Development of the Force Planning Scenario Framework
Inputs for the Scenario Analysis Tool

Larry Cochran; Doug Hales; Peter Race
CAE Professional Services (Canada) Inc.

Neil Chuka; Shaye K. Friesen; Charles Morrisey
DRDC CORA

LCdr Darren Harnett
Chief Force Development

Defence R&D Canada
Centre for Operational Research & Analysis

Strategic Analysis Section

National Defence   Défense nationale

Development of the Force Planning Scenario Framework

Inputs for the Scenario Analysis Tool

Larry Cochran; Doug Hales; Peter Race
CAE Professional Services (Canada) Inc.

Neil Chuka; Shaye K. Friesen; Charles Morrisey
DRDC CORA

LCdr Darren Harnett
CFD

The scientific or technical validity of this Contract Report is entirely the responsibility of the Contractor and the contents do not necessarily have the approval or endorsement of Defence R&D Canada.

Defence R&D Canada – CORA

Contract Report
DRDC CORA CR 2010-017
February 2010

Principal Author

Original signed by N. Chuka; S. Friesen; LCdr Harnett; C. Morrisey; L. Cochran; D. Hales; P. Race;

N. Chuka; S. Friesen; LCdr Harnett; C. Morrisey; L. Cochran; D. Hales; P. Race;

Approved by

Original signed by Stephane Lefebvre

Stephane Lefebvre

Section Strategic Analysis

Approved for release by

Original signed by Dr. Dean Haslip

Dr. Dean Haslip

Acting Chief Scientist

Sponsor: CFD
Partner Group 0, Thrust A

Defence R&D Canada – Centre for Operational Research and Analysis (CORA)

Abstract

This contractor report defines and analyzes the inputs of an effective framework required for characterizing the Force Planning Scenarios. The framework is used as a basis for developing a scenario analysis software tool that allows Defence Scientists to overlay the Force Planning Scenarios and ensure a range of dimensions, factors and variables is being addressed. This contractor report identifies the most relevant dimensions of the Force Planning Scenarios to support analysis and development. The information in this report is based on analysis performed by contractors in close collaboration with Defence Scientists from Defence Research and Development Canada's Centre for Operational Research and Analysis. This study should be viewed as an initial starting point for the development of a scenario writing methodology, and will be updated, modified and refined on an ongoing basis. The report outlines the applications for the scenario analysis tool and makes recommendations for potential areas of future research. The development of a systematic process will enhance the Capability Based Planning process by ensuring that the Force Planning Scenarios are selected and developed in a defensible, transparent and objective way that makes best use of analytical methods and techniques.

Résumé

Le présent rapport d'entrepreneur définit et analyse les données liées à la création d'un cadre efficace nécessaire pour la caractérisation des scénarios de planification des forces. Ce cadre est utilisé comme base d'élaboration d'un outil logiciel d'analyse de scénarios qui permettra aux scientifiques de la Défense de superposer les scénarios de planification des forces et de s'assurer que l'on tient compte de plusieurs dimensions, facteurs et variables. Ce rapport d'entrepreneur permet d'identifie les dimensions les plus pertinentes des scénarios de planification des forces pouvant appuyer les analyses et les développements. Les renseignements présentés dans ce rapport sont basés sur des analyses effectuées par des entrepreneurs travaillant en étroite collaboration avec des scientifiques de la Défense du Centre de recherche opérationnelle et d'analyse de Recherche et développement pour la défense Canada. Cette étude doit être considérée comme un point de départ dans l'élaboration d'une méthode de rédaction de scénario. Elle sera mise à jour, modifiée et raffinée de façon régulière. Ce rapport décrit les applications qui peuvent être faites de l'outil d'analyse de scénario et contient des recommandations sur des domaines de recherche futurs. La mise au point d'un processus méthodique améliorera le processus de planification fondée sur les capacités en s'assurant que les scénarios de planification des forces sont choisis et élaborés de façon transparente, objective et défendable, en utilisant au mieux les méthodes et techniques analytiques.

This page intentionally left blank.

Executive summary

Development of the Force Planning Scenario Framework: Inputs for the Scenario Analysis Tool

Larry Cochran, Doug Hales, Peter Race, Neil Chuka, Shaye K. Friesen, Charles Morrissey, Darren Harnett; DRDC CORA CR 2010-017; Defence R&D Canada – CORA; February 2010.

Background: Force Planning Scenarios serve as the key input to conducting integrated force development efforts in the context of Capability Based Planning. As such, the characterization and selection of these scenarios warrants the application of available analytical techniques to ensure an objective and defensible scenario set. To meet these needs, a representative Force Planning Scenario framework and methodology was developed. This contractor report identifies the most relevant dimensions, factors and variables of the Force Planning Scenarios to support analysis and development.

Results: This study defines a range of dimensions against which the Force Planning Scenarios can be characterized and assessed. It provides an initial set of inputs that will be used to support the development of a software tool that allows Defence Scientists to identify the total set of relationships and assess gaps in a given scenario set that may require the creation of new scenarios. The organization of the elements in the strategic environment into dimensions, factors and variables is discussed, and the various elements that comprise the Force Planning Scenarios framework structure are addressed.

Significance: This project incorporates methodological rigour to assess the coverage of the Force Planning Scenarios against a wide range of dimensions. It generates the "leave behind" decision support capability that can be used, modified or refined by future Defence Scientists engaged in scenario development. The process of analyzing scenarios against a range of operational dimensions provides a robust, defensible and transparent method for selecting and justifying scenario development and evolution to meet Capability Based Planning. By mapping the coverage of the scenarios against a broad range of dimensions, a balanced and relevant scenario set can be developed and maintained to ensure the development of Canadian Force capabilities across the spectrum of roles and environments.

Future plans: As the scenario set evolves, the methodology and analysis tool should be adapted or modified to suit changing operational conditions and scenario requirements. The framework is designed to be expanded and extended to capture new information and scenarios, and grow to meet new users and emerging requirements. Future plans are to refine the software tool by conducting a user validation that includes population of the scenario tool with historical data sets for comparative analysis. Future work could include extending the framework and tool to support mission analysis and capability assessments within the larger force development community.

Sommaire

Development of the Force Planning Scenario Framework: Inputs for the Scenario Analysis Tool

Larry Cochran, Doug Hales, Peter Race, Neil Chuka, Shaye K. Friesen, Charles Morrissey, Darren Harnett ; DRDC CORA CR 2010-017; R & D pour la défense Canada – CORA; Février 2010.

Contexte: Les scénarios de planification des forces sont utilisés en tant que données-clés permettant de mener des efforts intégrés de développement des forces dans le contexte de la planification fondée sur les capacités. En tant que tel, la caractérisation et la sélection de ces scénarios garantissent l'utilisation des techniques d'analyse disponibles, ce qui assure la création d'un ensemble de scénarios d'un point de vue objectif et défendable. Afin de pouvoir répondre à ces besoins, un cadre et une méthodologie représentatifs de création de scénarios de planification des forces ont été mis au point. Le présent rapport d'entrepreneur identifie les dimensions, les variables et les facteurs les plus pertinents des scénarios de planification des forces pouvant appuyer l'analyse et la mise au point.

Résultats: Cette étude définit une gamme de dimensions permettant d'évaluer et de caractériser les scénarios de planification des forces. Elle fournit un ensemble initial de données qui sera utilisé pour appuyer la mise au point d'un outil logiciel qui permettra aux scientifiques de la Défense d'identifier l'ensemble total de relations et d'identifier les lacunes présentes dans un ensemble de scénarios donné, ce qui pourraient entraîner la création des nouveaux scénarios. L'organisation des éléments dans l'environnement stratégique ─ sous formes de dimensions, de facteurs et de variables ─ fait l'objet d'une discussion et les différents éléments qui constituent la structure du cadre des scénarios de planification des forces sont abordés.

Importance: La rigueur méthodologique utilisée dans le présent projet permet d'évaluer la portée des scénarios de planification des forces par rapport à une vaste gamme de dimensions. Une capacité de soutien à la décision « à utiliser sur place » est ainsi produite et elle peut être utilisée, modifiée ou redéfinie par les prochains scientifiques de la défense qui travailleront à la mise au point de scénarios. Cette façon d'analyser les scénarios en fonction d'un certain nombre de dimensions opérationnelles permet d'établir une méthode de sélection de scénarios qui est à la fois solide, défendable et transparente. Elle justifie aussi l'élaboration et le développement de scénarios qui permettent de répondre aux besoins de la planification basée sur les capacités. En schématisant la couverture des scénarios en fonction d'une vaste gamme de dimensions, un ensemble de scénarios équilibré et pertinent peut être élaboré et tenu à jour et ainsi assurer le développement des capacités des Force canadiennes dans tout le spectre de ses rôles et des environnements.

Perspectives: À mesure que l'ensemble de scénarios évolue, la méthodologie et l'outil d'analyse devraient être adaptés ou modifiés afin de les faire correspondre aux changements de conditions opérationnelles et aux besoins du scénario. Ce cadre est conçu de façon à être développé et élargi, ce qui lui permettra de pouvoir intégrer de nouveaux renseignements et des scénarios et de se transformer pour accueillir de nouveaux utilisateurs et s'adapter aux nouveaux besoins. Les recherches futures doivent viser à raffiner l'outil logiciel en permettant une validation par les

utilisateurs qui comprendrait le chargement d'ensembles de données historiques aux fins d'une analyse comparative. Les recherches futures pourraient inclure l'agrandissement du cadre et le développement de l'outil afin qu'ils appuient l'analyse des missions et l'évaluation des capacités au sein de la plus grande communauté du développement des forces.

This page intentionally left blank.

Table of Contents

List of Figures

List of Tables

1　Introduction

1.1　Background

The departmental Force Planning Scenarios (FPS) set provides a representative range of domestic, continental and international situations in which the Canadian Forces (CF) anticipates conducting operations.[1] The FPS provide examples of 'real world' operational situations to bring greater precision to military assessments of the capabilities and force structure that may be required to support a particular operation. Through the study of these scenarios, the Chief of Force Development (CFD) can explore different options, force structure and requirements to delivering military capability.

Given the importance of the context created by the FPS, it is highly desirable that the scenario selection and development process be explicit and incorporate methodological rigour. A representative framework is required to test and evaluate the extent to which the Force Planning Scenarios cover a combination of different variables. The resulting information will be used as a basis for identifying, planning and developing scenarios for use in CFD's future Capability Based Planning efforts. The development of a systematic process will enhance the capability based planning process by ensuring scenarios are selected in a defensible and objective way that makes best use of analytical methods and techniques. This project has realized this goal by developing the components of a scenario methodology and supporting analysis tool for FPS evaluation.

The FPS set provides a common context for multiple users, and must be developed with their needs in mind. The scenarios are designed for use from a top-down perspective, by those involved in force development and CBP who must identify CF capabilities to address future challenges. The scenarios must also be applicable from the bottom-up, by operators conducting mission analysis and understanding the CF's current capabilities. The result is a set of scenarios that can serve as a tool for integrated planning and analysis.

The scenario set cannot be expected to address every potential future event, but must provide a range of futures that best covers the potential operational environment. The CF will still be required to respond to unforeseen events. Just as CBP seeks to generate a robust set of capabilities in the face of uncertainty, force planning scenarios seek to provide a balanced (not exhaustive) set of threats, hazards and conditions to invoke such capabilities.

1.2　Aim

This contractor report defines and analyzes the inputs of an effective framework required for characterizing the departmental Force Planning Scenarios. The framework is used as a basis for developing a software tool that allows Defence Scientists to overlay the Force Planning Scenarios and ensure a range of dimensions, factors and variables is being addressed.

---

[1] See Defence Research and Development Canada, "Statement of Work: Force Planning Scenarios Development Framework and Communication for Capability Based Planning," May 2009.

1.3   Objectives

The main outcome of this work is a practical, rigorous and easily configurable software tool that will allow Defence Scientists in the Concept Development and Operational Research & Analysis Team (CDORA) to identify the total set of relationships for a range of scenarios and assess gaps in the FPS set that may require new scenario development. The goal of the tool is to assess the Force Planning Scenarios by using a modified Field Anomaly Relaxation (FAR) technique. As the scenario set evolves, the methodology and tool should be adapted or modified to suit changing operational conditions and scenario requirements. By supporting Defence Research and Development Canada's Integrated Force Development Capability program, it is anticipated that the scenario analysis tool will facilitate the involvement of key stakeholders in the scenario development process, which in turn will support the Department of National Defence (DND)/CF CBP process.

1.4   Scope

The project focuses on the departmental Force Planning Scenarios, not future trends, shocks or alternative futures. The time horizon for these scenarios is the near future, around the year 2020.

The audience for this project is primarily those Defence Scientists involved in developing the FPS set with a view to broader applicability after the project. Future clients that fall outside of the scope of this work include force employers (i.e., the Joint Capability Planning Teams that engage in Mission Analysis) and capability managers (i.e., military personnel responsible for capability management and analysis). It is anticipated that the results of this work will eventually contribute to greater research into engaging these clients and developing the framework to meet their needs.

The scenario analysis tool is developed as a part of this project was delivered as a standalone prototype. The scope of this project did not extend to hosting the tool on a network, nor did it include the provision of a software service agreement or provision of ongoing maintenance. As a result, future development to the tool would need to be managed by CDORA or through additional initiatives.

1.5   Document Organization

This document is designed to describe the background and purpose of the FPS framework, how it was developed and its application. The document is organized as follows:

- Section 2 describes the operational concept of the FPS and framework, including stakeholder communities and applications;

- Section 2.2 describes the motivation for creating the scenario framework. It outlines the history of FPS and the policy guidance that drives their development;

- Section 3 describes the origins and justification behind the framework;

- Section 4 describes the observations from the initial framework population;

- Section 4.5 describes the analytical processes involved to be applied in evaluating scenarios using the framework;

- Section 5 outlines the prototype tool Concept of Operations (CONOPS) and specification;

- Section 6 outlines potential future research directions and potential next steps for the framework and this project; and,

- Section 7 provides the conclusion.

A companion report entitled "Analysis Tool for Force Planning Scenarios" includes the tool user's guide, providing a detailed description of the tool functions and instructions on its use.

2 FPS and the DND/CF Force Development Process

2.1 High Level Concept of Operations

The DND/CF Force Development (FD) and CBP processes are applied in an effort to improve CF composition for the future. In the CBP process, scenarios largely derived from government policy are analysed to determine the CF's capability goals in terms of the quality and quantity of capability required to conduct both domestic and international operations. Significant literature exists on the subject.[2] The Chief of Defence Staff (CDS) Action Team 3 (CAT-3) was established to examine the operational capabilities of the CF, with a mandate to "review the strategic direction, conduct a capability gap analysis, and provide force structure recommendations."[3] Through its research, the CAT-3 has remained consistent with the current body of literature that highlights the use of scenarios as a central element in CBP and FD.

---

[2] Paul K. Davis, *Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation* (Santa Monica: RAND, 2002); DND, Chief of Force Development, *Force Development and Capability Based Planning*, CFD Handbook v4.2 (July 2007); R. Burton, G. Christopher, P. Chouinard, L. Kerzner, K. Simonds, *Procedures, Processes and Tools of Capability-Based Planning: an Outline for a Canadian Approach*, DRDC CORA TR 2005-35 (Ottawa: DRDC CORA, November 2005).

