehicles and poor passability of roads), dynamics (e.g., because of a short planning timeline

General Theme	Description	Subcomponents	Overlap
	adequate resources	etc.	changes in one resource meant that other changes had to be made to accommodate it), multiple conflicting goals (e.g., requirements for new training programs are given without additional resources), underspecified goals (e.g., disagreements between stakeholders regarding scope of funding), and independent agents (e.g., the time of trainees is limited, so training package size is limited).
Role justification	Challenges related to having to convince others that the DM's role or the role of trainees is important	No subcomponents	Contains elements of connectivity (e.g., an outside consultant might have had a bigger impact), underspecified goals (e.g., "go PSYOPS those guys"), and independent agents (e.g., lack of appreciation for DM's contribution). There were no obvious examples of dynamics or multiple conflicting goals.
Strategic issues	Challenges related to the strategic level of operation	No subcomponents	Contains elements of connectivity (e.g., government announcements can force unexpected readjustments in training), multiple conflicting goals (e.g., political/strategic concerns limited resource options), and independent agents (e.g., got unwanted attention at strategic level when wore military uniforms). There were no obvious examples of dynamics or underspecified goals.

As can be seen from Table 18, most of the general themes from the bottom-up challenges analysis have significant overlap with the five main complexity factors examined in this project. However, although there is significant overlap, it should be noted that only in the case of the general theme "Goal conflict" and the complexity factor "Multiple conflicting goals" does there appear to be a close connection between how the SMEs think of the challenges to their decision making and the way that these challenges are presented in the complexity literature. This is important for education, as CF personnel should be able to identify with the way that challenges are presented during education and training to maximize understanding of the ideas being presented.

Another way of looking at the data presented in Table 18 is to organize the data according to the five complexity factors. This has been done in Table 19 below.

Table 19: Themes organized by five complexity factors

Complexity Factor	General Themes which Contain the Complexity Factor
Connectivity	Collaboration; Communication; Culture; Direction; Evaluation; Experience; Goal conflict; Information; Location; Personality; Planning; Resources; Role justification; Strategic issues
Dynamics	Authority; Collaboration; Communication; Evaluation; Goal conflict; Information; Location; Planning; Resources
Multiple conflicting goals	Authority; Collaboration; Direction; Experience; Goal conflict; Planning; Resources; Strategic issues
Underspecified goals	Collaboration; Direction; Planning; Resources; Role justification
Independent agents	Authority; Collaboration; Communication; Culture; Direction; Evaluation; Experience; Goal conflict; Information; Location; Personality; Planning; Resources; Role justification; Strategic issues

3.4.4.2 Gap analysis

One of the important pieces of information required from this comparison of the complexity literature and the actual experience of CF personnel is a determination of what important challenges to the decision making of CF personnel in seemingly complex environments are not well captured in the complexity literature. These gaps need to be identified and investigated further if the CF education and training processes are to be adequately supported. Note that the gap analysis is based upon the literature review described earlier in this report, and therefore is limited to the findings described in that subsection of documents which were reviewed.

To determine if there were gaps, the general themes and related examples generated from the bottom-up challenges analysis were examined and anything not apparently represented in the complexity literature was identified and included in the gap analysis. Explicit examples of how the complexity concepts have been investigated in microworlds and potential limitations in this research are included where applicable; however, just because a gap is noted does not mean that it would be difficult to investigate these concepts. The gap analysis is presented in Table 20 below:

Table 20: Gap analysis

General Theme	Description	Subcomponents	Gap Analysis
Authority	Challenges related to the power hierarchy	Subcomponents include challenges related to when people overstep their authority, when to call upon higher authority, not having enough authority to influence a situation, etc.	The complexity literature mentions independent agents; it is possible that some of these independent agents could be in a position of authority over the DM, although this was not explored in the literature reviewed. Often in microworlds the participant is the only DM; this means they are the main decision making authority in the situation and do not have to worry about a higher authority. Team decision making is likely underrepresented and more research is needed to

General Theme	Description	Subcomponents	Gap Analysis
			understand how authority influences complex decision making. There are examples in CF experience where the DM can only advise and doesn't have overt decision making power. There is also an example in CF experience of the rank of the DM creating a perception of the importance of his role – the perception of authority generally is not investigated in microworlds.
Collaboration	Challenges related to having to work with others	Subcomponents include challenges related to co-location (or lack thereof), change resistance of collaborators, distrust, hidden agendas, etc.	There was little acknowledgement in the complexity literature reviewed that decision making is a collaborative process, particularly in cases where the entire team makes decisions together, rather than each team member being responsible for task components. The collaborative nature of decision making is usually ignored in microworlds, whereas it is critical in the CF (people get direction from higher command, they work in teams, and decisions are usually implemented by teams). Specific aspects of collaboration worthy of mention include: the importance of networking, hidden agendas, co-location, building a common understanding, negotiation, having to deal with disagreements, team building, and dealing with personnel turnover.
Communication	Challenges related to exchanging information with others	Subcomponents include when collaborators use different jargon, when necessary procedures for communicating information were not in place, when communication was vague, etc.	The need to gather information appears to be included in the complexity literature; however, there is little discussion of how this is actually accomplished or the challenges involved. Communication appears to be much more important in CF contexts than as represented in microworlds, at least the ones reviewed in this project (although

General Theme	Description	Subcomponents	Gap Analysis
			there is a teamwork-based literature that may involve this issue). While communication plays a role in microworlds in that the DM needs to acquire information, generally how the DM interacts with the environment is not framed in terms of communication. Specific aspects of communication worthy of note include the need for communication to be clear, complete, and accurate, and the need to deal with different jargon when trying to communicate with different organizations.
Culture	Challenges related to cultural differences	Subcomponents include speaking different languages, lack of common understanding, differences in the legal system, etc.	The complexity literature mentions independent agents; it is possible that cultural differences between the DM and independent agents might add to the complexity of decision making, although this was not explored in the literature reviewed. Cultural issues as a whole are generally critical for the CF in expeditionary operations and yet examples of them in microworlds were not noted, at least in the literature reviewed for this report. Important aspects of culture include language differences, general differences in understanding (e.g., what does having a job mean? How should you be trained for a job?), differences in social norms (e.g., relationship of age to authority), social infrastructure (e.g., no banks in Afghanistan), and different literacy rates.
Direction	Challenges related to understanding command intent or other instructions	Subcomponents include getting clear direction, having an unclear chain of command, being asked to perform an impossible task, etc.	This category appears to be similar to the fact that in the complexity literature it is noted that it is sometimes difficult to get clear goals, whether it is getting goals from higher command or the DM creating concrete goals. Components of decision making involving direction which are

General Theme	Description	Subcomponents	Gap Analysis
			important to the CF which are not stressed in microworlds include the need to obey higher command, having the option to clarify orders with higher command, and the need to understand the command hierarchy.
Evaluation	Challenges related to determining if goals have been accomplished	Subcomponents include time delays, no baseline available, objective assessment being difficult, etc.	This theme overlaps heavily with the fact that the complexity literature notes that it is often difficult to determine your net effect on the environment, that feedback is delayed, etc. Microworld researchers are trying to improve how people evaluate their impact on complex environments – though clear solutions have yet to be determined. Thus, there are no obvious gaps between this theme and the complexity literature.
Experience	Challenges related to the skills and knowledge possessed by DMs	Subcomponents include making sure the right person is in the right job, using intuition, needing relevant experience, etc.	Many researchers (e.g., Dörner, 1996) note that experience likely plays an important role in determining the effectiveness of a DM in complex decision making. However, the actual components of experience which make a difference are not thoroughly understood (e.g., are there general skills or situation specific skills?). Often microworlds use novice decision makers (at least, the DM has limited experience in that environment). In the CF, people are trained to fill their roles, and are often carefully selected for their skills and experience ("need the right person in the right job").
Goal conflict	Challenges related to having multiple goals that can conflict	Subcomponents include considering multiple factors and achieving multiple conflicting objectives	This theme appears to overlap completely with the factor "Multiple conflicting goals" from the complexity literature. Some specific examples of goal conflict have social aspects which are usually not included in

General Theme	Description	Subcomponents	Gap Analysis
			microworlds (e.g., managing stakeholder expectations)[2].
Information	Challenges related to the information available to the DM (not meant to include challenges related to communicating with individuals)	Subcomponents include getting information with errors, finding it difficult to get correct information, having insufficient data, etc.	This theme overlaps heavily with the idea in the complexity literature that it is difficult to determine your net effect on the environment, and that there is often a great deal of information to deal with and it may change over time, etc. One noteworthy aspect of this theme is that information can actually be incorrect.
Location	Challenges related to where the scenario took place	Subcomponents include harsh conditions, security requirements, lack of flexibility, etc.	The complexity literature generally includes consideration that factors related to the location involved in decision making (e.g., weather) might make a decision more complex, even if they do not specify a location per se.
Personality	Challenges related to the personality of the DM	Subcomponents include independence, type A, having the right personality for the job, etc.	The complexity literature does consider individual differences, although these are generally differences in experience and general decision making skill rather than personality. Some of the behaviours noted as being effective or ineffective in complex decision making contexts (e.g., Grisogono, 2010) could be framed in terms of personality (e.g., the tendency to attribute failures to oneself or others). The personality of the DM is not generally considered in microworld research, although some is considered in the context of determining whether there are good and poor actor behaviours related to decision making. Most aspects of personality mentioned by the CF personnel do not seem to appear in the complexity literature (e.g., being type A, being

[2] Additional research from cognitive psychology and cognitive science (e.g., goal formation and selection) may also provide valuable insights that could be incorporated into complex decision making and microworld studies.

General Theme	Description	Subcomponents	Gap Analysis
			able to get along with other people and network). As noted in the section discussion the results of the literature review (see Section 3.1), there is currently an attempt by Dörner to create a framework integrating personality and motivational elements with good/poor actor behaviours. Unfortunately, as of the writing of this report that literature is not readily available in English, and so is not cited or reviewed here.
Planning	Challenges related to creating or modifying plans	Subcomponents include challenging assumptions, insufficient planning, lack of control, etc.	There appear to be a lot of complexity factors that are relevant for this theme (which is quite large). The need to plan and modify plans is central in the complexity literature. Components of planning that might not be adequately covered by the complexity literature include the need to involve other groups in planning as well as understand how the plan will be perceived by observers (similar to the Collaboration theme).
Resources	Challenges related to managing or finding adequate resources	Subcomponents include communications infrastructure, roads, budget, etc.	The complexity literature discusses time as a resource that must be managed, particularly in terms of the dynamics of the environment requiring the DM to monitor time and interact with the environment at particular times. Resources typically represent limitations that have to be considered when making decisions, and similar resource issues would likely be used in most microworld environments. Thus, resource management is central to most microworld research. One other aspect of resource management - stakeholder disagreements and the perceptions related to resource allocation - are important in CF

General Theme	Description	Subcomponents	Gap Analysis
			contexts but may not be adequately represented in the complexity literature.
Role justification	Challenges related to having to convince others that the DM's role or the role of trainees is important	No subcomponents	The complexity literature and microworld research do not appear to deal with issues such as the DM having to justify their role.
Strategic issues (e.g., governmental directives; considering strategic implications of actions)	Challenges related to the strategic level of operation	No subcomponents	Strategic issues are extremely important issues to the CF as they are generally related to high level international relations. These types of issues could likely be represented in the complexity literature as important goals, although the term strategic would not be used per se. Strategic issues could be one level of factor used in microworlds, if they were presented in a military context. Similar to resource issues.

The gap analysis presented above shows that, while a number of the general themes from the bottom-up challenges analysis are somewhat similar to those ideas we examined from the complexity literature, there appear to be a number of gaps in the complexity literature that was reviewed for this project when it is compared to the experience of CF SMEs. For example, as mentioned in the literature review section (Section 3.1), reviewing team decision making was considered beyond the scope of this project. Therefore, in the literature reviewed, there appeared to be little acknowledgement in the complexity literature that decision making is often a collaborative process, and DMs rely on other people for information as well as to implement their decisions. Specific related issues that should be examined in future work (including a more in-depth literature review) include having to deal with team building, having to deal with personnel turnover, and having to negotiate. Similarly, the need for DMs to justify their role also does not appear to be dealt with in the complexity literature reviewed for this project, but may be addressed elsewhere.

As previously noted, because the literature review undertaken in this project was rather limited, it is certainly possible that the gaps identified in this analysis are simply examined in other research that was not included in this review. However, to the extent that these gaps are real and not addressed in the complexity literature, they present a risk to the plan of using the complexity literature to guide the education and training of military SMEs to make decisions in complex environments, as critical factors may be omitted.

4. Discussion

The overall goal of this project was to determine the usefulness of existing research in complex decision making (in particular, findings from research using microworlds) for enhancing military education and training related to decision making in complex environments. To accomplish this goal, we attempted to answer several questions, including:

1. Do CF personnel experience the types of decision making challenges described in the complexity literature?
2. Are there challenges that CF personnel typically face in their decision making that are not covered by the complexity literature?
3. What challenges need to be addressed in CF education and training to support decision making?
4. Can microworlds likely be used to facilitate this education and training?

These questions will be answered in turn. As well, in this section we discuss additional insights gained, limitations of this research, and possible future work.

4.1 Do CF personnel experience the types of decision making challenges described in the complexity literature?

CF personnel do seem to experience the types of decision making challenges described in the complexity literature. Anecdotally, when we reviewed the five factors with the SMEs, they had little trouble coming up with multiple examples of each of the five factors from their experience, and generally agreed that such factors are challenging for their decision making.

We empirically assessed whether there was an overlap between the five main complexity factors we were examining and the experience of the CF SMEs by mapping the five complexity factors to the scenarios described by the SMEs. In every case, the five factors were represented in the scenarios to at least some extent, and added to the difficulty of the scenario. Thus, it can be concluded that the challenges described in the complexity literature are experienced by CF SMEs.

4.2 Are there challenges that CF personnel typically face in their decision making that are not covered by the complexity literature?

There do appear to be many types of decision making challenges related to complex environments that are not adequately addressed in the complexity literature. The gap analysis identified many challenges experienced by CF personnel which were not identified in the complexity literature review. Some aspects of CF decision making which can be challenging are either not present in the literature or deemed to be beyond the scope of the literature review performed for this project (e.g., the collaborative nature of decision making, role justification), whereas some challenges have important components which were not included in the literature review (e.g., communication issues such as jargon differences between organizations). As noted, it may be that these issues are addressed in other complexity research which was not examined in the current project.

4.3 What challenges need to be addressed in CF education and training to support decision making?

The first way to identify challenges that need to be addressed in CF education and training to support decision making is to examine the education and training suggestions offered by the SMEs. A second way to identify challenges that need to be addressed in CF education and training is to examine the challenges identified from the top-down analysis, and identify challenge types that may be the most broadly applicable and therefore good targets for intervention.

4.3.1 Challenges from SME suggestions

By examining the education and training suggestions provided by the SMEs, it can be seen that, by a wide margin, the largest category of suggestions had to do with enhancing collaboration (almost half of all suggestions). This strongly indicates that this is an area where CF instruction should be enhanced. Key components related to enhancing collaboration include creating and building networks, making sure to have face-to-face meetings as much as possible, knowing the people you are collaborating with (personalities, experience, etc.), and building skills such as emotional intelligence, interpersonal skills, and relationship building. Many of the SMEs interviewed for the project indicated that these skills are critical for success in many of the situations in which the CF currently finds itself operating. As the CF typically makes and implements decisions in a team environment, the ability to effectively collaborate is a critical decision making factor.

The education and training suggestion that CF personal need to be able to justify their role (related to the Role justification theme), at least as presented by the SMEs we interviewed, does appear to indicate that this is an additional gap in current CF instruction. CF personnel need to be able to justify their general role as well as the specific role they have in a particular situation, and this should be explicitly taught.

Some of the education and training suggestions made by the SMEs are likely related to things that are already part of CF instruction, but the fact that they were included as challenges and education and training suggestions indicates that they may not be performed effectively at all times. When these components of complex decision making are not performed effectively it likely leads to significant challenges with decision making. Examples include education and training suggestions related to Planning (e.g., "Need to be able to see when plans need to change") and Communication (e.g., "Make sure communication is clear"). It does appear that these aspects are taught; nonetheless, there is some component of these decision-making behaviours which are challenging. This could be because they are difficult to teach, it is difficult to understand when they should be performed, it is difficult to implement them effectively, etc.

Several education and training suggestions actually do not appear to be suggestions for enhancing learning; rather, they appear to be selection criteria. For example, making sure that you have the right person in the right job (a suggestion related to the Experience theme) and making sure that you have the right personality for the job (a suggestion related to the Personality theme) seem to be suggestions that certain people should be chosen for certain jobs, and other people should not be chosen for those jobs. Thus, it is possible that, in addition to teaching individuals to be better DMs, certain people may have certain attributes that make them more or less suitable for particular role – making some individuals more suitable for particular complex decision making environments than others.

By examining the bottom-up challenges, it can be seen that there were several challenge themes that represented a large proportion of the challenges mentioned by the SMEs. Of 310 challenges or

education and training suggestions mentioned, Collaboration (91 challenges), Planning (50 challenges), and Resources (45 challenges) represent two thirds of all challenges. If limited instructional changes can be made, it would seem to be beneficial to focus on those categories. In addition to these being the most frequent types of challenges mentioned, it should also be noted that they apply across all three scenario types examined (domestic operations, domestic day-to-day, and expeditionary operations), which should also mean that they are most broadly applicable and addressing them should provide greater benefit than addressing challenges that are only present in certain scenario types.

4.3.2 Challenges from complexity literature

There was evidence provided in the top-down analysis that all five complexity factors (connectivity, dynamics, multiple conflicting goals, underspecified goals, and independent agents) played some role in each of the scenarios. So, there is some evidence that these issues should be addressed in CF education and training if decision making is to be adequately taught. However, it would also be useful to determine if there are patterns in the degree to which different scenario types are affected by the different types of challenges to see if targeted intervention is required, or whether there are challenges that broadly apply so that general instruction could impact a wide variety of decision making situations.

As noted in the top-down analysis, a pattern related to which types of scenarios tend to have higher complexity ratings appears. Briefly, operations tend to have higher complexity ratings than domestic day-to-day functions. The scenario with the highest complexity score was the domestic operations scenario; however, it is difficult to make conclusions that domestic operations are intrinsically more complex than expeditionary operations, because there was only one example of a domestic operation. Thus, it is possible that education and training interventions aimed at improving complex decision making should be targeted first at CF personnel with an operations focus, rather than domestic day-to-day focus. Whether complex operational decision making education and training can be supplied "just in time" for operational deployment or is best provided throughout the career of CF personnel remains unknown to the authors.

It is difficult to make definitive conclusions about the relative difficulty produced by the different complexity factors in this research, as the complexity factors were only compared within the set of 10 scenarios produced for this project. Thus, it is not possible to determine whether one factor should be addressed more than another factor. However, future work should be performed to investigate this issue.

4.4 Can microworlds likely be used to facilitate this education and training?

Based on the gap analysis, there are many factors which are important for CF decision making that have not been implemented in microworlds; some of these could probably be easily implemented (e.g., DMs getting incorrect information), but some would likely be much more difficult to implement successfully (e.g., training people how to build relationships and increase their interpersonal skills).

The largest challenge area pointed out by the SMEs as needing development was the ability to facilitate collaboration. The typical microworld setting where a single DM interacts with a computerized virtual world seems fundamentally inadequate for addressing the issues related to facilitating collaboration, as the DM is not interacting with real people, building a real network of

relationships, etc. While microworld environments have been developed with a collaborative aspect (e.g., networked computer systems where teams interact with the world together), it seems as though there are still fundamental aspects of collaboration that still need additional research if they are to be implemented, or would be very challenging to implement (e.g., the ability to read and interpret body language, talk face-to-face, have informal gatherings where people get to know one another, etc.) However, some aspects of collaboration and related challenges could probably be implemented in microworlds. For example, simulating collaboration within a distributed team and components of dealing with different languages (i.e., some effects of culture as well as collaboration) and terminology have likely been successfully implemented in a microworld (but a thorough review of that literature was beyond the scope of this project).

4.5 Additional insights

4.5.1 The importance of social factors

The importance of social factors in decision making contexts experienced by CF personnel cannot be overemphasized. Social ties and social networks are critical for the way that CF personnel typically achieve their goals. Indeed, social factors were usually one of the first things that the SMEs mentioned during their interviews, and most SMEs mentioned specific education and training suggestions related to enhancing the ability to build social relationships.

One major difference between the decision making experienced by CF personnel and the types of decision making explored in the complexity literature that we reviewed is that real-life decision makers usually have to act in the context of other people, and there are a lot of ways this impacts the situation. Usually goals involve the state of other people (e.g., defeating an enemy), and usually the actions of the decision maker are implemented through the combined actions of others (e.g., in a military unit the soldiers actually carry out the decisions of the commander, as on his or her own the commander could do very little to implement his or her decisions). Also, decision making is often a social (i.e., team-based) activity rather than strictly an individual activity.

The effective representation of social factors in microworlds requires more research (at least based on the literature reviewed for this project) and it is unknown how it could be implemented effectively within the paradigm of a single user interacting with a simulation, typical of most microworld research. Not only is the social context fundamental, but it creates the risk of different types of errors; for example, errors in implementation due to misunderstandings etc., which makes communication critical. Note that there have been attempts to use virtual environments to teach people to be more effective decision makers when dealing with cultural challenges; these are discussed in the cultural section below.

It is worth considering that social factors may be fundamentally different from other aspects of complex decision making environments. It is possible that people process information related to social factors differently than other contextual factors, and find implications related to social factors easier to understand. One of the most difficult aspects of complex decision making is generally thought to be appreciating dynamic aspects of the environment; for example, time-lagged effects (i.e., when causes and effects are separated in time) are often not fully understood by decision makers (e.g., Dörner, 1996). However, one of the main time-lagged effects that the SMEs seemed to understand very well and mentioned frequently was the benefit of creating positive social relationships and social networks, and also the cost of creating negative social relationships. The creation and maintenance of positive social relationships was mentioned as a specific goal with immediate benefits, but it was also usually mentioned that these positive social connections would

likely pay off in some tangible way in the future. For example, people understand that when they do a favour for someone, this is generally a good thing, because if they require help in return someday they are more likely to get it. Thus, some aspects of social relationships etc. are seen a setting the stage for future benefits. In fact, building a social network is a form of risk management, putting something "in the bank" as a way of solving unknown future problems.

It is possible that this relatively developed ability to understand complexity as related to social issues may have contributed to the fact that social factors have typically been ignored in the complexity literature. Intuitively, the definition of what is "complex" is based on what humans are poor at doing. That is, if humans can do something relatively easily, then it is not seen as complex. However, it is not clear that social factors should be ignored by complexity researchers simply because humans for the most part are better at understanding the implications of social factors than other types of factors. Indeed, as social factors appear to be so critical to CF decision making contexts, it would seem as though these factors deserve a great deal of attention.

4.5.1.1 Culture

Culture appeared as a general challenge theme, and it is closely related to social factors. While culture was narrowly defined in the challenges analysis, cultural issues also come into play when different organizations or other groups have to work together (these types of challenges were generally included in the Collaboration challenge theme). The current focus in the CF on Joint, Interagency, Multinational, and Public (JIMP) operations means that challenges related to culture are likely to increase, and education and training programs should be developed to prepare CF personnel to operate effectively in the midst of such challenges.

An overview of research into what factors contribute to the ability to competently deal with other cultures (Adams & Brown, 2011) provided evidence supporting our claim that social factors are likely to be important in CF decision making. Factors that Adams and Brown found to be important for cultural competency which overlap with the social factors our SMEs thought were important included:

- Ability to negotiate
- Emotional stability and self-regulation (e.g., Emotional Quotient)
- Relationship building
- Influence and persuasion
- Extraversion
- Agreeableness
- Conflict resolution

Thus, independent research has found that the importance of social factors is likely to play a large role in the success of CF operations, and CF personnel should be adequately supported in the development of these skills and attributes.

