



Royal Military College Saint-Jean and Centre for National Security Studies

## Symposium on Systems Thinking and Design

### Panel 2

### Design and Systems Thinking Within the Canadian Armed Forces



Moderator:

**Lieutenant-Colonel Anne Reiffenstein,**  
Canadian Forces College

Panelists:

**Mr. Robert Lummack,** Royal Military  
College Saint-Jean

**Dr. Paul Mitchell,** Canadian Forces  
College

**Colonel Kevin Whale,** Special Assistant  
to the Minister of National Defence

**Lieutenant-Colonel James (Jimbo)  
Chorley,** Commander's Action Group,  
Canadian Special Operations Forces  
Command



***Teaching Systems Thinking and  
Design to Senior NCMs***

***Robert Lummack, Royal Military College SAINT-JEAN***

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Course	Format	Content
Intermediate Leadership Programme (ILP)  Sgt-WO	<ul style="list-style-type: none"> <li>Residential Lecture</li> </ul>	<ul style="list-style-type: none"> <li>Complexity of Operations and the Women, Peace and Security Agenda</li> </ul>
Advanced Leadership Programme (ALP)  WO- MWO	<ul style="list-style-type: none"> <li>DL Reading Lesson</li> <li>Essay</li> </ul>	<ul style="list-style-type: none"> <li>Systems concepts</li> <li>Military operations</li> </ul>
Senior Leadership Programme (SLP)  MWO - CWO	<ul style="list-style-type: none"> <li>Pre-reading</li> <li>Residential Lectures</li> <li>Application</li> </ul>	<ul style="list-style-type: none"> <li>Military Applications of Systems Thinking, Design</li> <li>Design experience</li> </ul>

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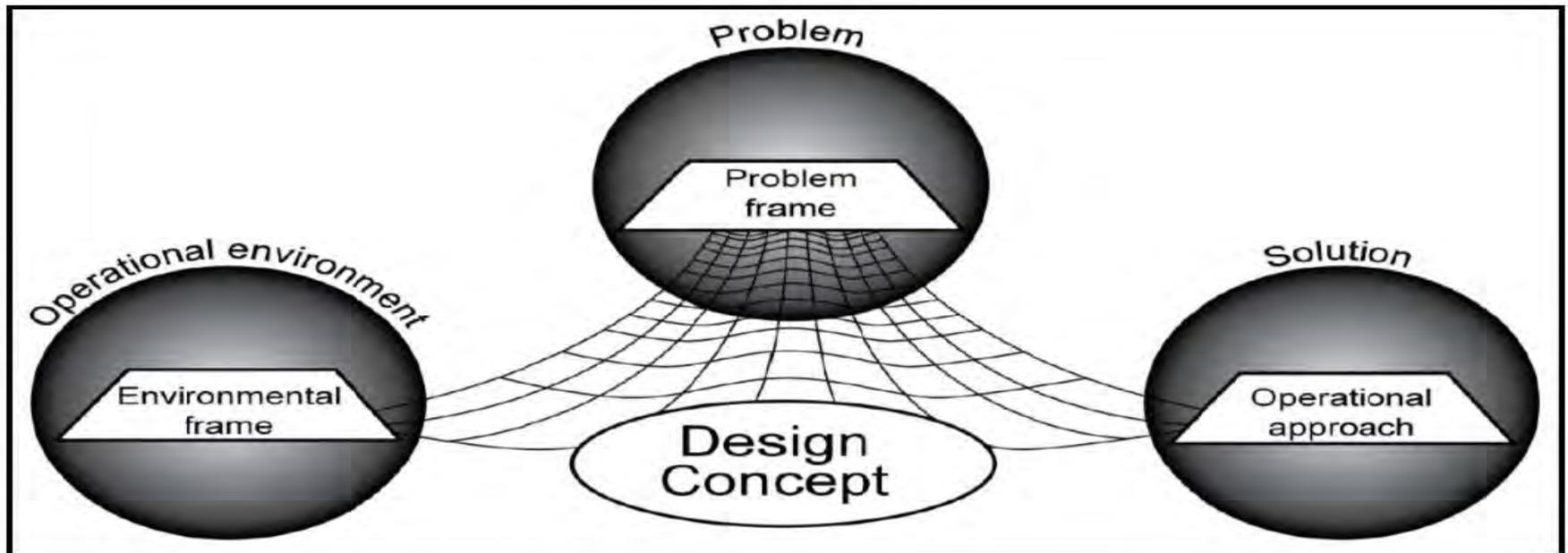
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## What:

- **Wicked Problems (Rittel and Webber, 1973)**
- **Complex Adaptive Systems**
- **Context**

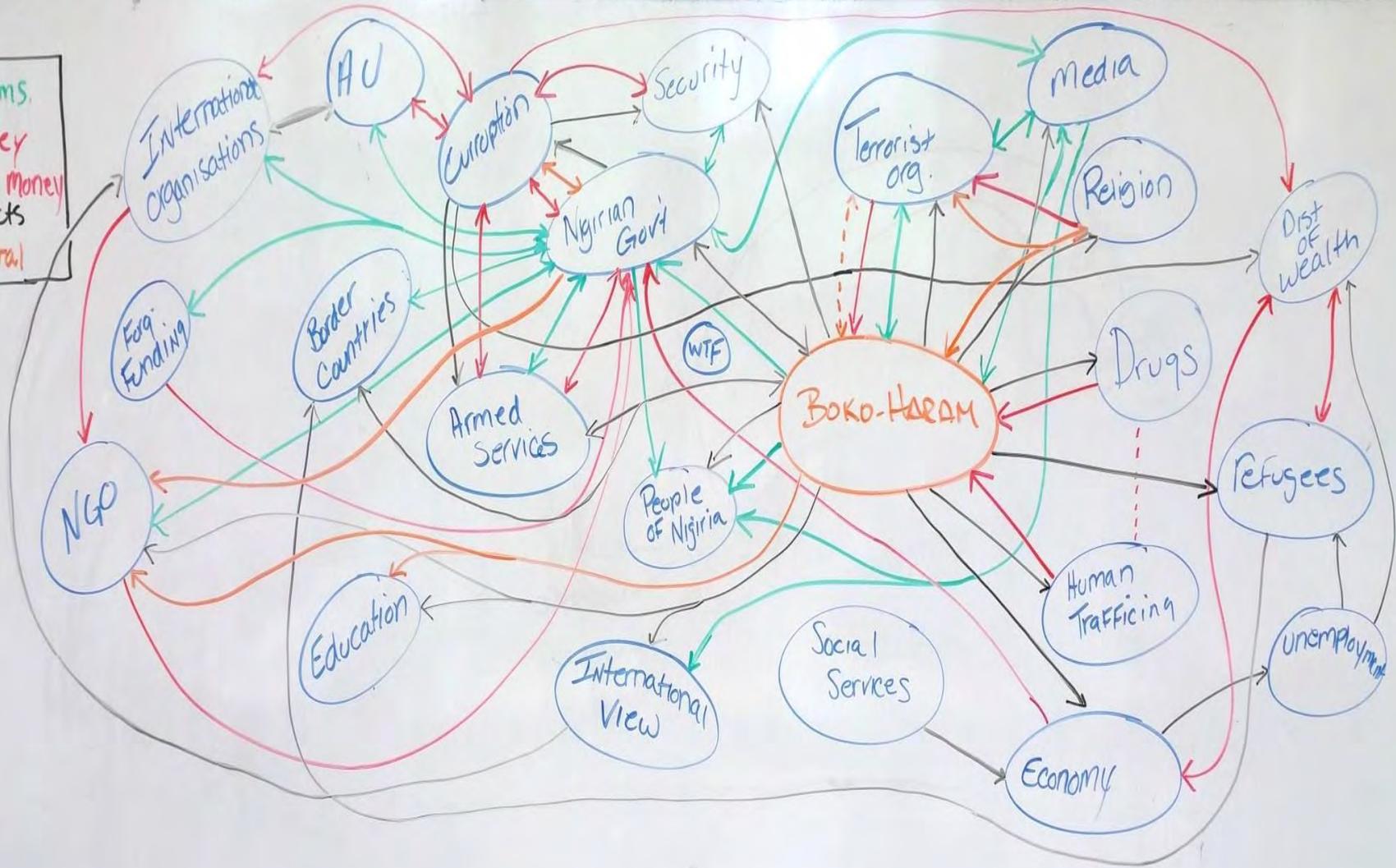
## How:

- **Andragogy**
- **Experience**
- **Design Activity**

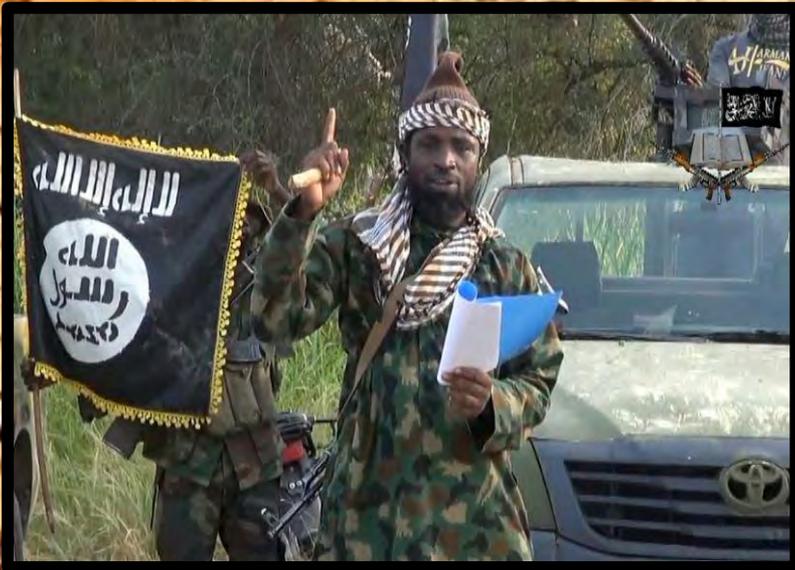


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**FIGURE 3-1. THE DESIGN METHODOLOGY**