[3] R. Burton, et. al., *Procedures, Processes and Tools of Capability-Based Planning: an Outline for a Canadian Approach*, p.1.
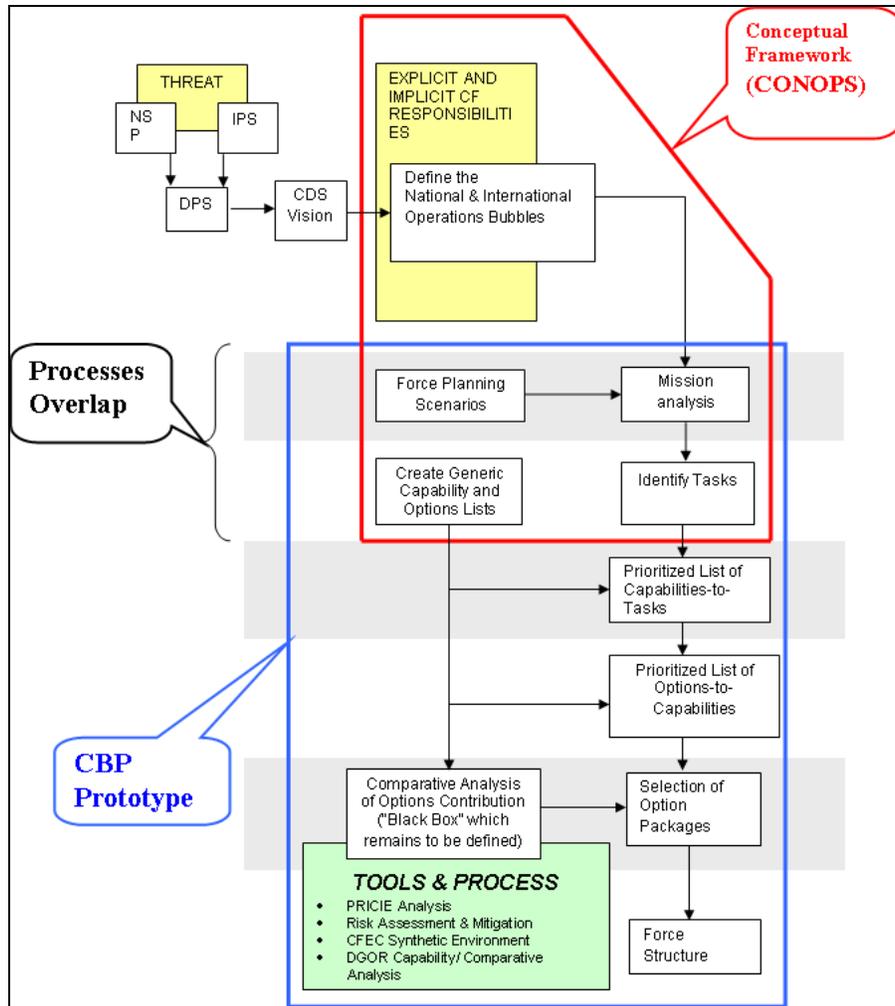
Figure 1: Scenarios and CBP

The process overlap depicted in Figure 1 demonstrates the key role scenarios play in articulating policy and defining capability targets.[4] They are common tool that must support multiple audiences. In addition, the link to mission analysis highlights the core function of FPS as providing the context, informed by policy, necessary for developing, applying and evaluating military capabilities.

2.2   FPS and Capability-Based Planning

Scenarios have always been a key planning tool. They provide a representation of current and emerging threats and operating environments. Following the Cold War, the international security environment changed dramatically, ushering in greater uncertainty in military planning. CBP was implemented to address this uncertainty, and a set of FPS were developed to characterize the potential future security environment. After identifying the need for a link between defence

---

[4] DND, CDS Action Team 3, *Final Report – Operational Capabilities* (Ottawa: August 2005), p. 21.

policy and CBP,[5] CBP become officially sanctioned by DND in 1999.[6] To meet the needs of CBP, a set of scenarios was developed that spanned the spectrum of CF operations. The original set of 11 FPS was extended to 18, and was mapped against a number of dimensions as depicted in Figure 2.
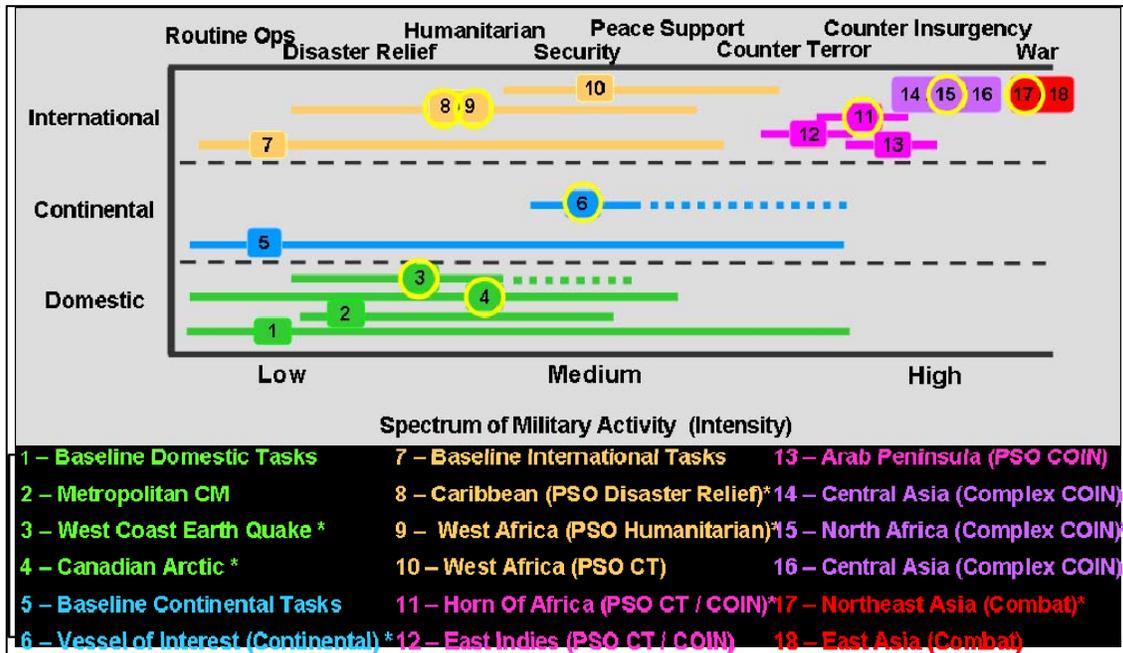
Figure 2: Force Planning Scenarios and Spectrum of CF Operations

The graphic, shown in Figure 2, describes the scenario set according to the three areas of operations (domestic, continental and international), the campaign themes (routine operations and operations other than war through to combat) as well as the spectrum of military intensity. As the set of 18 scenarios suggests, efforts have been also made to include a variety of likely theatres of operation that span multiple geographic regions. This high-level mapping is valuable, providing insight into how the set addresses past planning assumptions. Such representations are valuable, and should be expanded upon to include a greater set of dimensions. Further, Figure 2 does not indicate any sense of completeness; a clear substantive process should also accompany such depictions to substantiate the balanced scenario set.

The DND/CF have been using FPS in the context of CBP to ensure the CF has a coherent force structure for addressing the operational challenges associated with the future security environment. There have been two previous rounds of scenario development, and considerable information exists for improving the process and supporting follow-on analysis.   Scenario selection presents unique problems for analysts – it is inherently difficult to evaluate how the combined effects of multiple factors might influence a desired scenario and/or given scenario set.

---

[5] See DND, Chief of Land Staff, *Land Operations*. B-GL-300-001/FP-001 (Kingston: DND, January 2008).
[6] R. Burton, et. al., *Procedures, Processes and Tools of Capability-Based Planning: an Outline for a Canadian Approach*, p.1.

Some of these challenges have been raised by Defence Scientists over the course of outlining how the set of planning scenarios could be defined in the DND/CF. The requirement for scenario analysis tool is reinforced by the absence of a rigorous process that deals specifically with the FPS and its key dimensions. Surprisingly little attention has been devoted to the tools required to help develop an analytical framework for validating the FPS, thereby making it difficult for analysts to identify gaps in a given scenario set and drive the mission analysis process to prioritize capability requirements. Work on the original 11 FPS led to the development of the Scenario Operational Risk Assessment Model (SOCRAM),[7] which allowed analysts to take a sample of concurrent operations from the scenario set (based on probability of occurrence) and determine capability requirements.[8] While this work provided tremendous insights into which capabilities might be required to operate against a spectrum of operations depicted in the original FPS, it did not assess the scenarios in the future security environment that can trigger changes in capability requirements. Moreover, a report on procedures, processes and tools for CBP published a team of mainly operational research scientists suggested that it is important to consider multiple factors and the levels of those factors in designing scenarios.[9]

During the scenario development process in 2005, there was considerable disagreement over scenario content as well as brought to the surface divergent views of the future and the most effective conceptual approach to examine it.[10] It was determined during this period that there was a need to improve the process, time horizons and analytical techniques for identifying the future operational challenges that lie ahead. Part of the rationale for studying the components of the scenarios and developing a supporting tool was in response to lessons learned during the first two iterations of the FPS. The approach taken builds upon the lessons learned that have become apparent during scenario development. The lack of an effective framework can lead to a situation in which scenario choice and definition are based purely on speculation or subjectivity versus ones that are firmly grounded in the literature and based on a firm foundation of evidence-based objective reasoning. The use of the former makes it exceedingly difficult determine whether the scenarios are, indeed, targeting the "right" gaps in military capability, technology or operational response. Hence, there is a need to exploit tools, methods and approach and for producing a well-defined, easily understandable and comprehensive framework that supports scenario development and their applications in the context of CBP.

2.2.1   Research Questions for Scenario Tool

Accordingly, this analysis seeks to answer a number of questions in order to gain a better appreciation of the full extent and nature of dimensions, factors and variables that are addressed by a given scenario set. A preliminary list of questions was drafted as a guide to aid in developing

---

[7] SOCRAM, a simulation tool was developed by Defence Scientists, examined the risk of cumulative demand for military capabilities. G.L. Christopher, P. Comeau, R.W. Funk, S. Isbrandt, M. Macdonald, B. Ritchey, *Force Planning Scenario Framework Proof of Concept*, ORD-DOR (J&L) RN-9913 (Ottawa: October 1999).

[8] G.L. Christopher, P. Comeau, R.W. Funk, S. Isbrandt, *Towards the Development of a Force Planning Scenario Framework for DND*, ORD-DOR(J&L)-RN-9910 (Ottawa: October 1999), p. 28.

[9] R. Burton, et. al., *Procedures, Processes and Tools of Capability-Based Planning: an Outline for a Canadian Approach*, p.1.

[10] Michael L. Roi, Peter Archambault and Charles Morrisey, *The First Cycle in the Spiral Process to Develop New Force Development Scenarios,* DRDC CORA TM 2008-07 (Ottawa: Defence R&D Canada – CORA, February 2008), pp. 12-16.

the scenario analysis software tool and support the visualization of outputs (see Annex A for full list of questions). The research questions were guided by the aims and objectives of the contractor report, and were developed in accordance with the following broad goals in mind:

- What are the most important dimensions, variables or factors that can be used to define the FPS?

- Are there any notable gaps or trends in the data (both at the individual and aggregate level) that can be used to inform the development of new scenarios? and,

- To what extent are new variables required to define and describe the scenario set?

The consideration of these three broad research questions provided a foundation from which more specific questions of the scenarios could be generated. At the time of the writing, the questions have not benefitted from a complete validation of the tool. However, it was recognized that the list be flexible enough in order to allow for potential changes in the set of dimensions and factors or different types of questions being posed. Since there were numerous questions being asked, several different graphical techniques (e.g., histograms, tables, scatterplots etc.) could be employed to compare and contrast the scenarios. Most of the questions are centered on dimensions and factors that are drivers or descriptors in order to ensure that a majority of the variables are being covered off by the FPS.

2.3 Canada First Defence Strategy

In addition to ensuring a complete FPS set, there is often a need to refresh the scenario set based on the emergence of strategic shocks, new perceptions of the future operational environment and changes to defence policy. These strategic shocks, also referred to as "black swans", are unpredictable events that dramatically change the core of DND/CF engagement.[11] The attack on the World Trade Centre on September 11, 2001 was such a shock, leading to the Global War on Terrorism and an increased requirement for an FPS set that addressed domestic terror attacks as well as failed states. Changes in the perceived future operational environment requires a refreshed set of scenarios that tests the capabilities necessary to successfully execute missions against new threats and adversaries. Defence policy is the method through which the Government of Canada outlines how Canada will meet current and future defence and security challenges.[12] The current set of FPS is being refreshed to better align with the *Canada First* Defence Strategy (CFDS). The current policy, laid out in the CFDS, outlines the vision of the CF capabilities through six core missions that address the future security environment:

1. Conduct daily domestic and continental operations, including in the Arctic and through NORAD;

2. Support a major international event in Canada, such as the 2010 Olympics;

3. Respond to a major terrorist attack;

---

[11] Peter Perla, "So a Wargamer and a Black Swan Walk into a Bar…," *Phalanx* (December 2008).

[12] See CFD Handbook, *Force Development and Capability Based Planning*.

4. Support civilian authorities during a crisis in Canada such as a natural disaster;

5. Lead and/or conduct a major international operation for an extended period; and

6. Deploy forces in response to crises elsewhere in the world for shorter periods.[13]

These six missions serve as policy boundaries and are intended to guide current FPS development. The new baseline and terrorist scenarios have been developed to address these missions.[14] To ensure the scenario evaluation aligns with policy, these missions will be used as a lens for scenario analysis. After evaluating the range of plausible scenarios for the FPS set, they can be evaluated against these mission types to understand the degree of policy coverage from a given set of FPS. Alignment with defence policy is necessary when the number of plausible contingency operations is large and scenarios need to be consistent with political direction. The intent is not necessarily to provide a set of "handcuffs" that restrict scenario development. Rather, defence policy serves as a guide for scenario development and ensures representativeness across the spectrum of operations.

2.4   Stakeholder Communities

There are three major communities that exploit force planning scenarios: capability managers, capability planners and capability employers. The communities and functions are depicted in Figure 3. While planners are interested in the longer horizon (e.g., defining the CF in 2020), capability employers in the near future are looking at inventories, and the managers are concerned with the transition from planning to employment, thereby addressing gaps, proposing options and guiding investment.
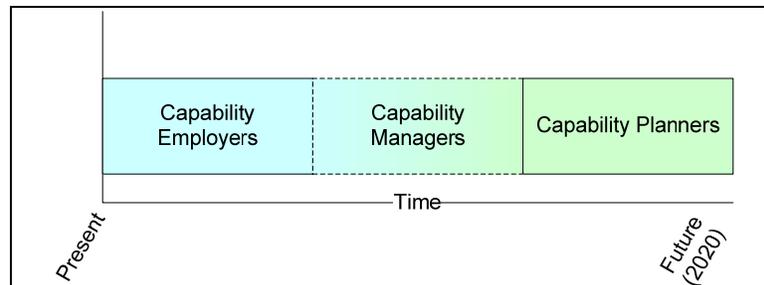
Figure 3: Spectrum of Scenario User Communities

The focus of the scenario set at this point is the capability planners and managers. To support this community, the team selected a standing timeframe of 2020 for the FPS set. Nonetheless, they will be used to integrate across domains within DND/CF.

---

[13] Government of Canada, *Canada First Defence Strategy* (Ottawa: Government of Canada, May 2008), p. 3.

[14] N. Chuka, S. Friesen, C. Morrisey, N. Waintraub, R. Heide, *Baseline Scenario of Department of National Defence/Canadian Forces Domestic and Continental Activities*, DRDC CORA TM 2009-015 (Ottawa: DRDC, April 2009); N, Chuka, S. Friesen, C. Morrisey, N. Waintraub, *Major Terrorist Attack Scenario: an Explosive Attack in the Quebec – Windsor Corridor* (Fall 2009 Draft) (Ottawa: DRDC CORA, 2009).

As an integrating core, scenarios serve to ensure force development activity alignment. Any tool that supports scenario development and analysis must cater to the functional needs of all user communities. CAT-3 identified five building blocks for conducting CPB, with the CF vision defining the concept, leading to an operational concept that answers how the CF will be trained, equipped and organized to fight in the future.[15] Critical to this second block is a set of scenarios that reflects this vision.