Adams and Brown (2011) also noted that there are immersive environments and virtual humans being used in cultural competence instruction. Immersive environments can help to provide a visual representation of another environment (e.g., dress, architecture) and get personnel used to situations that they will encounter in the future. For example, the Tactical Iraqi Language and Culture Training System (TLCTS) allows users to explore a virtual Iraqi village, and includes language, local sounds, buildings, etc. which allow a sense of a real Iraqi village. The Adaptive Thinking and Leadership (ATL) is a team-training system in which some users experience both sides of intercultural scenarios. Users take turns playing people from different cultures, and are

provided with backstories and goals to make their experience more accurate. Both of these systems can be adjusted to give feedback about cultural errors.

Although it is possible that systems similar to the TLCTS and the ATL could be modified to create microworlds to help train cultural competency, and perhaps even additional social factors, Adams and Brown (2011) noted that explicit feedback from a human instructor is required to facilitate learning. As well, these sorts of training systems teach cultural specific information and do little to teach the factors mentioned earlier in this section as generally required for effective decision making (e.g., ability to negotiate, emotional stability, etc.) Thus, it is likely that virtual environments and microworlds will continue to be inadequate for teaching cultural issues in complex decision making effectively.

4.5.2 Poor and good actor behaviours

As noted previously, originally it was hoped that we could gather information about good and poor actor behaviours related to complex decision making, and determine which of these should be taught so that CF personnel would be better able to handle complex decision making situations. Unfortunately, it was difficult to accomplish this, for several reasons. As already discussed, many of the good and poor actor behaviours are very difficult to empirically assess. Another reason that it proved to be very difficult to examine good or poor actor decision making behaviours was because it was unknown how well the SMEs understood their own decision making behaviours and environments. In some cases, SMEs had difficulty describing their decisions and decision making processes, which made it difficult to assess their behaviours as good or bad. Further, there were very few examples provided of bad actor behaviours on the part of the DM themselves. It is unknown whether this was due to report bias on the part of the SMEs, whether it was because they really didn't perform any poor actor behaviours, or whether there was a lack of understanding of what would constitute good or poor actor behaviour.

It is worth noting that there is some evidence that attempting to find behaviours that are always "good" or "poor" may be misguided, and that the critical ability of a DM in a complex environment is knowing what behaviour to display when. That discussion is the topic of the next section.

4.5.3 Knowing when to do what

Complex Adaptive Systems (CAS) (e.g., Grisogono, 2006) have often been studied to understand aspects of complexity. CAS are so named because they:

1. Are a set of interacting or interdependent components (i.e., a system),
2. Are composed of many parts which as a whole exhibit behaviours not predictable from individual components (i.e., they are complex), and
3. Show individual and collective behaviour change as a result of experience (i.e., they adapt).

Examples of CAS include the stock market, social insect colonies, the brain, and the immune system.

The study of CAS makes apparent that effectively adapting to a complex environment may require showing different properties at different times. For example, Grisogono (2006) discusses the "paradoxical" nature of CAS by pointing out the fact that many of the properties of CAS appear to conflict with one another. An example given is that "robustness to damage" requires that some changes in the CAS are inhibited, while "innovation" requires that some changes in the CAS are amplified. Thus, it may not be possible to determine certain properties which are always adaptive;

rather, what makes a CAS (or DM) effective might be the combination of having an adequate range of behaviours for the situations it encounters, as well as the ability to appropriately shift between this range of behaviours at the proper times for optimal results.

The fact that contrasting behaviours may be required to create an effective CAS has serious implications for teaching CF personnel to be better decision makers. It might not be so important to teach the DM to use particular skills, but rather the DM needs to be able to do a large number of different things, and the most important thing is knowing WHEN to do WHAT.

4.6 Limitations

There are several limitations related to the research presented in this report. Some limitations are related to the data collection method, some are related to the data analysis method, some are related to the scope of the report, and some are due to practical limitations related to recruitment of SMEs.

Some limitations have to do with the way that data was collected for this report. Although we acquired a lot of useful information, because the data we collected was elicited via interviews, it is possible that a lot of information was missed. It is possible that the interview questions were not adequate to elicit all of the important information from all SMEs. This could have been because SMEs might not have really appreciated all aspects of their complex decision making situations. As well, in some cases years had elapsed between the events we were asking about and the time of the interview. Thus, there could be missing information because SMEs did not appreciate the importance of it at the time, have since forgotten, or memory may be biased (e.g., availability heuristic, hindsight bias; see Adams, Rehak, Brown, & Hall, 2009 for a review of decision-making biases). In addition, two hours was not sufficient time to gather all relevant information about many of the scenarios. It is reasonable that more time would have been required to fully explore all aspects of a complex decision making domain, and only the highest level aspects may have been assessed in this study. It is also possible that information was not gathered because SMEs could not articulate aspects that they felt were important in their decision making (i.e., it may be difficult to describe complex decision making in words).

The education and training which SMEs have received might also have influenced the data we could collect for this project. In addition to shaping their behaviour, it is highly likely that SMEs' education and training influences their view of situations they encounter and shapes their understanding of the situation. This in turn would influence the information they would provide during interviews about these situations. For example, if SMEs are taught to pay attention to certain aspects of their decision making environment (e.g., who the authority figures are), then these aspects might prove to be more salient to the SMEs than other aspects, regardless of the amount each decision making aspect actually impacted the SMEs' decisions.

Because we were asking individuals about events they had experienced and we had little empirical evidence to compare the SMEs' statements with, it was unknown the extent to which any bad outcomes were the result of poor decision making behaviours or whether the situation was just extremely difficult. For example, several SMEs mentioned that they thought that they basically tried everything and nothing could be done to improve the situation. It is unclear whether this was the case (i.e., there was a set point in the environment that was highly resistant to change), or whether lack of change was the result of poor decision making.

Another limitation related to data collection was that there were some sensitive topics which SMEs did not wish to discuss, or which they did not wish to be included in our report. This limited our understanding and representation of the scenarios, as some factors could not be included.

There were also limitations related to the analysis method used in this project. The creation of the scenarios, the mapping between the scenarios and the complexity concepts, and the bottom-up extraction of challenges and education and training suggestions were done in a somewhat subjective manner. There may have been unknown bias on the part of the analyst which might have shaped the findings. Future work could use more objective methods for data analysis (e.g., a factor analysis).

It was also a limitation that validating the findings of the complexity research was out of scope for this project, and the amount of literature reviewed was quite small. Thus, it is possible that important factors related to complexity were either not found in the literature search (although the literature search findings were validated at least somewhat in the workshop) or that important factors are missing from the complexity literature. In some cases these omissions were noted (e.g., in the gap analysis), but there may be additional missing factors.

We were limited as to the experiences of the SMEs who were recruited for this project. Some limitations were known in advance (e.g., this project had an army focus rather than an air force or navy focus, so the results may not be as relevant for the air force or navy), whereas some were the result of recruitment limitations (e.g., humanitarian expeditionary operations were intended to be included but no SMEs were recruited; only one example of a domestic operation was included).

5. Conclusions and Recommendations

Challenging decision making environments such as those experienced by the CF are commonly being characterized as "complex" by researchers (e.g., Grisogono, 2010). However, many of these claims have been made based on intuition, rather than a detailed examination of whether the factors that make decision making "complex" according to the literature actually are present in the environments encountered by the CF. The main goal of this project was to determine whether research investigating complex decision making is relevant to the decision making actually experienced by Canadian Forces personnel, and how that research might be used to improve Canadian Forces instruction related to decision making.

A literature review identified major components of what makes decision making difficult according to the complexity literature. Five factors were chosen for further examination: Connectivity, dynamics, multiple conflicting goals, underspecified goals, and independent agents. Without exception, we found that these five factors appeared in each of the scenarios describing the experiences of the SMEs we interviewed. As well, the SMEs indicated that these factors do indeed make their decision making more difficult. Thus, it appears as though factors identified in the complexity literature are indeed part of the experience of CF personnel.

There appear to be some types of scenarios which are more challenging than others. For example, operations (both domestic and expeditionary) tend to contain more complexity components than domestic day-to-day functions. It also appears as though scenarios tend to be complex on all five complexity factors. This indicates that CF personnel who are going to engage in operations likely require more support to improve their decision making abilities than personnel who are principally engaging in domestic day-to-day functions.

Although there was significant overlap between the factors identified in the complexity literature and the factors which appeared to make decision making difficult for CF personnel, there were also significant gaps identified, with many additional challenges facing CF personnel that were not identified in the complexity literature review. The most important of these appear to be factors related to collaboration, including cultural factors. Other areas which challenge CF personnel which appear to require additional instruction include planning and dealing with resource challenges. CF education and training could also be enhanced if future work examines which of the complexity challenges examined in this project are the most challenging for CF personnel, and aim interventions at increasing DM's proficiency in those areas.

5.1 Future Work

Potential future work which could be logical extensions of this report include exploring different data collection techniques, using different data analysis techniques, and investigating different complexity and education and training topics.

5.1.1 Data collection

Using different approaches for collecting data could add to our knowledge about how complex decision making occurs in the CF. Conducting interviews with a two-hour time limit allowed us to gather useful information about decision making in complex CF environments at a high level, but there was probably a lot of lower-level information that was not collected. For example, it might be useful to collect more information about how SMEs attempted to understand the factors that were

important to their decision making as this could be used to determine whether there are general strategies for understanding a complex situation. Conducting longer interviews, or multiple interviews with the same SME, could allow for more information to be gathered.

Now that some information has been gathered about the types of challenges which play a role in CF complex decision making, it is possible that data collection methods could incorporate questionnaires to gather more data about aspects of these challenges such as their frequency of occurrence, the difficulty of dealing with the challenges, the degree of impact they have on the outcome in different situations, etc.

Data collection could also be done through other methods such as observation. One way of incorporating observation would be to combine observation with interviews similar to the method used in this project, if the scenarios being investigated were ongoing. Observing the situation would provide a more complete understanding of the complexity phenomena that could be compiled and used for instructional purposes. Another potentially useful way to collect data using observation is using experienced SMEs to observe the behaviour of novices being taught, and to get the SMEs to comment on things that the novices are doing well and what they are doing poorly. If there is some objective way to determine what the novices are actually doing (e.g., they are being instructed using microworlds which record their actions and the outcomes) this information could prove valuable for understanding what components of decision making the SMEs are actually considering when determining whether the novices are performing well or not. This would be particularly beneficial when considering that experts often do have good insight into what novices are doing well or doing poorly, but may have difficulty articulating exactly what is good or poor about the novices' behaviours. As well, experts often do not have a conscious understanding of how they determine that a novice's behaviours are good or poor, or their conscious understanding does not actually reflect the information that they are actually considering. Using an observational method such as the one described here would overcome many of these limitations.

5.1.2 Data analysis

It would also be possible to analyse data via a factor analysis. The benefit of performing a factor analysis of complexity would be to determine which factors influence the perception of complexity from a CF perspective. This could be used to guide our understanding of how CF personnel perceive complexity and enable education and training enhancements to be presented in terms intuitive to those being taught. To perform a factor analysis of complexity, researchers could ask SMEs to rate the similarity of the complexity of pairs of scenarios or situations. These ratings would be analysed to determine the underlying mental structure of complexity (i.e., what factors appear to determine what makes a situation complex in the SMEs' view). One of the benefits of this approach is that it is a data-driven (i.e., bottom-up) approach, so the SMEs would be telling us what complexity is rather than us trying to fit their statements into our structure. However, it would not necessarily tell us about their performance.

The data analysis methods used in this project were largely subjective. Semantic analysis is sometimes used to determine the main ideas and their relationships within written documents, and such an analysis would provide a more objective way of categorizing the experiences of CF SMEs.

Finally, if questionnaires are used to collect data, it would be possible to perform correlations between factors which have been rated in questionnaires. For example, if SMEs are used to rate the performance of novices, and information is gathered about what those novices are actually doing, those two sets of data can be correlated to determine which behaviours actually tend to result in

higher rankings from the SMEs, and experimenters will not have to rely on the ability of SMEs to articulate what they think is important in complex decision making.

5.1.3 Additional topics

Determining whether there are distinct types of behaviours which are generally effective or ineffective for complex decision making have been of interest to researchers (e.g., Grisogono, 2010). In this project, it proved to be extremely difficult to assess whether DMs showed good or poor actor behaviours, and this was partially due to behaviour descriptions being vague and not easily measured. Future work could be done to refine the good and poor actor behaviour descriptions and develop a method to empirically assess the presence of those good and poor actor behaviours. This could in turn facilitate the assessment of the viability of particular decision making behaviours, and determine whether there are general behaviours that should be taught to facilitate CF decision making. Note that this work should take into consideration that the factors of importance may be "meta-cognitive", or related to understanding what behaviours to produce when, than related to specific types of behaviours (e.g., always making goals concrete).

There was evidence that the five main complexity factors (connectivity, dynamics, multiple conflicting goals, underspecified goals, and independent agents) were all present to some extent in the 10 scenarios created for this project. However, because the five main complexity factors were only compared within the set of 10 scenarios produced for this project, it is difficult to make definitive conclusions about the relative difficulty of the different complexity factors in CF decision making. Future work could be performed to address this issue. Possible methods include attempting to create a general assessment measure for the complexity factors, perhaps with a different means of collecting data (e.g., observation of exercises).

It could be useful to investigate differences between novice and expert decision makers in complex CF domains. Assuming that there are differences, understanding these differences could help to streamline learning, if the different behaviours that experts engage in tend to result in better decision making. As well, novices, although they are not generally as effective as experts, often have better insight into how they are making decisions, and it would be useful to understand what novices find difficult. It is possible that novices find different decision making components more difficult than experts do, and experts were the focus of this project. It may be that instruction in complex decision making should occur in stages, with more basic skills having to be acquired before advanced strategies for dealing with complex decisions can be effectively taught or applied by the decision maker.

It should be noted that, if no consistent differences are found between novice and expert decision makers, this might indicate that instruction should focus on general rather than context specific strategies for making complex decisions. That is, if novice and expert decision makers do not appear to differ in consistent ways, it might indicate that there is no situation specific information or experience that benefits the decision maker. This is another area of research which should be further investigated. If there are strategies for making complex decisions that can be widely and effectively applied across a variety of situations, it would be of extreme benefit to teach these strategies rather than focus instruction on situation specific strategies. However, if there are situation specific elements that should be taught to support effective decision making in complex CF domains, this should be known and these strategies need to be described.

Another area for future research would be investigating possible interactions between effective decision making strategies and individual differences. It is very possible that there are general strategies that are effective in multiple decision making domains, but that different people will have

different levels of success at applying these strategies. For example, it would be possible that someone with a large working memory (i.e., they can keep track of more pieces of information and understand connections between them than average) might be able to keep track of many different factors at the same time and consider how they might interact with one another. Such an individual could benefit from instruction about which factors tend to be important and how they tend to interact in a specific domain. However, if that person is very shy, they might not benefit from learning which individuals were important in a particular context, because they might find it very difficult to create positive social interactions with these individuals. On the other hand, someone who was very extraverted but with a smaller working memory size might show the opposite pattern and benefit much more from learning with whom it might be beneficial to create positive social relationships, but benefit less from learning all of the factors which might impact their decisions as they would have less ability to reason about the interrelationships between them.

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Annex A: Mind Map of Complexity Factors and Behaviours

See the Mind Map.

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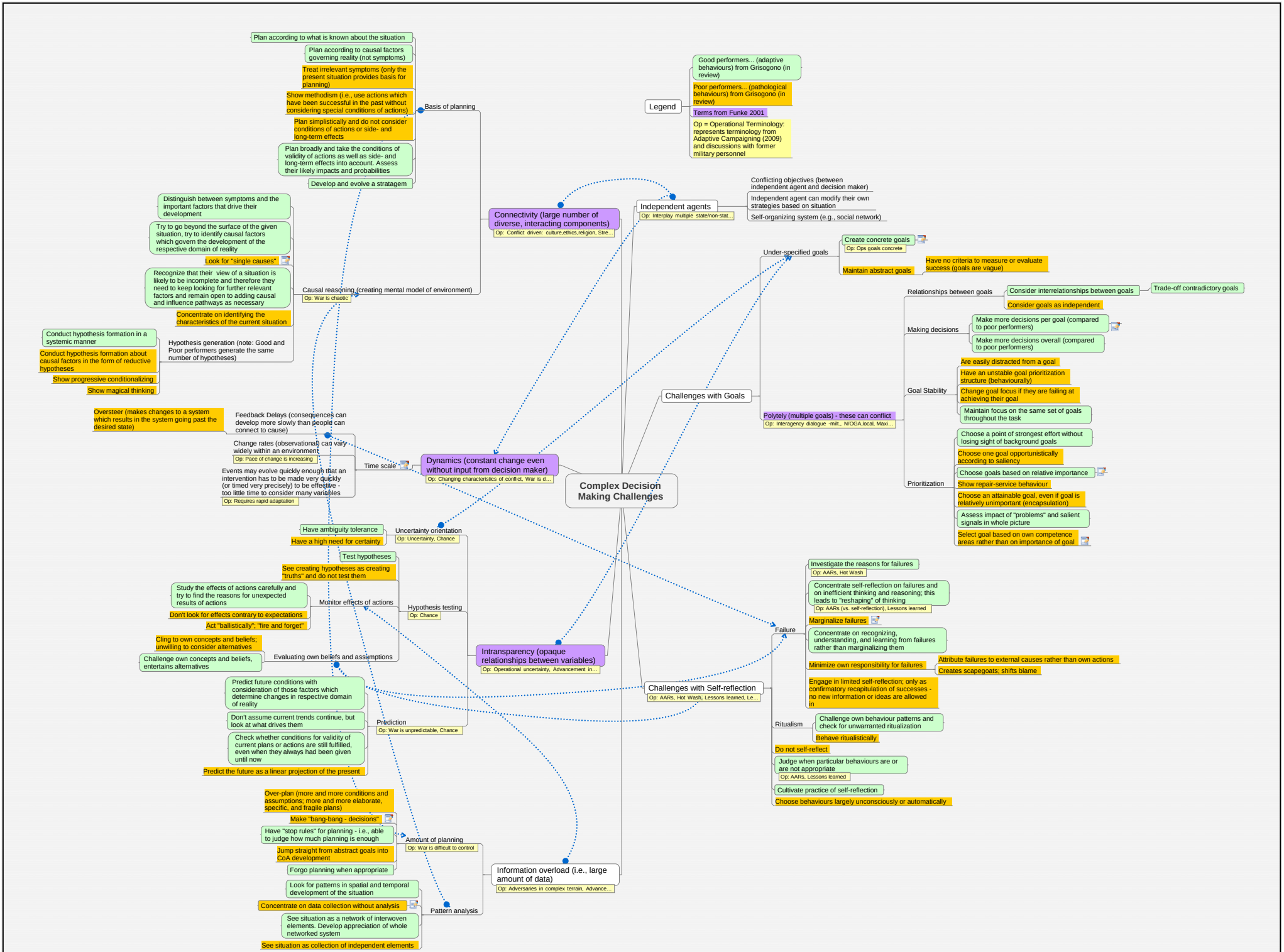
Complex Decision Making Challenges
Legend
Good performers... (adaptive behaviours) from Grisogono (in review)
Poor performers... (pathological behaviours) from Grisogono (in review)
Terms from Funke 2001
Op = Operational Terminology: represents terminology from Adaptive Campaigning (2009) and discussions with former military personnel
Connectivity (large number of diverse, interacting components)
Op: Conflict driven: culture,ethics,religion, Stre...
Independent agents
Op: Interplay multiple state/non-stat...
Conflicting objectives (between independent agent and decision maker)
Independent agent can modify their own strategies based on situation
Self-organizing system (e.g., social network)
Dynamics (constant change even without input from decision maker)
Op: Changing characteristics of conflict, War is d...
Time scale
Feedback Delays (consequences can develop more slowly than people can connect to cause)
Change rates (observational) can vary widely within an environment
Op: Pace of change is increasing
Events may evolve quickly enough that an intervention has to be made very quickly (or timed very precisely) to be effective - too little time to consider many variables
Op: Requires rapid adaptation
Oversteer (makes changes to a system which results in the system going past the desired state)
Intransparency (opaque relationships between variables)
Op: Operational uncertainty, Advancement in...
Uncertainty orientation
Op: Uncertainty, Chance
Have ambiguity tolerance
Have a high need for certainty
Hypothesis testing
Op: Chance
Test hypotheses
See creating hypotheses as creating "truths" and do not test them
Monitor effects of actions
Study the effects of actions carefully and try to find the reasons for unexpected results of actions
Don't look for effects contrary to expectations
Act "ballistically"; "fire and forget"
Evaluating own beliefs and assumptions
Cling to own concepts and beliefs; unwilling to consider alternatives
Challenge own concepts and beliefs, entertains alternatives
Information overload (i.e., large amount of data)
Op: Adversaries in complex terrain, Advance...
Pattern analysis
Look for patterns in spatial and temporal development of the situation
Concentrate on data collection without analysis
See situation as a network of interwoven elements. Develop appreciation of whole networked system
See situation as collection of independent elements
Amount of planning
Op: War is difficult to control
Over-plan (more and more conditions and assumptions; more and more elaborate, specific, and fragile plans)
Make "bang-bang - decisions"
Have "stop rules" for planning - i.e., able to judge how much planning is enough
Jump straight from abstract goals into CoA development
Forgo planning when appropriate
Prediction
Op: War is unpredictable, Chance
Predict future conditions with consideration of those factors which determine changes in respective domain of reality
Don't assume current trends continue, but look at what drives them
Check whether conditions for validity of current plans or actions are still fulfilled, even when they always had been given until now
Predict the future as a linear projection of the present
Causal reasoning (creating mental model of environment)
Op: War is chaotic
Distinguish between symptoms and the important factors that drive their development
Try to go beyond the surface of the given situation, try to identify causal factors which govern the development of the respective domain of reality
Look for "single causes"
Recognize that their view of a situation is likely to be incomplete and therefore they need to keep looking for further relevant factors and remain open to adding causal and influence pathways as necessary
Concentrate on identifying the characteristics of the current situation
Hypothesis generation (note: Good and Poor performers generate the same number of hypotheses)
Conduct hypothesis formation in a systemic manner
Conduct hypothesis formation about causal factors in the form of reductive hypotheses
Show progressive conditionalizing
Show magical thinking
Basis of planning
Plan according to what is known about the situation
Plan according to causal factors governing reality (not symptoms)
Treat irrelevant symptoms (only the present situation provides basis for planning)
Show methodism (i.e., use actions which have been successful in the past without considering special conditions of actions)
Plan simplistically and do not consider conditions of actions or side- and long-term effects
Plan broadly and take the conditions of validity of actions as well as side- and long-term effects into account. Assess their likely impacts and probabilities
Develop and evolve a stratagem
Challenges with Goals
Under-specified goals
Create concrete goals
Op: Ops goals concrete
Maintain abstract goals
Have no criteria to measure or evaluate success (goals are vague)
Polytely (multiple goals) - these can conflict
Op: Interagency dialogue -milt., N/OGA,local, Maxi...
Relationships between goals
Consider interrelationships between goals
Trade-off contradictory goals
Consider goals as independent
Making decisions
Make more decisions per goal (compared to poor performers)
Make more decisions overall (compared to poor performers)
Goal Stability
Are easily distracted from a goal
Have an unstable goal prioritization structure (behaviourally)
Change goal focus if they are failing at achieving their goal
Maintain focus on the same set of goals throughout the task
Prioritization
Choose a point of strongest effort without losing sight of background goals
Choose one goal opportunistically according to saliency
Choose goals based on relative importance
Show repair-service behaviour
Choose an attainable goal, even if goal is relatively unimportant (encapsulation)
Assess impact of "problems" and salient signals in whole picture
Select goal based on own competence areas rather than on importance of goal
Challenges with Self-reflection
Op: AARs, Hot Wash, Lessons learned, Le...
Failure
Investigate the reasons for failures
Op: AARs, Hot Wash
Concentrate self-reflection on failures and on inefficient thinking and reasoning; this leads to "reshaping" of thinking
Op: AARs (vs. self-reflection), Lessons learned
Marginalize failures
Concentrate on recognizing, understanding, and learning from failures rather than marginalizing them
Minimize own responsibility for failures
Attribute failures to external causes rather than own actions
Creates scapegoats; shifts blame
Engage in limited self-reflection; only as confirmatory recapitulation of successes - no new information or ideas are allowed in
Ritualism
Challenge own behaviour patterns and check for unwarranted ritualization
Behave ritualistically
Do not self-reflect
Judge when particular behaviours are or are not appropriate
Op: AARs, Lessons learned
Cultivate practice of self-reflection
Choose behaviours largely unconsciously or automatically

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Annex B: Operational Scenarios that Contain Complexity

This annex contains the operational scenario descriptions. The scenarios are presented in order of overall complexity ranking (see Table 10), with the most complex scenario first.