- Comms
- Money
- - - Poss Money
- Effects
- Cultural

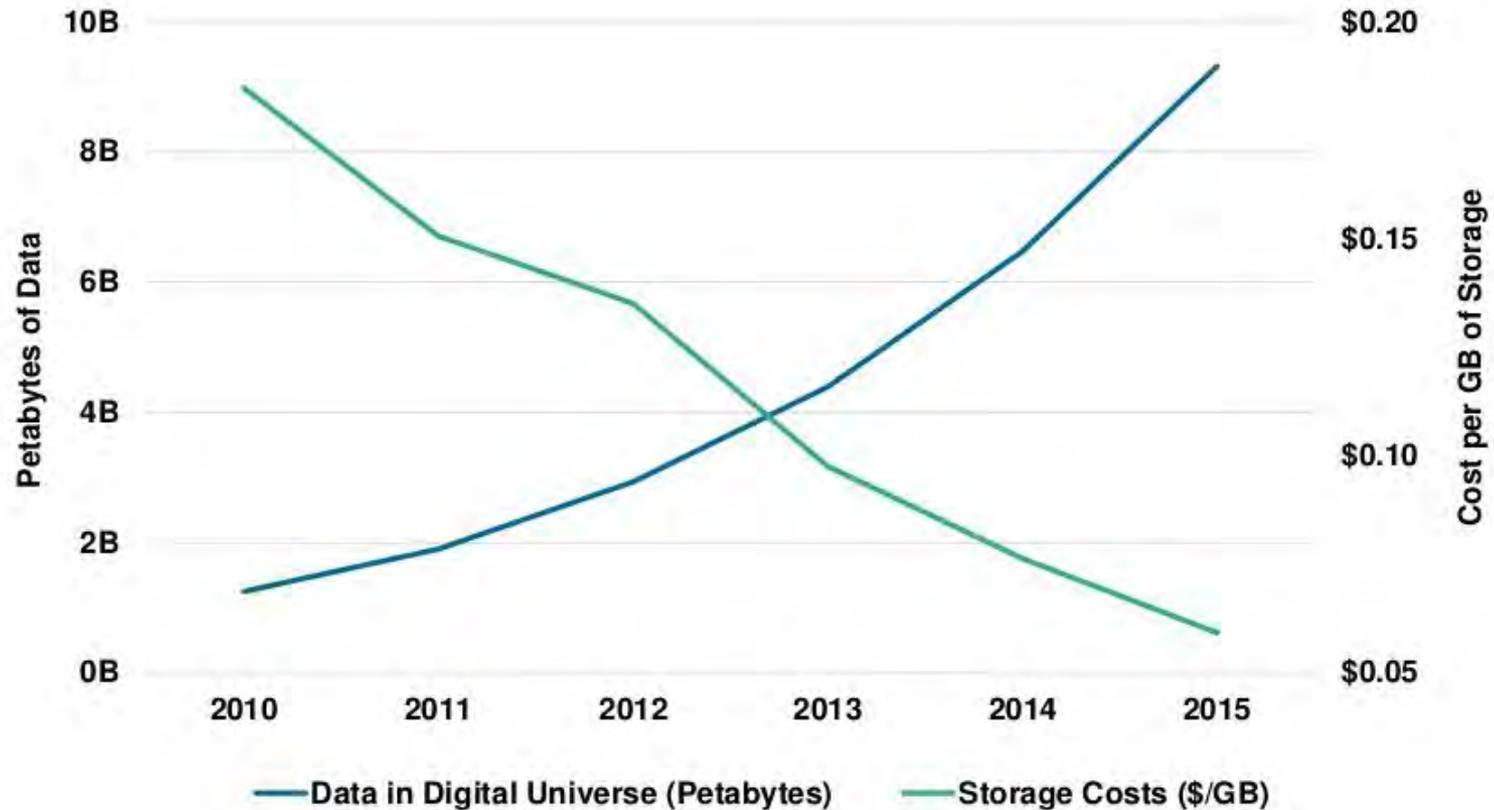


## SLP, Syndicate 4, August 31, 2015



# Global Data Growth Rising Fast = +50% CAGR since 2010... Data Infrastructure Costs Falling Fast = -20% CAGR

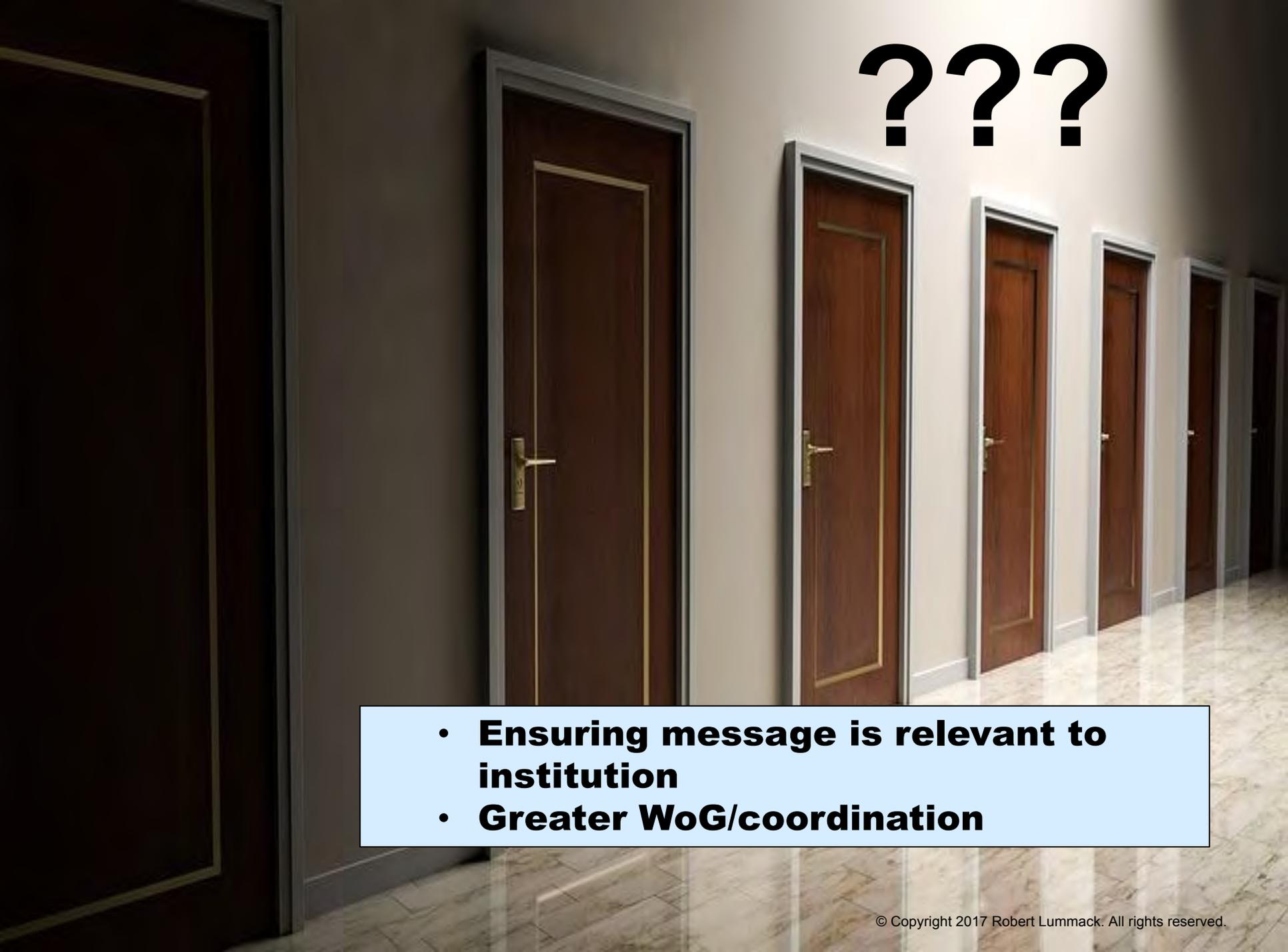
## Data in Digital Universe vs. Data Storage Costs, 2010 – 2015



# Why Teach this to senior NCMs?



Rank Group	Reg F		Primary Res F		Total Force	
	No	%	No	%	No	%
NCM	49810	75.44%	22190	82.81%	72000	77.57%
Officer	16216	24.56%	4605	17.19%	20821	22.43%
Total	66026		26795		92821	



# ???

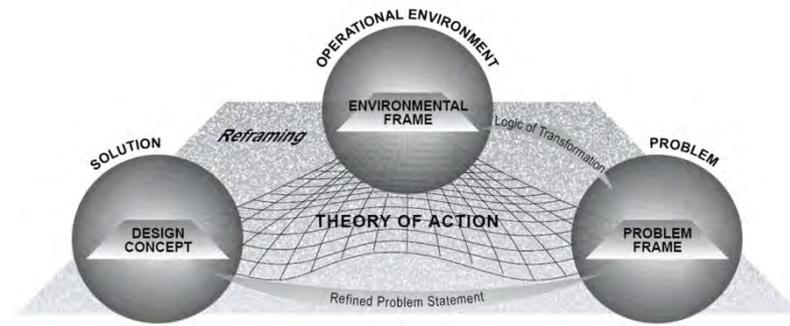
- **Ensuring message is relevant to institution**
- **Greater WoG/coordination**



# Stumbling into Design

## Teaching Operational Warfare for Small Militaries in Senior PME

Dr. Paul T. Mitchell  
Canadian Forces College

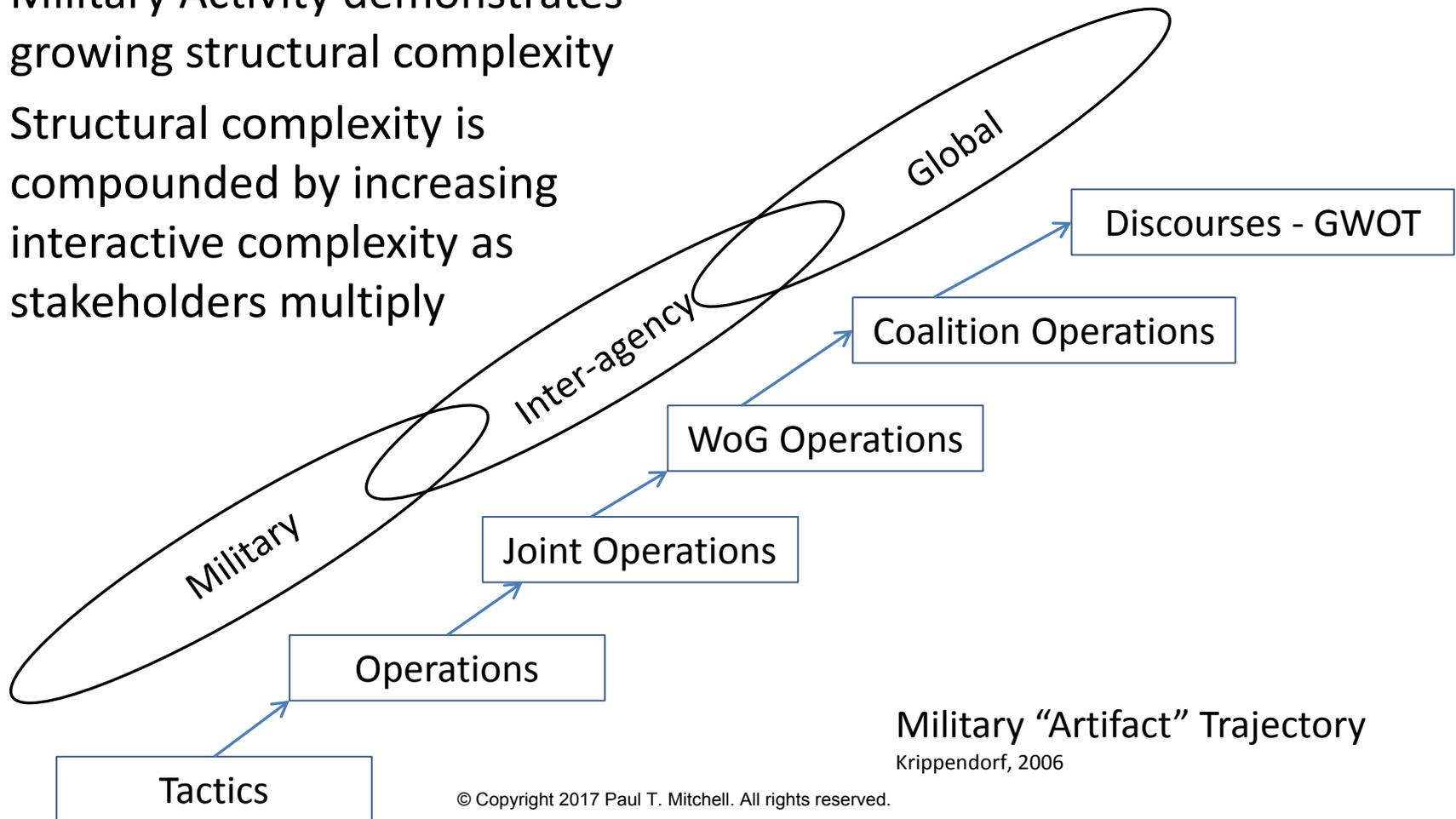


# Introduction

- Design is an approach for thinking through complex problems
- Employed in a variety of contexts including product design, architecture, medical services, and business strategy
- Growing numbers of militaries are employing
  - Israel: Systemic Operational Design
  - US: Army Design Methodology
  - Australia: Complex Adaptive Operations
  - United Kingdom
  - Netherlands

