Preparing for an uncertain future

Scenario design: A DND/CAF Force Development perspective

Context

- Bio: Defence Scientist at the Strategic Planning Operations Research Team

- Work: Support DND/CAF's upcoming Capability Based Planning process for force development to…
  - Help identify the future demand for capabilities (effects we want to generate), and assess if the future force could supply the demand when required
  - This helps informs how the CFD spends its budget to develop a future force capable of meeting the future challenge space
  - For us, **Canadian future scenarios are an engineering test plan of what anticipated challenges to prepare for**. Today's talk is on how we produce a scenario set to inform our work

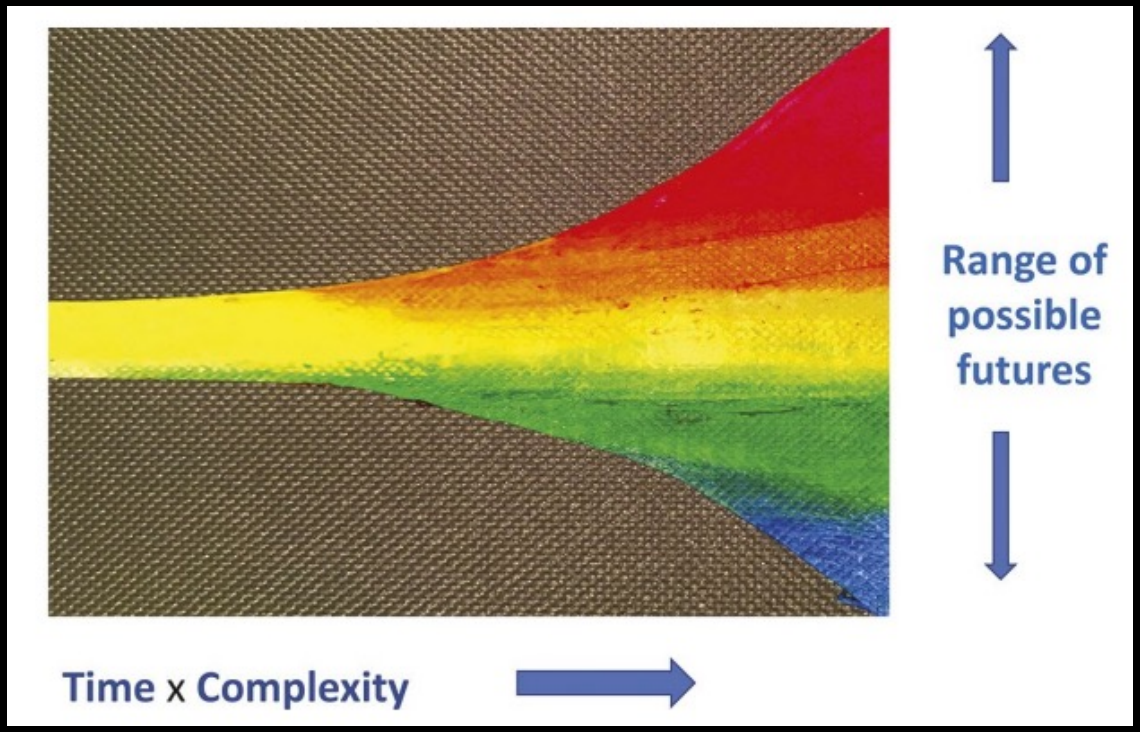
Build strategy = Military strategy

- Military strategy is informed by a government's stated policy objectives as per Clausewitz
  - WW2: France developed a largely defensive force; Germany developed an offensive force
- So… What does the government want us to prepare for?