1. Scenario Description: Military Liaison and Advisor, International Event

The decision maker (DM) was assigned to be the military liaison and advisor during a major international event. It was the responsibility of the DM to facilitate communications between the stakeholders (including the CF and other municipal, provincial, and federal authorities) and keep the DM's superior officers informed. The DM had to decide what information to communicate, with whom to communicate, and when to communicate it. During the event the DM was present in the Local Command Centre (LCC) and had to "manage" the sensitive time when a breakdown in C2 occurred during which security forces were ordered to "stand down" and the security situation surrounding the event was in jeopardy.

Factors which influenced the ability of the DM to manage these processes included:

- The international event was held at the same time as another important international event. These events had never taken place simultaneously before, meaning that there was a lack of previous events to draw on for lessons learned etc.;
- In general there was a high demand for information flowing in many directions at once which was difficult to manage;
- Security was not the only consideration in choosing the location for the event, therefore the event took place at a less than ideal location for security planning;
- Other security issues included:
    - There was an extremely large local population;
    - There were many public order units involved, creating great coordination problems;
    - Water access (increased accessibility);
    - Close to an international border;
- Morale among some personnel suffered as some security stakeholders resented their considerations not carrying the same weight as other factors; The DM had extensive experience as a police officer as well as a military officer. In many cases this worked to the DM's benefit (e.g., DM understood police procedure and had more credibility with the police) but sometimes was a disadvantage (e.g., sometimes the CF people would feel that DM might be more loyal to the police than the army);
- The DM replaced another individual of higher rank; because the DM was of lower rank, this led to the perception by the police that the CF saw this position as being less important;

- The DM knew the personalities of several people involved and could predict how they could lead to problems (e.g., knew some of the higher-level officers had more self-interest in mind).
- Collaboration between the federal police, the local police, and the CF was made more difficult because of different jargon (e.g., OPP to the CF means Operational Planning Process but to the police it is Ontario Provincial Police);
- Issues that arose were often sensitive, both legally and politically – highly political situation;
- There was massive media coverage that was not necessarily favourable to the international event;
- Security measures caused a number of unintended effects for local residents. Freedom of movement was restricted and security measures caused unwanted psychological effects (e.g., anxiety, isolation);
- Logistics planning was not de-conflicted with the establishment of security measures, which meant that moving supplies (e.g., getting food to personnel) was difficult. There was a short timeline for planning changes as the decision to restrict vehicle traffic inside the inner security cordon was not shared with stakeholders until less than 2 weeks before the event; There were misunderstandings about what the CF were willing and able to provide:
    - CF personnel were not properly equipped to be augment police or security forces should the need arise (they only had lethal force options available, they did not have proper personal protective equipment);
    - Inappropriate requests for unskilled assistance were made (e.g., a request was made for CF personnel to deliver meals);
    - There was a huge disconnect between what local security forces were requesting and what federal authorities were willing to provide in terms of financing;
    - Not all CF assets were declared to the security partners. Some security partners felt that all CF assets should have been made available;
    - Not all CF assets were declared to the security partners although some were obviously staged forward and in plain sight;
    - There were requests for assistance that were incomplete and the DM had to go to a lot of work to determine the details of needs. For example, a request from a security partner to use DND property started as a need for a small external corner of land evolved into a request for the use of an entire CF armoury and supplies;
    - The CF were frequently requested to conduct activities outside its lawful mandate, which was frequently misunderstood by other security partners. Inventive solutions were found to allow the CF to support other security partners to conduct surveillance as required;
- Everything was being recorded in the cells during the international event, so this led to people not wanting to talk in case they said something that could be used against them later;

- What was happening locally, funding issues, etc. meant that police forces might or might not send security forces to support the event (this meant that the number of security forces to be present was not certain until the last minute);
- Civilian police security partners conducted independent intelligence gathering despite the agreement that the operation would be joint and interagency;
- When new costs for security were published about a month before the planned event this caused a reassessment of what was needed ("we can't pay for it so we're not going to do it"), everyone was worried about the municipal budget;
- The DM was surprised at the lack of information coming out to the public about what was going on (e.g., where security boundary zones would go);
- Some tactical judgements during the crowd confrontation operations were unsound. Not all personnel were donning their Individual Protective Equipment when certain techniques were employed, leaving police personnel vulnerable;
- Everyone did not want to criticize others or hear negativity and so plans and situations were not objectively assessed;
- Because this was such a large and important event, careers were on the line which motivated people to be self-protective;
- General Rules of Engagement for CF acting in this situation were at times obscure, depending on location. (e.g., if they had to defend their assets);
- As a liaison, the DM had no authority to give direction (understandably, DM could only give advice, provide information, and put people in contact with one another). The DM did not have the authority to intercede in policing issues and there were cases where DM thought changes were needed (e.g., DM was surprised at the lack of operational-level planning).

Factors which unfolded over time:

- Strategic level decisions were made at the latest possible moment. This meant that the rate at which plans had to be made and implemented kept changing, and eventually tactical activities, like contracting, were done in haste; Treasury Board regulations and PWGSC contracting guidelines were not well-understood by Provincial and Municipal partners.. Originally local security partners were negotiating for federal resources, but they were unprepared when the contracting process took a lot of time and they received massive bills for the use of these assets. The DM suggested that the process should be changed so that requests were made from federal rather than local security partners. When this was done, the cost of many security aspects (e.g., renting a CF armoury) went down to nothing and the timelines for approval decreased;
- Over time it became clear to the DM that vital information was not known (e.g., knowledge of the legal case Regina vs. Knowlton, a case where the finding resulted in the authority to have cordons and protect them when countries are hosting internationally protected persons). The DM generally decided to inform people about the information (DM felt it would be remiss not to), but then the DM was marginalized because of this by some people because who felt the DM was "sticking their nose in". This caused concerns for interpersonal relationships and also conflicts between others because some people would

agree with the DM and some would disagree, and the implications of these incidents built over time;

- The individual agendas of security personnel involved played a role in how events unfolded. Certain individuals were trying to keep information to themselves (which led to delays in needed information being communicated), others appeared to have other priorities than maintaining security for the event, etc.;
- Personality played a role and the interactions between personality and events changed over time;
- There were several C2 cells actively coordinating during the event. . The DM was present in the LCC and the "main" HQ was located elsewhere, so this created a high demand on the DM for information as the DM was the person "on the ground" with access to information about events occurring at the international event. As events unfolded, the pressure became more and more intense;
- The demonstrations and protests unfolded over time, as well as their implications, such as how people were handling the situation, how C2 would operate, what extra security forces were available, etc.;
- The breakdown of C2 during the event unfolded over time and had profound effects, including far-reaching consequences for personal relationships and the relationship between security stakeholders;
- Investigations are on-going, and these investigations will unfold over time and have many consequences for organizational and personal relationships, organizational reputation, people's careers, recommendations for future events, etc. As the understanding that there would likely be investigations related to this event grew, this influenced decision-making and some individual's decision making became more and more self-protective.

2. Scenario Description: NSE Officer, Afghanistan

It was the responsibility of the decision maker (DM) to manage logistics to support military operations performed by the CF in Afghanistan. This involved managing a number of physical resources (e.g., food, artillery, vehicles, and other equipment) in terms of quantity, location, storage, maintenance, etc. Due to a strategic emphasis of combat and de-emphasis of logistics, as well as the fact that only a finite amount of money was made available to conduct the mission, logistics staff and other resources were extremely limited. The Concept of Operations (CONOPS) required these resources to be dispersed throughout the area of interest (i.e., decentralized), which in turn required the building and supply of Forward Operating Bases (FOBs). The number and locations of the FOBs were decided based on anticipated strategic and operational requirements - the DM had no input into these decisions. Due to the fact that the amount of resources was extremely limited, the dispersed physical location of resources combined with the difficulty of moving resources from one location to another (locations were far apart through rough terrain inhabited by the enemy; there were no air assets available to the CF other than for emergency medical evacuation) made the logistical situation extremely vulnerable to unexpected events.

Factors which influenced the ability of the DM to manage the resources included:

- Individual differences (e.g., some commanders used more artillery than others);
- Actions of the enemy (e.g., the number of attacks, the location of attacks);

- The relative importance of logistics considerations in the CF is quite variable and frequently little effort is directed at the sustainment estimate; Time lags between requesting and receiving replenishment of resources (e.g., some critical operational stocks require over 1 month to order and receive in a deployed setting; Need to work within resource limitations (e.g., only a limited staff);
- Orders from higher command (e.g., orders to conduct operations in new locations);
- Resources of allies (e.g., the need to share resources with allies) for tactical effect can sometimes compromise resupply of other Canadian units. Failing to assist allies with material support can mean denial of emergency access to allied resources; Strengths of relationships between allies (e.g., if we help someone they will be more likely to help us in return; have we helped them in the past; have they helped us);
- Lack of information to support planning as this was a relatively different situation than recent CF missions (e.g., this was a handover of fighting units which had not been done since the Korean war; there was a lack of information about how many resources such as ammunition were actually required as this was a peace-making rather than peacekeeping mission);
- Political/strategic concerns (e.g., it was not permitted for the CF to buy ammunition from some allies); and,
- Environmental effects (e.g., maintenance had to be performed frequently because sand interfered with vehicle operation).

Factors which unfolded over time:

- The enemy is constantly evolving their tactics (e.g., their ambush locations and methods). This means that the location of resources (e.g., FOBs) became more or less relevant depending on enemy locations and activity;
- Locations and number of FOBs strongly influenced logistics but they were planned without logistics input and had to be built well before they were needed; there was no way to influence where they were or know that they would be appropriately situated. As events unfolded, the FOBs were not useful as the CF were sent to another part of Afghanistan to fight;
- The relative importance of logistics considerations in the CF is quite variable and frequently little effort is directed at the sustainment estimate. Because more firepower was desired in the Afghanistan mission but the budget was limited, there was an increase in the proportion of combat to logistics personnel. This meant that there were relatively few logistics personnel sent to support the combat troops, which had both immediate and long-term effects on the ability of the logistics staff to keep up with resource needs (e.g., impacted psychological well-being and safety of logistics staff due to lack of sleep and rest, impacted number of convoys which could occur, impacted the rate at which items could move, impacted the ability of the staff to do maintenance);
- Another impact of directing little effort at the sustainment estimate was that during training, true sustainment was not practiced (e.g., soldiers could go to the base and get food easily). This led to a lack of advanced information for planners about true logistical needs (information had to be gathered over time during the operation) as well as a lack of training

for soldiers regarding true sustainment demands and readiness requirements, which likely impacted their morale and preparedness;

- The location of the conflict (Afghanistan) had a profound impact on logistics. Afghanistan is surrounded by other countries (i.e., no sea access); thus, ammunition has to be flown in. Because of the nature of artillery, flying artillery over other countries requires their consent, and therefore much preplanning is required to move ammunition (e.g., it can take over a month to receive ammunition from Canada). This in turn results in a lack of flexibility in the ammunition ordering process and a resulting vulnerability in the flow of resources;
- There was a radical change in the CONOPS for the Afghanistan mission which occurred immediately prior to the DM landing in Afghanistan. This CONOPS required changes in plans to how the LAV companies would be used (i.e., LAV companies were always in use rather than having one on base). This change in resource allocation had long-term repercussions to how maintenance could be scheduled and performed (e.g., all LAVs constantly being out in use means no preventative maintenance was possible);
- The use of ammunition varied greatly over time. Monitoring ammunition use at the beginning of the DM's tour indicated that X amount was used per unit time; however, this increased greatly when the pace of battle increased as well as when other factors changed (commanders changed and some commanders were more prone to use a lot of ammunition). Factors which increased the use of resources (especially ammunition) also had other effects such as making it more difficult for the BG to report ammunition use (i.e., as the pace of battle increased, the use of ammunition greatly increased, but the information from the BG about how much artillery was being used was not sent; this could have been due to the stress and time pressure of battle or other factors);
- Resource availability was so close to the minimum required that it had to constantly be balanced and plans changed; factors such as vehicles needing repair would mean that rebalancing was required frequently.

3. Scenario Description: Liaison Officer, Afghanistan

The DM was assigned to act as a liaison officer in the operations coordination centre in Kandahar, Afghanistan. It was the responsibility of the DM to act as a liaison between the Canadian Forces (CF) and the Afghanistan National Army (ANA), Afghanistan National Police (ANP), Kandahar Prison, Border Security, and the National Directorate of Security (NDS; the Afghanistan secret service). At the beginning of the DM's deployment, there was a massive escape from the Kandahar prison. This created an atmosphere of uncertainty about the level of security present in Kandahar, and part of the DM's role was to facilitate an increase in security. In particular, the DM was required to liaise with the relevant parties to increase security in preparation for voter registration which was to occur approximately 8 months later. The DM was to create a "Kandahar city security network"; had to convince the relevant stakeholders that it was necessary, persuade them to take part, and oversee the process.

Factors which influenced the ability of the DM to manage these processes included:

- The prison break was believed to be facilitated by assistance from inside the prison. Many of the senior leadership at the prison were either arrested or fired. This caused a massive change in personnel and a huge loss of confidence in the prison system and personnel, as

well as a re-evaluation of many assumptions held by CF personnel about security in Kandahar;

- Cultural differences between Afghanistan and Canada are profound; they can create a lack of trust and difficulty with coordination. These include:
    - Extremely high emphasis on interpersonal relationships in Afghanistan (e.g., the importance of personal relationships to Afghans is paramount). This has profound implications; for example, authority based on position alone is not "real" authority to the Afghans (obedience is based on personal relationships);
    - Differences in the legal system and widespread corruption (e.g., people responsible for the prison break probably were not punished as they could pay to be released);
    - A difference in the idea of what it is to have a job and the attendant responsibility (e.g., a police officer threw away his phone because DM was getting too many 911 calls, even though that was the only phone the calls were coming to);
    - The Afghans appeared to have the perspective that they had little control over events (e.g., "what Allah wills will happen"); whereas Canadians typically feel we do have control over events. This had implications; for example, the Afghans were not used to the concept of practicing for a possible event and were resistant to such training
    - Different social standards (e.g., the DM never met the wife of any Afghan the DM worked with). The DM knew that social relationships were important, but was not able to actually understand the relationships were as the DM was not privy to how families were interrelated through marriage;
    - Literacy is so low in Afghanistan that written records are rarely kept, which means data is not available that would help assess resource and training requirements;
    - Lack of appreciation for resources (e.g., communications equipment was given to the relevant stakeholders; one faction of the ANA changed locations but left the equipment in the old location unattended without notifying the DM);
    - Age is more of a factor in creating a sense of authority in Afghanistan. The DM felt that he would have received more respect if he had been older;
- Communication is difficult; communication systems are incomplete and there are few communication protocols within Afghan organizations;
- The ANA and the ANP have an adversarial relationship and do not work together well. It might have been an adequate solution for Kandahar security to just create a system between the ANA and the ANP; however, the animosity between them was just too great to only work with those 2 organizations;
- There was a quick turnover in Afghan personnel; for example, within 9 months there were 3 governors of Kandahar;
- The DM had to ensure that he did not insult the Afghans he was working with (e.g., while training them he had to be careful not to imply that they didn't know how to do their jobs);
- The DM had to balance the need to keep people invested versus giving honest feedback to improve performance;

- Mentors had to be persuaded to support the DM's goals. Mentors to the various Afghan organizations (e.g., RCMP Personnel mentored the ANP) provided guidance to the Afghan personnel and additional support to the DM. The mentors often could persuade the Afghans of the importance of training etc.;
- Sometimes official positions are not followed in actuality. For example, the DM was informed that he had deployment authority for the ANA quick reaction force, but he tried to deploy them three times and all three times he was denied;
- There is a lack of reliable power in Afghanistan; this means that the use of communications equipment is limited by power outages and often the communications equipment is turned off to conserve power.

Factors which unfolded over time:

- There was a 911 system that was implemented; this was supposed to be run by the ANP but the chief of police discarded the phone that was used for the 911 calls as he found it inconvenient. The DM volunteered to take over the 911 function; this became a tool to get the ANP involved as the operations room would receive the calls but the ANP would be contacted to answer them. This created additional (and unpredictable) windows of opportunity for collaboration with the ANP, for obtaining intelligence, and for facilitating relationships with civilians;
- The prison break led to a process of information gathering. This process gradually revealed that there was no Common Operating Picture (COP) among Afghan security agencies; that the ANP could not effectively get information about threats; that the ANP had difficulty responding to threats; that the ANP could not effectively ask for assistance from other security organizations; and that Afghan security organizations typically work at a tactical level and are not used to working at an operational or strategic level. These pieces of information changed how the DM saw their goals and how they could be accomplished;
- The DM attempted to get the relevant stakeholders to install, maintain, train on, and use communication equipment provided by the U.S. He found this very difficult for many reasons (e.g., the cultural differences listed above), and felt that any intervention he tried did not result in change (i.e., there seemed to be a "set point" in the environment that was highly resistant to change). This became more and more frustrating as time went on and the DM grew increasingly hopeless that the C2 infrastructure would be adequate to maintain security.

4. Scenario Description: CoE Training Developer

The DM was a trainer at the Centre of Excellence (CoE), at the Canadian Land Force Command and Staff College (CLFCSC). It was the responsibility of the DM to support the training function of the CoE. Duties included designing training packages and putting arrangements in place to deliver them. The DM had to incorporate multiple components into the training program including cultural information, working with translators, team training, interacting with the media (e.g., giving interviews), working with multiple OGDs (e.g., DFAIT, CIDA), dealing with unexpected events, and how to balance conflicting objectives (e.g., when CEFCOM and NATO have different policies or priorities). The DM evaluated what worked and what didn't work in training and attempted to improve the training program. The DM also acted as a liaison with non-military actors who would

be taking part in training. The DM had been involved from the beginning; at the time of the interview they were working on their 5th training cycle.

Factors which influenced the ability of the DM to manage these processes included:

- Having responsibility but no authority; the CF makes the decisions and the DM can only make requests;
- Large amounts of unpredictability about how trainees will respond to events in exercises, both in terms of what they will choose to do and also how well they will handle events;
- Difficulty evaluating actions and determining what likely results of trainee actions would be. One strategy used is to have observer/controller teams during exercises to observe people and give feedback about how people are performing. Usually these observers have just come back from theatre so they have recent experience;
- Challenges in creating training exercises etc. that are both realistic enough and controlled enough (e.g., present and understood 2nd and 3rd order effects for exercises). For example, in Afghanistan, no one in CIDA can tell you that the Dhala dam project will make things better for the Afghans; more irrigation could result in people growing more opium which would be negative. Because it is difficult to understand what consequences of events would be it is difficult to create realistic training scenarios, etc. One strategy used is to involve SMEs in exercise creation;
- Problems with creating believable training exercises. Sometimes things that actually happened in operations are not seen as believable in training, therefore reality has to be balanced with the perception of reality so that trainees will "buy in" to the training scenario (the DM noted that many of these "unbelievable" events actually happen; when trainees were questioned by the DM after they come back from their deployment they said that things happened that they wouldn't have believed in training);
- Some aspects of training (e.g., training people to give interviews) are difficult to mentor;
- Resource requirements are often not easily available (e.g., media representation, cultural component to incorporate into scenarios) and have to be built from scratch;
- Changes in organization. As the need for collaboration between different organizations became understood, the Privy council office, Afghanistan Task Force took over so that only one request for participation had to be made rather than the DM having to deal with all organizations individually;
- Trainees with limited time. There are generally a great many demands on trainees' time, and when there are conflicts often training is secondary in priority and therefore missed. For example, trainees have been required to perform a recce during the time that a training seminar had been set up, and so missed the training;
- Vague direction. When the training program began initially, the DM was working "in a void", had only limited staff and didn't really know what they needed;
- Lack of personal knowledge about training situation. The DM had never experienced the kind of meeting that they were trying to recreate in training, which made it more difficult to understand what they were trying to do;

- Feedback about training came in several forms, including trainer intuition and feedback from trainees when they came back ("we should have known about X"). In one case, the DM saw an interview with someone they had trained and it was not well done, which led to further training in how to give interviews.

Factors which unfolded over time:

- As operational environments and priorities changed, training had to change along with them. This required almost constantly updating SA about operational environments and priorities as well as implementing changes to effectively deal with changes. Someone from the CoE often went on the recce with the new HQ so they knew what was needed in theatre and what the current situation was;
- The degree to which the CF had to work with CIDA, DFAIT, and other organizations only became clear over time (e.g., the Manley panel report indicated a greater need for cooperation), therefore their involvement in providing and receiving training evolved over time. There were several components to this, including:
    - It took time to build the necessary trust between agencies (e.g., CF, CIDA, DFAIT) to effectively train together. Networking and relationship building were more actively encouraged over time (e.g., a "night out dinner" was built into OGD training to facilitate networking etc.);
    - Another aspect of OGD integration which took place over time was getting a common understanding of basic Operational Planning Process (OPP). Initially CIDA, DFAIT etc. have no training in the OPP and this basic training was begun. This training helped improve common understanding and build social networks which were useful for training and also in theatre. The DM said that there were many 2nd and 3rd order effects from these social relationships and other training benefits;
- The money available for training decreased over time, limiting opportunities and requiring adjustments to plans. At first, when the war started, the budget was virtually unlimited, but funding became more scarce as time when on and the mission began to wind up, the recession started, etc.;
- Generally training programs use rolling-wave planning (i.e., planning in stages) to accommodate different opportunities as there are many variables involved and things change over time (e.g., people's availability, training needs);
- Networks of people were built as the training was developed, and this helped in the acquisition of resources for training as well as getting other organizations involved. One or two people would get on board (e.g., one member of DFAIT) and then their contacts were useful for getting more people involved. Personal contacts often proved much more useful than "official" channels;
- Unlike in earlier training cycles, in later cycles trainers were often trainees from an earlier group. This meant that they generally understood what they needed to talk about and could improve training, and also decreased planning times;
- Changes to training programs had a distinct pattern. Changes were difficult to make within a training cycle, but there was generally a great deal of change that happened between training cycles.

5. Scenario Description: Chief of Staff, Strategic Advisory Team, Afghanistan

The DM was the Chief of Staff for the Strategic Advisory Team, Afghanistan, located in Kabul. It was the responsibility of the DM to bring generic planning skills to assist high levels of the Afghan government (e.g., ministers and their staffs); he was in charge of the day-to-day administration related to this effort. Events which the DM had to respond to include the reaction to the death of a known co-worker in an IED attack, protests related to the Danish cartoon about Mohammed, a traffic accident which resulted in riots, a negligent discharge by one of his personnel, and an information-gathering trip planned by some of his staff which was not well received by Task Force Afghanistan (TFA) command.