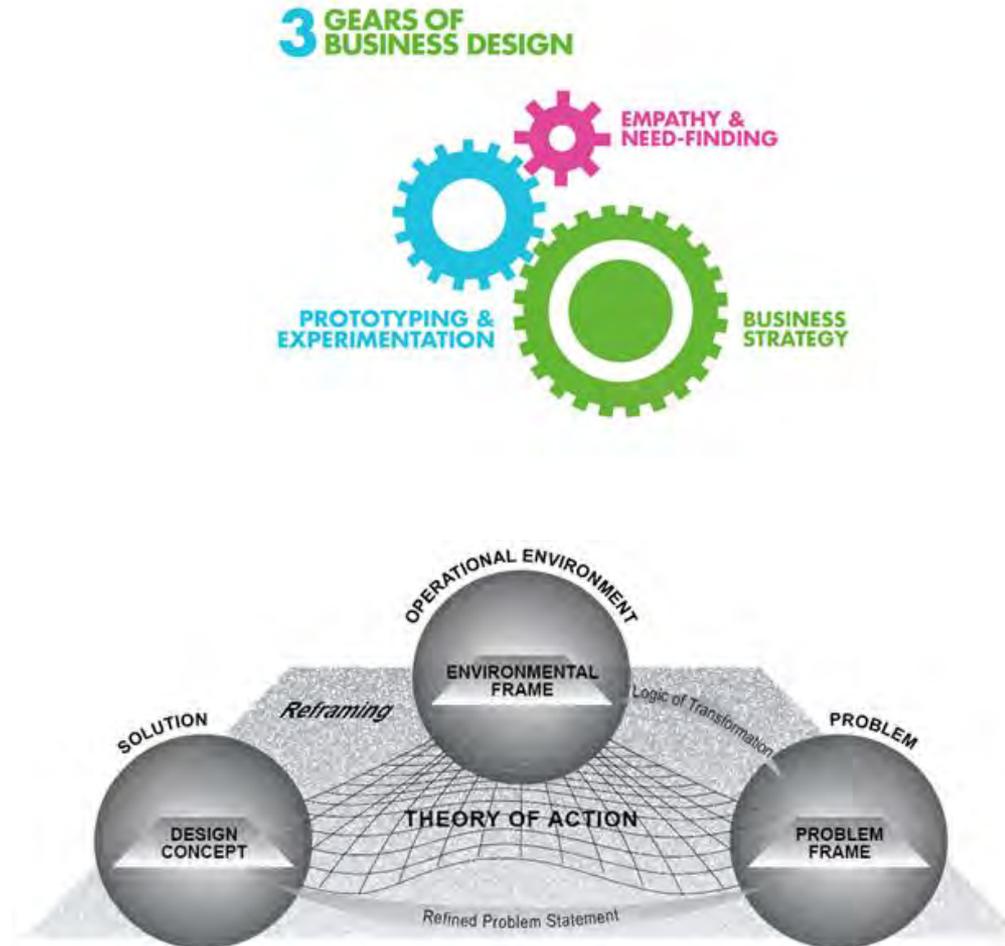
# The “Military Artifact Trajectory”

- Historical Development of Military Activity demonstrates growing structural complexity
- Structural complexity is compounded by increasing interactive complexity as stakeholders multiply



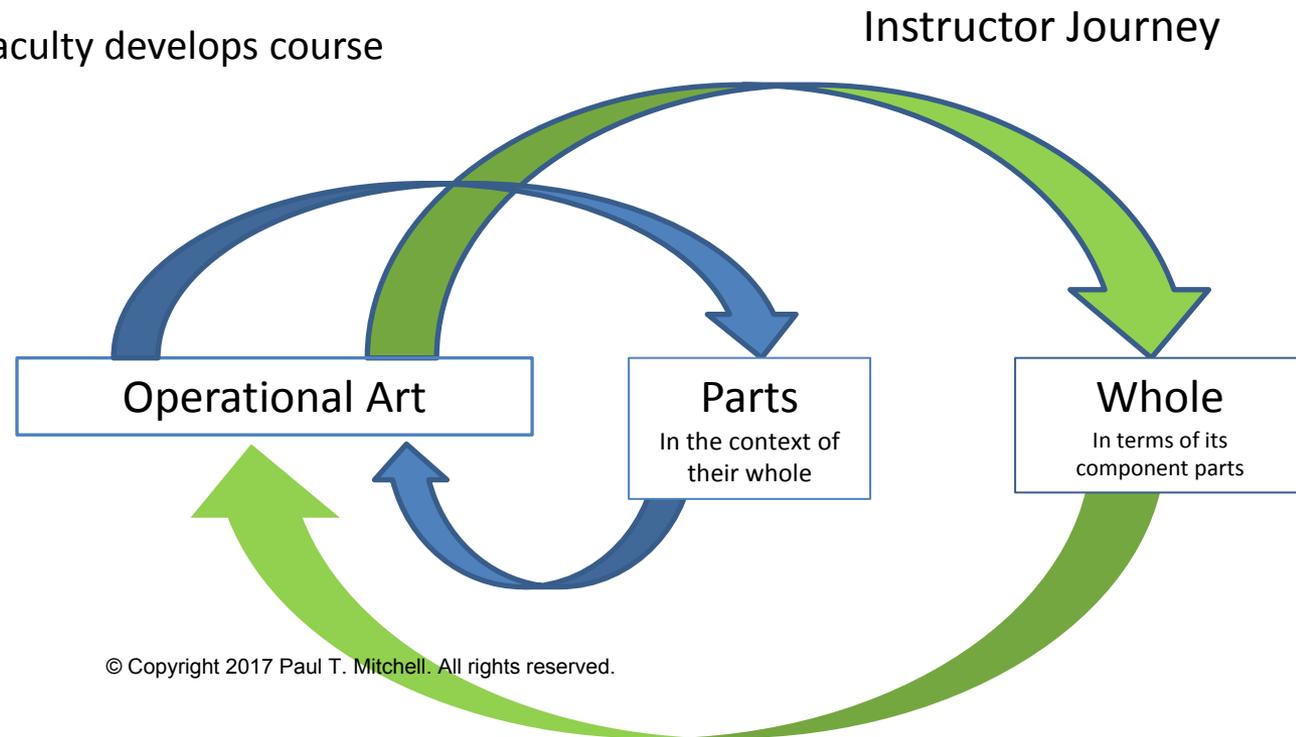
# Methodology

- Most design techniques employ similar model
  - What does the current environment look like?
  - What do we want the environment to look like?
  - What is stopping us from achieving our goals?
  - How might we influence the environment in desired direction?
  - What does the environment look like after we have intervened?
  - What have we learned?
  - How do we change what we are doing?



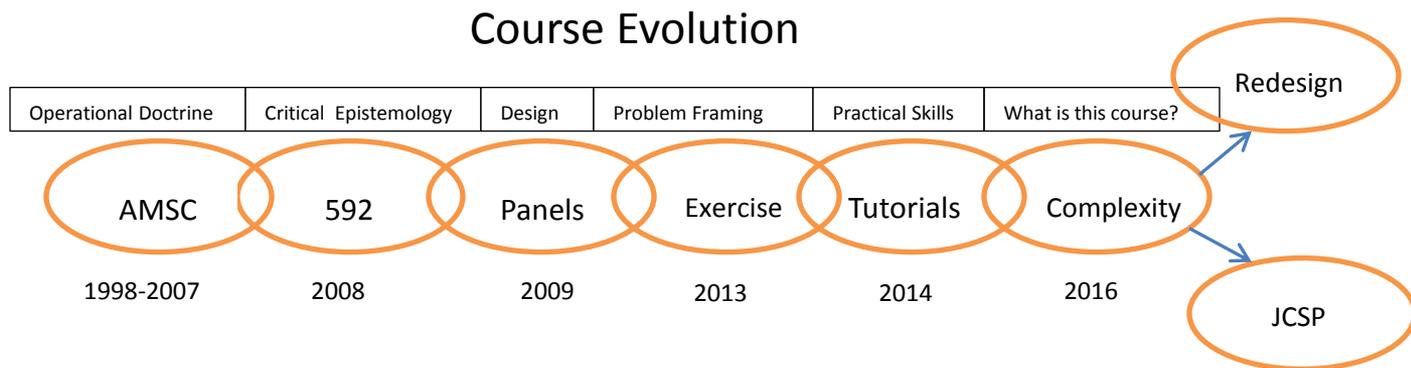
# The “Environmental Frame”