The government's defence objectives

- Government of Canada's (GC) 2017 Strong, Secure, Engaged Defence Policy:
  - Outlines eight missions the DND/CAF should prepare for
- The missions are a good start, but difficult to predict what the actual future security challenges could be…
  - Developing a future force takes time
  - So need to build a force that could adapt to a range of potential future capability challenges

The Trumpet of Uncertainty



The DND/CAF force development perspective

- Use scenario set as an engineering test plan of what future capability challenges to prepare for
- We identify a useful minimum of future scenarios which provides adequate coverage of the potential challenge space, and game them out to identify capability demands

The road to scenario development

- Start with the government's defence objectives
- Enrich it with a scenario characterization framework
- Assess what scenario states are more plausible than others
- Assign scenario states
- Dominated analysis to find a useful minimum
- For Capacity Analysis: Add in additional scenarios and vignettes

The road to scenario development: Step 1

- Know what missions the GC wants us to prepare for, but need to enrich it
- Develop a scenario characterization framework
  - Framework is composed of various critical dimensions that describe a scenario
    - Seven dimensions were identified, each with three level of challenge (L,M,H)
  - The framework helps us identify a useful minimum of scenarios which covers the challenge space

SSE Missions							
1	2	3	4	5	6	7	8

Dimension	Level of Challenge		
	Low	Medium	High
Geographic Reach			
Responsiveness			
Duration			
Threat level			
Human Terrain Complexity			
Physical Terrain Complexity			
Interoperability Requirements			

The road to scenario development: Step 2

- Plausibility assessment
  - Expert judgement was used to identify the plausibility of each pair of states
  - Pairs were scored from 0-4:
    - 0: Extremely unlikely
    - 1: Possible, but highly improbable
    - 2: Possible, but has not happened or happens infrequently
    - 3: Can, and has happened; not typical
    - 4: Happens frequently

		Geographic Reach		
		L	M	H
G - Geographic reach	L – Domestic	0	0	0
	M - Continental	0	0	0
	H – Global	0	0	0
R - Responsiveness	L – Months	3	1	4
	M – Weeks	1	1	3
	H - Immediate/days	4	3	3
D - Duration	L - Days/Weeks	4	3	2
	M - Few months	1	0	2
	H – Sustained	4	4	4
T- Threat Level	L – Permissive	4	4	3
	M - Non-peer	1	1	3
	H - Near-peer	1	4	4
H - Human Terrain Complexity	L - Limited population	2	3	3
	M - Peripheral population	2	1	2
	H - Within civilian population	3	1	3
P - Physical Terrain Complexity	L - Accessible with infrastructure	4	4	3
	M - Mixed environment	4	3	3
	H - Hostile and/or complex	4	3	3
C - Coalition context & Interoperability	L - Canadian or CAN-led	4	0	2
	M - Alliance operations	1	4	3
	H - Non-traditional partners	4	0	3

The road to scenario development: Step 2

- Once we assess the plausibility for every pair of states, we calculate the plausibility for every possible scenario with a unique set of sets
  - Plausibility Score range from 0 to 1: 1 is plausible, lower scores are less plausible
    - Score of a scenario lowers the more unlikely pair of states it contains
- We also identify possible set of states for each of the SSE missions
  - e.g., Defence of Canada missions require a reach of L (Domestic)

Scenario #	Geographic Reach **G**	Responsiveness **R**	Duration **D**	Threat Level **T**	Human Terrain Complexity **H**	Physical Terrain Complexity **P**	Coalition Context **C**	Relative Plausibility
1653	L	H	L	M	H	L	H	**0.80**

The road to scenario development: Step 3

- At this point, we know:
  - What SSE missions to prepare for
  - What challenge dimensions to consider
  - The plausible combination of dimensions for each SSE mission
- We can now assign specific states to each SSE mission based on:
  - Plausibility ratings
  - The nature of the mission
  - Ensuring full coverage of the challenge space

The road to scenario development: Step 3

- Fictional SSE missions
- Scenarios must cover all core missions

		1: Defence of Canada	2: Win the Stanley Cup	3: Win the Hockey Olympics	4:Search and Rescue in distress Canadian Polar bears	5:Work with police to crack down on global maple syrup smuggling	6:Hunt for Atlantis	7:Peacekeeping of Emus in Australia	8: Combating global Canadian geese insurgency
G - Geographic reach	L - Domestic								
	M - Continental								
	H - Global								
R - Responsiveness	L - Months								
	M - Weeks								
	H - Immediate/days								
D - Duration	L - Days/Weeks								
	M - Few months								
	H - Sustained								
T- Threat Level	L - Permissive								
	M - Non-peer								
	H - Near-peer								
H - Human Terrain Complexity	L - Limited population								
	M - Peripheral population								
	H - Within civilian population								
P - Physical Terrain Complexity	L - Accessible with infrastructure								
	M - Mixed environment								
	H - Hostile and/or complex								
C - Coalition context & Interoperability	L - Canadian or CAN-led								
	M - Alliance operations								
	H - Non-traditional partners								