Figure 4: Stakeholder Communities and Functions

The planning functions often involve experienced military subject matter experts. The prime role of these military subject matter experts (SME) is as a "repository of deep-lasting knowledge and competence, as well as the source of most innovations" and provides the means to satisfy operating objectives: forces, equipment and doctrine.[16] Similarly, while force employers are in general more interested in adopting a short-term perspective due to their focus on current operations, the "potential importance of [force employers] lies not in setting national strategy but

---

[15] CDS Action Team 3, *Final Report*, p. 7.
[16] David C. Gompert, Paul K. Davis, Stuart E. Johnson and Duncan Long, *Analysis of Strategy and Strategies of Analysis* (Santa Monica: RAND, 2008), p. xv.

in translating it into operating objectives and in turn expressing demand for capabilities to achieve those objectives, thus allowing strategy and resources to be linked."[17]

Other groups that have a key stake in the development and application of the FPS include:

Policy Developers. As policy provides the conceptual framework that outlines the future CF, it is important that the scenario set is reflective of this policy. Any scenario assumptions related to own-force engagement (e.g. duration or level of commitment) would need to be modifiable.

Capability Planners. CBP revolves around the use of scenarios. In the CFD Handbook, CBP is described as a "modified Operational Planning Process", involving the use of scenarios to conduct Intelligence Preparation of the Operational Environment, mission analysis, grouping of tasks and capabilities and eventual capability prioritization.

Capability Managers. Capability managers are responsible for developing and maintaining a balance of capability investment across all capabilities. They ensure that necessary gaps are being addressed, and need to use the FPS as the context to help weigh these gaps. As a result, the ability to review scenarios as they relate to capability prioritization would be required.

Operational Planning and Exercise Coordination Community. Operational planners make use of scenarios in much the same way as capability planners. The scenarios are used to conduct mission analysis on potential upcoming missions. As a result, the scenario set serves to provide the foundation to generate and evaluate Contingency Plans (CONPLANS). Once CONPLANS are developed, they are brought into training to introduce and clarify roles, standards and processes are in place. Exercise coordinators use the context and assumptions of the FPS to develop the CONOPs and Master Scenario Events List (MSEL) for such training. While the narrative may not include all necessary elements required to conduct an exercise, it provides the majority of the necessary variables to conduct planning and wargaming. The feedback from such exercises, when combined with lessons learned from the operational elements, could provide insight into capability analysis.

Defence Scientists. It is the role of Defence Scientists within the Operational Research and Operational Analysis communities to research and develop the FPS set that represents the future operational environment. Drawing on policy and operational information, as well as literature on changing future threats and adversaries, Defence Scientists must present an objective and balanced set of scenarios for use by all other users. This research is designed to primarily support this user group, thus enabling the creation of an optimal set for use by the other communities.

---

[17] Ibid, p. xiii.

3 Characterizing Scenarios Using the FPS Framework

3.1 Guiding Principles

A framework is schema designed to provide a structure for addressing problems with multiple stakeholders with differing accountabilities, multiple perspectives, divergence of interests, and considerable autonomy. A framework is independent of application and does not prescribe use, methodology or process. By remaining independent of organizational and institutional processes, the framework supports the aggregation and simplification of multiple components, dimensions or elements.

The FPS framework developed for this project makes use of this function for sorting and filtering, displaying, searching, analyzing and selecting scenarios for a number of uses. It is designed to be expanded and extended to capture new information and scenarios, and grow to meet new users and new requirements. Below are a set of explicit principles used to develop the FPS framework:

- The framework should facilitate coverage of the three CF roles: defend Canada; defend North America; and contribute to international peace and security;

- The framework should provide a link into defence policy as articulated by the Government of Canada in the CFDS, ensuring that the set includes at least one scenario for each of the missions outlined therein;

- The framework should be capable of accommodating all classes of users, supporting continued expansion through ready access and evolution;

- The framework should support logical, plausible and relevant situations that the CF may encounter in the future;

- The framework should draw on variety of authoritative and credible sources of information (e.g., government reports, journal articles etc); and,

- The framework should remain internally consistent with Canada's historical deployments, current military doctrine, future security environment analysis and concept development activities.

3.2 Identification of Dimensions

In developing the scenario framework, there are inherent trade-offs between the number of dimensions and the acceptable level of detail that must be considered. It is important that the framework be comprehensive enough to permit thorough and systematic analysis without becoming too detailed to the point that it is overly cumbersome, difficult characterize or simply unusable for the purposes of providing effective decision support. Moreover, if the dimensions are based on a fully complete and definitive depiction of all future threats, trends and drivers associated with the future security environment, it would impose difficulties on analysts to provide compelling analysis, and thwart their ability to maintain a coherent grasp of the most relevant variables for the purposes of scenario development. There is also the problem in making

a given dimension too ambiguous by assigning multiple factors, variables or values to the point that it looses parsimony and distinction. It is also recognized that a finite or closed model in which scenarios are compared against a range of variables entails accepting a certain amount of risk that the proposed solution or framework may not be wholly accurate.

Yet, it is clear, based on the analysis of the literature and consultation with the broader Defence Science community, that a scenario framework is representative of user-defined set of dimensions, factors, variables and values that are germane to the problem confronting analysts in the scenario development process. The literature review examined the development of past FPS and their critical elements, using the criteria developed above to refine and refresh several of these attributes. The resulting set of dimensions, factors and variables were thus a continuation of past efforts, adjusted and extended to address all relevant aspects of the future operational environment.

Equally important, the scenario framework is not intended to be used either as a forecasting or predictive tool. In other words, it does not provide insights into the specific timing, nature and location of events that may trigger CF involvement. The framework is a planning tool that is designed to improve the ability of defence scientists to analyze gaps in the existing scenario set and generate new scenarios that most effectively satisfy the requirements of force development using a consistent and structured approach. This involves the consideration of a range of dimensions, factors and variables that influence the existing scenarios and current operations, as well as anticipating the future threats, environments and missions for which defence forces must be developed and assessed in the context of CBP. Therefore, an appropriate balance must be achieved by stating the guiding principles upon which the framework is based and using expert judgement to capture dimensions, variables and factors deemed most relevant to scenario development in the DND/CF.

Accordingly, in identifying the dimensions, it is necessary to take into account the existing scenarios that have been developed, and those that are currently under development, to aid in the identification of the appropriate level of detail that is required. Yet, this process alone is insufficient. Existing scenarios provide guidance on the appropriate level of detail for enabling more in-depth analysis and decomposition. However, the scenarios themselves need to be expanded upon in order to highlight new variables and condition sets. To date, the current force planning scenario effort covers a broad range of strategic challenges.

The application of future joint concepts and integration of emerging changes in the international security environment will permit the tailoring of new scenarios in non-traditional areas. A refined set of scenarios is required to create a wider variety of challenges for planning and assessing the adequacy of capability employment and force structure rather than reinforcing conventional deficiencies. The methods chosen for scenario analysis (i.e., a combination of Morphological Analysis and Field Anomaly Relaxation) offer a systematic, transparent, objective and replicable way of filtering the number of scenarios and variables down to a manageable level. Ultimately, it is a combination of usability, utility, functionality, availability of information and relationship to the aims, purpose and need for the tool that establishes appropriate and acceptable levels of detail.

3.3   FPS Framework Structure

Several dimensions are required to meet the framework requirements. Each dimension serves a unique purpose, enabling both the development of a complete set and characterizing scenarios for planning. As a result, there is a degree of crossover between some of the dimensions (e.g., geographic regions and terrain). To assist the user in applying these dimensions, they have been organized into three types:

- Drivers: Includes the core elements of future scenarios. These driver dimensions are used to evaluate the range of plausible scenarios in evaluating the set as a whole.

- Descriptors: Used to characterize the important details within a scenario. Descriptors are necessary for developing individual scenarios to ensure they are suitable for mission analysis and CBP.

- Derivatives: Includes all dimensions that are invoked by a particular scenario.
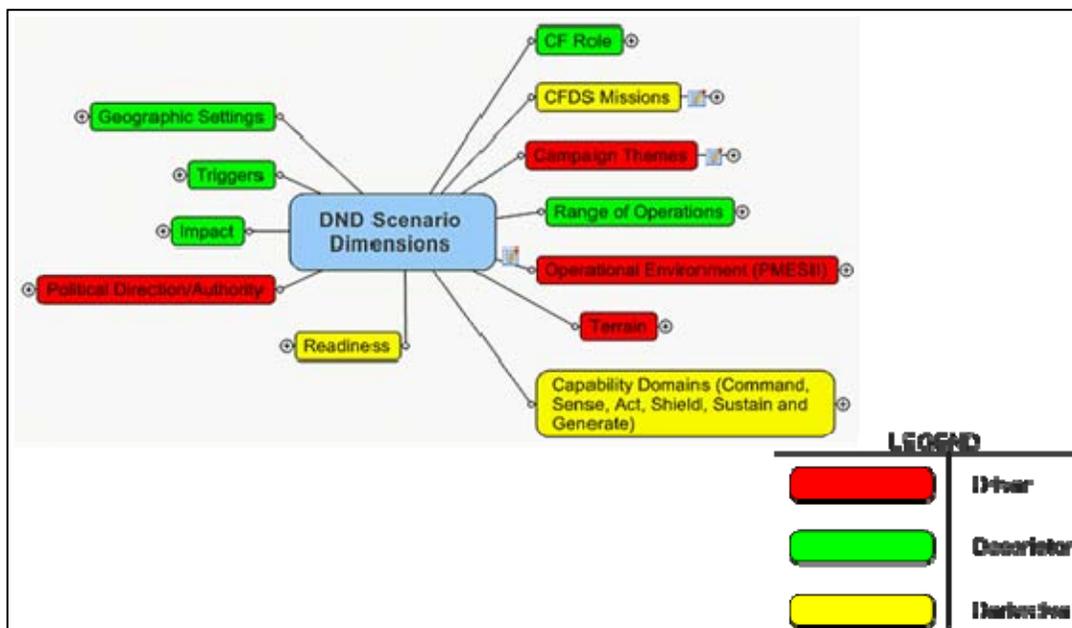
Figure 5: Dimensions as Drivers, Descriptors and Derivatives

The colour coding in Figure 5 outlines the current drivers, descriptors and derivatives within the framework. There are three exceptions of note. First, the Political, Military, Economic, Social, Infrastructure and Information dimension (see Section 3.3.2) includes all elements of the operational environment. However, the red force subset of the military dimension is the only portion considered a driver. Second, within the natural environment, the weather and climate are considered descriptors; terrain is the driver aspect of the dimension. Finally, the CFDS missions are anomalous, as they provide bounds for scenario development without functioning as a driver. The most appropriate categorization is derivative, as a final check to ensure the full FPS set adequately addresses the policy bounds laid out by the CFDS.

As noted previously, the FPS framework needed to balance between accessibility and completeness. That is, it needed to have a high-level component for ease of navigation, as well as a level of detail sufficient for describing all key aspects of the future security environment. Therefore, as a result, the framework was developed with three levels of decomposition:
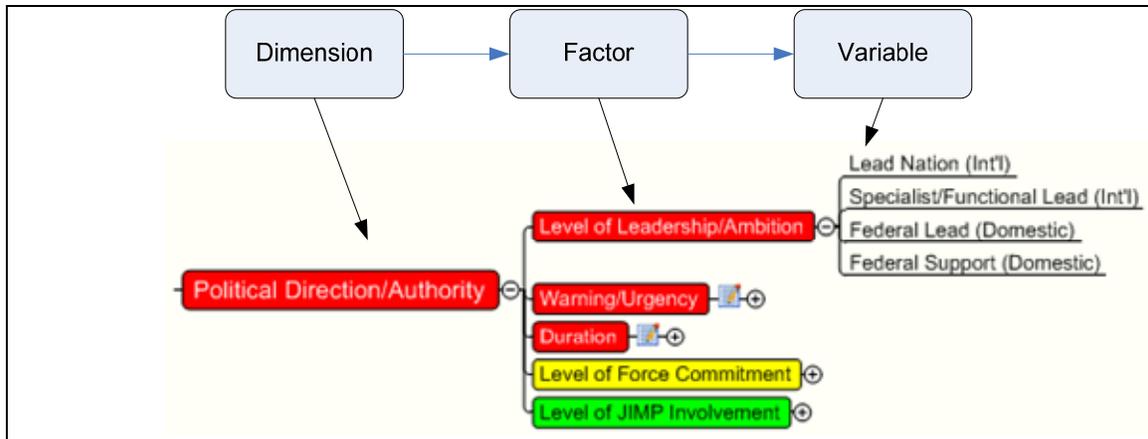
Figure 6: FPS Framework Structure - Dimensions, Factors and Variables

As a rule, every scenario will include at least one variable from each factor. Section 4 details on how the framework structure is applied.

3.3.1   Campaign Themes

The CF is mandated to serve as a multipurpose force. This has traditionally been interpreted to include the capability to operate across the spectrum of conflict, with the exception of nuclear deterrence. In one form or another, this has been a dominant axis for evaluating the completeness of the force planning scenario set. It successfully categorizes the range of CF operations along the continuum of operations at a high-level, and is well-documented in doctrine. As a result, campaign themes serve as the prime driver in the scenario framework.

Current Canadian joint and army doctrine describes four campaign themes. These are: Peacetime Military Engagement (PME); Peace Support Operations (PSO); Counterinsurgency Operations (COIN); and Major Combat Operations (MCO).[18] Broadly speaking, it is possible to organize the entire range of military operations that the CF conducts within this framework, except those activities that fall under the "Generate" functional domain.[19]

---

[18] DND, *Canadian Military Doctrine*, CFJP-01, B-GJ-005-000/FP-001 (Ottawa: DND, April 2009), section 2-13; DND, Chief of Land Staff, *Land Operations* B-GL-300-001/FP-001 (Kingston: DND, January 2008), sections 3-14 to 3-17.

[19] While it is recognized that the activities such as training, recruitment, and education that fall under the Generate functional domain are critical to CF operations, the exclusion of these activities from the parameters of this scenario tool fits with the mission analysis process that has been used to date. In essence, the 'generate' requirements fell out of mission analysis of a scenario, rather than there being a requirement to create a generate scenario for the CF writ large, something that would surely be a large, daunting task.

Figure 7: Campaign Themes and the Spectrum of Conflict

Campaign themes are simply a descriptive planning tool. As outlined in current Canadian Land Operations doctrine, campaign themes "describe the broad general conditions that exist in an AO [Area of Operations] and provide principles to guide planning and action as a campaign progresses."[20] In other words, it allows planners to "identify the predominant type of military activities to be conducted at any time within a joint operations area."[21] The themes are related to the continuum of operations and spectrum of conflict that spans from "peaceful interaction" through to "general war" and reflect a theoretical level of threat, risk, and violence.[22] As such, campaign themes have little detail and are designed to provide a high-level context for developing and evaluating the set of force planning scenarios.

Campaign themes are necessarily broad and general in nature. When used to illustrate a scenario, the range of activities that may be required within a given theme can be so diverse as to render the descriptive value of theme nearly useless. COIN operations, for instance, can involve multiple concurrent operations within a given AO, including combat against entrenched enemy forces, counter-terrorism, enforcement of approved sanctions, and the provision of humanitarian assistance. As a result, the driver dimension is designed primarily to drive context and establish a balanced FPS set; a second dimension, "Range of Operations", is used to provide the required nuance to describe individual scenarios. When provided with a range of operations that can be liked to a particular theme based on a scenario, a level of fidelity is achieved that enables informed decision making and analysis.