- Development of “Modern Comprehensive Operations and Campaign Design”
- Operational Warfare for small militaries
  - Separation of Strategy from Operations
  - Complex Battlespace at Strategic and Operational levels
  - Niche roles: “Contribution Warfare”
  - Civilian Academic Faculty develops course



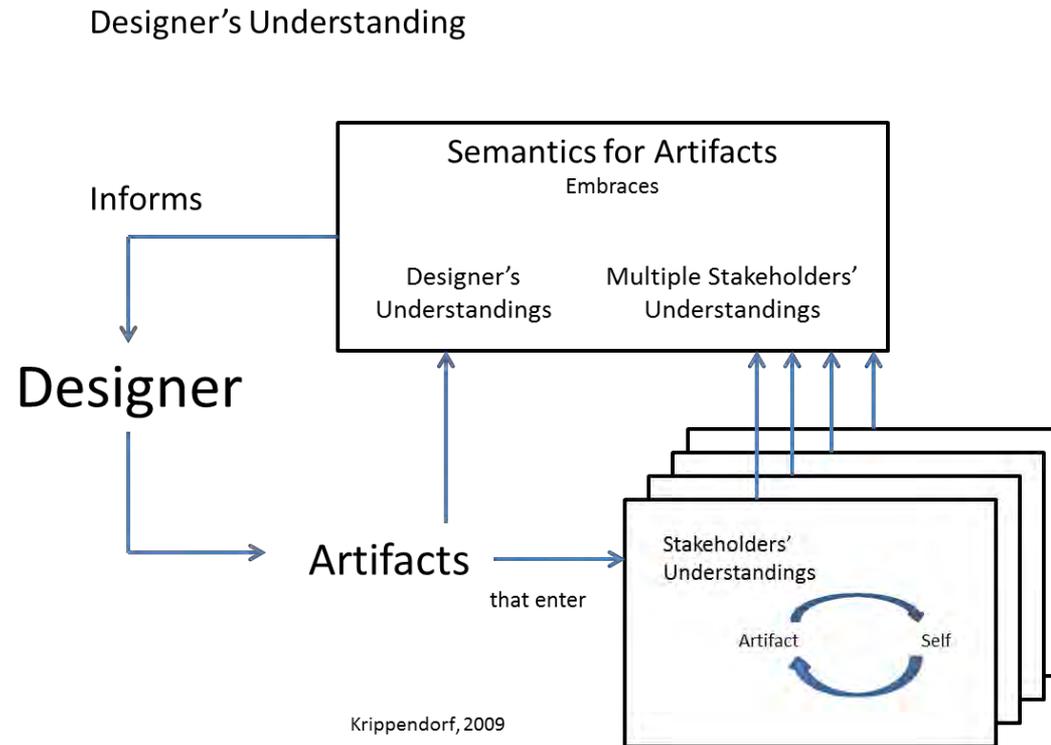
# Course Design Evolution

- Advanced Military Studies Course, 2007
- DS 592: Critical Operational Epistemology
- Solving Complex Problems
- Growing controversy



# Conclusions

- “Endogenizing Design”
- The intersection of theory and practice
- Creating staff capacity
- Friction and Champions
  - NIMBYs vs. Early Adopters



# References

- Klaus Krippendorf, *The Semantic Turn: A New Foundation for Design*, 2006.
- Donald A. Schön, *Educating the Reflective Practitioner*, 1987.
- Mikkel Rasmussen, *The Risk Society at War*, 2006.
- Bent Flyvbjerg, *Making Social Science Matter*, 2001.
- M. Ann Welsh; Gordon E. Dehler, “Combining Critical Reflection and Design Thinking to Develop Integrative Learners”, *Journal of Management Education*, 37(6) 2012.
- Chris Argyris, “Teaching Smart People How to Learn”, *Harvard Business Review*, May-June 1991.
- Col. Stefan Banach; Alex Ryan, “The Art of Design: A Design Methodology”, *Military Review*, March-April 2009.
- Maj. Ben Zweibelson, “Seven Design Considerations”, *Military Review*, November-December 2012.
- T. C. Greenwood; T.X. Hammes, “War Planning for Wicked Problems”, *Armed Forces Journal*, December 2009.

# Systems Thinking

*...the “beer game” in a military context*



*“The challenge of systems thinking lies in the ability to identify patterns by analyzing the system as a whole instead of focusing on isolated events or factors...”*

Bently, B. & Davy, M., *Military Decision Making and Soft Systems Methodology*, (26)

*“Dividing an elephant in half does not produce two small elephants.”*

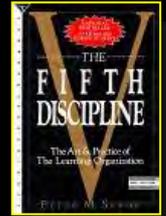
Peter M. Senge, *The Fifth Discipline*, (66)

Col K.G. Whale

11 April, 2017

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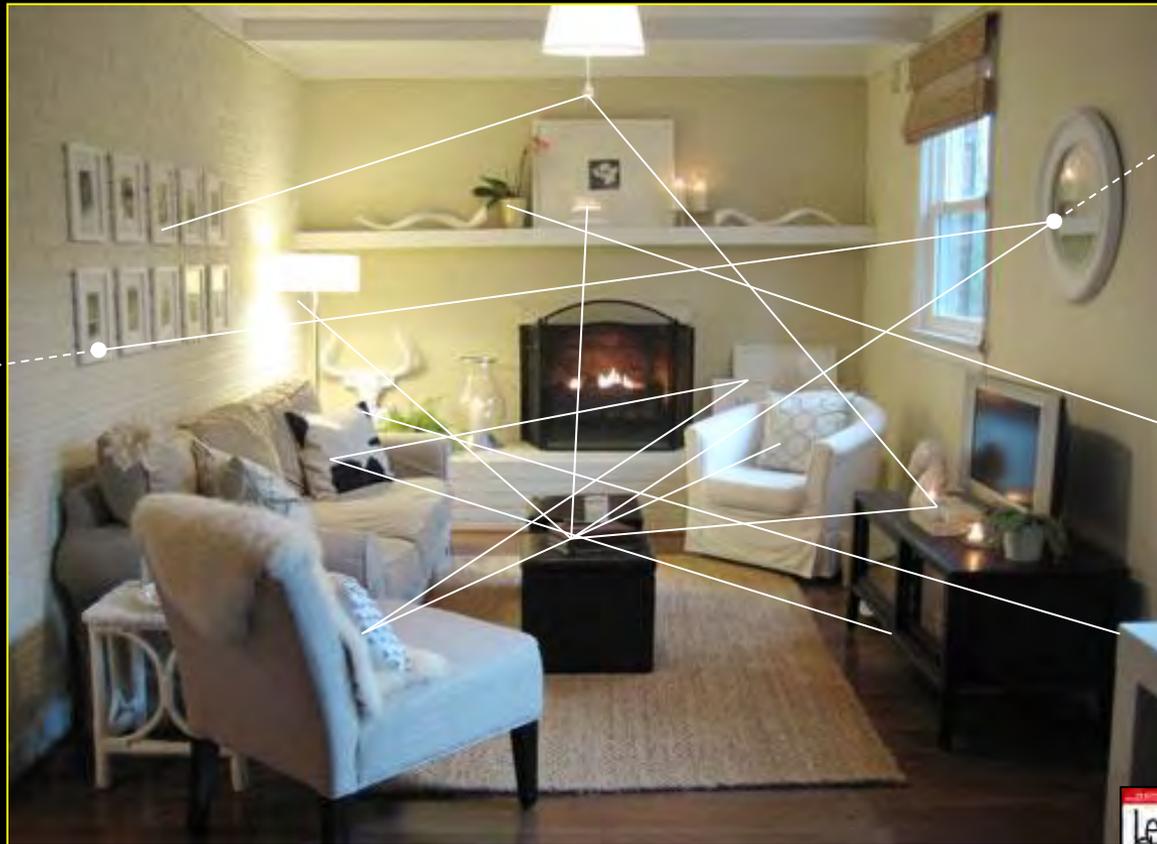
# Outline



- Why Systems Thinking?
- Complicated vs. Complex
- The Beer Game
- Applying The Beer Game in a Military Context
- Questions

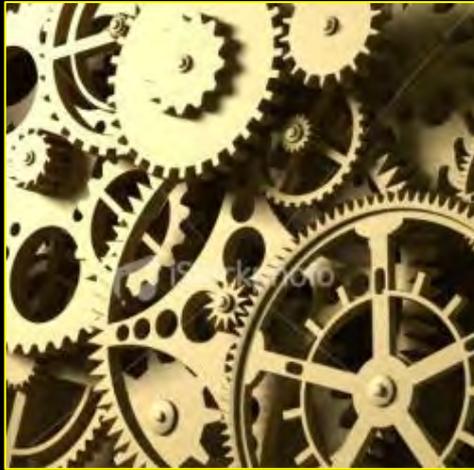
# Why Systems Thinking?