The road to scenario development: Step 3

- Many dimensions are pre-determined due to the nature of the mission
  - Defence of Canada: Domestic Reach (L)

		1: Defence of Canada	2: Win the Stanley Cup	3: Win the Hockey Olympics	4:Search and Rescue in distress Canadian Polar bears	5:Work with police to crack down on global maple syrup smuggling	6:Hunt for Atlantis	7:Peacekeeping of Emus in Australia	8: Combating global Canadian geese insurgency
G - Geographic reach	L - Domestic	L			L				
	M - Continental		M						
	H - Global			H		H	H	H	H
R - Responsiveness	L - Months						L		
	M - Weeks							M	M
	H - Immediate/days				H				
D - Duration	L - Days/Weeks				L				
	M - Few months								
	H - Sustained	H	H	H				H	H
T- Threat Level	L - Permissive								
	M - Non-peer								
	H - Near-peer		H	H				H	H
H - Human Terrain Complexity	L - Limited population								
	M - Peripheral population								
	H - Within civilian population								
P - Physical Terrain Complexity	L - Accessible with infrastructure								
	M - Mixed environment								
	H - Hostile and/or complex								
C - Coalition context & Interoperability	L - Canadian or CAN-led	L	L	L				L	L
	M - Alliance operations								
	H - Non-traditional partners					H			

The road to scenario development: Step 3

- We then add in plausible dimensions states to fill the table based on the constrained dimensions
- Could vary challenge level for unconstrained dimensions to provide coverage of the entire challenge range

		1: Defence of Canada	2: Win the Stanley Cup	3: Win the Hockey Olympics	4:Search and Rescue in distress Canadian Polar bears	5:Work with police to crack down on global maple syrup smuggling	6:Hunt for Atlantis	7:Peacekeeping of Emus in Australia	8: Combating global Canadian geese insurgency
G - Geographic reach	L - Domestic	L			L				
	M - Continental		M						
	H - Global			H		H	H	H	H
R - Responsiveness	L - Months						L		
	M - Weeks							M	M
	H - Immediate/days	H			H				
D - Duration	L - Days/Weeks				L				
	M - Few months								
	H - Sustained	H	H	H				H	H
T- Threat Level	L - Permissive								
	M - Non-peer								
	H - Near-peer		H	H				H	H
H - Human Terrain Complexity	L - Limited population								
	M - Peripheral population								
	H - Within civilian population								
P - Physical Terrain Complexity	L - Accessible with infrastructure								
	M - Mixed environment								
	H - Hostile and/or complex								
C - Coalition context & Interoperability	L - Canadian or CAN-led	L	L	L				L	L
	M - Alliance operations						M		
	H - Non-traditional partners					H			

The road to scenario development: Step 3

- In some cases, we don't need to assign a challenge level for each dimension (Gray boxes)
  - If we handle a medium-long duration mission, should be able to handle a short duration mission
- We now have a table with defined challenge levels, and where we can decide which scenarios will cover certain challenge levels

		1: Defence of Canada	2: Win the Stanley Cup	3: Win the Hockey Olympics	4:Search and Rescue in distress Canadian Polar bears	5:Work with police to crack down on global maple syrup smuggling	6:Hunt for Atlantis	7:Peacekeeping of Emus in Australia	8: Combating global Canadian geese insurgency
G - Geographic reach	L - Domestic	L			L				
	M - Continental		M						
	H - Global			H		H	H	H	H
R - Responsiveness	L - Months						L		
	M - Weeks							M	M
	H - Immediate/days	H			H				
D - Duration	L - Days/Weeks				L				
	M - Few months								
	H - Sustained	H	H	H				H	H
T- Threat Level	L - Permissive								
	M - Non-peer								
	H - Near-peer		H	H				H	H
H - Human Terrain Complexity	L - Limited population								
	M - Peripheral population								
	H - Within civilian population								
P - Physical Terrain Complexity	L - Accessible with infrastructure								
	M - Mixed environment								
	H - Hostile and/or complex								
C - Coalition context & Interoperability	L - Canadian or CAN-led	L	L	L				L	L
	M - Alliance operations						M		
	H - Non-traditional partners					H			