The second limitation is the fact that campaign themes are, in reality, fluid. This means that the predominant campaign theme can change over the course of a campaign, with subtle or abrupt transitions. Also, there is nothing limiting the return to a particular theme that might have been prevalent in the past in a given campaign. When applied against a set of scenarios, these limitations make it difficult to properly account for all of the types of activities that may be required, and to realistically portray the fluid nature of operations. This poses a challenge to scenario developers and to analysts. To align with this framework, scenario developers either need to develop separate yet related scenarios that capture the fluid nature of campaign themes, or tag a particular scenario with multiple campaign themes. From an analyst's perspective, the campaign themes provide a driver for developing a set of plausible scenarios, but fail to account for the need for fluid capabilities that can transition from humanitarian assistance to peace support through to major combat. This second challenge would be suited to a study into concurrency analysis based on multiple campaign themes, but such research falls outside the scope of this effort and should be considered as part of a separate initiative. The best available method is to cluster individual scenarios into a single representative scenario. This process has been outlined in section 4.

---

[20] *Land Operations*, section 3-14.
[21] *Canadian Military Doctrine*, section 2-13.
[22] *Land Operations*, sections 3-11 to 3-13; *Canadian Military Doctrine*, sections 2-13, 2-14.

The variables include the four campaign themes outlined in Canadian military doctrine:

- *Routine Operations or Peacetime Military Engagement (PME).* PME is defined as "military activity in peacetime that involves cooperation with other nations or agencies, primarily intended to shape the security environment."[23] It includes initiatives to improve mutual understanding and interoperability. Within Canada, the CF has responsibility for other peacetime military taskings through the conduct of routine operations, including search and rescue (SAR).

- *Peace Support*: A peace support campaign impartially makes use of diplomatic, civil and military means, normally in pursuit of United Nations (UN) Charter purposes and principles, to restore or maintain peace. Such operations may include:

    - Conflict prevention;

    - Peacemaking;

    - Peace enforcement;

    - Peacekeeping; or

    - Peace building.

- *Counter-Insurgency (COIN)*: Counter-insurgency is defined as "those military, paramilitary, political, economic, psychological and civic actions taken to defeat insurgency."[24] A COIN campaign is characterized by an insurgent based adversary, the political nature of the crisis, a need to address multiple facets of the environment and root causes of the crisis through a comprehensive approach with the military in an overall supporting role, and a degree of combat that is less than that experienced in a major combat campaign. As a result, most COIN campaign themes will typically address a smaller, innovative adversarial force.

- *Major Combat*: Major combat campaign is the most demanding of military campaigns and operations. It is characterized by combat that is frequent, widespread and intense. It will usually be conducted against other formal, conventional military forces.

3.3.2   Operational Environment

Every operational environment will be unique. The key for planning is to select from a spectrum of environments in order to accommodate uncertainty and provide a balanced set of scenarios. To ensure logical consistency, typically the operational environment is primarily used as a supporting dimension, i.e. to exemplify the campaign theme. As defined in the *Joint Intelligence Preparation of the Operational Environment* (JIPOE), the operational environment is "the composite of the conditions, circumstances, and influences that affect the employment of capabilities and bear on the decisions of the commander."[25] The Operational Environment is further broken down according to Political, Military, Economic, Social, Infrastructure and Information (PMESII).[26]

---

[23] *Land Operations*, sections 3-10.
[24] Ibid.
[25] United States, Department of Defense, *Joint Intelligence Preparation of the Operational Environment*, Joint Publication JP 2-01.3 (Washington: Government Printing Office, 16 June 2009), p. xi.
[26] The PMESII model is expanded in as PMESII + PT, which includes the two additional elements of Physical Environment and Time. In developing the scenario dimensions, the physical environment was given its own dimension to account for the natural environmental conditions of terrain, weather and

The use of PMESII for categorizing scenarios allows for the characterization of the adversary as well as the actors and factors that could potentially influence the outcome of an operation. The original basis for requesting CF support will be strongly linked to the macro-level structural conditions conducive to instability. PMESII also provides support to effects-based operations (EBO) from a system-of-systems perspective. It has been applied to analyze effects as a part of nodal analysis and operational net assessment (ONA). ONA is "the integration of people, processes, and tools that use multiple information sources and collaborative analysis to build shared knowledge of the adversary, the environment and ourselves."[27] As a result, PMESII has the potential to serve two purposes: first, it serves as a checklist to ensure scenario completeness and a balanced set; secondly, it serves as a possible link to support mission analysis, exercise design and contingency planning.

The prime use of the operational environment domain is to characterize the scenario rather than to drive scenario selection. Only the red force military subset of the dimension is considered a driver. The range of potential adversaries is a fundamental aspect of any scenario set, and thus is useful for evaluating the set of plausible scenarios.

3.3.3   Natural Environment

For commanders to make decisions based on a scenario, they must have a strong understanding of the adversary, weather and terrain.[28] For Operations Other Than War (OOTW), the adversary may be replaced by another threat or hazard, but the factors of relevance to the operational commander remain the same. Much of the descriptors of the adversary, as well as other factors that could influence the outcome of a mission, are described using the PMESII model. The Natural Environment dimension includes all aspects related to the other two areas of the environment of interest to the commander: weather (and climate) and terrain.

Both weather and climate are addressed as a part of Natural Environment. Weather is the state of the atmosphere regarding wind, temperature, precipitation, moisture, barometric pressure, and cloudiness. Climate is the composite or generally prevailing weather conditions of a region, averaged over a number of years.[29] Both are useful for describing the context of a particular event, ensuring capabilities can function across all climates.

Terrain is the only aspect of the natural environment considered a driver. The terrain provides insight into both the region and climate in which the CF may operate. As a result, it ensures capabilities are capable of operating through a range of environmental factors.

---

climate. Time was addressed through the Duration dimension, which determines the length of the CF mission. See DND, Chief of Land Staff, *Intelligence Field Manual*, B-GL-357-001/FP-001 (Kingston: DND, 2000).

[27] United States, Department of Defence, Joint Warfighting Center, *Doctrinal Implications of Operational Net Assessment (ONA)*, Joint Doctrine Series Pamphlet 4. (Suffolk VA: Joint Warfighting Center, 24 February 2004), p. 4.

[28] United States, Department of Defense, US Army Training and Doctrine Command (TRADOC), *The Operational Environment* (White Paper) (Fort Monroe VA: TRADOC, May 2009).

[29] *Joint Intelligence Preparation of the Operational Environment*, II-38

Like campaign themes, climate and terrain are often not constant throughout the duration and geographic bounds of a scenario. While there may be a prevailing climate or terrain, CF capabilities will continue to require the flexibility to operate in diverse environments. The CF in Afghanistan is a case in point, forced to address both mountain, urban and desert terrain, and could encounter both arid and frozen climates. As the scenario set is developed and analyzed, the framework must include a mechanism to address such diversity.

3.3.4   Political Direction/Authority

In many cases, the extent of CF contribution is discretionary; the level of ambition is determined through political direction. The response to a scenario will vary based on circumstances, leading to unique leadership roles and levels of commitment. In the past, this has been accommodated by introducing variants to a scenario. However, it is important to be explicit in this level of ambition, as it defines the nature of required future autonomous CF capabilities. For example, certain capabilities may be reduced in priority if they are only employed in coalition engagements where the CF functions in a supporting role. Similarly, those scenarios where DND provides domestic support highlights areas where Other Government Department (OGD) capabilities must facilitate such multi-agency engagement. There are five different factors that warrant discussion: Level of Leadership/Ambition; Duration; Warning/Urgency; Level of Commitment; and Level of JIMP (i.e., Joint, Interagency, Multinational and Public) Involvement.

3.3.4.1   Level of Leadership/Ambition

Taken from the findings of CAT-3, the level of leadership ambition will also shape the tasks and capability contributions expected of integrated CF force packages. It is envisioned that CF leadership roles in international operations could take on one of two forms:

1. Lead Nation: nation with the will, capability, competence and influence to provide the essential elements of political and military leadership to coordinate the planning, mounting and execution of a Coalition Campaign;

2. Functional/Specialist Lead: the nation with the will, capability, competence and influence to provide the essential elements of political and military leadership to coordinate the planning, mounting and execution of Coalition operations within a functional component command or geographic area of responsibility, or a provide a Coalition specialist role in support of the Lead Nation;

In particular, this dimension provides a sense of Command, Control, Computers, Communications, Information Surveillance and Reconnaissance (C4ISR) capability requirements and is used to define the additions necessary to support coalition leadership. It is important that this aspect be covered within the scenario suite. This is beyond national command and control, and moves into considerations of expanded scope and interoperability.

For domestic events, each government department is given lead or support roles over the several Emergency Support Functions. DND involvement could take one of two forms:

1. Domestic Lead: DND is the lead department responsible for Search and Rescue (SAR) operations within Canada.

2. Domestic Support: DND provides OGD assistance, such as humanitarian support.

3.3.4.2   Duration

The mission timeline is described using three categorizations: enduring; long and short. An enduring mission does not have a prescribed start or end time within a scenario. A long mission involves multiple rotations (ROTOs), while a short mission is limited to a single deployment. The duration can be mapped against the CFDS missions, as seen in Table 1.

CFDS Mission	Duration
Baseline	Enduring (10+ ROTOs)
Major Domestic Event	Short (1 ROTO)
Major Terrorist Attack	Short (1 ROTO)
Domestic Natural Disaster	Short (1 ROTO)
Expeditionary Lead	Long (2-3 ROTOs)
Expeditionary Short	Short (1 ROTO)

Table 1: Duration and CFDS Missions

3.3.4.3   Warning/Urgency

Speed of response is designed to provide a sense of the planning tempo being applied to each scenario. With each speed of response, different constraints are placed on personnel and materiel availability, thus limiting the capabilities available to conduct the mission. The three speeds selected were days, weeks and months. These three speeds of response can be mapped to the six CFDS missions, as shown in Table 2.

CFDS Mission	Speed of Response
Baseline	Days/Weeks/Months
Major Domestic Event	Months
Major Terrorist Attack	Days
Domestic Natural Disaster	Days
Expeditionary Lead	Months
Expeditionary Short	Days/Weeks

Table 2: CFDS Missions and Speed of Response

While there are a number of iterations that may be possible, Canadian defence policy has typically laid out implicit constraints on the nature of anticipated future missions. For example, a nuclear war would fall under the expeditionary lead, but would likely require an immediate response. However, these unforeseen "strategic shocks" are unanticipated and are most likely not a valuable planning focus.

The speed of response dimension provides both a planning constraint as well as a potential standard for measuring capabilities. For example, a potential standard of having a disaster assistance response team deployed within 72 hours in response to a domestic natural disaster (i.e. flood) would provide the ability to measure future capabilities against both present capabilities as well as an objective threshold. From an operational research and analysis perspective, the dimension is only being applied for planning and evaluating scenarios; any definition of response standards falls outside the scope of this project.

3.3.4.4   Level of Commitment

Level of commitment describes allocation of resources to a particular CF mission. This is related to the level of leadership in that commitment typically reflects leadership ambitions. Level of commitment is described in terms of tactically self-sufficient units which provide a capability contribution. The variables defining level of commitment would be organizationally driven based on environmental doctrine (e.g. allocation of naval platforms). In practice, the level of commitment to concurrent operations constrains options. In force planning, concurrency assumptions will drive level of commitment and should inform mission analysis. This could take the form of defining the scenario or in providing the constraints in resource allocation. The bottom line is that the assumptions are more important than predefined level of commitment. Level of commitment is considered a derivative, defined through mission analysis.

3.3.4.5   Descriptor: Level of JIMP Involvement

CF operations are often complex, including a range of challenges that fall outside the traditional scope of defence. These challenges have implications for dual-use or overlapping capabilities within national defence and other government departments. The Government of Canada is increasingly seeking to involve actors outside government, including other states, international organizations (IOs) and non-government organizations (NGOs). As a result, scenarios may

involve the adoption of a force that is joint, interagency, multinational and public (JIMP)-enabled. The term JIMP is a descriptor that identifies the various categories of players (i.e. organizations) which inhabit the broad environment in which military operations take place: Joint forces include military elements and support forces; inter-agency involves OGDs from Canada or other state governments, as well as IOs; multi-national includes allies and coalition partners; and Public involves NGOs as well as other non-government actors that are brought in to support the mission.[30] The FPS Framework includes all of these elements:

- No JIMP involvement;

- Joint Force;

- Inter-Agency/OGD involvement;

- Multinational/IO involvement; and

- Public/NGO involvement.

3.3.5   Range of Operations

It is possible to identify a basic "range of operations"[31] describing the various operations the CF conducts. A number of sources describe ranges of operations using different language. For example, a two part compilation of CF operations between 1945 and 2000 categorizes operations based on the eleven CF force planning scenarios written circa 1999. This study had 11 categories: domestic search and rescue; domestic disaster relief; international humanitarian assistance; surveillance and control of Canadian territory and approaches; evacuation of Canadians overseas; peace support operations (under UN Chapter VI); aid of the civil power; national sovereignty/interests enforcement; peace support operations (under UN Chapter VII); defence of North America; and, collective defence (NATO).[32] NATO, during the 2003 and 2005 Defence Requirements Review (DDR), categorized operations based on consideration of three major variables: appropriate Alliance responses to a type of political-military problem; responses to specific potential threats to Alliance member territory, and; mission types based on the Alliance's strategic goals and the contemporary security environment.[33] Using these variables, the NATO DDR produced a range of 14 operations: collective defence; counter-terrorism; coercion to comply with international law; defence of Alliance economic lines of communication;

---

[30] Peter Gizewski and Michael Rostek, "Toward a JIMP-Capable Land Force," *Canadian Army Journal*, Vol. 10, No.1 (Spring 2007), pp.55-72.

[31] "Range of Operations" vice "Types of Operations" is specifically used here to avoid conflict with existing CF Joint and Army doctrine. At the Joint level, three "types of operations" are listed: routine; contingency; and, rapid response (See *Canadian Military Doctrine*, section 6-2). The Canadian Army describes four types of operations: offensive, defensive, stability, and enabling (see Land Operations, section 3-9). For the purposes of this tool, what is required is a more descriptive set of categories, therefore the term "range of operations" is employed here.

[32] L.A. Willner, S. Maloney, S. Babcock, *Canadian Forces Operations 1945-1969*, ORD Project Report PR 2002/11. Ottawa: DND, Operational Research Division, October 2002; L.A. Willner, S. Maloney, *Canadian Forces Operations 1970-2000*, ORD Project Report 2002/01 (Ottawa: DND, Operational Research Division, March 2002).

[33] NATO, *Overview of the DRR Analytical Process*. NATO: Brussels, circa 2004, p.5; NATO, *NATO Defence Requirements Review, 1993-2003: A Decade in Transition* (PowerPoint presentation). NATO: Brussels, circa 2004.

consequence management of terrorist acts; peace enforcement; peace agreement implementation; crisis monitoring; evacuation of peacekeeping forces; preventive deployment (crises containment); preventative deployment to counter potential aggression; sanction enforcement; and, humanitarian assistance. A further categorization can be based upon the classified ten 2005 CF force planning scenarios. This scenario set included aid of the civil power, surveillance and control of Canadian territory, emergency assistance, counter-terrorism, sovereignty assertion, major combat, peace support, maritime interdiction, peacekeeping, and humanitarian assistance operations.

None of these categorizations can be directly transferred to use in this scenario tool. All have contextual limitations that make a direct transfer inappropriate, and each scheme of categorization was designed for a different purpose. For example, the NATO categories are exclusive to the types of operations the Alliance may conduct and naturally exclude any operations that might occur because of Alliance member domestic policy. The Willner and Maloney categories are closer to the requirements of the force planning scenarios as promulgated in CFDS, but combine a number of types of operations under "aid of the civil power" in a manner that lacks the nuance required for this project, and my not be entirely applicable to new scenario development. Willner and Maloney's work is similar to the literature on the subject in that it places the majority of domestic operations under the same rubric, [34] although it does distinguish between aid of the civil power and domestic disaster relief. However, aid of the civil power refers to specific legislation and process, regardless of the types of activities the CF may be called upon to conduct. So, for example, support to an Olympic or G-20 type event is classified the same as OP Salon (OKA), and Op Pelican (prisoner riot in Kingston, Ontario, 1971). While sufficient for the Willner and Maloney study, this categorization is too broad for this project. The 2005 scenario set categorization is not comprehensive enough, and is reflective of outdated policy.