- because in a complex strategic environment the answer is rarely, if ever, linear...



# Systems

## Complicated or Complex?



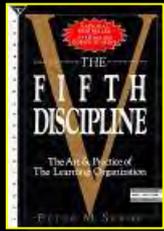
- Logical
- Linear & inflexible
- Predictable
- Proportional
  - output is direct result of input
- Additive
  - whole = sum of parts
- External environment has little impact



- Often illogical
- Non-linear & adaptive
- Often un-predictable
- Un-proportional
  - output varies with the same input
- Non-additive
  - whole > sum of parts
- External environment can have large impact

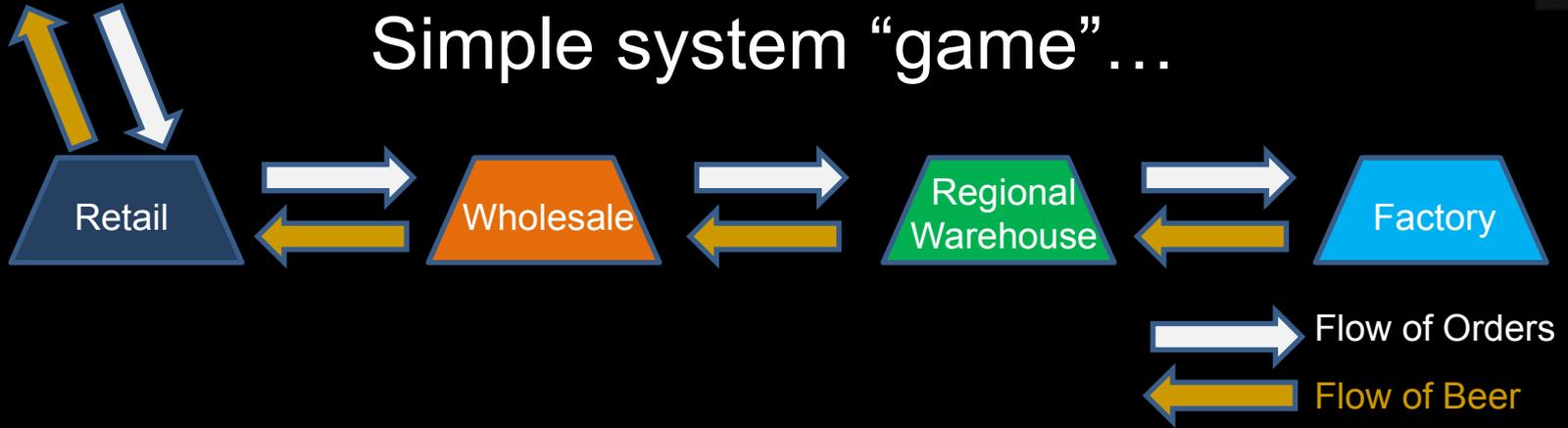


# The Beer Game



Customers

Simple system “game”...

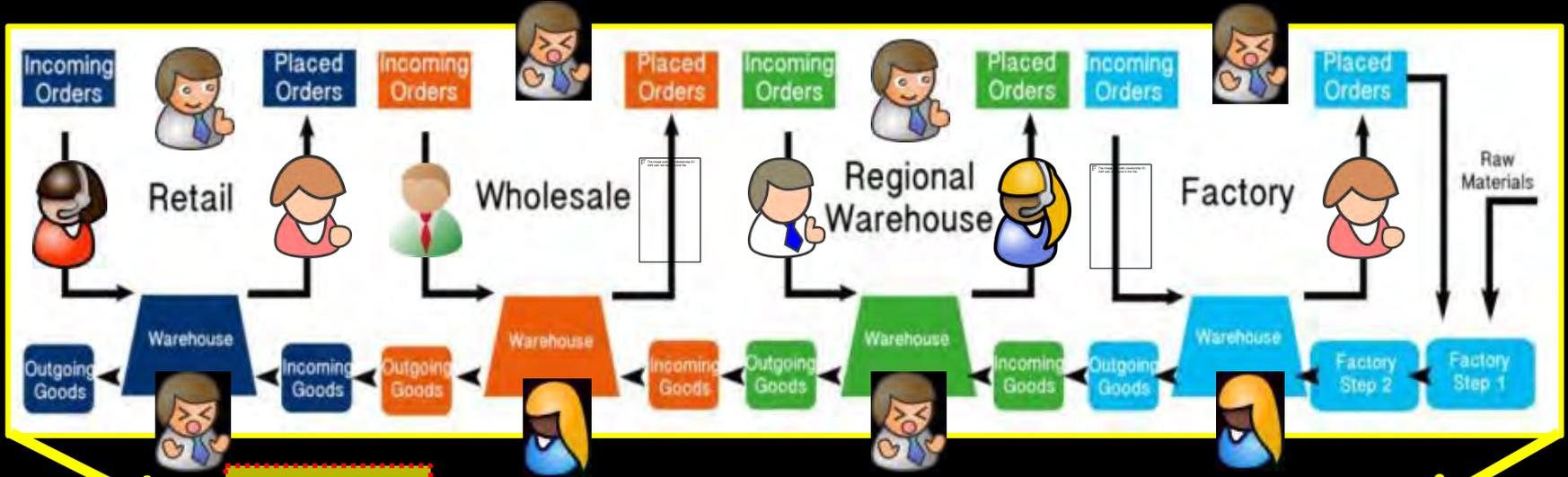


Complicated System?