Factors which influenced the ability of the DM to manage these events included:

- Difficulty in getting accurate information in a timely way, as there was no access to news reports or "ground truth";
- The ability of the Afghan population to communicate information quickly (most Afghans have cell phones), which made riots more likely;
- Communications back to Canada and down to TFA were tenuous. The estimate was that the DM was out of touch with either Canada or TFA for at least one full day a week;
- The location of the DM's compound (close to the US embassy), which meant that they had support close by but also were close to any riots which were targeting the Americans;
- Poor roadway infrastructure. Roads were often poor, and information about their passability was not gained before a major trip occurred. This created problems with finishing the trip and getting personnel back to the compound;
- Poor communication infrastructure. For example, a cell network was used to communicate, but when voice traffic increased it was not always possible to contact people by voice (although texting generally remained functional);
- The availability of only a limited number of vehicles so travel required a lot of coordination;
- Differences in culture that made it difficult to coordinate with the Afghans:
    - "Afghan time" meant that people were often late;
    - Many times agreements were reached but then it became clear that the Afghans did not support the agreement, so agreements had to be renegotiated;
    - Afghans did not do things the way that the DM and the DM's team members expected; for example, the senior staff of governmental agencies often "didn't know how to run a meeting";
    - Records were often not kept. For example there was no log of visitors to the president or briefings to the president ahead of state visits;
    - The DM had to perform administrative functions such as renting buildings but there was basically no banking system in Afghanistan;
- Ambiguous direction. The goal of the mission was to "do it their way", but it was a process to understand what that meant;

- The presence of a lot of different organizations in Kabul at the time (including the American coalition operation groups, ISAF mission groups, UN mission and UN agencies, individual nations with their embassies and ambassadors) and their agendas were not always in line;
- The organization of a daily meeting for the team to coordinate and make sure that everyone knew what was going on, that people had transportation, etc.;
- Building relationships with chaplains at a nearby US base. The chaplains acted as a resource when Canadians needed counselling in difficult situations (e.g., when a known co-worker was killed);
- Afghan security was deployed outside the wall of the DM's compound. This meant that the armed people outside the wall were of the same nationality as protestors or rioters and so their presence was less inflammatory than armed Canadian military would likely have been;
- Communication with team members. Members of the team did not always appropriately communicate information to the DM in a timely way. For example, when contacted by the team member who had had the negligent discharge, he didn't inform the DM promptly that he had not informed his direct supervisor about the incident;
- The command structure. The mission required a mission command approach (which was used) rather than an overly hierarchical C2 approach because flexibility was required and individuals had to exercise initiative to effectively conduct the mission.

Factors which unfolded over time:

- One goal of the DM was to build relationships; relationship networks were built over time and had many, sometimes unexpected benefits. For example, the DM made contact with the chaplains at a nearby US base, and these chaplains acted as a resource when Canadians needed counselling (e.g., when their co-worker was killed). To facilitate relationship building, the DM's group hosted an open house BBQ every Friday night, and as relationships built more and more people would attend. This created a growing network of connections between people and facilitated many interactions;
- There was an on-going balancing act between being openly military (e.g., wearing uniforms, driving military vehicles) and trying to pass as civilian, which were influenced by factors such as the current state of tension in the area. The costs (e.g., being targeted, legal trouble and safety issues if caught with weapons out of uniform) and benefits (e.g., being protected in more secure vehicles, being protected by military law as on-duty military officers) have to be weighed. This had far-reaching consequences, including strategic implications if other country members saw Canadian military entering Afghan military buildings;
- The chain of command was fuzzy. Task Force Afghanistan (TFA) in Kandahar was in charge of the DM's group for administrative purposes, but the team actually worked directly through CEFCOM. As time went on it became more and more clear that TFA felt they had more authority over the DM's team than the DM thought, and this made decision making more difficult. For example, TFA kept pressuring the DM to get electronic counter-measures put on their vehicles, but the DM kept putting this off as that would make them targets (because it would be obvious they were military vehicles);

- Team cohesion issues waxed and waned during this time period. For example, the team member who experienced the negligent discharge was teased about it by the group for some time afterward. The group lived together and had to be a tight-knit group, so any tensions could profoundly impact the mood of the entire compound and the ability of team members to work effectively together. The DM experienced 2 different team configurations and the second configuration included more team players than the first, which brought home the importance of this factor;
- Events which threatened the security of the compound led to reassessment of the security plan for the compound as well as an on-going effort to work with the British and other embassies to arrange for a more secure location in case an evacuation was required, and also an attempt to improve communication between these stakeholders.

6. Scenario Description: PME Revitalization Supervisor

It was the responsibility of the decision maker (DM) to oversee and evolve the Professional Development (PD) system and to ensure that CF schools were implementing, conducting, and delivering education and training as laid out according to the PD system. When entering the position, the DM became aware that there was an on-going issue with Professional Military Education (PME) revitalization. This file had been sitting, not moving forward, for 18 months. The main issue appeared to be getting funding approval for the program. There appeared to be a fundamental disagreement between one CF educational institution (referred to as "School") and the staff from another organization who were supposed to assist in creating a funding proposal (referred to as "Staff"). Thus, the responsibilities of the DM included coordinating several organizations to exchange needed information and managing disagreements that arose between the different stakeholders.

Factors which influenced the ability of the DM to manage this process included:

- Disagreements between stakeholders about the scope of project financing (e.g., were overhead and general infrastructure upgrades to the School [e.g. modernize classrooms, expand quarters, etc.] meant to be included?) which led to different estimates of the funding requirements;
- Stakeholders not acting within their range of authority and mandate (e.g., Staff were questioning the value of the PME Revitalization [asking if it was money well spent, etc.] when this was not supposed to be part of their role);
- There were continual delays brought upon by Staff requiring clarification on small details;
- Difficulty in understanding what other people's motivations are (i.e. are there hidden agendas);
- Periods of silence of significant duration (e.g., several weeks or more) often occurred after submission of requested information to Staff;
- Requirements for new or expanded educational programs often do not come with additional funds, requiring a shifting of resources;
- Requests for clarification from superiors about what programs are a priority (and therefore which can be reduced or eliminated to fit budget constraints) do not result in clear direction;

- A major Strategic Review being undertaken that affected the whole CF during this time period. It was anticipated that the results of the review will profoundly affect funding, including funding related to PME revitalization. It was believed that this led some people to be reluctant to make decision;
- The requirement (on several occasions) to push something to a higher level of authority for a decision or try to get resolution (i.e., ask for clarification of Staff commander objectives) due to conflicting outputs from Staff (i.e. told that this is a priority for them, but they do not see a need to put members forward to attend a 2 day workshop). The decision to push an issue up the chain of command involves evaluating the risks involved (as it could mean unnecessary delays, etc.);
- A need to balance short-term and long-term gains in terms of management style (e.g., enforcing authority can help to solve some problems in the short term but relying on authority can reduce buy-in longer term);
- Communication clarity (e.g., terminology meant different things to different people);
- Difficulties in organizing people to be in the same place at the same time for meetings;
- The School was told that their funding would no longer have the flexibility of receiving in-year funding, so resources would be further limited;
- If an educational program is being changed, the changes have to be made with consideration of all environments (army, navy, and air force) to ensure that the changes to the system or course are consistent with needs of all elements and their philosophies. Because of significant differences it is difficult to determine what education is required, how it should be done, how they are going to get buy-in from different stakeholders, etc.;
- Changes in one aspect of an education program have to take into account other phases of the program. For example, each Developmental Period (DP) requires that you meet certain necessities so that the person can move on to the next DP level;
- If something is added to a DP, then something else may have to be removed and this could cause knock-on effects through the other DP levels as other things have to be shuffled out;
- The time of those being educated is limited.

Factors which unfolded over time:

- Command direction slowed the achievement of goals and more scrutiny was paid as the number of small information requests increased. Whether there was general risk aversion or other factors were at play is unknown; Meeting requests were responded to less favourably over time, which delayed the process;
- The DM's own staff had difficulty staying motivated and stress increased as the process carried on over time with little apparent progress;
- Lack of continuity; as old people left and new people entered (including the DM) the process it meant that tasks were performed multiple times, people had to be gotten up to speed, etc.;
- The complexity of the operating environment changed over time. The Training and Education (T&E) system is meant to keep up with changes; However, the T&E system was

typically fairly slow to react to new things, and so important windows of opportunity might have been missed;

- The rate at which things changed was variable; for example, sometimes submitting information to the Staff meant that the DM and the DM's staff were bombarded with requests for more information, and sometimes weeks would go by with no feedback from the Staff at all;
- Instructors had to be hired to run programs; this had to be done far in advance (e.g., to go through PWGSC process). Due to delays in the PME process, opportunities to have particular instructors at particular times were likely missed, and decisions had to be made without proper support from a finalized PME process.

7. Scenario Description: CoE Training Development Supervisor

The DM was the contract site leader at the Centre of Excellence (CoE), at the Canadian Land Force Command and Staff College (CLFCSC). It was the responsibility of the DM to support the training function of the CoE. One of the groups requiring training are the members of HQs to be deployed to Afghanistan involving a 4-week package of training they deliver to the HQ in their base location. This training development is an on-going, iterative process. There is a need to look forward by at least a year, both to arrange the logistics of training (e.g., preparations for an exercise in February have to start by September for an HQ deploying in July) and incorporate upcoming changes into training programs. The current change being considered is a focus change from Counterinsurgency (COIN) operations to mission termination.

Factors which influenced the ability of the DM to manage these processes included:

- There needs to be overlap and continuity in training (e.g., one HQ has to both take over from another HQ and set the conditions for the next HQ to come in);
- Government announcements (e.g., moving main location from Kandahar to Kabul) can force unexpected readjustments in training;
- Changes may be announced but details may not be known, requiring assumptions to be made so that enough lead time is available to plan training;
- Training cannot be largely template because the rate of change is too high (e.g., commanders are given different primary tasks);
- Outside events force a lot of change, e.g., changes in policy, different events happening in Afghanistan;
- Writing teams who design the training are experienced and generally understand what is required;
- There are often overlapping requests for training time and resources that require on-line resource shifting;
- Long lead times are often required for training objectives to be met (e.g., the new HQ has new objectives to move equipment back to Canada, a lot of equipment and containers have to be inspected, inspectors are few and require time to inspect, etc.);
- Training of CF personnel also involve training them to deal with other actors including members of DND, DFAIT, CIDA, Correctional Services, Policing Associations, NGOs – the DM and his staff have to put in a lot of work to get these groups adequately involved;

- The different stakeholders involved often have different jargon and ways of doing things which make communication and collaboration difficult;
- The timelines of the stakeholders are different. For example, the CF focuses on short-term (e.g., 6 month long) projects with high impact, whereas CIDA focuses on projects with much longer timelines (e.g., 15 years);
- Money has become much more of a constraint than previously, which affects the size and duration of the writing board (who create scenarios and other training materials) and other resources available;
- Often HQs standing up have basic teamwork etc. issues to sort out (e.g., sort out SOPs, learn about each other's working styles and create a team) rather than just training for a specific mission;
- The DM had a long-term relationship with the project lead and therefore had a foundation of trust that he could use to convince the lead of needed changes;
- Training scenarios have to be firmly grounded in the current state in Afghanistan (or other area of interest related to the training), because often training is being done after the HQ does an initial recce, so the trainees are usually well aware of the current situation and what is relevant. Trainers have to have current knowledge;
- The DM had relationships with members of some groups which helped the DM get needed personnel involved in writing boards and other aspects of training (i.e., he used his social networks);
- The DM had been involved in this training program for some time (over 3 years) and had an understanding of many aspects of what will work and what will not. For example, it is important to have 2 exercises separated in time rather than 1 exercise, as one needs to be a "walk" and the next needs to be a "run". If these are not separated somewhat in time (i.e., more than a day or two) there is not enough time for the trainees to absorb what they learned from the "walk" session before the next exercise;
- The request to include logistics personnel in the training made CANOSCOM aware that more logistics preparation for the mission was required (the DM was unaware that this had not been a part of plans – it was surprising and seemed to show a lack of foresight);
- The DM and his civilian staff have to have personalities which can accept not having real authority (i.e., the CF has the final say).

Factors which unfolded over time:

- Training program changed over time as different strategies were tried as the opportunity arose, and what worked was kept or improved and what didn't work was removed or changed;
- Early attempts were made to integrate organizations such as DFAIT, CIDA, and CANOSCOM into the training process to ensure mutual awareness of methods and build networks. Over time it became apparent that these training sessions could prove very beneficial so some organizations became more involved relatively early (e.g., DFAIT). When certain training goals changed to become very relevant to other organizations (e.g., CANOSCOM), then they became involved at that point;

- The personnel recruited to run the training changed frequently across time. A new training focus may require a change in SME personnel. This requires active recruitment of personnel with the relevant experience to create a pool of people who can be drawn upon for training needs. There is always a need to find recently retired people with more current experience, as people who have been retired for longer may have lost touch with current issues, processes, etc. As well, for each individual occasion people have to be scheduled in and often there are fluid schedule constraints based on other people's priorities (holidays etc.) and the needs of other projects (e.g., preparations for the Olympics required a large staff);
- The CF staff in the training programs change cyclically and frequently over time (e.g., in the 3.5 years the DM had been doing this, he had 4 bosses). So, certain things need to be done over and over again (building relationships, making people aware of how things have been done, what worked, what didn't, etc.);
- There was a request to inject another group (high-readiness HQ) into the training schedule. This had follow-on effects such as having to plan for concurrent training, having to re-distribute the workload, and new people had to be hired;
- The training programs and operational plans inform one another and both change over time. For example, the writing board looks for weak or grey areas in the plan to use as injects for training. This information is then used by the planners to tighten up weak spots and hopefully avoid problems.

8. Scenario Description: HF Engineer, Capital Acquisition

The DM was a Human Factors (HF) Engineer on a capital acquisition project for the CF. It was the responsibility of the DM to validate user requirements and write HF-based specifications for the project. Goals of the project included creating a specification that was: easy to meet, met empirical standards, and met user requirements including usability, as well as meeting time and financial resource requirements. The DM had to develop measures for user requirements and determine which form of evaluation to use (e.g., objective tests, a controlled usability trial, etc.)

Factors which influenced the ability of the DM to manage these processes included:

- Different team members and the DM had consistently different perspectives. While the DM thought getting user involvement was important, the other team members didn't want user involvement in the requirements specification process;
- The DM tried many different methods and explained the importance of HF to other team members many times but was largely ignored. This interpersonal conflict created a feeling that the DM was doing everything they could but nothing changed;
- Insufficient data was available regarding certain aspects of the equipment needed to specify HF requirements
- Feedback from industry about initial requirements caused a lot of assumptions by the DM's team to be questioned;
- The DM was involved in other similar projects and attempted to do related R&D by leveraging those projects to get needed information as opportunities arose;

- Because of previous work the DM had a network of interpersonal relationships that could be leveraged to get additional data;
- The DM used their own network of interpersonal relationships to push the HF agenda (e.g., got the Deputy Project Director who did work on other projects to talk to other team members about HF issues);
- The DM was not co-located with other decision makers. One impact of this was that the DM was not always consulted before major scoping or other project changes were made;
- It was difficult to convince the project team to use a testing baseline for bid evaluation (to ensure systems being acquired would offer improved capability over in-service systems, an approach necessary in the absence of performance data for in-service systems), because the baseline equipment was in short supply, it would impose a lot of logistic challenges to make this equipment available to bidders, and much of the baseline equipment was composed of controlled goods;
- Users have multiple conflicting needs. Changing equipment to address one of these needs will generally affect all of the other needs as well (either positively or negatively);
- Other teams on the project had hired staff too early (i.e., hired a large engineering team before the Statement of Requirements (SOR) was finalized) and therefore the project was going through budget resources quicker than anticipated. This resulted in a significant spend early in the project on engineering, with little actual project advancement, because engineering specifications kept having to change to reflect SOR changes. It also meant that less money was available for HF SOR and test specification validation work.
- The credibility of the HF engineers and their approach was continually questioned – as evidenced by the requirement to continually present arguments with supporting data to the larger project management team for approval (whereas the other specialty engineering teams were not questioned by the project management team) , the requirement to provide way too much detail in bid evaluation documentation (which later needed to be dramatically revised and abbreviated, at additional cost to the project, to reflect the changes in project scope), as well as evidenced in changes made by other team members that were readily accepted by project management with little questioning or demands for evidence;
- There was resistance to including testing for all important interacting human factors; while there were thousands of engineering specifications, HF criteria were continually being eliminated until they numbered fewer than 50;
- There were concerns that there would not be enough bidders because the bidders would not be willing to have their systems subjected to usability testing comprising scientifically administered user ratings of acceptability. The Engineering Section wanted to water down the technical requirements that had been empirically validated by the DM to ensure as many bidders as possible, but at the risk of buying a system that would not meet the demonstrated user needs. There were no strategies put in place to control the number of bidders and there turned out to be more bidders than could easily be handled in bid evaluation;
- The scope of the project changed from a situation in which the DM's team would work with the winning bidder to develop and customize a system, to a situation where systems the bidders presented to be evaluated were what the project would buy for the CF (i.e., no

CF customization). This shortened the project schedule, but created a huge increase in risk, greatly increased the required specificity for the statement of requirements, and made the bid evaluation process much more important.

Factors which unfolded over time:

- The awareness of technology that was available changed over the course of the project, which influenced ideas about what was possible and created different opportunities;
- The specification of requirements was an iterative process and feedback from industry caused assumptions about available technology to be re-evaluated and changed;
- Financial resource availability for HF changed over time; initially they were supposed to have resources for Research and Development (R&D) but this allocation of resources dropped over time without needed R&D being accomplished (i.e., it was reallocated for other non-HF purposes);
- The project proved to be quick to spend and slow to deliver; the strategic review and other forces caused scope changes, resource restrictions, and pressure to deliver;
- The scope of the work changed repeatedly over time which had impacts on the other aspects of the project.

9. Scenario Description: PME Revitalization Staff Member

The DM was a senior staff officer who supported Professional Development (PD) for the CF. Part of the DM's responsibilities was to oversee the creation of policies and processes related to pan-CF training programs. At the beginning of this scenario, there was a demand from higher command to create a Distance Learning (DL) option for education and training, which was associated with a revamping of the Professional Military Education (PME) system (called PME revitalization). The DM had to perform tasks such as organizing meetings, putting together briefing packages for meetings, and maintaining communications between the various stakeholders to facilitate the PME revitalization process.

Factors which influenced the ability of the DM to manage this process included:

- The need for consultation. If a training program is being changed, the DM shouldn't make any recommendations that affect policies for CF programs without consulting all elements (army, navy, air force);
- Changes to the proposal submission process. The process required to submit proposals related to PME Revitalization changed during this time period. As the procedure was new, there was a general lack of clarity about expectations and difficulty in following this process;
- The Strategic Review. A major Strategic Review was undertaken that affected the whole CF during this time period. It was anticipated that the results of the review will profoundly affect funding, including funding related to PME revitalization;
- Differing interpretations between stakeholders about the scope of project financing (e.g., was overhead and general infrastructure upgrades meant to be included?);
- Inaccuracies in databases of funding requirements (there appeared to be accounting errors);

- Difficulty in isolating components of programs to get accurate costing information. Proposals for funding generally involve many interrelated factors such as actual cost to deliver a program, infrastructure and overhead issues (e.g., creation of a virtual library is required for a program but it is also used for other things so how can you determine what program should pay what proportion of the cost?);
- Periods of silence of significant duration (e.g., several months or more) after submission of requested information to higher headquarters;
- The need for briefings to be thorough yet concise because those being briefed don't have a lot of time to read the documents;
- Requirements for new training programs which often do not come with additional funds, requiring a shifting of resources.

Factors which unfolded over time:

- Improvements and changes in technology (e.g., the possibility of creating a virtual library) put different demands on and created different opportunities for T&E;
- As the recession occurred and got more serious it caused increasing funding concerns;
- As the impact of the Canadian operation in Afghanistan changed, other priorities increased (e.g., setting up resource centres for returning soldiers, supporting military families, supporting the health and welfare of returning soldiers) so projects like the PME revitalization got pushed to a lower priority and delayed;
- Training priorities changed over time as senior commanders, governments, and governmental priorities changed (e.g., more or less demand for aboriginal programs);
- Things would go quiet for a few months and then there would be a flurry of activity (e.g., requests for more information) which would require a response and then it would go quiet again; this appeared to the DM to be a cyclical process;
- Meeting requests were responded to less favourably over time, which created delays in scheduling;
- Lack of continuity, with new people entering the process, due to annual postings, meant that tasks were performed multiple times as people had to be gotten up to speed, etc.

10. Scenario Description: PSYOPS Training Program Developer

It was the responsibility of the DM to develop a training program for a PSYOPS component of an Afghanistan deployment. The goal was to create the best PSYOPS platoon possible, able to influence and disseminate information in a productive manner.

Components of training that the DM was responsible for included arranging quarters and rations, planning basic courses and the schedule, arranging course locations, creating an internal confirmation exercise, arranging a 2-week long final exercise in Alberta, and coordinating PSYOPS training with the general training requirements that also had to be provided. Instructors had to be identified and recruited. There was a general concept plan "in pencil" before the DM took over, but final arrangements were generally up to the DM.

Factors which influenced the ability of the DM to develop the training program included:

- This was the first time such a thorough training program was being developed for PSYOPS training in Afghanistan so previous courses were not available to use to guide planning;
- There was a very short timeline as budget approval was obtained 6 weeks before the 4-month training program was to begin. Because of the short timeline, changes in one resource (e.g., instructor availability) meant that things had to be shifted (e.g., the order of instruction changed);
- Some elements of planning were done before the DM took over, including preliminary arrangements for quarters and rations. This limited the DM's options (e.g., there was pressure to have the training at the PSTC in Kingston but financial approval for rations were given for Toronto);
- There was pressure to have the trainees be able to prove their worth right away – they were to be handed off to the BG very quickly after their training ended;
- The trainees were a diverse group of people with very different backgrounds and levels of military experience (although none were new soldiers);
- Two group members had significant experience in close quarter combat training; this was used by the DM and two weeks of close quarter combat training was offered internally. This offered a basic review, built trust within the group, increased the confidence of the group, and gave the trainees an additional skill set to increase their value to the other personnel they were stationed with;
- The DM was requested by the training location to not have the trainees in uniform;
- The DM had a network of resources that proved very useful for providing training opportunities (e.g., he knew someone at TV Ontario; this created an opportunity for 5 trainees to observe their communications methods);
- Locating the training in Toronto allowed access to a population of Afghan immigrants that were used to assist training (e.g., to provide experience using translators and to provide cultural information);
- Instructor schedules produced constraints on when information could be delivered (there were a lot of availability challenges, as instructors were generally booked farther in advance then the lead time given for this course). This meant that sometimes information could not be delivered in the optimal order.

Factors which unfolded over time:

- Planning for the training programming was still underway during the training itself (i.e., rolling-wave planning). For example the close-combat training was arranged after the group had already started training and the skills of the trainees became known. This allowed the DM to take advantage of opportunities that arose but was not optimal for long-term planning;
- Group cohesion was an important process for facilitating training; this process worked well in this situation and was impacted by factors such as the training centre requiring use of civilian clothes, trainees boarding together, and team members conducting close quarter combat training. In this case, the group gelled together well (teambuilding was considered to be "outstanding");

- Some of the benefits of training unfolded over time rather than being immediately apparent. For example, some adversarial intent theory was provided by the DRDC group. The usefulness of this was not immediately apparent to the trainees but the relevance and importance was understood later (e.g., when they had to defend their ideas in the field they could call upon related academic literature for support).

Annex C: Operational Experience Mapped to Five Key Complexity Factors

This annex contains the operational experience mappings to the five key complexity factors for each scenario. The mappings are presented in order of overall complexity ranking (see Table 10), with the most complex scenario first. Note that some specifics have had to be removed due to concerns about privacy.