These three examples do, however, provide a solid foundation upon which to base a range of operations suitable for the scenario tool that will provide the required detail to make the campaign theme construct useful. Thus, based on the historical survey of CF operations, current and past defence policy, limited projections of likely operations, and the NATO operations titles, 13 categories are proposed for inclusion into the FPS framework (Table 3).

---

[34] See for example, Desmond Morton, "No More Disagreeable or Onerous Duty: Canadians and Military Aid of the Civil Power, Past, present, and Future," in David Dewitt and David Leyton-Brown, *Canada's International Security Policy* (Scarborough: Prentice-Hall, 1995), pp.129-152.

Range of Operations	
Category	Description
Collective Defence (CD)	Collective defence of Canadian or allied territory
Counter Terrorism (CT)	Elimination of terrorist havens or reaction to a specific event
Enforcement Operation (EO)	Coercion of a foreign government to comply with international law and/or enforcement of approved sanctions
Defence of Lines of Communication (LoC)	Defence of critical Canadian or allied lines of communication
Consequence Management (CM)	Consequence management of natural disasters or human induced events
Peace Enforcement (PE)	Peace enforcement to restore order
Peacekeeping (PK)	Implementation and monitoring of a peace agreement
Surveillance and Monitoring (SMO)	Surveillance and monitoring, including Canadian territory.
Non-Combatant evacuation (NEO)	Evacuation of Canadians or others from danger (human or natural induced)
Conflict Prevention (CP)	Deployment to contain a developing crises or to act as a deterrent
Humanitarian Assistance (HA)	Provision of CF support for humanitarian assistance in support of international relief efforts
Search & Rescue (SAR)	Provision of domestic CF support for SAR operations
Support to Major Domestic Events (SME)	Provision of CF support to one-time, planned, major domestic events.

Table 3: Range of Operations

3.3.6   CF Role

CF roles have remained consistent within CF policy for a number of years. The CFDS both reiterates these roles and places them in context of the current environment:

> …the Canadian Forces must be able to deliver excellence at home, be a strong and reliable in the defence of North America, and project leadership abroad by making meaningful contributions to international security.[35]

As a dimension, CF roles help shape the nature of CF responsibilities. This is consistent with previous categorization of the 2005 FPS set (see Figure 2). The three CF roles from CFDS were included in this dimension:

- Defend Canada;

- Defend North America; and

---

[35] CFDS, p. 3.

- Contribute to international peace and security.

The dimension is considered a descriptor. It overlaps with the campaign themes, which was selected as the prime driver dimension. However, its value as a dimension in understanding the balance of scenarios is of value, and thus is included in the framework.

3.3.7 Geographical Region

In addition to terrain and climate, geographical region provides an important descriptor for scenarios. It helps the audience contextualize a scenario within a specific geographical setting, providing a regional bound for conducting planning. Also, different regions pose varying challenges on logistics and operational support. Further, the scenario set can be evaluated against the geographical regions to ensure the FPS set addresses the full global range.

While a critical element to scenarios and analysis, the geographical region was deliberately omitted from the set of drivers. In terms of providing the capabilities necessary to operate globally, variance in terrain were considered sufficient as a driver.

The following geographical areas were identified for inclusion within the framework:

- Canada;
- North America;
- South America;
- Africa;
- Europe;
- East Asia;
- West Asia; and
- Pacific.

3.3.8 Impact

Increasingly there is a requirement to consider aspects across the physical and moral planes. Analogous to the spectrum of conflict, it is envisaged that this dimension is required to ensure the range of psychosocial challenges are both recognized and explored. Scenario selection should drive mission analysis and ensure the psychosocial dimension is addressed. Whereas mission analysis will drive capability requirements, this dimension will define the psychosocial environment and frame the discussion. For example, it draws planners to consider intervention in a case where mass casualties (i.e. genocide) have occurred. The psycho-social impact is described using the following criteria:

- Displaced persons – significant;
- Displaced persons - low/significant;
- Casualties and Fatalities (pre-mission) – High; and,

- Casualties and Fatalities (pre-mission) - Low/None.

In similar fashion, it is useful to include a physical impact dimension. While PMESII provides the necessary framework for conducting mission analysis, a dimension that specifically addresses the magnitude of physical destruction helps to better define the context of the environment. Both the physical and psychosocial impact derives in part from the triggers. The physical impact is described using the following criteria:

- Infrastructural impact - Negligible/None ;

- Infrastructural impact - Significant/Devastating ;

- Economic impact - Negligible/None;

- Economic impact - Significant/Devastating;

- Environmental Impact - Negligible/None; and

- Environmental Impact - Significant/Devastating.

3.3.9   Triggers

Scenarios are used by planners as discrete political-military situations and/or crises that have been precipitated by a specific change in the strategic environment, requiring some form of military intervention. This intervention covers situations, from crisis response operations to collective defence of allied territory. Triggers constitute the starting point of the scenario and logically allow the culminating event(s) that produces a situation under which CF capabilities are generated, readied and ultimately deployed.[36] But there are many forms of triggers. Within the (PITF) state failure document, a trigger is defined as "a discrete event that represents culminating stimulus that may cause state instability leading to a high likelihood of state failure."[37] It is *not the cause of state failure or state instability* but rather an event reflecting the culmination of a trend in the direction of instability or failure. For FPS development, triggers are a single event or series of events that, when combined, affects Canada's ability to exercise national power and influence to degree such that it prompts the Government of Canada to direct the CF to action. As a result, the FPS framework needs to identify triggers that are relevant to defence and would capture the attention of the decision-makers, prompting them to turn to the CF for military assistance.

Within the context of state and regional stability, triggers are often related to proximate causes or events. These events include various political, military, economic and technical factors and trends (.e.g., inter-state conflict) influencing the international security environment that define how the CF will respond to a scenario.[38] Such factors Are exacerbated by the rise of trans-

---

[36] The exception, of course, is the Baseline Scenario, which is a fundamentally different type of scenario. The Baseline deals with routine domestic and continental activities that are not preceded by a "triggering" event that causes force element generation to respond to a specific contingency.

[37] Doug Hales, Jordan Miller and Peter Tikusis, "Triggers of State Failure,"Draft (Defence R&D Canada - Toronto, 2008), p. 9.

[38] United Kingdom (UK), Ministry of Defence, Development, Concepts and Doctrine Centre (DCDC), *The DCDC Strategic Trends Programme 2007-2036*; United Kingdom, Cabinet Office, "Countries at Risk of Instability Risk Assessment and Strategic Analysis," Process Manual February 2005; Chief of Force Development (CFD). *The Future Security Environment 2008-2030, Part One: Current and Emerging*

national organizations and non-state actors enabled by a growing lethality of weapon systems and anti-access capabilities (e.g., sea-mines, volumetric munitions and man-portable missiles and rockets), which are encountered with greater frequency by deployed forces and are exceedingly difficult to defend against. In this environment, Canada's interests can be threatened with little or no warning, and with or without a direct physical attack on the homeland. Despite the strong tie between triggers and their proximate factors, the causal linkages cannot be easily included within the framework and may be misleading. As a result, proximate events are described within the Operational Environment dimension using the PMESII model.

The inclusion of triggers as an independent dimension in the framework allows scenario developers to identify the culminating event that, when combined with relevant proximate factors within the operational environment, outline the causes of instability at the national and international levels that trigger CF involvement in a given scenario.

There are numerous types of possible triggering events, conditions or circumstances that may generate instability, thereby necessitating a response. However not all of these events or occurrences affect Canadian interests, nor do they necessarily fit within the mandate of the DND/CF. Part of the difficulty in defining appropriate triggers is that the information sources use different indicators for classifying triggers. For instance, a study written in 2001 for the United States' (US) Center for Army Analysis analyzes complex threats for operations and readiness levels of instability uses 4 different conflict types to categorize causes of instability: war, violent crisis, crisis and none.[39] While this may be useful for forecasting country trends to generate probabilities of certain levels of conflict intensity, it may not be the best framework for the scenario tool, since the categories do not address potential deployments that are triggered by natural disasters, computer network attacks, criminal activity or malicious incidents of other non-state actors, including adversarial use of chemical, biological, radiological or nuclear materials.

There are other analyses that focus on triggers and indicators for failed, fragile or failing states, perhaps the most significant of which is the Failed States Index – a collaborative index developed between The Fund for Peace, an independent research organization, and Foreign Policy, a think-tank based in the US.[40] However, not all triggers are linked to failed states, and the CF may be called upon to conduct operations that are completely unrelated to the underlying socio-economic conditions that may bring about poor governance, political instability and violent conflict.

The literature review conducted in support of this study indicates that triggers need to encompass both natural and human-induced operational challenges. A human-made trigger is as a disaster or emergency of which the principal, direct causes are identifiable to human actions, deliberate or

_____

Trends. Draft as of 27 January 2009; United States, National Intelligence Council, *Mapping the Global Future* (Washington, D.C.: U.S. Government Printing Office, December 2004); United States, Department of Defense, *US Capstone Concept for Joint Operations* (Washington: 2009).

[39] See Sean O'Brian et. al., *Analyzing Complex Threats for Operations and Readiness* (Fort Belvoir: Center for Army Analysis, 2001).

[40] "The Failed States Index 2009," accessed at http://www.foreignpolicy.com/articles/2009/06/22/the_2009_failed_states_index in September 2009.

otherwise.[41] An exceptional case is included to account for the decision to deploy the CF in the case where there is a threat to Canadian or international peace and security.

- Man-made disasters:
    - CBRN incident;
    - Accidental disasters (plane crash, sinking at sea)
    - Mass population movement;
    - Inter-state violence;
    - Intra-state violence; and
    - Threats to Canadian/international peace and security.

Natural hazards that have implications for scenario development have been broken down into two categories: disasters and accidents. Disasters are termed *natural* if caused by uncontrollable forces of nature. Natural is defined as phenomenon that occurs in proximity to and poses a threat to people, structures or economic assets and may cause a disaster. A hazard is as a rare or extreme event that adversely affects human life, property or activity to the extent that it causes a disaster.[42] The following list, which is by no means comprehensive, indicates the type of natural hazards that could trigger CF involvement:

- Disasters
    - Earthquakes and landslides;
    - Floods and tsunamis/tidal waves;
    - Hurricanes;
    - Wildfires; and
    - Ice-Storm/Blizzard.

3.3.10   Derivative: Canada First Defence Strategy Mission

The CFDS outlines the six core missions for the CF. These core missions bound the spectrum of operations to be used in planning and investment. They are also the six missions that the CF should be able to conduct concurrently. These core missions, as outlined in Section 2.3, are:

- *Baseline.* Conduct daily domestic and continental operations, including in the Arctic and through NORAD.

- *Major Domestic Event.* Support a major international event in Canada, such as the 2010 Olympics.

- *Major Terrorist Attack.* Respond to a major terrorist attack.

---

[41] DND, *Humanitarian Operations and Disaster Relief Operations*, B-GJ-005-307/FP-040 (Ottawa: May 2005), sections I-1-2.
[42] Ibid.

- *Domestic Natural Disaster.* Support authorities during a crisis in Canada such as a natural disaster.

- *Expeditionary Long.* Lead and/or conduct a major international operation for an extended period.

- *Expeditionary Short.* Deploy forces in response to crises elsewhere in the world for shorter periods.

This core mission suite defines the policy bounds and forms a key dimension in the scenario framework.

3.3.11 Capability Domains (Command, Sense, Act, Shield, Sustain, Generate)

The capability domains are defined as operational functions in Land Operations 2021:[43]

Command integrates all the operational functions into a single, comprehensive strategic, operational or tactical level concept. It is the nexus of all activities, integrating all functions towards the attainment of specific operational goals. The human nature of command will remain paramount, whereby a command-centric approach will be shaped by mission command.

Sense integrates sensor and sensor analysis capabilities into a single concept. This initiative breaks previous sensor and information stovepipes, allowing for comprehensive sensor fusion and all source analysis within a single system. This concept moves beyond the simple collection of data or information to provide commanders with timely and relevant knowledge.

Act integrates maneuver, firepower and offensive information operations to create a desired effect and end state through the synchronized application of the entire array of available capabilities, both lethal and non-lethal. The concept is relevant across the continuum of operations, from domestic and humanitarian missions to combat.

Shield provides for the protection of a force's survivability and freedom of action. Shield is a layered, integrated and comprehensive operational function that seeks to prevent any impact on friendly forces across the physical, moral and informational plane that could affect survivability or freedom of action.

Sustain integrates strategic, operational and tactical levels of support to generate and maintain force capability. This function addresses issues of sustainment on the physical and moral planes. It integrates the provision of materiel and personnel support to ensure the sustainment of combat power. It fully integrates all levels towards the attainment of this objective, linking combat activities to the national base.

---

[43] DND, Chief of Land Staff, *Land Operations 2021: Adaptive Dispersed Operations, The Force Employment Concept for Canada's Army of Tomorrow*, B-GL-310-001/AG-001 (Kingston: DND, 2007). Domains are also defined in: Government of Canada, *Integrated Capstone Concept [draft]*, (DFSA, 20 October 2009 version).

Each of these capability domains can be further decomposed to describe specific operational capability goals that would be invoked by a particular scenario. A full list of such capabilities was not included in this iteration of this framework, as the primary purpose of the framework is to support analysis of the scenario set. The development and application of derivatives are the realm of mission analysis and are a natural area for future development of the framework so as to meet the needs of other potential users.

4 Applying and Exploiting Scenarios and the Framework

4.1 Applying the FPS Framework

The framework was developed to provide a mechanism to develop, test and analyze the departmental FPS. The user communities identified in Section 2 have guided the development of the framework so that it can serve as an effective tool:

- The framework must be able to incorporate input from the policy community;

- The framework must be able to support CBP through the development of new scenarios and evaluation of the FPS set;

- The framework must enable mission analysis from the operational community;

- The framework must support the development and maintenance of a balanced, objective scenario set from the defence scientific community; and

- The framework must provide a collaborative environment that supports all users.

Five use cases were created to ensure the framework would support these user communities and tasks. The tool was developed to meet the first two use cases. The focus was on supporting the defence scientific community in evaluating the total set of relationships and identifying a balanced set of plausible scenarios. To enable this, the tool needed to support users in conducting FAR activities. This includes the development of a framework with driving variables, a mechanism for evaluating significance and plausibility, and a way to visualize the results for analysis. The tool also needed to assist in characterizing the existing set of scenario to identify gaps and assist in the development of new scenarios. Additional use cases were developed, but were considered outside the scope of work for this project.

The use cases provided the foundation for developing specific prototype tool requirements. The result was a selection of Microsoft Access, a readily accessible commercial-off-the-shelf tool capable of meeting the primary needs of the users.

4.2 Use Case #0: Development of the Scenario Framework

This use case includes the development and organization of the FPS framework for application in evaluating and characterizing scenarios. The process of developing the framework has been documented within this report. The population of this framework within the prototype tool serves as the initial setup for all other use cases, and may only be conducted once. However, this use case accounts for extensions and modifications to the framework so that it can evolve to changing circumstances or to meet the needs of additional users.

Tool requirements:

- Relational database, providing the links to facilitate decomposition of dimensions into factors and variables; and

- FPS set configuration management (i.e., governance, including version control and archiving).

The output of this use case is the framework within the prototype tool.