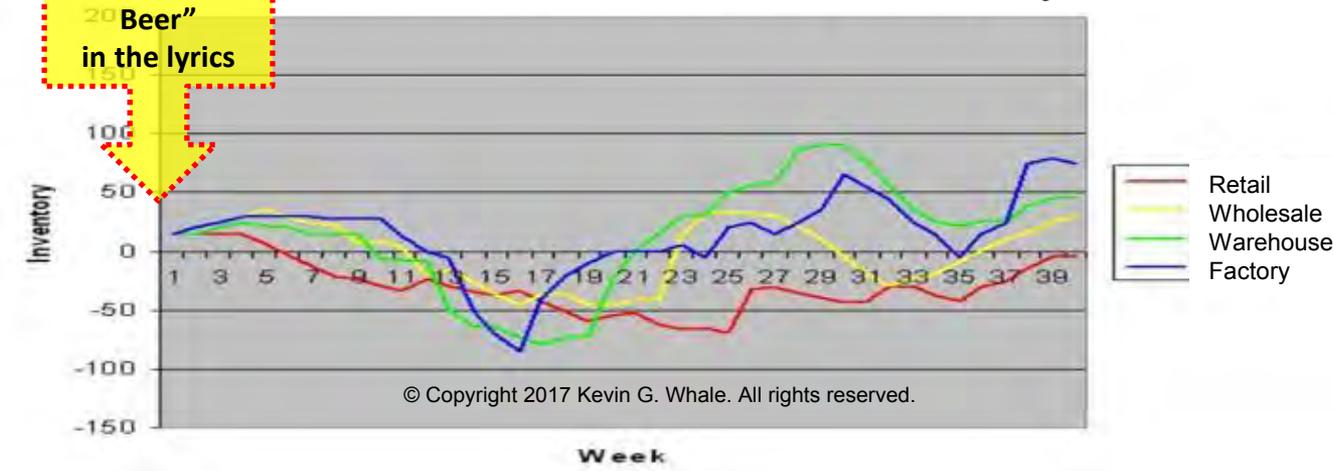
# The "Lover's Beer" Game

## Complex System!



Rock video is released with "Lover's Beer" in the lyrics

### Lover's Beer Game Results...Every Time!

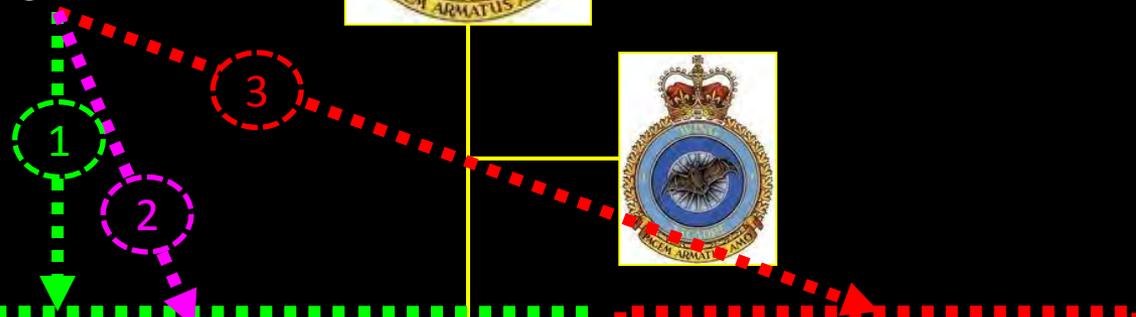


# Applying the Beer Game in a Military Context

# 1 Wing (tactical aviation) 1990s Cold War Design

Linear/Complicated  
System?

- 3 X independent “Sabre” Sqns
- One per Army Brigade



400  
Borden



403  
Gagetown



408  
Edmonton



427  
Petawawa



430  
Valcartier



438  
St Hubert



450  
Ottawa



# OP RENAISSANCE Avn Det for Philippines Relief

...a full system effort...



- **1 Wg HQ, Kingston**

- tactical C2 of Avn Det force generation via JFACC
- battle rhythm surge
- Load Master & RMS support at APOE

- **400 Sqn, Borden**

- provision of 1 X CH146, aircraft prep/load team, air transport kits, eqpt

- **403 Sqn, Gagetown**

- provision of Log/Mov O at APOE, ALSE gear

- **408 Sqn, Edmonton**

- generate Avn Det pers, vehs, equipment
- pack, load, deploy

- **427 Sqn, Petawawa**

- provision of CH146 Contingency Response Kit

- **430 Sqn, Valcartier**

- provision of 2 X CH146, vehs & augmentee stby
- ready to provide additional 3 pack if required

- **438 Sqn, St Hubert**

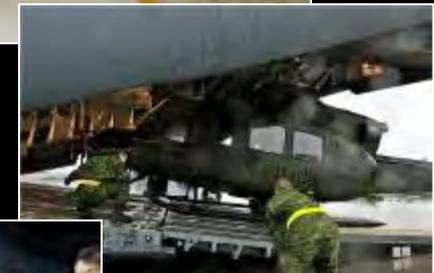
- provision of mission kit, augmentee stand-by

- **450 Sqn, Petawawa**

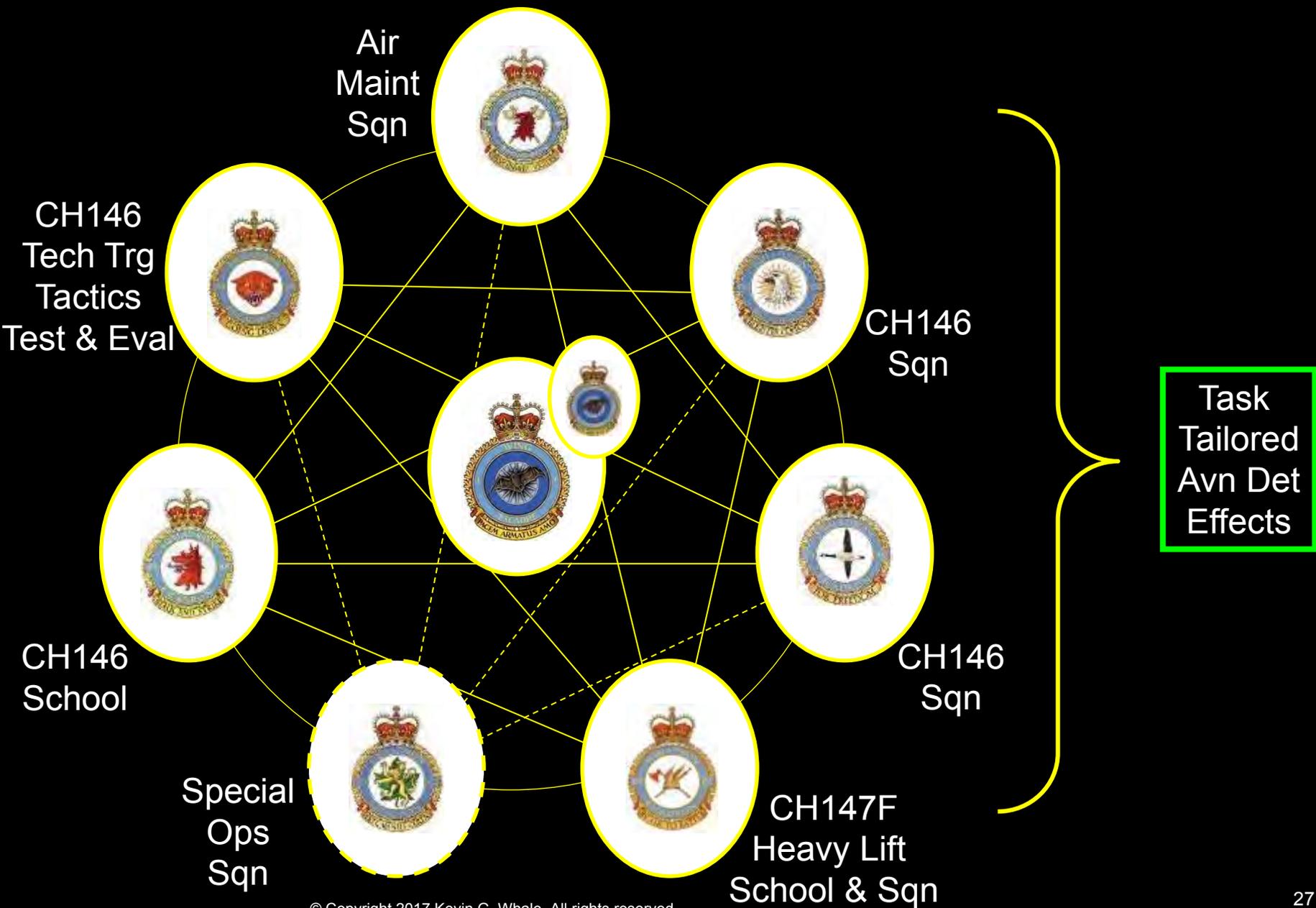
- Provision of DART ALO, Traffic Tech at APOE

- **Plus...**

- 1 CAD/CANR HQ, Winnipeg, key staff coord
- 8 Wing, Trenton, Ops-424 Sqn-436 Sqn-24 H Svcs Unit support
- 1<sup>st</sup> Cdn Div, Kingston, DART force generation lead
- 3<sup>rd</sup> Cdn Div/1 ASG, Edmonton, support to 408 pers prep
- 4<sup>th</sup> Cdn Div/2 Svc Bn, Petawawa, deliver pers wpons for recce party
- ADM(Mat)/DAEPM(TH), Ottawa, CH146 Wpn System Manager support
- Industry Partner - Bell Helicopter Textron Canada, Montreal, CH146 parts prioritization & OEM support
- and, and, and...



# 1 Wing Restructure 2013-2017 - System of Systems



# 1 Wing Restructure 2013-2017

## Required Regular Force Position Changes

Complicated?