1. Experience to complexity factor mapping: Military Liaison and Advisor, International Event

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: All groups were requesting information from the DM. Many requests for information were for information that would have been outside of the CF's lawful mandate. There were requests from local security partners for information about CF capacity and capabilities but the DM could not tell them (secret or operationally sensitive information). This situation required a lot of juggling to figure out what the DM can do, what the DM can say, how the DM can get around those situations and make it work without stepping outside of CF bounds. The breakdown of C2 during the event had profound effects. For example, federal authorities decided that they were going to take over from local authorities. This had many implications for the DM including the fact that tactical officers had to be moved from one location to another on short notice. However, the tactical officers were not available to redeploy, which meant other options had to be found. As well, if other tactical officers were to be brought in suddenly, other arrangements have to be made including feeding, housing, and pay. There are implications for C2, including whether the local authorities would be told to officially stand down, was the army going to deploy? Were CF assets at risk and should they be protected? What were the ROEs going to be (the CF only had lethal force)? So the possible political implications of the situation were profound. There were follow-on effects such as career implications and public perception (e.g., if it was perceived that the local authorities were ineffective this could have far-reaching implications). This could also have far-reaching consequences for personal	High Many factors that are interrelated and that have to be considered when making decisions (e.g., the negotiation for the use of DND property involved at least 11 factors that the DM had to consider) Examples of 2nd and 3rd order effects (e.g., the breakdown of C2 involved at least 10 additional decisions or effects, including effects on dozens of personal relationships and organizational relationships)

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	relationships and the relationship between the security stakeholders. There was a request from the local authorities to use CF property. The DM was acting as a liaison to help with arrangements. Originally the local authorities said that access to a piece of property was all they needed, but upon questioning by the DM they also wanted access to many other related facilities and amenities	
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: Strategic level decisions were made at the latest possible moment. This meant that the rate at which plans had to be made and implemented kept changing, and eventually tactical activities, like contracting, were done in haste; Treasury Board regulations and PWGSC contracting guidelines were not well-understood by Provincial and Municipal partners. There was general ignorance about the best way to negotiate for the use of federal assets for security related to the event. Originally local security partners were negotiating for federal resources, but they were unprepared when the contracting process took a lot of time and they received massive bills for the use of these assets. The DM suggested that the process should be changed so that requests were made from federal rather than local security partners. When this was done, the cost of many security aspects (e.g., renting a CF armoury) went down to nothing and the timelines for approval decreased. According to the DM, if this strategy had been done in the beginning much difficulty, wasted effort, and bad feelings could have been avoided; Over time it became clear to the DM that vital information was not known (e.g., knowledge of the legal case Regina vs. Knowlton, a case where the finding resulted in the authority to have cordons and protect them when countries are hosting internationally protected persons). The DM generally decided to inform people about the information (felt would be remiss not to), but then the DM was marginalized because of this by some people because who felt the DM was "sticking their nose in". This caused concerns for the DM's interpersonal relationships and also conflicts between others because some people would agree with the DM and some would disagree, and the implications of these incidents built over time; The individual agendas of security personnel involved played a role in how events unfolded. Certain individuals were trying to keep information to themselves (which led to delays in needed information being communicated), others appeared to have other priorities than maintaining	High Nine specific examples of situations that unfolded over time that profoundly affected decision making Twenty-seven subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	security for the event, etc.; Personality played a role and the interactions between personality and events changed over time; There were several C2 cells actively coordinating during the event. The DM was present in the LCC and the "main" HQ was located elsewhere, so this created a high demand on the DM for information as the DM was the person "on the ground" with access to information about events occurring at the international event. As events unfolded, the pressure became more and more intense; The demonstrations and protests unfolded over time, as well as their implications, such as how people were handling the situation, how C2 would operate, what extra security forces were available, etc.; The breakdown of C2 during the event unfolded over time and had profound effects, including far-reaching consequences for personal relationships and the relationship between security stakeholders; Investigations are on-going, and these investigations will unfold over time and have many consequences for organizational and personal relationships, organizational reputation, people's careers, recommendations for future events, etc. As the understanding that there would likely be investigations related to this event grew, this influenced decision-making and some individual's decision making became more and more self-protective. There were subsystems which had their own dynamics in this context. These included: • At least 22 different security agencies. Dynamics of the security personnel were different based on location as they had different types of areas to police, different groups, different numbers of attendees/observers, etc.; • Dynamics of the security personnel were also different based on organization as they had different planning approaches and other processes, different cultures, and different timelines over which they were accustomed to working; • Other subsystems with different dynamics (cultures, timelines, processes) included: o Peaceful protestors; o Violent protestors; o Attendees of the event; o General citizens; o Media.	

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Building and maintaining personal relationships; • Building and maintaining relationships between organizations; • Meeting responsibilities to the situation; • Meeting obligations to higher command; • Providing advice about CF capabilities to security organizations; • Maintaining the security of confidential CF assets; • Supporting negotiations for the use of federal assets for security related to the event; • Making sure actions are legal; • Making sure actions are defensible morally; • Making sure the CF does not "become the face" of the event (i.e., the CF wanted to advise and stay behind the scenes). Most of these goals can conflict depending on the situation; for example, building and maintaining relationships with one group was sometimes seen as negative by another group and so hurt the relationship with them; providing certain information could damage relationships if it was seen negatively (e.g., it was seen as "sticking your nose in"); providing information to local security personnel often contradicted the goal of maintaining the security of confidential CF assets.	High There were an extremely high number of important goals that conflicted in different ways in different situations (10 distinct goals) Three examples of goal conflict
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included: The DM didn't really get clear terms of reference for the job, which gave the DM needed flexibility but the DM's job might have been easier with clearer terms of reference; When asked what information would be useful, the DM was instructed by the boss to "Give me everything", so basically every decision and conversation was communicated. There was no other specific direction and the DM didn't actually know what the boss needed to know and what was going on at his end; When things started going wrong, the instruction was generally "sort it out", which was not helpful (although this was instruction to others more than the DM).	High Three examples of vague goals that impacted the ability of the DM to make decisions
Independent agents: There are independent entities in the environment who influence it (they may	Independent agents who influenced decision making included: • At least 22 public order units involved – there were several ways the DM mentioned that their	High Twenty-eight independent agents who impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
have different goals than the decision maker)	goals conflicted with the DM's own. Because of the importance of the event, many were in self-protection mode, which meant they were not cooperative with the DM or each other, and also were not focussing on security. Some public order units just left, meaning that they were no longer contributing to security. There were many difficulties because of territoriality of different groups and the goal of self-protection held by many of them; • Media with its own biases and agenda (e.g., getting a good story); • Mayor – wanted a briefing – caused reprioritization and pulled the DM away from other tasks; • Peaceful protestors; • Violent protestors (wanted to disrupt the event and threatened security); • Attendees of the event; • General citizens (didn't want to have to deal with security measures such as the fence). • There were issues with learning the same language/terminology because collaboration was made difficult by a lack of common language.	Seven examples of independent agents with goals that conflicted or could interfere with the DM's goals

2. Experience to complexity factor mapping: NSE Officer, Afghanistan

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: The DM was responsible for meeting logistics needs which included quantity, storage, maintenance, and location of food, artillery, vehicles, and other equipment using a limited number of personnel and vehicles to transport items. Because the resources were dispersed (decentralized), this meant that a lot of juggling had to be done to make sure supplies were where they were needed; The relative importance of logistics considerations in the CF is quite variable and frequently little effort is directed at the sustainment estimate. Because more firepower was desired	High Many factors that are interrelated and that have to be considered when making decisions (e.g., the basic logistics problem involved over a dozen factors including many different vehicles, many different types of items, many different locations, and limited staff. These were all

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	in the Afghanistan mission but the budget was limited, there was an increase in the proportion of combat to logistics personnel. This meant that there were a relatively small number of logistics personnel sent to support the combat troops, which had both immediate and long-term effects on the ability of the logistics staff to keep up with resource needs (e.g., impacted psychological well-being and safety of logistics staff due to lack of sleep and rest, impacted number of convoys which could occur, impacted the rate at which items could move, impacted the ability of the staff to do maintenance); Another impact of little effort being directed at the sustainment estimate is that during training, true sustainment was not practiced (e.g., soldiers could go to the base and get food easily). This led to a lack of information for planners about true logistical needs as well as a lack of training for soldiers regarding true sustainment demands and readiness requirements, which likely impacted their morale and preparedness; The location of the conflict (Afghanistan) had a profound impact on logistics. Afghanistan is surrounded by other countries (i.e., no sea access); thus, ammunition has to be flown in. Because of the nature of artillery, flying artillery over other countries requires their consent, and therefore much preplanning is required to move ammunition (e.g., it can take over a month to receive ammunition from Canada). This in turn results in a lack of flexibility in the ammunition ordering process and a resulting vulnerability in the flow of resources.	factors that the DM had to consider) Examples of 2nd and 3rd order effects (e.g., side effects of directing little effort at the sustainment estimate involved at least 13 additional decisions or effects)
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: The enemy is constantly evolving their tactics (e.g., their ambush locations and methods). This means that the location of resources (e.g., FOBs) became more or less relevant depending on enemy locations and activity; Locations and number of FOBs strongly influenced logistics but they were planned without logistics input and had to be built well before they were needed; there was no way to influence where they were or know that they would be appropriately situated. As events unfolded, the FOBs were not useful as the CF were sent to another part of Afghanistan to fight; The relative importance of logistics considerations in the CF is quite variable and frequently little effort is directed at the sustainment estimate. Because more firepower was desired in the Afghanistan mission but the budget was limited, there was an increase in the proportion of combat to logistics personnel. This meant that there were relatively few	High Eight specific examples of situations that unfolded over time that profoundly affected decision making At least twelve subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	logistics personnel sent to support the combat troops, which had both immediate and long-term effects on the ability of the logistics staff to keep up with resource needs (e.g., impacted psychological well-being and safety of logistics staff due to lack of sleep and rest, impacted number of convoys which could occur, impacted the rate at which items could move, impacted the ability of the staff to do maintenance); Another impact of directing little effort at the sustainment estimate was that during training, true sustainment was not practiced (e.g., soldiers could go to the base and get food easily). This led to a lack of advanced information for planners about true logistical needs (information had to be gathered over time during the operation) as well as a lack of training for soldiers regarding true sustainment demands and readiness requirements, which likely impacted their morale and preparedness; The location of the conflict (Afghanistan) had a profound impact on logistics. Afghanistan is surrounded by other countries (i.e., no sea access); thus, ammunition has to be flown in. Because of the nature of artillery, flying artillery over other countries requires their consent, and therefore much preplanning is required to move ammunition (e.g., it can take over a month to receive ammunition from Canada). This in turn results in a lack of flexibility in the ammunition ordering process and a resulting vulnerability in the flow of resources; There was a radical change in the CONOPS for the Afghanistan mission which occurred immediately prior to the DM landing in Afghanistan. This CONOPS required changes in plans to how the LAV companies would be used (i.e., LAV companies were always in use rather than having one on base). This change in resource allocation had long-term repercussions to how maintenance could be scheduled and performed (e.g., all LAVs constantly being out in use means no preventative maintenance was possible); The use of ammunition varied greatly over time. Monitoring ammunition use at the beginning of the DM's tour indicated that X amount was used per unit time; however, this increased greatly when the pace of battle increased as well as when other factors changed (commanders changed and some commanders were more prone to use a lot of ammunition). Factors which increased the use of resources (especially ammunition) also had other effects such as making it more difficult for the BG to report ammunition use (i.e., as the pace of battle increased, the use of ammunition greatly increased, but the information from the BG about how much artillery was being used was not sent; this could	

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	have been due to the stress and time pressure of battle or other factors); Resource availability was so close to the minimum required that it had to constantly be balanced and plans changed; factors such as vehicles needing repair would mean that rebalancing was required frequently. There were subsystems which had their own dynamics in this context. These included: • The Battle Group (BG); • The logistics unit; • Personnel at the FOBs (multiple groups); • The CF as a whole; • CEFCOM; • CANOSCOM; • Other armies (e.g., US, British, Netherlands); • The ANA • The Taliban (the enemy) • For example, the events experienced by the BG have profound effects on logistics, but these effects were sometimes delayed. • Personnel manning different FOBs experienced different levels of activity and required different logistical support. • Enemy activity also has profound effect on logistics requirements and it waxes and wanes unpredictably.	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Maintaining Canadian security • Making sure that Canada was well represented • Taking away Taliban training areas • Maintaining a positive public perception of the CF • Making and keeping strong relationships with allies • Lowering the stress level of commanding officers • Managing physical resources (food, artillery, vehicles, other equipment) • Acting within resource constraints. The DM indicated that many of these goals were extremely important and yet had to be delicately balanced due to lack of resources. For example, the need to share resources with allies for tactical effect can sometimes compromise resupply of other	High There were an extremely high number of important goals that conflicted in different ways in different situations (8 distinct goals) Three examples of goal conflict

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	Canadian units; time lags in resupply meant that the balance between managing physical resources (i.e., having needed resources) and acting within resource constraints (i.e., not spending too much money and having extra supplies not being used) were in conflict.	
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included: • What role the logistics component and CF was supposed to have with the ANA was not fully developed when the DM was involved. The DM was just told to "do what you can" to work with ANA logistics. • The DM noted that, although difficult to achieve, goals were generally clear (at least at a high level).	Medium One example of a vague goal that impacted the ability of the DM to make decisions
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included: • The CF (ensure Canadian security is preserved, make sure Canada is well represented, take away Taliban training areas); • US army (make sure US is well represented); • NATO (follow NATO doctrine and ensure it is followed by others); • Netherlands army (make sure Netherlands are well represented); • British Army (make sure British are well represented); • RCMP (mentor the ANP); • CIDA (provide humanitarian aid); • DFAIT (assist in provincial reconstruction program); • ANA (protect own country, maintain independence); • Taliban (defeat enemies including CF, other NATO forces). Many independent agents with conflicting resource needs which had to be accommodated (e.g., CF, other allied forces, ANA, NATO personnel, US army) Several groups (e.g., Taliban, ANA at times) had goals which were in conflict with the DM's goals.	High Ten independent agents who impacted decision making Seven examples of independent agents with goals that conflicted or could interfere with the DM's goals

3. Experience to complexity factor mapping: Liaison Officer, Afghanistan

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: The prison break led to a process of information gathering. This process gradually revealed that there was no Common Operating Picture (COP) among Afghan security agencies; that the ANP could not effectively get information about threats; that the ANP had difficulty responding to threats; that the ANP could not effectively ask for assistance from other security organizations; and that Afghan security organizations typically work at a tactical level and are not used to working at an operational or strategic level. These pieces of information changed how the DM saw his goals and how they could be accomplished; Cultural differences between Afghanistan and Canada are profound; they created a lack of trust and difficulty with coordination, affecting many of the DM's decisions. Factors included: • Extremely high emphasis on interpersonal relationships in Afghanistan (e.g., the importance of personal relationships to Afghans is paramount). This has profound implications; for example, authority based on position alone is not "real" authority to the Afghans (obedience is based on personal relationships); • Differences in the legal system and widespread corruption (e.g., people responsible for the prison break probably were not punished as they could pay to be released, which destroyed trust); • A difference in the idea of what it is to have a job and the attendant responsibility (e.g., a police officer threw away his phone because DM was getting too many 911 calls, even though that was the only phone the calls were coming to); • The Afghans appeared to have the perspective that they had little control over events (e.g., "what Allah wills will happen"); whereas Canadians typically feel they do have control over events. This had implications; for example, the Afghans were not used to the concept of practicing for a possible event and were resistant to such training • Different social standards (e.g., DM never met the wife of any Afghan the DM worked with). The DM knew that social relationships were important, but was not able to actually understand what the relationships were as he was not privy to how families were interrelated through marriage; • Literacy is so low in Afghanistan that usually no written records are kept, which means data is not available that would help assess resource and training requirements;	High Many factors that are interrelated and that have to be considered when making decisions (e.g., there were 15 important cultural effects and implications which influenced the DM's decisions) Examples of 2nd and 3rd order effects (e.g., the DM having to work in a different culture involved at least 15 additional decisions or effects)

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	• Lack of appreciation for resources (e.g., communications equipment was given to the relevant stakeholders; one faction of the ANA changed locations but left the equipment in the old location unattended without notifying the DM); • Age is more of a factor in creating a sense of authority in Afghanistan. The DM felt that more respect would have been received if DM had been older;	
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: There was a 911 system that was implemented; this was supposed to be run by the ANP but the chief of police discarded the phone that was used for the 911 calls as he found it inconvenient. The DM volunteered to take over the 911 function; this became a tool to get the ANP involved as the operations room would receive the calls but the ANP would be contacted to answer them. This created additional (an unpredictable) windows of opportunity for collaboration with the ANP, for obtaining intelligence, and for facilitating relationships with civilians; The prison break led to a process of information gathering. This process gradually revealed that there was no Common Operating Picture (COP) among Afghan security agencies; that the ANP could not effectively get information about threats; that the ANP had difficulty responding to threats; that the ANP could not effectively ask for assistance from other security organizations; and that Afghan security organizations typically work at a tactical level and are not used to working at an operational or strategic level. These pieces of information changed how the DM saw his goals and how they could be accomplished; The DM attempted to get the relevant stakeholders to install, maintain, train on, and use communication equipment provided by the U.S. DM found this very difficult for many reasons (e.g., cultural differences), and felt that any intervention tried did not result in change (i.e., there seemed to be a "set point" in the environment that was highly resistant to change). This became more and more frustrating as time went on and the DM grew increasingly hopeless that the C2 infrastructure would be adequate to maintain security. There were subsystems which had their own dynamics in this context. These included: • The ANA; • The ANP • Kandahar prison personnel; • The CF; • Civilians; • The operations centre in which the DM was working.	Medium Three specific examples of situations that unfolded over time that profoundly affected decision making Six subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	Canadian and other foreign military organizations appeared to have a relatively fast rate of change compared to the Afghan organizations (e.g., longer time to train, longer time to change procedures), with an exception being in the rate of personnel change, with higher turnover in the Afghan organizations.	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Creating an effective Kandahar city security network • Building and maintaining relationships with members of the ANA, ANP, Kandahar prison personnel, Border Security, and the NDS. There were some cases in which it was difficult to achieve all of these goals. One example was that the ANP and ANA were adversaries that the DM was trying to get to work together, and it was difficult to meet both of their needs and expectations. Another example is that the DM had to balance the feedback accuracy that the DM provided to trainees with allowing them to save face and remain invested (i.e., too much negative feedback would likely have resulted in stakeholders withdrawing from the training).	Medium There were a number of important goals that conflicted in different ways in different situations (6 distinct goals) Two examples of goal conflict Primary difficulty due to problems with getting stakeholder buy-in and participation rather than goals conflicting
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included: The goal of creating an effective Kandahar city security network was superficially clear but what was actually required and the poor state of the current system was only revealed over time.	Medium One example of a vague goal that impacted the ability of the DM to make decisions Goals at a high level were fairly clear, the main challenge was to determine current security situation and needs
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included: • The CF; • The ANA (didn't like working with the ANP and vice versa); • The ANP; • Kandahar prison personnel (not trusted; most were new after the prison break); • Border security; • NDS; • IEC (Independent Electoral Commission) – required protection; • Mentors. Large problems due to interpersonal conflicts between different stakeholders (e.g., ANA and ANP didn't want to work together; no one wanted to work with the Kandahar prison personnel)	High Eight independent agents who impacted decision making Seven examples of independent agents with goals that conflicted or could interfere with the DM's goals

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	Large problems related to getting stakeholder buy-in and adequate participation; this partially a cultural problem (e.g., all Afghani groups didn't want to cooperate with the DM's training plans)	

4. Experience to complexity factor mapping: CoE Training Developer

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: cultural information, working with translators, team training, interacting with the media (e.g., giving interviews), working with multiple OGDs (e.g., DFAIT, CIDA), dealing with unexpected events, and how to balance conflicting objectives (e.g., when CEFCOM and NATO have different policies or priorities) Factors the DM must consider how to include in training: The degree to which the CF would have to work with CIDA, DFAIT, and other organizations only became clear over time (e.g., the Manley panel report indicated a greater need for cooperation), therefore their involvement in providing and receiving training evolved over time. There were several components to this, including: • It took time to build the necessary trust between agencies (e.g., CF, CIDA, DFAIT) to effectively train together. Networking and relationship building were more actively encouraged over time (e.g., a "night out dinner" was built into OGD training to facilitate networking etc.); • Another aspect of OGD integration which took place over time was getting a common understanding of basic Operational Planning Process (OPP). Initially CIDA, DFAIT etc. have no training in the OPP and this basic training was begun. This training helped improve common understanding and build social networks which were useful for training and also in theatre. The DM said that there were many 2nd and 3rd order effects from these social relationships and other training benefits; As operational environments and priorities changed, training had to change along with them. This requires almost constantly updating SA about operational environments and priorities as well as implementing changes to effectively deal with changes. Someone from	Medium Factors that are interrelated and that have to be considered when making decisions (e.g., the trainers have to consider at least 7 different aspects of training when designing the programs.) Examples of 2nd and 3rd order effects (e.g., involvement of CIDA and DFAIT in the OPP training involved "many" 2nd and 3rd order effects (although these were not explicitly listed)

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	the CoE often went on the recce with the new HQ so they knew what's needed in theatre and what the current situation was.	
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: As operational environments and priorities changed, training had to change along with them. This required almost constantly updating SA about operational environments and priorities as well as implementing changes to effectively deal with changes. Someone from the CoE often went on the recce with the new HQ so they knew what's needed in theatre and what the current situation was; The degree to which the CF would have to work with CIDA, DFAIT, and other organizations only became clear over time (e.g., the Manley panel report indicated a greater need for cooperation), therefore their involvement in providing and receiving training evolved over time. There were several components to this, including: • It took time to build the necessary trust between agencies (e.g., CF, CIDA, DFAIT) to effectively train together. Networking and relationship building were more actively encouraged over time (e.g., a "night out dinner" was built into OGD training to facilitate networking etc.); • Another aspect of OGD integration which took place over time was getting a common understanding of basic Operational Planning Process (OPP). Initially CIDA, DFAIT etc. have no training in the OPP and this basic training was begun. This training helped improve common understanding and build social networks which were useful for training and also in theatre. The DM said that there were many 2nd and 3rd order effects from these social relationships and other training benefits; The money available for training decreased over time – at first, when war started, the budget was virtually unlimited, but funding became more scarce as time when on and the mission began to wind up, the recession started, etc.; Generally training programs use rolling-wave planning as there are many variables which have to be set and things change over time (e.g., people's availability, what training needs are); Networks of people were built as the training was developed, and this helped in the acquisition of resources for training as well as getting other organizations involved.	Medium Eight specific examples of situations that unfolded over time that profoundly affected decision making Six subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	One or two people would get on board (e.g., one member of DFAIT) and then their contacts were useful for getting more people involved. Personal contacts often proved much more useful than "official" channels; Now, trainers are often trainees from an earlier group. This means that they generally understand what they need to talk about and can improve training; Changes to training programs have a distinct pattern. Changes are difficult to make within a training cycle, but there is a great deal of change that happens between training cycles. There were subsystems which had their own dynamics in this context. These included: • OGDs (DFAIT, CIDA) • Trainees • Instructors • Writing group (SMEs) • CF • CoE military vs. civilian chain of command • CIDA and DFAIT have different deployment schedules than the CF (CF HQ 9 months, OGDs 6 months) which causes problems with building networks and understanding capabilities of individuals. • CoE military vs. civilian chain of command – both chains of command have different authority structures and processes.	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Getting the trainees ready for war (main goal) – this is really clear. Generally this goal comes with formation battle task standards (a list of things the HQ needs to be able to do in war); • Coordinating with operational needs of trainees; • Meeting requirements of superiors; • Building and maintaining network of contacts. Sometimes the training goals of the government and higher HQ don't align Training needs are sometimes in conflict with operational needs (e.g., time for training vs. time for performing operational tasks) Some conflicts arise simply due to time limitations and other resource limitations (e.g., can't do everything with limited resources)	Medium There were 4 important goals that conflicted in different ways in different situations Three examples of goal conflict

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included: When the training program began initially, the DM was working "in a void", had only limited staff and didn't really know what they needed; The DM had never experienced the kind of meeting that they were trying to recreate, which made it more difficult to understand what they were trying to do; Some changes did occur which were vague. For example, the Canadian Government announced a counter-insurgency strategy but failed to provide any firm direction; NATO generally gives good direction but when higher level command changes so can the direction (not so much vague goals as changing goals).	High Three examples of vague goals that impacted the ability of the DM to make decisions
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included: • Trainees (have conflict between training needs and operational needs (e.g., may have the command group take off to do a recce for the time during which a training seminar was scheduled)); • NATO (objectives may conflict with Canadian Government objectives and policies); • CoE civilian vs. CF military chain of command (may have different goals and processes); • OGDs (CIDA, DFAIT, etc.) (have different goals, processes, and timelines). Often difficult to coordinate meetings and training because people have multiple priorities and commitments.	Medium Six independent agents who impacted decision making Five examples of independent agents with goals that conflicted or could interfere with the DM's goals