The road to scenario development: Step 4, dominated analysis to find a useful minimum

		1: Defence of Canada	2: Win the Stanley Cup	3: Win the Hockey Olympics	4:Search and Rescue in distress Canadian Polar bears	5:Work with police to crack down on global maple syrup smuggling	6:Hunt for Atlantis	7:Peacekeeping of Emus in Australia	8: Combating global Canadian geese insurgency
G - Geographic reach	L - Domestic	L			L				
	M - Continental		M						
	H - Global			H		H	H	H	H
R - Responsiveness	L - Months						L		
	M - Weeks							M	M
	H - Immediate/days	H			H				
D - Duration	L - Days/Weeks				L				
	M - Few months								
	H - Sustained	H	H	H				H	H
T- Threat Level	L - Permissive								
	M - Non-peer								
	H - Near-peer		H	H				H	H
H - Human Terrain Complexity	L - Limited population								
	M - Peripheral population								
	H - Within civilian population								
P - Physical Terrain Complexity	L - Accessible with infrastructure								
	M - Mixed environment								
	H - Hostile and/or complex								
C - Coalition context & Interoperability	L - Canadian or CAN-led	L	L	L				L	L
	M - Alliance operations						M		
	H - Non-traditional partners					H			

		1: Defence of Canada & Polar bear rescue vignette	3: Win the Hockey Olympics & Stanley Cup Vignette	5:Work with police to crack down on global maple syrup smuggling	6:Hunt for Atlantis	8: Combating global Canadian geese insurgency & Emu Vignette
G - Geographic reach	L - Domestic	L				
	M - Continental		M			
	H - Global		H	H	H	H
R - Responsiveness	L - Months				L	
	M - Weeks					M
	H - Immediate/days	H				
D - Duration	L - Days/Weeks	L				
	M - Few months					
	H - Sustained	H	H			H
T- Threat Level	L - Permissive					
	M - Non-peer					
	H - Near-peer		H			H
H - Human Terrain Complexity	L - Limited population					
	M - Peripheral population					
	H - Within civilian population					
P - Physical Terrain Complexity	L - Accessible with infrastructure					
	M - Mixed environment					
	H - Hostile and/or complex					
C - Coalition context & Interoperability	L - Canadian or CAN-led	L	L			L
	M - Alliance operations				M	
	H - Non-traditional partners			H		

Output

- A smallest set of scenarios that:
  - Covers the key missions
  - Presents low, medium, and high capability challenges against each dimension
  - Comprised of plausible combinations
- Scenarios could then be written which covers these elements

Mission	Title	Dimensions						
		Geographic Reach	Responsiveness	Duration	Threat Level	Human Terrain Complexity	Physical Terrain Complexity	Interoperability
		G	R	D	T	H	P	I
1 & 4	Defence of Canada & Polar rescue vignette	L	H	L H	L	M	M H	L
2 & 3	Hockey Olympic & Stanley Cup vignette	M H	M	H	H	M	L	L
5	Maple syrup smuggling	H	H	M H	M	H	M H	H
6	Hunt for Atlantis	H	L	M	L	M	H	M
7 & 8	Geese Insurgency & Emu peacekeeping vignette	H	M	H	H	M H	L M H	L

Scenarios for capacity analysis

- To test the DND/CAF capacity to generate future capabilities, we supplement our force development scenarios with additional vignettes and scenarios that cover additional types of force deployments
  - Historical precedent
  - Older generation of scenario sets that are appropriate to the missions assigned to the DND/CAF
  - This produces a richer set of scenarios that supports capacity analysis

Recap

- We start off with the missions the GC wants us to prepare for
  - We develop a scenario set that covers the anticipated challenge space to help us prepare to meet the projected future capability challenges
  - We add in additional vignettes which may not drive capability requirements, but which represents the breadth of demand for Canadian military forces to help us see if the DND/CAF could generate the anticipated forces