4.3   Use Case #1: Testing and Analysis of FPS Set

This use case includes an articulation of policy and analysis of spectrum coverage at the strategic level. The set is examined through the modified FAR approach outlined in Section 4.5. It will ensure the right dimensions, parameters and variables are addressed. The result is an identification of key factors, prioritization of scenario variables and confirmation of coherence.

The inputs to this use case would include a set of policy and environmental assumptions, as well as a referenced database of existing scenarios.

Tool Requirements:

- The FPS set configuration management (i.e., governance, including version control and archiving);
- User privileges (i.e., read-write and account management);
- FAR (i.e., brainstorming, multi-user pair-wise comparisons, clustering/filtering, justifications and presentation); and,
- Visualization of results.

The output of the use case is an appreciation of the current level of scenario coverage across all dimensions and the ability to identify requirements for new scenario development and/or refreshment to achieve balanced coverage.

4.4   Use Case #2: Development and Refreshment of Scenarios

This use case includes consideration of primary and secondary dimensions, moving to lower levels of granularity. It includes collaborative efforts in the scenario development. The framework and associated tool drive the structure of the scenario.

The inputs to this use case are the identified requirements based on scenario set evaluation, as well as content from existing scenarios. This is where contributions from SMEs come into play. This should include an appreciation of threat trends and thus may involve some input from the intelligence community.

Tool Requirements:

- Scenario configuration management (i.e., governance, archiving and version control);
- Collaboration (i.e., distributed access, version management);
- Tagging of scenarios based on framework dimensions;
- Monitoring and management of workflow.

The key output from this use case is a scenario that could be included within the FPS set.

4.5   Selecting Scenarios

The primary purpose of the FPS framework is to promote the development of a balanced set of FPS Scenarios for CBP. With any scenario analysis, the goal is to develop a "manageable number of representative scenarios" to support planning.[44] This requires an appropriate analytical methodology to ensure the set includes all the critical elements of the future operational environment.

The scenario selection process can be conducted in two broad ways:

- Non-Bayesian Method: Morphological Analysis (MA), FAR and Batelle; and,

- Bayesian Method: Cross- impact analysis using a system of equations.[45]

The use of a Bayesian analysis provides the value of assigning weights and values to individual scenario aspects, and can provide a wide distribution of potential scenarios based on mathematical models. However, the manipulation of scenario variables takes into account the range of all scenarios, including those which are implausible. As a result, a non-Bayesian analysis is required prior to any Bayesian approach.

MA is "a method for structuring and investigating the total set of relationships contained in multi-dimensional, non-quantifiable problem complexes."[46] It is of use in determining the scope of the possible permutations of scenario combinations, stimulating consideration of possible scenarios that may have otherwise been overlooked. However, it leaves the analyst with an extensive list that must be refined through a time-consuming elimination process.

There are several versions of MA. This project adopted the FAR, a modified version of the typical approach to include a greater degree of accuracy in evaluating scenarios. FAR is a version of MA that involves the evaluation of a scenario set using a series of filtrations to arrive at the final   set.   Typically,   compatibility   is   evaluated   using   a   binary   rating   (i.e., compatible/incompatible). However, similar to the Batelle approach, this FAR process applies a five-point plausibility rating to evaluate each pair.[47] The result is a compatibility value, averaging the value for a particular scenario.

The original architect of FAR outlined a four-step method.[48]

---

[44] Gary Christopher, "Strategic Capability Roadmap", PowerPoint Presentation given 17 July 2008 at Architectures Community of Interest, Ottawa.

[45] Ibid.

[46] Tom Ritchey,"General Morphological Analysis: A General Method for Non-Quantified Modeling". Swedish Morphological Society, 2009, accessed at http://www.swemorph.com/ma.html on 10 August 2009.

[47] M.–T. Nguyen and M. Dunn, *Some Methods for Scenario Analysis in Defence Strategic Planning* DSTO-TR-2242 (Canberra: Australian Defence Science and Technology Organisation, February 2009).

[48] Russell Rhyne, "Whole-Pattern Futures Projection Using Field Anomaly Relaxation," *Technological Forecasting and Social Change* Vol. 19 (1981), pp. 331-360; Russell Rhyne, "Field Anomaly Relaxation - The Arts of Usage," *Futures*, Vol. 27, No. 6 (1995), pp. 657-674.
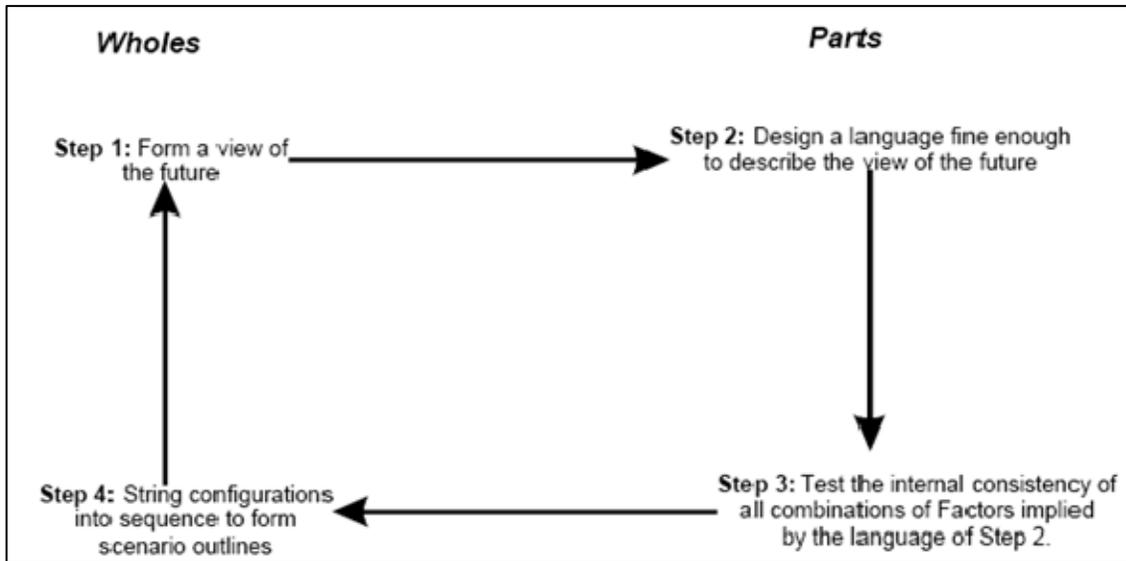
Figure 8: The FAR Cycle

Step 1: Form an initial view of the scenarios that could unfold within the area of interest. For this project, the framework is informed by defence policy, military operations and an understanding of the future security environment.

Step 2: Construct a language using 'Sectors' that will become the dimensions of describing the area of interest; and Factors, which become the alternative states within each Sector and array these on a matrix to form Whole Field (full sector range) descriptors of all possible configurations.

The typical FAR taxonomy is not used within the prototype; however, this has no impact on the analytical process. A mapping of terms is included in Figure 9 below:
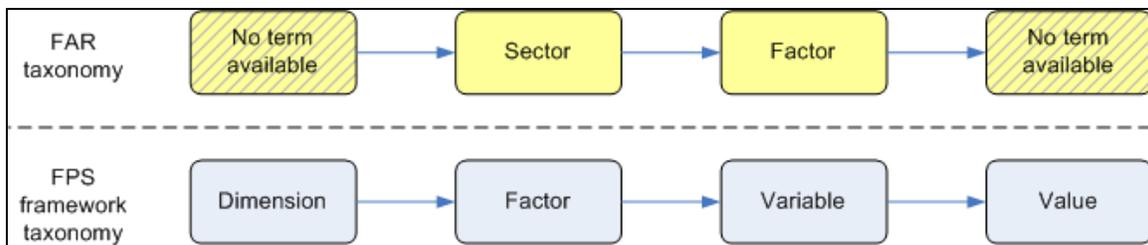
Figure 9: Comparison of FAR and FPS Taxonomy

For each of the driver factors, a variable is selected. The framework uses six factors: Campaign Theme; Terrain; Adversary - Red Force; Political Leadership/Authority; Duration and Warning. Each scenario is a combination of these variables, such as C_1 A_1 T_1 L_1 D_1 W_1 (i.e. the first variable in the Campaign Theme factor, the first variable in the adversary factor, etc.).

Step 3: Eliminate those factor pairs that are illogical or cannot co-exist, forming a reduced set of whole field configurations.

The project incorporates a series of pair-wise comparisons to eliminate illogical pairs. The process is time-consuming, but critical to completeness. The end result can be displayed using a matrix of pairs. Figure 10: Pairwise Comparison Matrix shows this matrix, populated with illustrative data. Each pair is given a plausibility value between 0 and 4.

	L1	L2	L3	L4	W1	W2	D1	D2	D3	T1	T2	T3	T4	T5	T6	M1	M2	M3	M4	M5	M6	C1	C2	C3	C4
L1:International Lead	0	0	0	0	1	2	3	4	0	1	1	2	1	2	0	3	4	2	1	2	4	1	4	3	0
L2:Int'l Spec/Func Lead	0	0	0	0	1	1	2	3	4	1	1	1	1	1	1	1	1	1	1	1	2	1	4	1	4
L3:Domestic Lead	0	0	0	0	1	1	1	1	1	4	1	1	1	2	3	0	1	1	1	3	1	1	4	1	2
L4:Domestic Support	0	0	0	0	1	1	1	2	1	4	1	3	2	1	0	1	1	1	1	2	1	1	4	0	3
W1:Immediate (Hours)	1	1	1	1	0	0	1	1	2	2	2	3	2	1	2	4	2	3	4	1	2	2	1	3	4
W2:Extended (Days)	2	1	1	1	0	0	3	3	4	3	2	2	2	2	1	1	1	1	1	1	1	1	4	4	4
D1:Short	3	2	1	1	1	3	0	0	0	2	3	3	3	4	4	4	4	4	3	2	2	2	3	4	4
D2:Long	4	3	1	2	1	3	0	0	0	2	1	4	3	2	1	1	1	1	1	1	2	2	2	2	2
D3:Enduring	0	4	1	1	2	4	0	0	0	1	1	1	1	1	2	3	1	1	4	4	4	3	3	1	1
T1:Arctic	1	1	4	4	2	3	0	2	1	0	0	0	0	0	0	3	2	3	2	1	1	1	0	2	1
T2:Desert	1	1	1	1	2	2	3	1	1	0	0	0	0	0	0	2	4	4	2	0	0	4	4	3	2
T3:Mountain	2	1	1	3	3	2	3	1	1	0	0	0	0	0	0	3	2	3	3	4	3	1	3	2	1
T4:Urban	1	1	1	2	2	2	3	4	1	0	0	0	0	0	0	2	3	2	3	2	2	4	1	2	1
T5:Littoral	2	1	2	1	1	2	4	3	1	0	0	0	0	0	0	1	2	2	2	2	2	1	4	2	1
T6:Ocean	0	1	3	0	2	1	4	2	2	0	0	0	0	0	0	2	3	1	2	1	1	4	3	4	4
M1:Small/Low-Tech	3	1	0	1	4	1	4	1	3	3	2	3	2	1	2	0	0	0	0	0	0	0	2	3	4
M2:Medium/Low-Tech	4	1	1	1	2	1	4	1	1	2	4	2	3	2	3	0	0	0	0	0	0	2	3	3	4
M3:Large/Low-Tech	2	1	1	1	3	1	4	1	1	3	4	3	2	2	1	0	0	0	0	0	0	3	2	1	1
M4:Small/Hi-Tech	1	1	1	1	4	1	3	1	4	2	2	3	3	2	2	0	0	0	0	0	0	3	2	4	1
M5:Medium/Hi-Tech	2	1	3	2	1	1	2	1	4	1	0	4	2	2	1	0	0	0	0	0	0	4	1	3	1
M6:Large/Hi-Tech	4	2	1	1	2	1	2	4	4	1	0	3	2	2	1	0	0	0	0	0	0	3	4	3	1
C1:Routine Ops	1	1	1	1	2	1	2	2	3	1	4	1	4	1	4	0	2	3	3	4	3	0	0	0	0
C2:Peace Support	4	4	4	4	1	4	3	2	3	0	4	3	1	4	3	2	3	2	2	1	4	0	0	0	0
C3:COIN	3	1	1	0	3	4	4	2	1	2	3	2	2	2	4	3	3	1	4	3	3	0	0	0	0
C4:Major Combat	0	4	2	3	4	4	4	2	1	1	2	1	1	1	4	4	4	1	1	1	1	0	0	0	0

Figure 10: Pairwise Comparison Matrix

The pair-wise comparison process is discussed in greater detail within the Force Planning Scenario Framework User's Guide.

Step 4: Position the surviving whole field configurations on a 'tree' whose branches represent possible future states and transitions from one configuration to the next.[49]

This step is modified to include a filtering based on plausibility value. After populating the matrix with plausibility values, the whole set of plausible scenarios can be displayed and filtered. A plausible scenario is made up of one variable from each factor, and includes no plausibility values of zero. As a result, there are 15 plausibility values that are assessed and averaged for each scenario combination. For example, the plausibility value for scenario $C_1 M_1 T_1 L_1 D_1 W_1$:

$$= [(C_1M_1) + (C_1T_1) + (C_1L_1) + (C_1D_1) + (C_1W_1) + (M_1 T_1) + (M_1L_1) + (M_1 D_1) + (M_1 W_1) + (T_1 L_1) + (T_1 D_1) + (T_1 W_1) + (L_1 D_1) + (L_1 W_1) + (D_1 W_1)] * [2/(5 * 6)]$$

---

[49] M.-T. Nguyen and M. Dunn, *Some Methods for Scenario Analysis in Defence Strategic Planning*.

These values are used to refine and prioritize the most significant scenario configurations.

4.6 Additional Use Cases

In developing a framework for all potential stakeholders, two additional use cases were identified. The development of a methodology and tool for applying the framework fall outside the scope of this project, but are worthy of consideration in future initiatives.

4.6.1 Use Case #3: Mission Analysis

This case study includes the ability to map blue force elements and capabilities against the scenario. The process, driven by OPP, would support the ability to generate capability mixes to achieve a desired end-state.

The input that drives this use case is one of the approved scenarios nominated/selected from the FPS set. There also needs to be a link into an approved capability framework or task list to permit capability mapping across scenarios.

- Scenario configuration management (i.e., governance, archiving and version control);
- Collaboration (i.e., distributed access, version management);
- User-tailored interfaces (i.e., filtering enabled); and,
- Monitoring and management of workflow.

The outputs from this use case are the tasks to be performed and capabilities required to achieve these tasks for the selected scenario. Additionally, an initial CONPLAN would be a secondary output.

While framework and tool ensures the FPS set caters to mission analysis activities, this use case falls outside the scope of this project. This is a valuable link, and the use case does serve the CBP/FD community. To ensure the use case is viable for future initiatives, the scenario tool was developed to extend or link to mission analysis systems. However, the primary audience is the defence scientists responsible for the development of the FPS set, with any links to mission analysis left for potential future initiatives.

4.6.2 Use Case #4: Capability Management

This use case supports portfolio and risk management, linking programmatic options to missions across campaign themes. It builds upon the use case of mission analysis, providing the ability to view and compare capability applications and conduct concurrency analysis. The outcome is the ability to prioritize capabilities based on the FPS set.

The inputs for this use case are the tasks and capabilities derived from the scenarios within the FPS set.

Requirements:

- Scenario configuration management (i.e., governance, archiving and version control);

- Collaboration (i.e., distributed access, version management);

- User-tailored interface (i.e., filtering enabled);

- Aggregation of tasks and capabilities across scenarios;

- Ability to tie into cost and time sequencing models (i.e., investment roadmaps); and,

- Monitoring and management of workflow.

The output from this use case is a set of aggregated capability demands that can be used to drive risk-based investment decisions.