5. Experience to complexity factor mapping: Chief of Staff, Strategic Advisory Team, Afghanistan

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: One goal of the DM was to build relationships; relationship networks were built over time and had many, sometimes unexpected benefits. For example, the DM made contact with the chaplains at a nearby US base, and these chaplains acted as a resource when Canadians needed	Medium Many factors that are interrelated and that have to be considered when making decisions (e.g., the consideration of whether to be openly military involved

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	counselling (e.g., when a co-worker was killed). To facilitate relationship building, the DM's group hosted an open house BBQ every Friday night, and as relationships built more and more people would attend. This created a growing network of connections between people and facilitated many interactions; There was an on-going balancing act between being openly military (e.g., wearing uniforms, driving military vehicles) and trying to pass as civilian. The costs (e.g., being targeted, legal trouble and safety issues if caught with weapons out of uniform) and benefits (e.g., being protected in more secure vehicles, being protected by military law as on-duty military officers). This had far-reaching consequences, including strategic implications if other country members saw Canadian military entering Afghan military buildings.	at least 8 decisions and possible consequences that the DM had to consider) Examples of 2nd and 3rd order effects (e.g., the possible consequences of being openly military or not involved at least 6 possible consequences)
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: One goal of the DM was to build relationships; relationship networks were built over time and had many, sometimes unexpected benefits. For example, the DM made contact with the chaplains at a nearby US base, and these chaplains acted as a resource when Canadians needed counselling (e.g., when a co-worker was killed). To facilitate relationship building, the DM's group hosted an open house BBQ every Friday night, and as relationships built more and more people would attend. This created a growing network of connections between people and facilitated many interactions; There was an on-going balancing act between being openly military (e.g., wearing uniforms, driving military vehicles) and trying to pass as civilian, which were influenced by factors such as the current state of tension in the area. The costs (e.g., being targeted, legal trouble and safety issues if caught with weapons out of uniform) and benefits (e.g., being protected in more secure vehicles, being protected by military law as on-duty military officers) have to be weighed. This had far-reaching consequences, including strategic implications if other country members saw Canadian military entering Afghan military buildings; The chain of command was fuzzy. Task Force Afghanistan (TFA) in Kandahar was in charge of the DM's group for administrative purposes, but the team actually worked directly through CEFCOM. As time went on it became more and more clear that TFA felt they had more authority over the DM's team than the DM thought, and this made decision making more difficult. For example,	Medium Five specific examples of situations that unfolded over time that profoundly affected decision making Six subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	TFA kept pressuring the DM to get electronic counter-measures put on their vehicles, but the DM kept putting this off as that would make them targets (because it would be obvious they were military vehicles); Team cohesion issues waxed and waned during this time period. For example, the team member who experienced the negligent discharge was teased about it by the group for some time afterward. The group lived together and had to be a tight-knit group, so any tensions could profoundly impact the mood of the entire compound and the ability of team members to work effectively together. The DM experienced 2 different team configurations and the second configuration were more team players than the first; Events which threatened the security of the compound led to reassessment of the security plan for the compound as well as an on-going effort to work with the British and other embassies to arrange for a more secure location in case an evacuation was required, and also an attempt to improve communication between these stakeholders. There were subsystems which had their own dynamics in this context. These included: • TFA; • CEFCOM; • The DM's team; • Forces from different countries; • The group at the US base near the DM's compound; • The Afghan security force hired by the DM. The DM's group had fewer resources than many groups and so were more affected by change (e.g., need for resource allocation); The TFA and CEFCOM, as well as other countries' forces had different rates of information exchange and slower processes as they were much larger groups than the DM's team; The Afghan security force had a different culture and different practices than the DM's team.	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Ensuring team members' safety • Ensuring safety of the compound and equipment • Building relationships • Performing administration tasks effectively	Medium There were a number of important goals that conflicted in different ways in different situations (6 distinct goals) Two examples of goal

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	• Dealing with unexpected events effectively • Meeting demands and requirements of higher command • Some of these goals conflicted – for example, higher command at TFA ordered the DM to have the vehicles fitted with electronic counter-measures, but the DM thought that this would make his team targets and actually decrease their safety; • One main problem with managing multiple goals was lack of time rather than goals being inherently contradictory.	conflict provided
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included: • There was the requirement to assist the Afghans and "do it their way", but what this actually meant was unclear.	Medium One example of vague goals that impacted the ability of the DM to make decisions
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included: • DM's team members • American coalition groups • ISAF mission groups • UN mission groups • UN agencies • Other nations with embassies and ambassadors • Afghan civilians • Afghan military • Enemy It was clear that the DM thought these groups had different agendas but clear examples were not provided; Potential enemy action drove many decisions.	Medium Nine independent agents who impacted decision making One explicit example of independent agents with goals that conflicted or could interfere with the DM's goals

6. Experience to complexity factor mapping: PME Revitalization Supervisor

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and	Examples of decisions which involved interrelated factors included: If an educational program is being changed, the changes have to be made with consideration of all elements (army,	Medium Factors that are interrelated and that have to be considered when making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
unpredictable ways	navy, and air force) to ensure that the changes to the system or course are consistent with needs of all elements and their training philosophies. Because of significant differences it is difficult to determine what training is required, how it should be done, how they are going to get buy-in from different stakeholders, etc.; If something is added to a DP, then something else may have to be removed and this could cause ripple changes through the other DP levels as other things have to be shuffled to make sure that things are learned in the right order and prerequisites are maintained. The fact that the time of trainees is limited also creates problems with prioritizing material (usually if something is added something else has to be dropped to fit within time constraints).	decisions (e.g., educational program changes involved at least 6 interacting factors that the DM had to consider) Examples of 2nd and 3rd order effects (e.g., adding something to a DP could involve considering at least 3 other DPs and consideration of the relative priority of many constituent units in those DPs)
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: Command direction slowed the achievement of goals and more scrutiny was paid as the number of small information requests increased. Whether there was general risk aversion or other factors were at play is unknown; Meeting requests were responded to less favourably over time, which delayed the process; The DM's own staff had difficulty staying motivated and stress increased as the process carried on over time with little apparent progress; Lack of continuity; as old people left and new people entered (including the DM) the process it meant that tasks were performed multiple times, people had to be gotten up to speed, etc.; The complexity of the operating environment changed over time. The Training and Education (T&E) system is meant to keep up with changes; however, the T&E system was typically fairly slow to react to new things, and so important windows of opportunity might have been missed; The rate at which things changed was variable; for example, sometimes submitting information to the Staff meant that the DM and his staff were bombarded with requests for more information, and sometimes weeks would go by with no feedback from the Staff at all; Instructors had to be hired to run programs; this had to be done far in advance (e.g., to go through PWGSC process). Due to delays in the PME process, opportunities to have particular instructors at particular times were likely missed, and decisions had to be made without proper	Medium Seven specific examples of situations that unfolded over time that profoundly affected decision making Four subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	support from a finalized PME process. There were subsystems which had their own dynamics in this context. These included: • The DM's team (working on specific tasks); • The School; • The Staff; • The Federal government. • The School and the Staff seemed to have their own systems and timelines. • The overall Federal governmental processes played a role (e.g., the Strategic Review process).	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Increasing the number of staff educated; • Ensuring the education program met the needs of the CF; • Meeting budget requirements • Meeting other requirements from higher command regarding the nature of what and who should be trained (e.g., running an aboriginal program). It was impossible to meet the budget requirements, increase the number of people educated, as well as running all of the other programs required. It was unclear what the priorities of these goals should be and they could not all be accomplished at the same time (resources were too limited).	Medium There were a number of important goals (4 distinct goals) Three examples of goal conflict provided
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included: • The goals of running the joint command staff program appeared to be clear, although their relative priority were not always clear.	Low No examples of vague goals that impacted the ability of the DM to make decisions Goals at a high level seemed to be fairly clear.
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included: • Each environment (army, navy, air force): each has its own things they want from the T&E system; • The School personnel: had goal of obtaining money for out-of-scope items (e.g., infrastructure improvements); • Students may have individual constraints (e.g.,	Medium Six independent agents who impacted decision making Two examples of independent agents with goals that conflicted or could interfere with the DM's goals

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	senior officers may be extremely time limited with regard to training); many have to balance education with a full-time position and family needs; • The Staff (may have had the goal of delaying the PME project). The goals of the School personnel and the Staff appeared to directly contradict goals of the DM. Other goals had to be accommodated during planning.	

7. Experience to complexity factor mapping: CoE Training Development Supervisor

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: There needs to be overlap and continuity in training (e.g., one HQ has to both take over from another HQ and set the conditions for the next HQ to come in); Training of CF personnel also involve training them to deal with other actors including members of DND, DFAIT, CIDA, Correctional Services, Policing Associations, NGOs – the DM and his staff have to put in a lot of work to get these groups adequately involved; The request to include logistics personnel in the training made CANOSCOM aware that more logistics preparation for the mission was required; There was a request to inject another group (high-readiness HQ) into the training schedule. This had follow-on effects such as having to plan for concurrent training, having to re-distribute the workload, and new people had to be hired.	Medium Multiple factors that are interrelated and that have to be considered when making decisions (e.g., integrating other actors into training involves considering six groups that the DM had to consider) Examples of 2nd and 3rd order effects (e.g., the need to inject another group into training involved at least three additional decisions or effects)
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects.	Situations that unfolded over time that profoundly affected decision making included: Training program changed over time as different strategies were tried as the opportunity arose, and what worked was kept or improved and what didn't work was removed or changed; Early attempts were made to integrate organizations such as DFAIT, CIDA, and CANOSCOM into the training process to ensure mutual awareness of methods and build networks. Over time it became apparent that these	Medium Six specific examples of situations that unfolded over time that profoundly affected decision making Six subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	training sessions could prove very beneficial so some organizations became more involved relatively early (e.g., DFAIT). When certain training goals changed to become very relevant to other organizations (e.g., CANOSCOM), then they became involved at that point; The personnel recruited to run the training changed frequently across time. A new training focus may require a change in SME personnel. This requires active recruitment of personnel with the relevant experience to create a pool of people who can be drawn upon for training needs. There is always a need to find recently retired people with more current experience, as people who have been retired for longer may have lost touch with current issues, processes, etc. As well, for each individual occasion people have to be scheduled in and often there are fluid schedule constraints based on other people's priorities (holidays etc.) and the needs of other projects (e.g., preparations for the Olympics required a large staff); The CF staff in the training programs change cyclically and frequently over time (e.g., in the 3.5 years the DM had been doing this, the DM had 4 bosses). So, certain things need to be done over and over again (building relationships, making people aware of how things have been done, what worked, what didn't, etc.); There was a request to inject another group (high-readiness HQ) into the training schedule. This had follow-on effects such as having to plan for concurrent training, having to re-distribute the workload, and new people had to be hired; The training programs and operational plans inform one another and both change over time. For example, the writing board looks for weak or grey areas in the plan to use as injects for training. This information is then used by the planners to tighten up weak spots and hopefully avoid problems. There were subsystems which had their own dynamics in this context. These included: • Independent contractors (e.g., writing board members); • CDA civilian training personnel (the DM and his staff); • CF training personnel at CDA; • DFAIT; • CIDA; • CANOSCOM. Groups have their own procedures and timelines related	

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	to making training demands or supporting training.	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Meeting training requirements for multiple groups • Meeting budget constraints • Building a network of resources • Getting buy-in from relevant groups and getting their involvement as required Resource constraints seem to be the main source of goal conflict	Medium There were four distinct goals One example of goal conflict
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included: • Over time training objectives are made clear but when new mission priorities occur a development process for creating clear training objectives is required. • The DM usually does have specific training objectives both at individual and HQ level.	Low No examples of vague goals that impacted the ability of the DM to make decisions
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included: • Trainees • ADM materiel (owner of all equipment) wants to send team but not work for Cdr., wants to work for Ottawa • Independent contractors (e.g., writing board members) • CDA civilian training personnel (the DM and his staff) • CF training personnel at CDA • DFAIT • CIDA • CANOSCOM Different groups have different hierarchies, processes, goals, priorities, relationships, and see their role in this training in different ways from one another. Different groups play different roles and became involved at different levels and at different times. Ways of getting involvement had to differ. Sometimes the DM wants involvement of individuals or groups which are not supported by them (e.g., ADM, DFAIT, CIDA, CANOSCOM)	Medium Eight independent agents who impacted decision making Four examples of independent agents with goals that conflicted with the DM's goals

8. Experience to complexity factor mapping: HF Engineer, Capital Acquisition

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: Users have multiple conflicting needs. Changing equipment to address one of these needs will affect all of the other needs as well (either positively or negatively); Feedback from industry about initial requirements caused a lot of project assumptions to be questioned; The DM was involved in other similar projects and attempted to gain some needed information by leveraging those projects to get information needed for other projects as opportunities arose; The scope of the project changed from a situation in which the DM's team would work with the winning bidder to develop and customize a system, to a situation where systems the bidders presented to be evaluated were what the project would buy for the CF (i.e., no CF customization). This created a huge increase in risk, greatly increased the required specificity for the statement of requirements, and made the bid evaluation process much more important.	Low There are interrelated factors that have to be considered when making decisions (e.g., user needs involved at least 3 factors that the DM had to consider). NOTE: the specific needs mentioned were deleted to maintain confidentiality. Examples of 2nd and 3rd order effects (e.g., the scope change involved at least 3 additional decisions or effects)
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: The awareness of technology that was available changed over the course of the project, which influenced ideas about what was possible and created different opportunities; The specification of requirements was an iterative process and feedback from industry caused assumptions about available technology to be re-evaluated and changed; Financial resource availability for HF changed over time; initially they were supposed to have resources for Research and Development (R&D) but this allocation of resources dropped over time without needed R&D being accomplished (i.e., it was reallocated for other non-HF purposes); The project proved to be quick to spend and slow to deliver; the strategic review and other forces caused scope changes, resource restrictions, and pressure to deliver; The scope of the work changed repeatedly over time which had impacts on the other aspects of the project. There were subsystems which had their own dynamics in this context. These included:	Medium Five specific examples of situations that unfolded over time that profoundly affected decision making Two subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	• The other decision makers in the project were not collocated with the DM. Information flow was different between these two groups.	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Creating a usable and valid statement of requirements; • Meeting resource constraints; • Conducting necessary R&D; • Working productively in the team. These goals proved difficult to achieve at the same time due to different priorities (e.g., difficult to create statement of requirements) and changing requirements (difficult to create requirements while meeting resource constraints).	Medium There were four important goals that conflicted in different ways in different situations Two examples of goal conflict Primary difficulty due to interpersonal conflict and changes in project priorities and requirements
Under-specified goals: Goals may be difficult to achieve because they are too vague	Goals were not necessarily vague; however, project requirements were changed frequently leading to confusion and wasted effort.	Low Goals at a high level were fairly clear, the main challenge was to create concrete measures and subgoals Problems were created by goal changes rather than goals being unclear
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included: • Other team members who didn't think HF issues were important and didn't want them included; • Potential bidders (whether they would be interested in bidding; how adequate their equipment would be; what information they needed); • Users (multiple conflicting needs); • Members of the DM's interpersonal network (e.g., PMs on other projects) who had their own goals (e.g., validating their own equipment).	Low Four independent agents who impacted decision making One example of an independent agent with goals that conflicted or could interfere with the DM's goals Large problems due to interpersonal conflicts

9. Experience to complexity factor mapping: PME Revitalization Staff Member

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: If a training program is being changed, the DM shouldn't make any decisions that affect policies for CF programs without consulting all elements (army, navy, air force); The process required to submit proposals related to PME Revitalization changed during this time period. As the procedure was new, there was a general lack of clarity about expectations and difficulty in following this process; A major Strategic Review was undertaken that affected the whole CF during this time period. It was anticipated that the results of the review will profoundly affect funding, including funding related to PME Revitalization; There was difficulty in isolating components of programs to get accurate costing information. Proposals for funding generally involve many interrelated factors such as actual cost to deliver a program, infrastructure and overhead issues (e.g., creation of a virtual library is required for a program but it is also used for other things so how can you determine what program should pay what proportion of the cost?).	Low Multiple factors that are interrelated and that have to be considered when making decisions (e.g., proposals for funding involved at least 3 factors that the DM had to consider Examples of 2nd and 3rd order effects (e.g., change to proposals for the PMB had follow-on effects for the process)
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: Improvements and changes in technology (e.g., the possibility of creating a virtual library) put different demands on and created different opportunities for T&E; As the recession occurred and got more serious it caused increasing funding concerns; As the impact of the Canadian operation in Afghanistan changed, other priorities increased (e.g., setting up resource centres for returning soldiers, supporting military families, supporting the health and welfare of returning soldiers) so projects like the PME revitalization got pushed to a lower priority and delayed; Training priorities changed over time as senior commanders, governments, and governmental priorities changed (e.g., more or less demand for aboriginal programs); Things would go quiet for a few months and then there would be a flurry of activity (e.g., requests for more information) which would require a response and then it would go quiet again; this appeared to the DM to be a cyclical process; Meeting requests were responded to less favourably over time, which created delays in scheduling;	Medium Seven specific examples of situations that unfolded over time that profoundly affected decision making Five subsystems with somewhat different dynamics which impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
	Lack of continuity, with new people entering the process, due to annual postings, meant that tasks were performed multiple times as people had to be gotten up to speed, etc. There were subsystems which had their own dynamics in this context. These included: • CF educational institutions; • The DM's institution; • The institution that was to help prepare the PME proposal; • Trainees; • Instructors. There were different subsystems at play during PME revitalization: the group implementing the training had different timelines and rates of change (e.g., represented in rates of information flow) than the group responsible for guiding the training; The trainees and instructors work at a longer timeline than the other CF organizations (e.g.., they need more notice than was actually available for scheduling).	
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Meeting task requirements; • Meeting budget constraints; • Effectively using limited resources (multiple programs were being created and revised simultaneously which required level of effort prioritization). If goals conflicted it was usually due to resource constraints (i.e., not enough resources to meet task requirements)	Low There were 3 important goals Goal conflict occurred, largely due to resource constraints
Under-specified goals: Goals may be difficult to achieve because they are too vague	Examples of underspecified goals included: • The DM thought the goals were fairly well defined and the vision from superiors was clear. However, often the DM would spend a lot of time on a project and then it would get "parked"; this seems to indicate a mismatch between priorities and/or lack of clarity at a higher level.	Low No explicit cases of vague goals were provided. Goals at a high level were fairly clear but command intent at a higher level seemed to change (or be different from explicit statements of intent)
Independent agents: There are independent entities in the environment who influence it (they may	Independent agents who influenced decision making included: • The staff of CF educational institutions; • Other Staff at the DM's institution;	Medium Six independent agents who impacted decision making

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
have different goals than the decision maker)	• Staff at the institution that was to help prepare the PME proposal; • Trainees; • Instructors; • The Federal government. The staff of CF educational institutions had their own agenda (e.g., fund infrastructure through training projects); The staff at the institution that was to help prepare the PME proposal seemed to have hidden agendas to delay PME; The trainees have individual constraints (e.g., students often have time constraint conflicts between their job, their family, and their studies) which impact their ability to complete T&E, which in turn impacts retention rates; Instructors have their own agendas and availability can impact training plans; The Federal government added additional demands (e.g., ministerial inquiries had to take precedence over other work when they occurred, which interfered with the DM's other duties).	Five examples of independent agents with goals that conflicted or could interfere with the DM's goals

10. Experience to complexity factor mapping: PSYOPS Training Program Developer

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Connectivity: Things in the environment influence one another in complicated and unpredictable ways	Examples of decisions which involved interrelated factors included: Multiple factors had to be planned which impacted one another including quarters, rations, course content, course schedules, course locations, and exercises; Because of the short timeline, changes in one resource (e.g., instructor availability) meant that things had to be shifted (e.g., the order of instruction changed); Two group members had significant experience in close quarter combat training; this was used by the DM and two weeks of close quarter combat training was offered internally. This offered a basics review, built trust within the group, increased the confidence of the group, and gave the trainees an additional skill set to increase their value to the other personnel they were stationed with, which in turn improved their chances of integrating well.	Medium Many factors that are interrelated and that have to be considered when making decisions (e.g., planning includes six interacting variables that the DM had to consider) Example of 2nd and 3rd order effects (e.g., close quarter combat training resulted in five additional effects)

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
Dynamics: The system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects. It is important to note hierarchical aspects if present (i.e., subsystems that have their own dynamics which are part of the DM context).	Situations that unfolded over time that profoundly affected decision making included: Planning for the training programming was still underway during the training itself (i.e., rolling-wave planning). For example the close-combat training was arranged after the group had already started training and the skills of the trainees became known. This allowed the DM to take advantage of opportunities that arose but was not optimal for long-term planning; Group cohesion was an important process for facilitating training; this process worked well in this situation and was impacted by factors such as the training centre requiring use of civilian clothes, trainees boarding together, and team members conducting close quarter combat training. In this case, the group gelled together well (teambuilding was considered to be "outstanding"); Some of the benefits of training unfolded over time rather than being immediately apparent. For example, some adversarial intent theory was provided by the DRDC group. The usefulness of this was not immediately apparent to the trainees but the relevance and importance was understood later (e.g., when they had to defend their ideas in the field they could apply some academic rigor). There were subsystems which had their own dynamics in this context. These included: • There were several subsystems involved, including: • The CF and the instructors. • These two groups had their own processes and timelines. For example, the CF wanted to arrange the training on a short timeline, but many instructors were booked much farther in advance.	Low Three specific examples of situations that unfolded over time that profoundly affected decision making Two subsystems with somewhat different dynamics which impacted decision making
Multiple conflicting goals: Having to achieve multiple objectives which may not be all achievable at the same time	The goals of the DM included: • Meeting training requirements; • Meeting resource requirements; • Meeting deadlines. • Although these goals could work against one another there did not seem to be a large conflict; the main issue appeared to be a lack of planning lead time.	Low There were three distinct goals Primary difficulty due to a lack of time (i.e., resource conflicts)
Under-specified goals: Goals may be difficult to achieve because they are	Examples of underspecified goals included: • The goal of creating the best PSYOPS platoon possible was the goal. Ways to assess this and	Low Goals at a high level were fairly clear, the main

Concept and Definition	Concept Examples	Concept Importance for Scenario (High, Medium, Low) and Justification
too vague	methods to achieve this had to be developed.	challenge was to create concrete measures and subgoals
Independent agents: There are independent entities in the environment who influence it (they may have different goals than the decision maker)	Independent agents who influenced decision making included: • Trainees (they had different backgrounds and therefore may have had somewhat different training needs; this didn't really conflict with the DM's goals but did have to be accommodated); • Instructors (their schedules dictated when they could teach their material, rather than optimal scheduling); • Training location staff (they had other goals related to maintaining a civilian-centred institution so they did not want the trainees to wear uniforms).	Low Four independent agents who impacted decision making Two examples of independent agents with goals that conflicted or could interfere with the DM's goals

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Annex D: Bottom-up Challenges List

Note that some statements include challenges or training suggestions that can be categorized into more than one general theme. These have been entered more than once so that they can be noted as belonging to each appropriate theme. Duplicated challenges and training suggestions are highlighted in yellow in the excel file.

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Initial Order	Scenario	Challenge/training recommendation	Challenge or Training	General theme	Subtheme
1	Mil advisor: international even	No nexus existed for communicating CF intelligence to other organizations (e.g., RCMP) and this was a serious problem as it was illegal to communicate information from CF assets that had to do with conducting surveillance of Canadians on Canadian soil	Challenge	Planning	Insufficient planning
2	Mil advisor: international even	No nexus existed for communicating CF intelligence to other organizations (e.g., RCMP) and this was a serious problem as it was illegal to communicate information from CF assets that had to do with conducting surveillance of Canadians on Canadian soil	Challenge	Communication	Procedure
3	Mil advisor: international even	Specific terms of reference might have made his job easier (although flexibility was needed)	Challenge	Collaboration	Flexibility required
4	Mil advisor: international even	Specific terms of reference might have made his job easier (although flexibility was needed)	Challenge	Direction	Vague
5	Mil advisor: international even	If he had been upranked one that would have helped (replaced someone who was a rank above and the perception was that his job wasn't important)	Challenge	Authority	Not enough
6	Mil advisor: international even	It would have helped if he had been brought in sooner (could have built up relationships more in advance)	Challenge	Collaboration	Insufficient lead time
7	Mil advisor: international even	Make sure you have access to SMEs and that you listen to them - experienced SMEs who can walk you though case studies and case analyses of previous situations - use the knowledge of previous events	Training	Experience	Use SMEs
8	Mil advisor: international even	Need to objectively analyse all of the steps that were taken and the OPP that was used - compare plans to the actual operation, identify what worked, examine whether the right assumptions were made	Training	Evaluation	Objective assessment required
9	Mil advisor: international even	Make sure you use the right tool at the right time - e.g., the IPP is often more appropriate that the OPP	Training	Planning	Right tool at right time
10	Mil advisor: international even	Need the right person in the right job - need the right experience and the right personality - e.g., CIMIC is a reserve capacity for the CF because those people know how to walk both sides of the fence - need a certain amount of maturity and respect for relationships	Training	Experience	Right person in right job
11	Mil advisor: international even	Need the right person in the right job - need the right experience and the right personality - e.g., CIMIC is a reserve capacity for the CF because those people know how to walk both sides of the fence - need a certain amount of maturity and respect for relationships	Training	Personality	Right person in right job
12	Mil advisor: international even	Have the police identify some of their upcoming leaders and have them attend CF training related to higher C2 so when these events take place you have familiarity with people, with language, ongoing exercises, embedded liaison	Training	Collaboration	Extend training to collaborators
13	Mil advisor: international even	Difficult to manage large demand for information flow	Challenge	Information	Overload
14	Mil advisor: international even	Location of the event was not optimal for security	Challenge	Location	Security requirements
15	Mil advisor: international even	The personalities of some of the people involved were not optimal for collaboration	Challenge	Collaboration	Poor collaborators
16	Mil advisor: international even	The event was a highly political situation	Challenge	Planning	Highly political situation
17	Mil advisor: international even	Collaboration made difficult because of different jargon used by the different organizations	Challenge	Communication	Jargon
18	Mil advisor: international even	Fencing caused problems of many types, including the perception of the event, deliveries, etc.	Challenge	Location	Security requirements
19	Mil advisor: international even	There were substantial misunderstandings about what the CF were willing and able to provide	Challenge	Collaboration	Misunderstanding roles and responsibilities
20	Mil advisor: international even	Lack of previous similar events to use for planning (e.g., no lessons learned)	Challenge	Planning	Lack of previous similar events
21	Mil advisor: international even	Status of security force attendance was highly fluid (e.g., what was happening locally could have meant that police forces would or would not send forces to assist with security for the event)	Challenge	Planning	Lack of firm plans
22	Mil advisor: international even	Budget concerns	Challenge	Resources	Budget concerns
23	Mil advisor: international even	People did not want to criticize others or hear negativity	Challenge	Communication	Lack of clarity and honesty
24	Mil advisor: international even	People were highly motivated to be self-protective	Challenge	Collaboration	Hidden agendas
25	Mil advisor: international even	No known ROEs for the CF if they had to act in this situation (e.g., to defend CF assets from a mob)	Challenge	Planning	Lack of previous similar events
26	Mil advisor: international even	The DM had no authority to give direction	Challenge	Authority	Responsibility without authority
27	Mil advisor: international even	Deliverables kept changing (e.g., where the fence would be) so contracting was difficult	Challenge	Planning	Uncertainty
28	Mil advisor: international even	Negotiators often had misunderstandings about the process	Challenge	Collaboration	Lack of knowledge
29	Mil advisor: international even	Vital legal information was not known by appropriate authorities	Challenge	Collaboration	Lack of knowledge
30	Mil advisor: international even	Cases where individuals had personal agendas which superseded security needs	Challenge	Collaboration	Hidden agendas
31	Mil advisor: international even	Conflict between maintaining pleasant personal relationships and getting the job done	Challenge	Goal conflict	Achieve multiple conflicting objectives
32	Afgh Liaison	After the prison break there was a lot of distrust of the prison staff and a reassessment of many assumptions about the state of security in Kandahar	Challenge	Planning	Incorrect assumptions

Initial Order	Scenario	Challenge/training recommendation	Challenge or Training	General theme	Subtheme
33	Afgh Liaison	After the prison break there was a lot of distrust of the prison staff and a reassessment of many assumptions about the state of security in Kandahar	Challenge	Collaboration	Distrust
34	Afgh Liaison	Many challenges related to cultural issues, including different priorities (interpersonal relationships highest in Afghanistan, age more indicative of authority), differences in the legal system, widespread corruption, different understandings of jobs and job responsibilities, different beliefs about the amount of control one can exert over a situation, different social standards, differences in literacy rates (few written records in Afghanistan), and a need for Afghans to save face	Challenge	Culture	Different priorities
35	Afgh Liaison	Many challenges related to cultural issues, including different priorities (interpersonal relationships highest in Afghanistan, age more indicative of authority), differences in the legal system, widespread corruption, different understandings of jobs and job responsibilities, different beliefs about the amount of control one can exert over a situation, different social standards, differences in literacy rates (few written records in Afghanistan), and a need for Afghans to save face	Challenge	Culture	Legal system
36	Afgh Liaison	Many challenges related to cultural issues, including different priorities (interpersonal relationships highest in Afghanistan, age more indicative of authority), differences in the legal system, widespread corruption, different understandings of jobs and job responsibilities, different beliefs about the amount of control one can exert over a situation, different social standards, differences in literacy rates (few written records in Afghanistan), and a need for Afghans to save face	Challenge	Culture	Corruption
37	Afgh Liaison	Many challenges related to cultural issues, including different priorities (interpersonal relationships highest in Afghanistan, age more indicative of authority), differences in the legal system, widespread corruption, different understandings of jobs and job responsibilities, different beliefs about the amount of control one can exert over a situation, different social standards, differences in literacy rates (few written records in Afghanistan), and a need for Afghans to save face	Challenge	Culture	Different understanding of jobs & responsibilities
38	Afgh Liaison	Many challenges related to cultural issues, including different priorities (interpersonal relationships highest in Afghanistan, age more indicative of authority), differences in the legal system, widespread corruption, different understandings of jobs and job responsibilities, different beliefs about the amount of control one can exert over a situation, different social standards, differences in literacy rates (few written records in Afghanistan), and a need for Afghans to save face	Challenge	Culture	Different belief in individual control
39	Afgh Liaison	Many challenges related to cultural issues, including different priorities (interpersonal relationships highest in Afghanistan, age more indicative of authority), differences in the legal system, widespread corruption, different understandings of jobs and job responsibilities, different beliefs about the amount of control one can exert over a situation, different social standards, differences in literacy rates (few written records in Afghanistan), and a need for Afghans to save face	Challenge	Culture	Social standards
40	Afgh Liaison	Many challenges related to cultural issues, including different priorities (interpersonal relationships highest in Afghanistan, age more indicative of authority), differences in the legal system, widespread corruption, different understandings of jobs and job responsibilities, different beliefs about the amount of control one can exert over a situation, different social standards, differences in literacy rates (few written records in Afghanistan), and a need for Afghans to save face	Challenge	Culture	Literacy
41	Afgh Liaison	Many challenges related to cultural issues, including different priorities (interpersonal relationships highest in Afghanistan, age more indicative of authority), differences in the legal system, widespread corruption, different understandings of jobs and job responsibilities, different beliefs about the amount of control one can exert over a situation, different social standards, differences in literacy rates (few written records in Afghanistan), and a need for Afghans to save face	Challenge	Culture	Saving face
42	Afgh Liaison	Communication infrastructure is poor in Afghanistan	Challenge	Communication	Infrastructure
43	Afgh Liaison	Communication infrastructure is poor in Afghanistan	Challenge	Resources	Communication infrastructure
44	Afgh Liaison	ANA and ANP have an adversarial relationship and do not work well together	Challenge	Collaboration	Adversarial relationships
45	Afgh Liaison	Quick turnovers in Afghan personnel make it difficult to get to know people and form relationships	Challenge	Collaboration	Turnover
46	Afgh Liaison	Delicate balance between giving accurate and helpful feedback and making people demotivated	Challenge	Collaboration	Motivation
47	Afgh Liaison	Delicate balance between giving accurate and helpful feedback and making people demotivated	Challenge	Goal conflict	Achieve multiple conflicting objectives
48	Afgh Liaison	Lack of reliable power in Afghanistan	Challenge	Resources	Power infrastructure

Initial Order	Scenario	Challenge/training recommendation	Challenge or Training	General theme	Subtheme
49	Afgh Liaison	No common COP among Afghan security agencies	Challenge	Collaboration	No COP
50	Afgh Liaison	Found collaborators highly resistant to change	Challenge	Collaboration	Change resistance
51	Afgh Liaison	Difficult to get correct information and difficult to evaluate information	Challenge	Information	Difficult to get correct information
52	Afgh Liaison	Difficult to get correct information and difficult to evaluate information	Challenge	Information	Difficult to evaluate
53	Afgh Liaison	Official positions often contradict what actually happens (e.g., told you have authority to do something but when try to do it you are denied)	Challenge	Collaboration	Hidden agendas
54	Afgh Liaison	Afghans think at tactical level only	Challenge	Culture	Lack of knowledge
55	Afgh Liaison	Different ideas of how to train and what training is (e.g., no experience with exercises)	Challenge	Culture	Lack of knowledge
56	Afgh Liaison	Afghans didn't understand that you should use data to make conclusions	Challenge	Culture	Lack of knowledge
57	Afgh Liaison	Afghan intel was not good at instructing patrols what they should look for	Challenge	Communication	Vague
58	Afgh Liaison	Often different people would come to meetings - low continuity in personnel	Challenge	Collaboration	Turnover
59	Afgh Liaison	Sometimes people wouldn't want to share information because it would get them into trouble	Challenge	Collaboration	Hidden agendas
60	Afgh Liaison	Lots of demands for resources from people who couldn't really help the DM's mission	Challenge	Resources	
61	Afgh Liaison	Had to convince Afghans that a security network was even necessary	Challenge	Role justification	
62	Afgh Liaison	People needed to mentor the Afghans about operational rather than just tactical level	Training	Culture	Lack of knowledge
63	Afgh Liaison	The enemy has at least some personnel better at strategic and operational level thinking than the Afghan security forces allied with the CF	Challenge	Planning	
64	Afgh Liaison	The DM had to deal with multiple Afghan languages	Challenge	Culture	Language
65	Afgh Liaison	Had the need to appear to maintain enthusiasm to keep others motivated and involved	Challenge	Collaboration	Motivation
66	Capital Acqusition	Different perspectives between team members	Challenge	Collaboration	Different perspectives
67	Capital Acqusition	Lack of appreciation for DM's contribution (value of HF)	Challenge	Role justification	
68	Capital Acqusition	Increased workload due to differences of opinion about value of HF	Challenge	Collaboration	Workload
69	Capital Acqusition	Other personnel resistant to change of opinion	Challenge	Collaboration	Change resistance
70	Capital Acqusition	Insufficient data available to make requirements recommendations	Challenge	Information	Insufficient data
71	Capital Acqusition	DM not collocated with other decision makers which impacted communication	Challenge	Collaboration	Collocation
72	Capital Acqusition	Difficult to share some information with bidders as it is confidential	Challenge	Communication	Procedure
73	Capital Acqusition	Difficult to share equipment with bidders as it is being used	Challenge	Resources	Lack of equipment
74	Capital Acqusition	Difficult to create a testing baseline	Challenge	Evaluation	No baseline
75	Capital Acqusition	Users have multiple conflicting needs; making changes will almost inevitably affect multiple needs both positively and negatively	Challenge	Goal conflict	Consider multiple factors
76	Capital Acqusition	Resources were not used optimally and decreased resources available for needs identified by the DM (e.g., research to determine HF requirements)	Challenge	Resources	Budget
77	Capital Acqusition	The credibility of the DM was questioned based on decisions not made by them	Challenge	Collaboration	Credibility
78	Capital Acqusition	There was resistance to including testing for all important interacting factors	Challenge	Information	Insufficient data
79	Capital Acqusition	There was no strategic plan put in place to control the number of bidders and so there turned out to be more bidders than could easily be handled in bid evaluation	Challenge	Planning	Insufficient planning
80	Capital Acqusition	Scope changes increased risk and required specificity for SOR, increased pressure on bid evaluation process	Challenge	Planning	Scope changes
81	Capital Acqusition	Awareness of available technology changed over the life of the project	Challenge	Information	Changing information
82	Capital Acqusition	Financial resource availability for HF changed over time without needed R&D being accomplished	Challenge	Resources	Budget
83	Capital Acqusition	Pressure to deliver rose over time	Challenge	Resources	Timeline
84	Capital Acqusition	Scope of work changed repeatedly over time which had impacts on other project aspects	Challenge	Planning	Scope changes
85	Capital Acqusition	Should have used high-level specification rather than very detailed ones and maintained maturation phase	Training	Planning	Planning incorrect
86	Capital Acqusition	Need to improve when resources brought on board relative to when they are actually needed	Training	Resources	Planning
87	Capital Acqusition	Reduce collocation issues (management team should be collocated if possible)	Training	Collaboration	Collocation
88	Capital Acqusition	Need to take advantage of multiple related projects and achieve multiple goals from multiple projects	Training	Resources	Achieve multiple objectives
89	Capital Acqusition	Sometimes can use social network to facilitate interactions with team members and other collaborators	Training	Collaboration	Networking
90	Capital Acqusition	Give incoming staff history of team members to prepare them for likely challenges	Training	Collaboration	Sharing information
91	Capital Acqusition	Perhaps an outside HF consultant would have had a bigger impact than someone in the same team	Training	Role justification	
92	Capital Acqusition	Heavily prepared presentations for meetings with basic justifications (sometimes over and over)	Training	Role justification	
93	Capital Acqusition	Use empirical evidence if available	Training	Evaluation	Use empirical evaluation
94	Capital Acqusition	Know who the players are on the team	Training	Collaboration	Know your team

Initial Order	Scenario	Challenge/training recommendation	Challenge or Training	General theme	Subtheme
95	Capital Acqusition	Teach basic arguments for justifying HF	Training	Role justification	
96	Capital Acqusition	Make sure you know the current state of knowledge - what other team members know	Training	Collaboration	Know your team
97	Capital Acqusition	Know how and what to communicate	Training	Communication	
98	Capital Acqusition	Have a network of contacts (e.g., from conferences, trade shows, literature) - look beyond the obvious for information	Training	Collaboration	Networking
99	Capital Acqusition	Don't use your own experience and intuition alone when evaluating designs - often people don't like designs that they think they will	Training	Evaluation	Use empirical evaluation
100	PME Staff	Changes to programs should be done in consultation with a large number of stakeholders (e.g., all elements)	Challenge	Goal conflict	Consider multiple factors
101	PME Staff	The process required to submit proposals related to PME Revitalization changed; there was a general lack of clarity about expectations and difficulty related to the new process	Challenge	Planning	Procedure changes
102	PME Staff	The process required to submit proposals related to PME Revitalization changed; there was a general lack of clarity about expectations and difficulty related to the new process	Challenge	Direction	Vague
103	PME Staff	Major strategic review occurred which is anticipated to profoundly affect funding	Challenge	Resources	Funding review
104	PME Staff	Disagreements between stakeholders regarding scope of funding	Challenge	Collaboration	Disagreements
105	PME Staff	Disagreements between stakeholders regarding scope of funding	Challenge	Resources	Inconsistent expectations
106	PME Staff	Accounting errors in database	Challenge	Information	Errors
107	PME Staff	Proposals for funding involve many interrelated factors - difficult to isolate some costs to one program alone (e.g., virtual libraries)	Challenge	Information	Interrelated factors
108	PME Staff	Lack of timely feedback after information submitted	Challenge	Evaluation	Lack of feedback
109	PME Staff	Briefings must be thorough yet concise because those being briefed have limited time	Challenge	Resources	Time limitations
110	PME Staff	Additional requirements often do not come with additional funds	Challenge	Resources	Budget
111	PME Staff	Changes in technology puts different demands on and creates different opportunities for T&E	Challenge	Resources	Changes in available resources and consequences
112	PME Staff	Recession created additional funding pressure	Challenge	Resources	Budget
113	PME Staff	The prioritization of programs like PME is influenced by other strategic priorities out of the control of the DM (due to changing operations, changing governments, etc.)	Challenge	Planning	
114	PME Staff	Unpredictable requests for information that have to be filled quickly; these alternate with periods of silence.	Challenge	Information	Workload
115	PME Staff	Lack of continuity in personnel	Challenge	Collaboration	Turnover
116	PME Staff	Planning for training programs had to be done in advance of funding certainty	Challenge	Planning	Lack of required information
117	PME Staff	Should approach data collection related to funding needs from first principles rather than relying on previously compiled data	Training	Information	First principles
118	PME Staff	When new programs begin collect new data and start from scratch	Training	information	New data
119	PME Staff	Need face to face meetings	Training	Collaboration	Collocation
120	PME Staff	Need to work on getting everyone speaking the same language	Training	Communication	Jargon
121	PME Staff	The DM tried to meet demands for requirements but they kept coming back and asking for more and for information to be presented in different ways	Challenge	Collaboration	Inconsistent expectations
122	PME Staff	The DM tried to meet demands for requirements but they kept coming back and asking for more and for information to be presented in different ways	Challenge	Collaboration	Hidden agendas
123	PME Staff	Need to make sure all important people at meetings	Training	Collaboration	Get proper people involved
124	PME Supervisor	Instructed to begin training before funding terms available	Challenge	Resources	Uncertainty
125	PME Supervisor	Changes to programs need to be made in consideration of many stakeholders with different philosophies	Challenge	Goal conflict	Consider multiple factors
126	PME Supervisor	Changes to one aspect of a training program has to take into account past and future T&E (e.g., the DP education packages are interdependent)	Challenge	Planning	Interdependence
127	PME Supervisor	Time of trainees is limited, so training package size is limited	Challenge	Resources	Time
128	PME Supervisor	Disagreements between stakeholders regarding scope of funding	Challenge	Collaboration	Disagreements
129	PME Supervisor	Previous databases of funding requirements were padded	Challenge	Collaboration	Dishonesty
130	PME Supervisor	Stakeholders were overstepping their range of authority	Challenge	Authority	Overstepping
131	PME Supervisor	Lack of clear command intent within other organizations	Challenge	Direction	Vague
132	PME Supervisor	Periods of silence of significant duration	Challenge	Evaluation	Lack of feedback
133	PME Supervisor	Requirements for new training programs are given without additional resources	Challenge	Resources	Budget
134	PME Supervisor	Requests for clarification from superiors about prioritization of programs did not result in clear direction	Challenge	Direction	Vague
135	PME Supervisor	Strategic Review is likely to profoundly affect funding	Challenge	Resources	Funding review
136	PME Supervisor	Pushing something up the authority hierarchy for resolution means that the DM risks delays etc.	Challenge	Authority	Loss of control
137	PME Supervisor	Requirement to balance short-term with long-term goals (e.g., using authority can get your way in the short term but poisons relationships)	Challenge	Goal conflict	Consider long-term effects

Initial Order	Scenario	Challenge/training recommendation	Challenge or Training	General theme	Subtheme
138	PME Supervisor	No in-year funding available, so resources even more restricted	Challenge	Resources	Budget
139	PME Supervisor	Impression that command intent to subordinates was actually to delay the process	Challenge	Collaboration	Hidden agendas
140	PME Supervisor	Meeting requests responded to less favourably over time	Challenge	Collaboration	Hidden agendas
141	PME Supervisor	Lack of continuity in personnel - people have to be gotten up to speed, etc.	Challenge	Collaboration	Turnover
142	PME Supervisor	T&E system meant to keep up with rapid changes in operational environment; however, T&E process is typically actually slow to adapt and change	Challenge	Planning	Lead time required is too long
143	PME Supervisor	Unpredictable response after information exchange (e.g., silence or bombarded with more information requests)	Challenge	Information	Workload
144	PME Supervisor	Planning for training programs had to be done in advance of funding certainty	Challenge	Planning	Lack of required information
145	PME Supervisor	Given instructions from higher command to do things without any funds available	Challenge	Direction	Impossible task
146	PME Supervisor	Given instructions from higher command to do things without any funds available	Challenge	Resources	Budget
147	PME Supervisor	Has to manage stress on staff from them having to work on something and then having it shelved	Challenge	Collaboration	Morale and stress
148	PME Supervisor	Subordinate commanders have to take on more risk than they should due to lack of direction from command	Challenge	Direction	Vague
149	PME Supervisor	Most decisions the DM made were intuitive based on experience and how you work with people and can try to move things forward	Training	Experience	Use intuition
150	PME Supervisor	Most problems seemed to be due to communication issues	Challenge	Communication	
151	PME Supervisor	Should have trigger points in place for when follow-up or other actions required	Training	Planning	Use trigger points in plans
152	PME Supervisor	Need clear intent recorded as well as records of decisions (e.g., who told what to do what on what date)	Training	Direction	Need clear direction
153	PME Supervisor	Need clarity of words, intent, effect, etc.	Training	Direction	Need clear direction
154	PME Supervisor	Stakeholders had different interpretations of one-line objective/intent which should have been clarified	Training	Direction	Vague
155	PME Supervisor	Stakeholders had different interpretations of one-line objective/intent which should have been clarified	Training	Collaboration	Different understanding
156	PME Supervisor	Terminology had to be agreed upon	Training	Communication	Jargon
157	PME Supervisor	Comes down to making sure all communication is clear	Training	Communication	Clarity
158	PME Supervisor	Can be a problem that superiors don't give very concrete and clear intent - incumbent on subordinates to go back and clarify	Training	Direction	Vague
159	PME Supervisor	Can be a problem that superiors don't give very concrete and clear intent - incumbent on subordinates to go back and clarify	Training	Direction	Need to get clarification
160	PME Supervisor	Realize that if you are seen as obstructionist people will learn to work around you	Training	Collaboration	
161	PME Supervisor	Be sure to engage higher levels at proper points to ensure best effect	Training	Authority	Engage higher authority at proper time
162	PME Supervisor	Make sure to integrate with your staff to make sure they stay on top of things you are interested in	Training	Collaboration	Teamwork
163	PME Supervisor	Keep staff engaged by remaining engaged yourself	Training	Collaboration	Leadership
164	PME Supervisor	Most effective problem solving was when everyone was brought together	Training	Collaboration	Collocation
165	Strategic Advisory Team	Difficult to get timely and accurate information - no "ground truth"	Challenge	Information	Inadequate
166	Strategic Advisory Team	Difficult to get timely and accurate information - no "ground truth"	Challenge	Information	Inaccurate
167	Strategic Advisory Team	News can travel quickly in the Afghan population, adding to the risk of riots	Challenge	Communication	Speed of information travel among civilians
168	Strategic Advisory Team	Communications back to Canada and to TFA were not reliable	Challenge	Communication	Unreliable infrastructure
169	Strategic Advisory Team	Heavily influenced by Afghan actions against U.S. and other nearby embassies etc.	Challenge	Collaboration	Interdependence
170	Strategic Advisory Team	Roads were often poor	Challenge	Resources	Roads
171	Strategic Advisory Team	Difficult to get travellers back to the compound when necessary - both due to lack of vehicles and poor passability of roads	Challenge	Resources	Roads
172	Strategic Advisory Team	Difficult to get travellers back to the compound when necessary - both due to lack of vehicles and poor passability of roads	Challenge	Resources	Transportation
173	Strategic Advisory Team	Poor communication infrastructure between team members (local cell network)	Challenge	Communication	Infrastructure
174	Strategic Advisory Team	Poor communication infrastructure between team members (local cell network)	Challenge	Resources	Communication infrastructure
175	Strategic Advisory Team	Limited number of vehicles so travel required a lot of coordination	Challenge	Resources	Transportation
176	Strategic Advisory Team	Differences in culture (different communication clarity, literacy levels, no banking system to support transactions)	Challenge	Culture	Clarity
177	Strategic Advisory Team	Differences in culture (different communication clarity, literacy levels, no banking system to support transactions)	Challenge	Culture	Literacy
178	Strategic Advisory Team	Differences in culture (different communication clarity, literacy levels, no banking system to support transactions)	Challenge	Culture	Banking
179	Strategic Advisory Team	Vague mission goal ("do it their way")	Challenge	Direction	Vague
180	Strategic Advisory Team	Had to function in a situation where there were a lot of different organizations who had different goals	Challenge	Collaboration	Goal conflict