The ability to conduct concurrency analysis against CF capabilities using this framework is seen as a valuable area for further research. As outlined in the CFDS, the CF should be able to meet the demands of all six mission areas concurrently. Through capability analysis, the implications of investing in a particular capability can be seen both against individual scenarios and the full FPS set. This is a valuable undertaking requiring concerted attention. As this falls outside the scope of this project, it should be considered as part of a future initiative.

4.7   Tool Selection

In developing a prototype, the first goal was to develop an initial stand-alone tool. The prototype could then be validated amongst a core group of users, with a view to potentially deploying the tool on a network at a future time. To meet the needs of these users, the prototype needed to meet the requirements identified in use cases 0-2:

- *Relational Database:* providing the links to facilitate decomposition of dimensions into factors and variables; tagging of scenarios based on framework dimensions;

- *Field Anomaly Relaxation:* assignment of significance values, pair-wise comparisons, clustering/filtering, as well as monitoring and management of workflow.

- *Visualization:* graphical representation of results from FAR, as well as assessing coverage from existing set.

For the prototype, the tool would not be configured to deconflict entries from multiple users over a number of iterations. As a result, some of the requirements were dropped:

- *Collaboration*: distributed access, version management. As a single group maintaining the framework on a standalone platform, this requirement was omitted from the tool specification;

- *User privileges*: read-write and account management, as well as scenario configuration management (Governance, archiving and version control). These requirements were necessary to control different classes of users creating several sessions. As the prototype tool was designed for a single user group, this requirement was omitted from the initial specification.

While not included in the development of the prototype, the tool was developed with these requirements in mind. Collaboration and user privileges can thus be included in future releases of the tool.

Based on the specified requirements, MS Access was selected as the software platform for developing the prototype. It is well-suited to the development of relational databases, and provides the means to capture data and visualize results. Further, the data captured in Access can be exported to several other applications, allowing for integration with other tools in future initiatives. As it is already deployed across DND, there are no licence fees for the software.

5   Future Research Directions

5.1   Extending the Framework

The FPS framework represents a current worldview of the relevant scenario dimensions, factors and variables and is based on existing research. This worldview will change over time, and may require a governance process to validate assumptions and ensure doctrinal alignment. Currently, the framework is focused on support to FPS generation. Future work could include extending the framework and tool to support mission analysis and capability assessments within the larger force development community. To support operational feedback into the force development process, separate thrust could exploit the framework as a means for characterizing lessons learned. In addition, this framework is currently defence-oriented, but is designed to engender a whole of government approach to capability development. This framework is well-suited to serve as a mechanism for engaging OGDs and outside stakeholders.

5.2   Concurrency Analysis

One potential area for development lies in concurrency analysis. Identified as a potential future use case, this would involve understanding of potential concurrent scenarios based both on future outlook and past trends. However, the requirement for concurrency analysis or assessment of military requirements was beyond the scope of this effort. Once a scenario has been associated with a capability set, concurrency analysis can help provide insight for capability managers seeking to balance investment based on potential capability and capacity constraints.

One consideration would be to migrate the results of previous trend analysis into the current framework. Previous research into concurrency analysis categorized scenarios along the range of operations, along similar lines as the current framework

The overlay of historical case studies would greatly benefit in defining future Force Planning Scenarios. It would provide the ability to demonstrate the shift in priorities based on the anticipated future operational environment, and would open up new avenues for research into other aspects of case studies that could benefit scenario generation.

5.3   Involvement of Operational Community

The current framework is designed as a standalone system. However, it stands to serve the operational community through mission analysis and capability gap analysis. The tool could serve to augment the process through additional analytical rigour. By interfacing with existing capability analysis tools, data can be examined across scenarios and specific scenario dimensions, informing gap prioritization for capability managers.

5.4   Link to Threat and Risk Analysis

The framework and associated tool were designed to provide expert analysis on plausible scenarios, informed by knowledge of the future security environment. To improve this analysis, this framework could serve as the common context for involving SMEs from the intelligence community, who could provide insight into the process over time. The framework serves as a explicit means to associate policy with risk analysis and could serve as a departure point as a tool for communicating risk.

5.5   Improved Analytical Capability

The thrust of this project was on evaluating scenarios using MA. As a result, the prototype focused on analyzing the coverage of driver factors based on plausibility and significance. However, comparative analysis and application of the descriptor factors would serve the defence science community in understanding and analyzing the coverage of descriptors as the FPS set expands over time.

5.6   Exploiting Techniques

 This project has illustrated how FAR can be used to scale MA and support pair-wise comparison as a methodological approach, this has application beyond DND/CF force development. FAR makes it practical to objectively explore multi-dimensional problems through exhaustive consideration of relevant dimensions. Driver, descriptor and derivative perspectives are a useful lens for characterizing problem spaces.

6   Conclusion

This report has described the key dimensions, factors and variables of an effective and comprehensive framework for characterizing the departmental Force Planning Scenarios. It provides an initial set of inputs for constructing a scenario analysis tool. It generates the "leave behind" capability in the form of a decision support tool that can be used, modified or refined by future Defence Scientists engaged in scenario development. Like all models, however, the framework is a simplification of elements in the larger strategic environment that are likely to confront the CF in the future. The intent is not to be definitive or predictive, but to generalize and ensure representativeness in designing scenarios that are plausible, relevant and challenging. The development of a well-researched framework serves as a start point from which to build a scenario analysis that allows Defence Scientists to assess the coverage of a given scenario set against a wide range of possible operating environments. The framework will be updated, modified and refined on an ongoing basis, for instance, to reflect changes in defence policy, government priorities and the evolving international security environment. The process of analyzing scenarios against a range of dimensions, factors and variables provides a robust, defensible and transparent method for selecting and justifying scenario development and evolution to meet Capability Based Planning. By mapping the coverage of driving scenario dimensions, a balanced and relevant set of scenarios can be developed and maintained to ensure the development of CF capabilities across the spectrum of roles and environments.

This page intentionally left blank.

Annex A Queries for Scenario Tool

1. What are the main geographic regions by scenario?

2. What are the main campaign themes by geographic region?

3. What is the range of military operations by geographic region?

4. What is the political direction/authority (e.g., level of ambition, warning, duration etc) by scenario and geographic region

5. What is the count of impacts (and by individual scenario)?

6. What is the count of campaign themes (and by individual scenario)?

7. What is the count of range of military operations (and by individual scenario)?

8. What is the count of warning time (and by individual scenario)?

9. What is the count of duration (and by individual scenario)?

10. What is the count of triggers by scenario and geographic region

11. What is the percentage of PMESII factors addressed by scenario?

12. What is the percentage of natural environment factors addressed by scenario?

13. What is the aggregate of variables by scenario?

14. What is the aggregate of all scenarios by all variables (e.g., scatter plot)?

This page intentionally left blank.

Bibliography

Burton, R., G. Christopher, P. Chouinard, L. Kerzner, K. Simonds, *Procedures, Processes and Tools of Capability-Based Planning: an Outline for a Canadian Approach*. DRDC CORA TR 2005-35. (Ottawa: DRDC CORA, November 2005).

Christopher, G.L., P. Comeau, R.W. Funk, Isbrandt, M. Macdonald, B. Ritchey, *Force Planning Scenario Framework Proof of Concept*, ORD-DOR (J&L) RN-9913 (Ottawa, Oct 1999).

Christopher, Gary, "Strategic Capability Roadmap", PowerPoint Presentation given 17 July 2008 at Architectures Community of Interest, Ottawa.

Christopher, G.L., P. Comeau, R.W. Funk, S. Isbrandt, *Towards the Development of a Force Planning Scenario Framework for DND*, ORD-DOR(J&L)-RN-9910 (Ottawa, Oct 1999).

Chuka, N., S. Friesen, C. Morrisey, N. Waintraub, R. Heide, *Baseline Scenario of Department of National Defence/Canadian Forces Domestic and Continental Activities*. DRDC CORA TM 2009-015. (Ottawa: DRDC, April 2009).

Chuka, N, S. Friesen, C. Morrisey, N. Waintraub, Major Terrorist Attack Scenario: an Explosive Attack in the Quebec – Windsor Corridor. (Fall 2009 Draft) (Ottawa: DRDC CORA, 2009).

Davis, Paul K. *Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation*. (Santa Monica: RAND, 2002).

DND, *Canadian Forces Operations*, B-GJ-005-300/FP-000. (Ottawa: DND, 15 August 2005).

DND, *Canadian Military Doctrine*, CFJP-01 B-GJ-005-000/FP-001. (Ottawa: DND, April 2009).

DND, *CDS Action Team 3, Final Report – Operational Capabilities* (Ottawa: August 2005).

DND, *Humanitarian Operations and Disaster Relief Operations*, B-GJ-005-307/FP-040 (Ottawa: May 2005).

DND, Chief of Force Development, *The Future Security Environment 2008-2030, Part One: Current and Emerging Trends*. (Ottawa: DND, 2009).

DND, Chief of Force Development, *Force Development and Capability Based Planning*, CFD Handbook v4.2 (July 2007).

DND, Chief of Land Staff, *Land Operations*. B-GL-300-001/FP-001 (Kingston: DND, January 2008).

DND, Chief of Land Staff, *Land Operations 2021: Adaptive Dispersed Operations, The Force Employment Concept for Canada's Army of Tomorrow*. B-GL-310-001/AG-001. (Kingston: DND, 2007).

DND, Chief of Land Staff, *Intelligence Field Manual*. B-GL-357-001/FP-001. (Kingston: DND, 1 Sep 2000).

Defence Research and Development Canada. "Statement of Work: Force Planning Scenarios Development Framework and Communication for Capability Based Planning". May 2009.

Duczynski, G., *A Practitioner's Experience of Using Field Anomaly Relaxation (FAR) to Craft Futures*. http://www.systemdynamics.org/conferences/2000/PDFs/ducz124p.pdf Accessed December 2009.

Gizewski, Peter, M. Rostek, "Toward a JIMP-Capable Land Force," *Canadian Army Journal*, Volume 10, No.1, Spring 2007. (Kingston: Army Publishing Office), pp.55-72.

Gompert, David C., Paul K. Davis, Stuart E. Johnson and Duncan Long. *Analysis of Strategy and Strategies of Analysis*. (Santa Monica: RAND, 2008).

Government of Canada, *Canada First* Defence Strategy. (Ottawa: Government of Canada, May 2008).

Government of Canada, *Integrated Capstone Concept [draft],* (DFSA, 20 October 2009 [version]).

Hales, Doug, Jordan Miller and Peter Tikusis, "Triggers of State Failure,"Draft, Defence R&D Canada - Toronto, 2008.

Morton, Desmond, "No More Disagreeable or Onerous Duty: Canadians and Military Aid of the Civil Power, Past, present, and Future," in David Dewitt and David Leyton-Brown, *Canada's International Security Policy*. (Scarborough: Prentice-Hall, 1995)

NATO, *NATO Defence Requirements Review, 1993-2003: A Decade in Transition* (PowerPoint presentation). (NATO: Brussels, circa 2004)

NATO, *Overview of the DRR Analytical Process*. (NATO: Brussels, circa 2004).

Nguyen M.–T., and M. Dunn, *Some Methods for Scenario Analysis in Defence Strategic Planning* DSTO-TR-2242 (Canberra: Australian Defence Science and Technology Organisation, February 2009).

O'Brian, Sean, et. al., *Analyzing Complex Threats for Operations and Readiness* (Fort Belvoir: Center for Army Analysis, 2001).

Ritchey, Tom. "General Morphological Analysis: A General Method for Non-Quantified Modeling". Swedish Morphological Society, 2009. http://www.swemorph.com/ma.html. Last accessed 10 August 2009.

Rhyne, Russell, "Whole-Pattern Futures Projection Using Field Anomaly Relaxation," *Technological Forecasting and Social Change* Vol. 19 (1981), pp. 331-360.

Rhyne, Russell, "Field Anomaly Relaxation - The Arts of Usage," *Futures* Vol. 27, No. 6 (1995), pp. 657-674.

Smethurst, Alex. "Analysis Support to Concept Development," presentation given to the NATO Concept Development and Experimentation (CD&E) Course, Oberammergau, Germany, 2 June 2009.

United Kingdom, Ministry of Defence (MoD), Development, Concepts and Doctrine Centre (DCDC), *The DCDC Strategic Trends Programme 2007-2036*. (Shrivenham: MoD, January 2007).

United Kingdom, Cabinet Office, *Countries at Risk of Instability: Risk Assessment and Strategic Analysis Process Manual*. (London: HMG, February 2005).

United States, National Intelligence Council. *Mapping the Global Future*. (Washington: Government Printing Office, December 2004).

United States, Department of Defense, *US Capstone Concept for Joint Operations* (Washington: Government Printing Office, 2009).

United States, Department of Defense, *Joint Intelligence Preparation of the Operational Environment*, Joint Publication JP 2-01.3. (Washington: Government Printing Office, 16 June 2009).

United States, Department of Defence, Joint Warfighting Center, *Doctrinal Implications of Operational Net Assessment (ONA)*, Joint Doctrine Series Pamphlet 4. (Suffolk VA: Joint Warfighting Center, 24 February 2004).

United States, Department of Defense, US Army Training and Doctrine Command (TRADOC), *The Operational Environment* (White Paper). (Fort Monroe VA: TRADOC, May 2009).

Willner, L.A., S. Maloney, S. Babcock, *Canadian Forces Operations 1945-1969*, ORD Project Report PR 2002/11. (Ottawa: DND, Operational Research Division, October 2002).

Willner, L.A., S. Maloney, *Canadian Forces Operations 1970-2000*, ORD Project Report 2002/01. (Ottawa: DND, Operational Research Division, March 2002).

This page intentionally left blank.

List of Acronyms

AO	Area of Operations
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance
CAT	CDS Action Team
CBP	Capability Based Planning
CBRN	Chemical, Biological, Radiological, Nuclear
CDORA	Concept Development Operational Research and Analysis Team
CDS	Chief of Defence Staff
CF	Canadian Forces
CFD	Chief of Force Development
CFDS	Canada First Defence Strategy
COIN	Counterinsurgency Operations
CONOPS	Concept of Operations
CONPLANS	Contingency Planning
CORA	Centre for Operational Research and Analysis
COTS	Commercial Off The Shelf
DDR	Defence Requirements Review
DS	Defence Scientist
DND	Department of National Defence
DRDC	Defence Research & Development Canada
DRDKIM	Director Research and Development Knowledge and Information Management
FAR	Field Anomaly Relaxation
FD	Force Development
FPS	Force Planning Scenarios
IO	International Organization
JIMP	Joint, Interagency, Multinational, Public
JIPOE	Joint Intelligence Preparation of the Operational Environment
MA	Morphological Analysis
MCO	Major Combat Operations

MS	Microsoft
MSEL	Master Scenario Events List
NATO	North Atlantic Treaty Organization
NGO	Non-Governmental Organization
NORAD	North American Aerospace Defence Command
OE	Operational Environment
OGD	Other Government Department
ONA	Operational Net Assessment
OPP	Operational Planning Process
PITF	Political Instability Task Force
PME	Peacetime Military Engagement
PMESII	Political, Military, Economic, Social, Infrastructure, Information
PMESII + PT	Political, Military, Economic, Social, Infrastructure, Information, Physical Environment, Time
PSO	Peace Support Operations
R&D	Research & Development
ROTO	Rotation
SAR	Search and Rescue
SME	Subject Matter Expert
UN	United Nations

Glossary

Term	Definition	Usage/Source
Act	In force development, the military use of capability to achieve desired effects in support of government policy.	Defence Terminology Bank DTB 34945[50]
Capability	Capability is the power to achieve a desired operational effect in a nominated environment within a specified time and to sustain that effect for a designated period. (GUIDEx, Ver.1.1, February 2006)	The Technical Cooperation Program, Guide for Understanding and implementing Defense Experimentation (GUIDEx) Version 1.1, February 2006
Capability Based Planning	A force development process to achieve capability requirements.	DTB 19928
Capability Development	The process by which Land Force capabilities are conceived, designed and built. *Proposed: The process by which Joint or Service capabilities are conceived, designed and built.*	DTB 26174
Capability Package	A combination of national and NATO funded assets and support facilities which, together, will enable a Strategic Command to fulfil a specific military function or requirement. *Proposed modification: (also known as capability set) A combination of national and coalition assets and/or support facilities which, together, will enable command to fulfil a specific military function or requirement.*	DTB 13799
Capability Requirement	Capability required by the CF to meet Defence policy, Defence objectives, and Defence commitments.	DTB 26175

---

[50] Note: 'DTB' represents Defence Terminology Bank, and the number following is the DTB reference number for a particular definition. 'DFSA DCP' represents the Directorate of Future Security Analysis, Domain Concept Paper.