Initial Order	Scenario	Challenge/training recommendation	Challenge or Training	General theme	Subtheme
181	Strategic Advisory Team	DM organized a daily meeting to support team coordination	Training	Collaboration	Coordinating work
182	Strategic Advisory Team	DM build relationships with chaplains at nearby US base	Training	Collaboration	Networking
183	Strategic Advisory Team	Some team members did not appropriately communication information to the DM in a timely way	Challenge	Communication	Timeliness
184	Strategic Advisory Team	Large amount of flexibility required for mission - mission command rather than strict hierarchy	Training	Direction	Flexibility
185	Strategic Advisory Team	One goal of the DM was to build relationships - facilitated interactions	Training	Collaboration	Networking
186	Strategic Advisory Team	Had to balance being openly military with trying to pass as civilian	Challenge	Goal conflict	Achieve multiple conflicting objectives
187	Strategic Advisory Team	Chain of command was fuzzy - what aspects of DM's mission controlled by CEFCOM vs. TFA	Challenge	Direction	Unclear chain of command
188	Strategic Advisory Team	Team cohesion issues sometimes arose - much pressure to be cohesive as the team lived together	Challenge	Collaboration	Team cohesion
189	Strategic Advisory Team	Security issues (e.g., riots)	Challenge	Location	Security requirements
190	Strategic Advisory Team	Lack of sufficient evacuation plan	Challenge	Planning	Lack of sufficient planning
191	Strategic Advisory Team	Challenging to mentor a person in an embarrasing situation that could impact their career	Challenge	Collaboration	Mentoring difficulty
192	Strategic Advisory Team	Need to establish relationships - personality is key	Training	Personality	Networking
193	Strategic Advisory Team	Need to establish relationships - personality is key	Training	Collaboration	Networking
194	Strategic Advisory Team	Need to get different HQs talking when issues arise	Training	Collaboration	
195	Strategic Advisory Team	Need to see implications of situation when things go wrong - e.g., after riot saw need for improved coordination and communication between their team and nearby embassies etc. in case evacuation etc. required	Training	Planning	Adapt as required
196	Strategic Advisory Team	Carefully consider whether to wear civilian or military clothing on this type of mission (strategic advisor) - would have avoided unwanted attention at strategic level if didn't wear military clothing from the beginning	Training	Strategic issues	
197	Strategic Advisory Team	Carefully consider whether to wear civilian or military clothing on this type of mission (strategic advisor) - would have avoided unwanted attention at strategic level if didn't wear military clothing from the beginning	Training	Goal conflict	Achieve multiple conflicting objectives
198	Strategic Advisory Team	When communicating about unpleasant events with subordinates make sure you get all pertinent information	Training	Communication	Get all required information
199	Strategic Advisory Team	Make sure you have information about road passability if relevant and also have backup plans to get people home (flight cancelled), give travellers resources in case they have to stay away longer than planned	Training	Planning	Create backup plans
200	Strategic Advisory Team	Make sure you have information about road passability if relevant and also have backup plans to get people home (flight cancelled), give travellers resources in case they have to stay away longer than planned	Training	Planning	Get required information
201	Strategic Advisory Team	Make sure as much as possible to work on getting everyone to work as a team - even one person who is not a team player affects morale and decision making	Training	Collaboration	Team cohesion
202	Strategic Advisory Team	Try to make decisions as a team as much as possible	Training	Collaboration	Teamwork
203	Strategic Advisory Team	Use meetings to understand everyone's views and needs as well as practical details for coordination etc.	Training	Collaboration	Teamwork
204	Strategic Advisory Team	Coordination meetings were led by COS rather than the CO - this is not common - allowed for more openness and collegiality	Training	Collaboration	Coordinating work
205	Strategic Advisory Team	Pick the right person for the team - right amount of initiative, passion, and skills	Training	Collaboration	Right person in right job
206	Strategic Advisory Team	Needed to properly balance mission command approach with C2 approach to get needed benefits of both (e.g., C2 constant re-evaluation of plans, mission command flexibility)	Training	Goal conflict	Achieve multiple conflicting objectives
207	CoE Training Development	Have responsibility but no real authority	Challenge	Authority	Responsibility without authority
208	CoE Training Development	Trainees respond unpredictably to events (what they will choose to do and how well they respond)	Challenge	Evaluation	Unpredictability
209	CoE Training Development	Difficult to evaluate likely results of trainee actions	Challenge	Evaluation	Objective assessment difficult
210	CoE Training Development	Need to create exercises that are both realistic and controlled enough - difficult to balance	Challenge	Goal conflict	Achieve multiple conflicting objectives
211	CoE Training Development	Sometimes events that could (and do) actually happen in operations are not seen as realistic by trainees before they go on the operation - perceived vs. actual realism have to be balanced	Challenge	Goal conflict	Achieve multiple conflicting objectives
212	CoE Training Development	Some aspects of training are difficult to mentor (e.g., interview training)	Challenge	Collaboration	Mentoring difficulty
213	CoE Training Development	Required resources are often not easily available and have to be built from scratch	Challenge	Resources	Availability in general
214	CoE Training Development	Generally a great many demands on trainee's time: this means sometimes they miss scheduled training	Challenge	Resources	Time
215	CoE Training Development	When training program began, the DM was working "in a void" - didn't really know what was needed	Challenge	Direction	Vague

Initial Order	Scenario	Challenge/training recommendation	Challenge or Training	General theme	Subtheme
216	CoE Training Development	The DM had never experienced the type of situation/meeting he was trying to recreate which made his job more difficult	Challenge	Planning	Lack of required information
217	CoE Training Development	SA about operational environments and priorities must be constantly updated and changes made to follow them in training	Challenge	Information	Updates
218	CoE Training Development	Took time to build the necessary trust between agencies	Challenge	Collaboration	Trust building
219	CoE Training Development	Networking and relationship building were actively encouraged and built into training over time	Training	Collaboration	Networking
220	CoE Training Development	Effective collaboration required training to evolve a common understanding between organizations (e.g., of OPP process)	Training	Collaboration	Common understanding
221	CoE Training Development	Money available for training decreased over time, requiring restructuring	Challenge	Resources	Budget
222	CoE Training Development	Networks of people were built as training developed which helped in the acquisition of resources for training and for getting other organizations involved.	Training	Collaboration	Networking
223	CoE Training Development	Personal contacts often proved more useful than "official" channels	Training	Collaboration	Networking
224	CoE Training Development	Changes are difficult to make within a training cycle	Challenge	Planning	Lead time required is too long
225	CoE Training Development	Importance of networking and relationship building - night-out dinner most important part of workshop as you learn more about the people you are dealing with and create networks	Training	Collaboration	Networking
226	CoE Training Development	Building networks and developing trust is the most important part of his job	Training	Collaboration	Networking
227	CoE Training Development	Social side is most important aspect of the job - create shared values, have interpersonal skills, etc.	Training	Collaboration	Networking
228	CoE Training Development	Need to have good IQ and EQ	Training	Collaboration	Emotional intelligence
229	CoE Training Development	Have to be able to coerce or convince people to give you what you need	Training	Collaboration	Negotiation
230	CoE Training Development	Have to be able to build trust	Training	Collaboration	Trust building
231	CoE Training Development	How you connect with people is fundamental	Training	Collaboration	Networking
232	CoE Training Development	Ability to negotiate really well is important in theatre	Training	Collaboration	Negotiation
233	CoE Training Development	Need to have a joint lessons learned cell - shouldn't wait until the mission is done, get information as its happening	Training	Information	Lessons learned
234	CoE Supervisor	Needs to be overlap and continuity in training	Challenge	Planning	Interdependence
235	CoE Supervisor	Government announcements can force unexpected readjustments in training	Challenge	Strategic issues	
236	CoE Supervisor	Changes may be announced but details not known, requiring assumptions must be made so that enough planning lead time is available	Challenge	Planning	Lack of required information
237	CoE Supervisor	Training cannot rely on templates because the rate of change is too high	Challenge	Planning	High rate of change
238	CoE Supervisor	Outside events (e.g., changes in policy, different operational events) force a lot of change	Challenge	Planning	Changes dictated by outside forces
239	CoE Supervisor	Often overlapping requests for training time and resources which require on-line resource shifting	Challenge	Planning	Resource shifting
240	CoE Supervisor	Long lead times are often required for training objectives to be met	Challenge	Planning	Lead time required is too long
241	CoE Supervisor	Training of CF personnel have to include training them to interact with other organizations - requires a lot of work to get these groups adequately involved	Challenge	Collaboration	Get proper people involved
242	CoE Supervisor	Different stakeholders typically have different jargon and different ways of doing things which make communication and collaboration difficult	Challenge	Communication	Jargon
243	CoE Supervisor	Timelines of stakeholders are different	Challenge	Collaboration	Timelines
244	CoE Supervisor	Money has become more of a constraint which influences other resource availability (e.g., number of people who can be involved in the writing boards)	Challenge	Resources	Budget
245	CoE Supervisor	Often training has to support other issues like basic teamwork training, sort out SOPs, etc.	Challenge	Planning	Interdependence
246	CoE Supervisor	Training scenarios have to be firmly grounded in the current operational state because trainees are often aware of the situation and will be influenced by the perceived relevance of the training (as well as the relevance actually being affected)	Challenge	Planning	Updated information required
247	CoE Supervisor	Use social networks to get needed personnel resources	Training	Collaboration	Networking
248	CoE Supervisor	The job requires people with personalities which can accept not having real authority	Training	Personality	Authority
249	CoE Supervisor	The personnel recruited to run training must change over time, due to current experience levels, scheduling conflicts, etc.	Challenge	Collaboration	Turnover
250	CoE Supervisor	CF staff in the training programs change cyclically and frequently over time so certain things have to be done repeatedly (e.g., building relationships, informing people about what works and what doesn't)	Challenge	Collaboration	Turnover
251	CoE Supervisor	Requests to inject other groups into training can cause scheduling and other resource conflicts	Challenge	Resources	Scheduling
252	CoE Supervisor	Use personal networks to get needed people involved	Training	Collaboration	Networking
253	CoE Supervisor	Ensure that people creating training exercises have proper and recent experience	Training	Experience	Right person in right job

Initial Order	Scenario	Challenge/training recommendation	Challenge or Training	General theme	Subtheme
254	CoE Supervisor	Identify personnel/SME needs as soon as possible and inform the relevant groups as early as possible to facilitate their involvement	Training	Collaboration	Inform collaborators early about desired involvement
255	CoE Supervisor	Identify personnel/SME needs as soon as possible and inform the relevant groups as early as possible to facilitate their involvement	Training	Planning	Identify needs early
256	CoE Supervisor	Need to know how Ottawa works - different from the tactical level. Dealing with public servants, the procurement world, etc.	Training	Experience	Need relevant experience
257	CoE Supervisor	If required, write your own terms of reference for yourself and your staff	Training	Direction	Need to create clarity
258	CoE Supervisor	Must be flexible to adapt to new situations and deal with ambiguity	Training	Planning	Flexibility
259	CoE Supervisor	Can't have type-A personalities in full-time CoE positions because they may butt heads with the military	Training	Personality	Type A
260	CoE Supervisor	Need to coordinate as much as possible with higher command (e.g., CANOSCOM) to get information needed to form training objectives	Training	Direction	Get needed information
261	PSYOPS training	It was the first time such a thorough training program was being developed - previous courses were not available to use to guide planning	Challenge	Planning	Lack of previous similar events
262	PSYOPS training	Short timeline to plan	Challenge	Planning	Short timeline
263	PSYOPS training	Short timeline to plan	Challenge	Resources	Short timeline
264	PSYOPS training	Because of short planning timeline changes in one resource meant that other changes had to be made to accommodate it (e.g., instructor availability changes meant that the order of course material might have to change	Challenge	Resources	Balancing
265	PSYOPS training	Some elements of planning occurred before the DM took over which meant they were not in his control or of his choosing	Challenge	Planning	Lack of control
266	PSYOPS training	Pressure to have the trainees ready to go right after training (ready to prove their worth)	Challenge	Planning	High stakes
267	PSYOPS training	Trainees were a diverse group of people with very different backgrounds and levels of military experience (although none were new soldiers) - note that this was both a challenge and an asset	Challenge	Collaboration	Diverse experience
268	PSYOPS training	Demands by the training course location to not have the trainees in uniform	Challenge	Location	
269	PSYOPS training	Have and use a network of resources through personal contacts etc. to provide training opportunities	Training	Collaboration	Networking
270	PSYOPS training	Take advantage of local resources as much as possible (e.g., training located where there is a large Afghan community so could get them involved as actors etc.)	Training	Planning	Use available resources
271	PSYOPS training	Instructor schedules produced constraints on information delivery - information was not delivered in optimal order	Challenge	Resources	Scheduling
272	PSYOPS training	Take care of group cohesion	Training	Collaboration	Team cohesion
273	PSYOPS training	Planning had to remain an ongoing process during the training itself	Challenge	Planning	Ongoing
274	PSYOPS training	Be aware that some of the benefits of training may not be appreciated at the time	Training	Evaluation	Time delay
275	PSYOPS training	Need to be prepared (and prepare trainees) to justify their role - often PSYOPS is not understood (e.g., get an order to "go PSYOPS those guys and be done in an hour" or appreciated - need to be able to relate to a strategic/political end goal	Training	Role justification	
276	PSYOPS training	Need to be able to do job and give limelight to the people who feel they deserve it	Training	Collaboration	Credit
277	PSYOPS training	Can learn more from interacting with the actual civilian community than you can from training	Training	Information	Real world
278	PSYOPS training	Had go/no go criteria for each exercise	Training	Planning	Use go/no go criteria
279	PSYOPS training	Some instructors gave too much information too quickly and at too high a level - took time to absorb after training	Challenge	Information	Overload
280	PSYOPS training	Attempted to integrate other needed skills into PSYOPS training to increase their usefulness - close quarter combat training, combat casualty care	Training	Planning	Interdependence
281	Logistics - NSE	Logistics staff and other resources were extremely limited	Challenge	Resources	Staff
282	Logistics - NSE	CONOPS required dispersed logistics whereas for logistics it is always easier to be centralized	Challenge	Resources	Location
283	Logistics - NSE	Difficult to move resources (locations far apart; difficult terrain; requirement to travel through areas inhabited by the enemy)	Challenge	Resources	Location
284	Logistics - NSE	Logistics extremely brittle and vulnerable to unexpected events (due to lack of resources etc.)	Challenge	Planning	Vulnerability to the unexpected
285	Logistics - NSE	Individual differences in BG members meant that it was difficult to track resource usage (e.g., rate of artillery usage)	Challenge	Collaboration	Individual differences
286	Logistics - NSE	Individual differences in BG members meant that it was difficult to track resource usage (e.g., rate of artillery usage)	Challenge	Information	Updates
287	Logistics - NSE	Enemy actions were unpredictable	Challenge	Planning	Unpredictability
288	Logistics - NSE	Logistics considered secondary to combat forces	Challenge	Role justification	
289	Logistics - NSE	Time lags between resource requests and replenishment from Canada	Challenge	Resources	Replenishment

Initial Order	Scenario	Challenge/training recommendation	Challenge or Training	General theme	Subtheme
290	Logistics - NSE	Very limited logistics staff	Challenge	Resources	Staff
291	Logistics - NSE	Need to consider resources of allies	Challenge	Collaboration	Resources
292	Logistics - NSE	Lack of information to support planning (mission type relatively different from recent missions)	Challenge	Planning	Lack of previous similar events
293	Logistics - NSE	Political/strategic concerns limited resource options	Challenge	Strategic issues	
294	Logistics - NSE	Environmental effects (e.g., maintenance more frequent)	Challenge	Location	Harsh conditions
295	Logistics - NSE	Location of resources (e.g., FOBs and contents) change relevance based on actions of the enemy and orders from higher command (e.g., where to deploy)	Challenge	Resources	Location
296	Logistics - NSE	Logistics could not influence locations of FOBs but had to keep them supplied	Challenge	Planning	Lack of control
297	Logistics - NSE	Psychological well-being of logistics staff endangered due to lack of sleep and rest	Challenge	Resources	Sleep and rest
298	Logistics - NSE	True sustainment not practiced by BG - led to lack of information for planners and lack of prep for soldiers	Challenge	Planning	Lack of required information
299	Logistics - NSE	Location of conflict (Afghanistan) had large impact on flexibility to replenish resources (e.g., land-locked country)	Challenge	Location	Lack of flexibility
300	Logistics - NSE	Radical change to CONOPS that the DM was unaware of prior to deployment had profound negative effects on logistics (e.g., went from centralized to decentralized logistics)	Challenge	Planning	Lack of required information
301	Logistics - NSE	The use of resources varied greatly over time and made it very difficult to keep track of when replenishment needed	Challenge	Information	Updates
302	Logistics - NSE	The use of resources varied greatly over time and made it very difficult to keep track of when replenishment needed	Challenge	Resources	Information
303	Logistics - NSE	Have to be able to handle whatever level of independence given by higher command	Training	Personality	Independence
304	Logistics - NSE	Need to understand and know how to deal with the personalities of those you have to work with	Training	Collaboration	Personality

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Acronyms

Acronym	Full Term
AAR	After Action Review
ANA	Afghan National Army
ANP	Afghan National Police
ATL	Adaptive Thinking and Leadership
BG	Battle Group
C2	Command and Control
CANOSCOM	Canadian Operational Support Command
CAS	Complex Adaptive Systems
CDA	Canadian Defence Academy
CDM	Critical Decision Method
CEFCOM	Canadian Expeditionary Force Command
CF	Canadian Forces
CFC	Canadian Forces College
CIDA	Canadian International Development Agency
CIMIC	Civil Military Cooperation
CLFCSC	Canadian Land Force Command and Staff College
CMP	Chief of Military Personnel
CoE	Centre of Excellence
COIN	Counter Insurgency
CONOPS	Concept of Operations
COP	Common Operating Picture
DFAIT	Department of Foreign Affairs and International Trade
DL	Distance Learning
DM	Decision Maker
DND	Department of National Defence
DRDC	Defence Research and Development Canada
EQ	Emotional Quotient
FOB	Forward Operating Base
HF	Human Factors
HSI®	Human*Systems* Incorporated

Acronym	Full Term
HQ	Headquarters
IEC	Independent Electoral Commission
IPP	Intuitive Planning Process
ISAF	International Security Assistance Force
LAV(s)	Light Armoured Vehicle(s)
LCC	Local Command Centre
NDS	National Directorate of Security
NGO	Non-Governmental Organization
NSE	National Support Element
OPP	Operational Planning Process; Ontario Provincial Police
PD	Professional Development
PMB	Program Management Board
PME	Professional Military Education
PoC(s)	Point(s) of Contact
PSYOPS	Psychological Operations
R&D	Research and Development
RCMP	Royal Canadian Mounted Police
SA	Scientific Authority
SOP	Standard Operating Procedure
SME(s)	Subject Matter Expert(s)
TFA	Task Force Afghanistan
TLCTS	Tactical Iraqi Language and Culture Training System
UN	United Nations

Glossary

Term	Definition
Complexity	According to Dörner (1996), the more variables in a system and the greater their independence, the more complex that system is.
Connectivity	A factor that influences the complexity of a decision making situation. The extent to which things in the environment influence one another in complicated and unpredictable ways.
Critical Decision Method	The Critical Decision Method (or CDM) is a method of knowledge elicitation that focuses the interviewee on an incident in their experience which contained a critical decision related to the topic under discussion. The interviewee is asked to elaborate on their experience to elicit information of interest to the interviewer.
Dynamics	A factor that influences the complexity of a decision making situation. The extent to which the system has aspects that unfold over time. For example, the environment changes over time even when you do nothing; the rate at which things change may be variable; there may be delays between actions and effects.
Independent agents	A factor that influences the complexity of a decision making situation. The extent to which there are independent entities in the environment who influence it (they may have different goals than the decision maker).
Microworlds	Microworlds are computer simulations of complex environments. They generally allow interaction and are used to examine the effectiveness with which people can interact with complex and dynamic domains.
Multiple conflicting goals	A factor that influences the complexity of a decision making situation. The extent to which the DM has to achieve multiple objectives which may not be achievable at the same time.
Underspecified goals	A factor that influences the complexity of a decision making situation. The extent to which goals may be difficult to achieve because they are too vague.

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(U) Challenging decision making environments such as those experienced by the Canadian Forces are commonly being characterized as “complex” by researchers (e.g., Grisogono, 2010). The main goal of this project was to determine whether research investigating complex decision making is relevant to the decision making actually experienced by Canadian Forces personnel, and how that research might be used to improve Canadian Forces education and training related to decision making. Complex decision making environments are characterized by requiring a series of interdependent decisions in a context which changes both autonomously and as a function of the actions of the decision maker, and where timing is a key element (e.g., decision makers may have to act at particular time in order to have their intended effect). Although factors identified in the complexity literature did appear to play a strong role in Canadian Forces decision making, further research is required to determine the relative role that these factors play in increasing decision making difficulty. Research identified additional challenges faced by Canadian Forces personnel which were not noted in the complexity literature, including challenges related to collaboration and communication. Other areas which pose significant challenges to CF personnel which appear to require additional education and training include planning and dealing with resource challenges. Canadian Forces personnel who are engaged in domestic and expeditionary operations appear to encounter the highest level of complexity in their decision making, and initial education and training efforts should probably focus on these individuals rather than individuals engaged in domestic day−to−day functions.

(U) Les chercheurs (dont Grisogono, 2010) qualifient généralement de « complexes » les milieux décisionnels difficiles comme ceux dans lesquels les Forces canadiennes sont appelées à servir. Ce projet avait pour but premier de déterminer si l’étude de processus décisionnels complexes serait utile à la prise de décisions qui constitue la réalité du personnel des Forces canadiennes, et comment ces travaux pourraient servir à améliorer l’éducation et l’instruction des militaires canadiens en ce qui concerne la prise de décisions. Les milieux décisionnels difficiles exigent une série de décisions interdépendantes, dans un contexte qui change à la fois de façon autonome et en fonction des mesures que prend le décideur et dont la synchronisation est primordiale (p. ex., les décideurs peuvent devoir agir à un moment en particulier afin d’obtenir l’effet souhaité). Les facteurs relevés dans la documentation sur la complexité semblaient effectivement exercer un rôle important dans le processus décisionnel des Forces canadiennes, mais d’autres études s’imposent afin de déterminer le rôle relatif qu’exercent ces facteurs par rapport à la difficulté de la prise de décisions. Les études ont relevé d’autres défis auxquels se heurte le personnel des Forces canadiennes qui n’étaient pas mentionnés dans la documentation sur les décisions complexes, y compris des défis liés à la collaboration et à la communication. D’autres secteurs qui posent des défis importants aux membres des FC et dans lesquels une plus ample formation semble nécessaire sont notamment la planification et les difficultés liées aux ressources. Comme les membres des Forces canadiennes affectés à des opérations nationales et expéditionnaires semblent être appelés à prendre les décisions les plus complexes, les premiers efforts d’éducation et d’instruction devrait probablement viser ce groupe de personnes plutôt que les militaires qui exercent des fonctions courantes au Canada.

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(U) complexity; decision making; dynamic decision making; complex decision making; complex adaptive systems; system dynamics; dynamic systems; training; microworlds; land operations

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