CF Readiness	A measure of the ability of an element of the CF to undertake an approved task.	SJS Interim Readiness Directive, 18 December 2008, p.5/34.
Command	The authority vested in an individual of the armed forces for the direction, coordination, and control of military forces.	DFSA Command DCP
Command and Control	The exercise of authority and direction by a designated commander over assigned forces in the accomplishment of the force's mission. The functions of command and control are performed through an arrangement of personnel, equipment, communications, facilities and procedures which are employed by a commander in planning, directing, coordinating and controlling forces in the accomplishment of his mission.	DTB 5950
Concept	A notion or statement of an idea, expressing how something might be done or accomplished, that may lead to an accepted procedure.	DTB 3861
Concept Development	The process by which operating concepts are conceived and translated into capability requirements.	DTB 26300
Conceptual Model	A model used to express systems, entities, phenomena, processes or ideas through their simplification into words, diagrams and pictures or other depictions.	DTB 32078
Conflict Prevention	A peace support operation employing complementary diplomatic, civil, and - when necessary - military means, to monitor and identify the causes of conflict, and take timely action to prevent the occurrence, escalation, or resumption of hostilities.	DTB 22795
Counter-insurgency operation	Those military, paramilitary, political, economic, psychological, and civic actions taken to defeat insurgency.	DTB 3941

Counterterrorism	All offensive measures taken to neutralize terrorism before and after hostile acts are carried out. Note: Such measures include those counterforce activities justified for the defence of individuals as well as containment measures implemented by military forces or civilian organizations.	DTB 23370
Domain	In force development, a sphere of activity or knowledge.	DTB 34947
Force Development	A system of integrated and interdependent processes that identifies necessary changes to existing capability and articulates new capability requirements for the CF. It is driven by changes in policy, actual or projected, changes in the security environment and lessons learned from operations. Force development comprises capability based planning, capability management and capability production.	DTB 32172
Force Employment	The command, control and sustainment of generated forces on operations. *Proposed: The application of allocated military means to achieve specified objectives or effects through such activities as operations, defence diplomacy, and unilateral, bilateral or multilateral defence activities.*	DTB 32173 Strategic Joint Staff, Director General Plans, "The CF Force Employment Planning Process: An Aide-Mémoire," 17 September 2008, p.I-1.
Force Employment Concept	Principles and fundamentals that dictate how the force intends to fight (force employment). As such, it is the foundation for combat development. Examples of fundamentals: combined arms, mission command, manoeuvre warfare, and indirect approach. The identification of functions (command, sense, act, shield, sustain) is part of the concept, providing a basis for structuring works. (DTB 22570)	DTB 22570

	Proposed definition: A notion or statement of an idea, expressing how forces might be employed, to achieve specified objectives or effects through such activities as operations, defence diplomacy, and unilateral, bilateral or multilateral defence activities.	
Force Employment Structure	An organization designed for military operational purposes. The structure can be optimized for a specific mission (e.g. a peace support operation) or a range of missions (e.g. a rifle company). These structures are based on doctrinal principles, applied to operational imperatives. Force employment structures are not component (Regular or Reserve) specific.	DTB 23288
Functional Area	The area of responsibility within an organization where specific operational, administrative or technical functions are performed.	DTB 13816
Generate	The method by which Defence recruits, trains and develops personnel, procures equipment, infrastructure and services, and all are made ready in order to meet the defence mission.	DFSA Generate DCP
Information Operations	Info Ops is a military function to provide advice and coordination of military information activities in order to create desired effects on the will, understanding and capability of adversaries, potential adversaries and other approved parties in support of Alliance mission objectives.	NATO, AJP-3.10 Information Operations May 2008 ratification draft; MC422/3 – 'NATO Military Policy on Information Operations'[51]

---

[51] The Defence Terminology Bank only contains an outdated 1991 definition for Information Operations; Canadian Joint level Info Ops doctrine of 1998 has not been updated and continues to use a similar outdated definition. The NATO definition is the starting point for Joint level doctrine writers and groups such as Public Affairs and the Directorate of Army Doctrine.

Initial Operational Capability	The first attainment of the capability to employ effectively a weapon, item of equipment, or system of approved specific characteristics that is manned or operated by an adequately trained, equipped, and supported military unit or force.	JP 1-02, October 2007
Insurgency	A competition involving at least one non-state movement using means that include violence against an established authority to achieve political change.	B-GL-323-004/FP-003 Counter-Insurgency Operations 18 Dec 2008 p. 1-2
Institutional Task	Any action, military or civilian, performed in support of the DND/CF institution. These would be actions such as recruiting, professional development and training; everything that supports force generation and achievement of the three core roles of the CF (excellence at home, a strong partner, leadership abroad).	DFSA
Integrated	Said of separate elements or groups that are combined or coordinated to function cooperatively.	DTB 34192
Intelligence, Surveillance, Reconnaissance	The integrated capabilities to collect, process, exploit and disseminate accurate and timely information that provides the battlespace awareness to successfully plan and conduct operations. Note: This includes policy and doctrine development, management, personnel and training issues.	
Interagency	Within the context of Department of Defense involvement, the coordination that occurs between elements of Department of Defense, and engaged US Government agencies for the purpose of achieving an objective.	US and Canada (JP 1-02 October 2007 definition for 'interagency cooperation' and DRDC-CORA TM-2007-60)

	Involving other government departments (OGDs) and agencies (OGAs) both domestic and foreign (these agencies will include: host nation government departments including security forces; government departments and agencies from support nations; and international government bodies, such as UN agencies)	
Joint, Interagency, Multinational and Public.	Command and Control concepts of specific interest will directly relate to interoperability issues associated with operations within the JIMP framework. Interoperability across JIMP categories will occur in three broad domains: information interoperability (the way we share information including technological and procedural aspects); cognitive interoperability (the way we perceive and think reflected in doctrine and decision processes); and behavioural interoperability (the way we carry out the selected course of action).	Canada (definition for 'JIMP' in CFEC Glossary http://www.cfd-cdf.forces.gc.ca/sites/page-eng.asp?page=77)
Logistics	The science of planning and carrying out of the movement and maintenance of forces. In its most comprehensive sense, those aspects of military operations which deal with design and development, acquisition, storage, movement, distribution, maintenance, evacuation and disposition of materiel.	DTB 15760
Major Combat Operations	The most demanding of military campaigns and operations. It is characterized by combat that is frequent, widespread and intense. It will usually be conducted against other formal, conventional military forces.	B-GL-300-001/FP-001 Land Operations 2008 p. 3-10
Non-combatant evacuation operation (NEO)	An operation conducted to relocate designated non-combatants threatened in a foreign country to a place of safety.	DTB 22803

Operating Concept	Concerned with the employment of future capabilities.	(Brad Gladman, *The Requirements for a Canada Command Integrated Operating Concept*, Ottawa: DRDC-CORA TR 2006-39, January 2007, p.1, fn. 3.)
Operational Capability	The actual capability of an element or asset of the CF to perform the mission for which it is organized and designed.	SJS Interim Readiness Directive, 18 December 2008, p.5/34.
Operational Task	Any action intended to lead to mission success in domestic or international operations. In general, these actions would fall under one or more of the functional domains of Command, Sense, Act, Shield, and Sustain. Operational tasks are not limited to activities at the operational level of war, but can take place at both the strategic and tactical levels as well.	DFSA
Peace building	A peace support operation employing complementary diplomatic, civil and - when necessary - military means, to address the underlying causes of conflict and the longer-term needs of the people. It requires a commitment to a long-term process and may run concurrently with other types of peace support operations.	DTB 22801
Peace enforcement	A peace support operation conducted to maintain a ceasefire or peace agreement where the level of consent and compliance is uncertain and the threat of disruption is high. The peace support force must be capable of applying credible coercive force and must apply the provisions of the ceasefire or peace agreement impartially.	DTB 23352
Peacekeeping	A peace support operation following an agreement or ceasefire that has established a permissive environment where the	DTB 22800

	level of consent and compliance is high, and the threat of disruption is low. The use of force by a peace support force is normally limited to self-defence.	
Peacemaking	A peace support operation, conducted after the initiation of a conflict to secure a ceasefire or peaceful settlement, that involves primarily diplomatic action supported, when necessary, by direct or indirect use of military assets.	DTB 22799
Peace support operations	An operation that impartially makes use of diplomatic, civil and military means, normally in pursuit of United Nations Charter purposes and principles, to restore or maintain peace. Such operations may include conflict prevention, peacemaking, peace enforcement, peacekeeping, peace building and/or humanitarian operations.	DTB 22802
Peacetime military engagement (PME)	Military activity in peacetime that involves cooperation with other nations or agencies, primarily intended to shape the security environment. (Note PME is not exclusively meant to shape the security environment so activities such as SAR and Maritime Surveillance can be included under this theme.)	B-GL-300-001/FP-001 Land Operations 2008 p. 3-10
Readiness	Readiness is the level of preparedness for personnel and materiel to respond to the tasks described in a scenario or to an operation being considered.	DTB 34053
Readiness State	The measure of the capability of forces at a given point in time to execute their assigned missions.	DTB 18998
Readiness Time	The time within which a unit can be made ready to perform the tasks for which it has been organized, equipped and trained. This time is amplified or measured by indicators of the unit's current personnel, materiel and training	DTB 18980

	state. It does not include transit time.	
Response time	The maximum time permitted for the designated CF element or asset, to assemble in a specified location possessing the approved Operational Capability, and ready to undertake the assigned task.	SJS Interim Readiness Directive, 18 December 2008, p.5/34.
Scenario	The political-military situation, including force disposition and intent, associated with a given theatre of operation (e.g. Canada deploying forces overseas within a larger Coalition mandated to intervene in a country facing a terrorist-based insurgency).	CAT-3 Report
Sense	The acquisition and processing of information to enable commanders and authorities to understand the characteristics and conditions of the operating environment pertinent to military decision-making.	DFSA Sense DCP
Shield	In force development, the comprehensive protection of tangible and intangible assets.	DTB 34948
Sustain	The provisioning of all support services required to maintain routine and contingency operations – domestic, continental, and expeditionary – including prolonged deployed operations	DFSA Sustain DCP
Sustainment	In force development, the ability to maintain the necessary fighting power and/or effectiveness to achieve desired effects.	DTB
Terrorism	The unlawful use or threatened use of force or violence against individuals or property in an attempt to coerce or intimidate governments or societies to achieve political, religious or ideological objectives.	DTB 2738

Distribution list

Document No.: DRDC CORA CR 2010-017

Information

Internal

DDG [PDF]
SH Strategic Analysis [PDF]
Library [HC + PDF]
Authors [PDF]

External

DFSA [PDF]
DST IC [PDF]
CAE [PDF]
DRDKIM [PDF]

	DOCUMENT CONTROL DATA		
(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATOR (The name and address of the organization preparing the document. Organizations for whom the document was prepared, e.g. Centre sponsoring a contractor's report, or tasking agency, are entered in section 8.) CAE Professional Services (Canada) Inc. 1135 Innovation Drive Ottawa, Ontario K2K 3G7	2. SECURITY CLASSIFICATION (Overall security classification of the document including special warning terms if applicable.) UNCLASSIFIED

3. TITLE (The complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title.)

Development of the Force Planning Scenario Framework: Inputs for the Scenario Analysis Tool

4. AUTHORS (last name, followed by initials – ranks, titles, etc. not to be used)

Chuka, N.; Cochran, L.; Friesen, S.; Hales, D.; Harnett, LCdr; Morrisey, C.; Race, P.

5. DATE OF PUBLICATION (Month and year of publication of document.) February 2010	6a. NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.) 76	6b. NO. OF REFS (Total cited in document.) 51

7. DESCRIPTIVE NOTES (The category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

Contract Report

8. SPONSORING ACTIVITY (The name of the department project office or laboratory sponsoring the research and development – include address.)

9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.) 10ab	9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.) WW7714-09/00710
10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document.)	10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.) DRDC CORA CR 2010-017

11. DOCUMENT AVAILABILITY (Any limitations on further dissemination of the document, other than those imposed by security classification.)

Unlimited

12. DOCUMENT ANNOUNCEMENT (Any limitation to the bibliographic announcement of this document. This will normally correspond to the Document Availability (11). However, where further distribution (beyond the audience specified in (11) is possible, a wider announcement audience may be selected.))

Unlimited

13. ABSTRACT (A brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C), (R), or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual.)

This contractor report defines and analyzes the inputs of an effective framework required for characterizing the Force Planning Scenarios. The framework is used as a basis for developing a scenario analysis software tool that allows Defence Scientists to overlay the Force Planning Scenarios and ensure a range of dimensions, factors and variables is being addressed. This contractor report identifies the most relevant dimensions of the Force Planning Scenarios to support analysis and development. The information in this report is based on analysis performed by contractors in close collaboration with Defence Scientists from Defence Research and Development Canada's Centre for Operational Research and Analysis. This study should be viewed as an initial starting point for the development of a scenario writing methodology, and will be updated, modified and refined on an ongoing basis. The report outlines the applications for the scenario analysis tool and makes recommendations for potential areas of future research. The development of a systematic process will enhance the Capability Based Planning process by ensuring that the Force Planning Scenarios are selected and developed in a defensible, transparent and objective way that makes best use of analytical methods and techniques.

Le présent rapport d'entrepreneur définit et analyse les données liées à la création d'un cadre efficace nécessaire pour la caractérisation des scénarios de planification des forces. Ce cadre est utilisé comme base d'élaboration d'un outil logiciel d'analyse de scénarios qui permettra aux scientifiques de la Défense de superposer les scénarios de planification des forces et de s'assurer que l'on tient compte de plusieurs dimensions, facteurs et variables. Ce rapport d'entrepreneur permet d'identifie les dimensions les plus pertinentes des scénarios de planification des forces pouvant appuyer les analyses et les développements. Les renseignements présentés dans ce rapport sont basés sur des analyses effectuées par des entrepreneurs travaillant en étroite collaboration avec des scientifiques de la Défense du Centre de recherche opérationnelle et d'analyse de Recherche et développement pour la défense Canada. Cette étude doit être considérée comme un point de départ dans l'élaboration d'une méthode de rédaction de scénario. Elle sera mise à jour, modifiée et raffinée de façon régulière. Ce rapport décrit les applications qui peuvent être faites de l'outil d'analyse de scénario et contient des recommandations sur des domaines de recherche futurs. La mise au point d'un processus méthodique améliorera le processus de planification fondée sur les capacités en s'assurant que les scénarios de planification des forces sont choisis et élaborés de façon transparente, objective et défendable, en utilisant au mieux les méthodes et techniques analytiques.

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

Force Planning Scenarios; Capability Based Planning; Force Development; Framework; Analysis

Defence R&D Canada

Canada's Leader in Defence
and National Security
Science and Technology

R & D pour la défense Canada

Chef de file au Canada en matière
de science et de technologie pour
la défense et la sécurité nationale

DEFENCE **R&D** DÉFENSE

www.drdc-rddc.gc.ca