Squadrons	2012	2017	Change
<b>Wg HQ</b>	75	73	<b>-2</b>
<b>400</b>	68	114	<b>46</b>
<b>403</b>	166	151	<b>-15</b>
<b>408</b>	228	199	<b>-29</b>
<b>427</b>	247	247	<b>0</b>
<b>430</b>	186	199	<b>13</b>
<b>438</b>	103	92	<b>-11</b>
	<b>1073</b>	<b>1075</b>	<b>2</b>

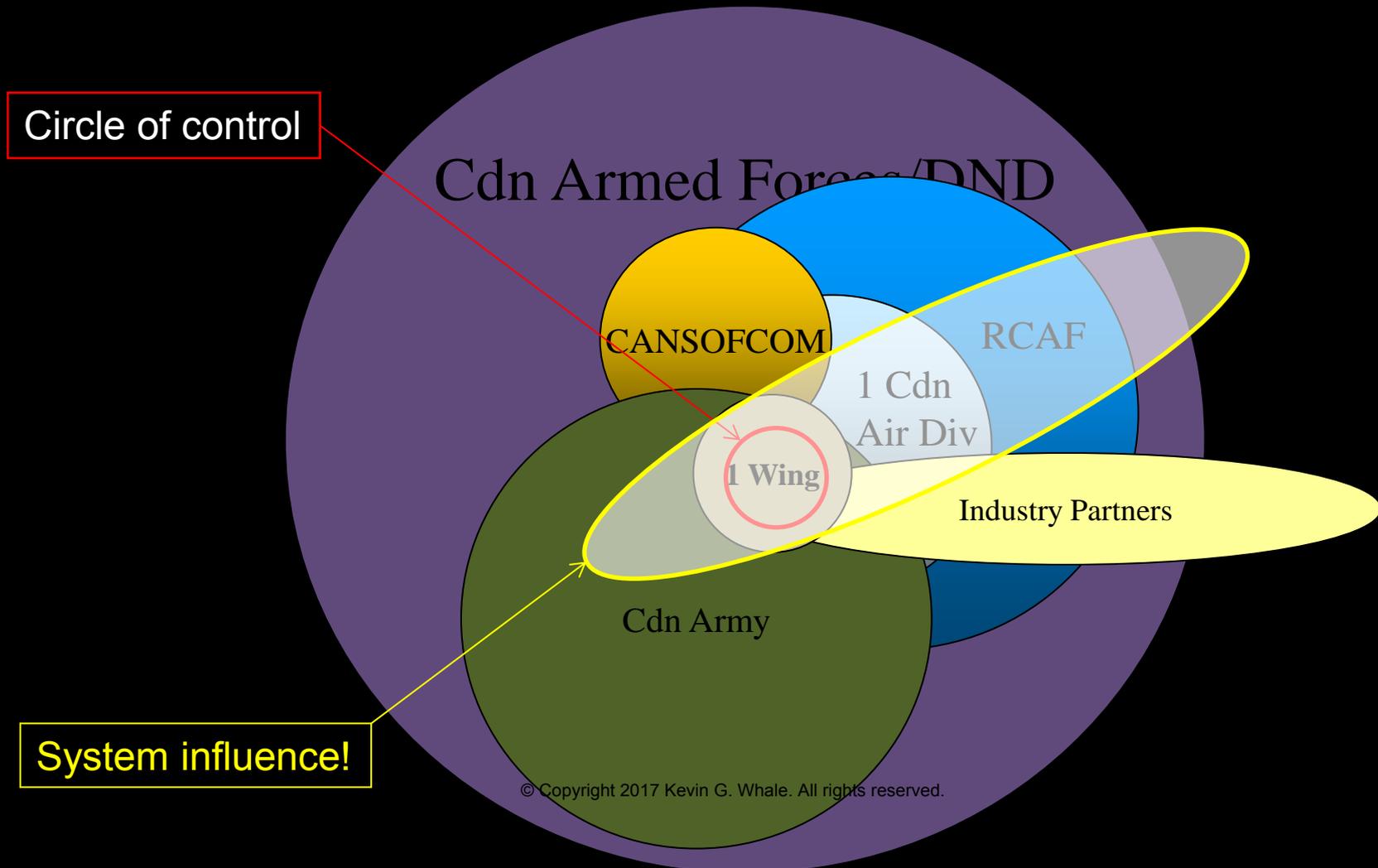
# 1 Wing Restructure 2013-2017

## Required Regular Force Position Changes

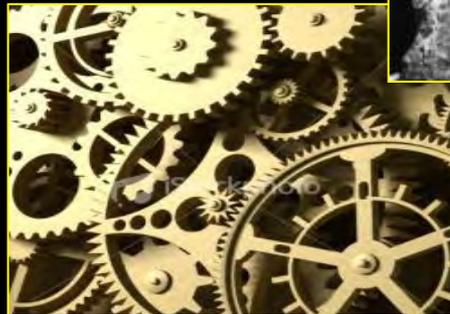
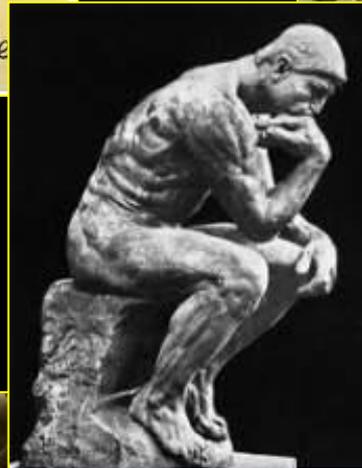
# Complex!

MOC	APS 12								APS 17								MOC				
	400 Sqn	403 Sqn	408 Sqn	427 Sqn	430 Sqn	438 Sqn	1 Wg HQ	APS 12 TOTAL	400 Sqn	403 Sqn	408 Sqn	427 Sqn	430 Sqn	438 Sqn	1 Wg HQ	APS 17 TOTAL		DELTA UTTH	450 Sqn	DELTA w/ MHLH	
AC OP - RDR		3	4	7	3	1		18		3	3	7	3		16	-2		-2		AC OP - RDR	
ACS TECH	7	9	14	9	11	7		57	16	10	13	9	13	5		80	9	14	23		ACS TECH
AEC		2	1	1	1			5		1	1	1	1			4	-1		-1		AEC
AERE	1	6	2	2	2	2	7	22	5	3	3	2	3	5	5	31	4	5	9		AERE
AM SUP	2	3	3	4	3	3	5	23	6	3	3	4	3	3	4	37	3	11	14		AM SUP
ANY				1			2	3				1			2	3					ANY
ATIS TECH	1	2	2	2	1			8	1	3	3	2	3	2		15	6	1	7		ATIS TECH
AVN TECH	14	35	48	55	35	32		219	52	37	38	53	38	29		355	28	108	136		AVN TECH
AVS TECH	12	16	21	22	13	22	1	107	25	14	17	22	17	16	1	168	5	56	61		AVS TECH
AWS TECH	1	2	2		2	1	2	10			2	2	2	1	4	18	1	7	8		AWS TECH
COOK			4	3	3			10			3	3	3			14	-1	5	4		COOK
CWO		1	1	1	1		3	7		1	1	1	1		3	8		1	1		CWO
FCS TECH																1		1	1		FCS TECH
FLT ENGR	10	17	27	28	21	12	3	118		18	21	28	21	7	3	123	-20	25	5		FLT ENGR
IMAGE TECH		1						1									-1		-1		IMAGE TECH
INT OP		1	2	2	2		3	10			5	2	5	1	2	23	5	8	13		INT OP
LCIS TECH			1	1	1			3			1					1	-2		-2		LCIS TECH
LOAD MASTER							1	1							1	26		25	25		LOAD MASTER
LOG AIR	1	1	1	1	1	1	4	10		1	2	1	2		4	13		3	3		LOG AIR
MSN SPEC		1	3	5	3	1		13			2	5	2	1		15	-3	5	2		MSN SPEC
MET TECH			3	3	3			9			3	3	3			12		3	3		MET TECH
MSE OP	1	3	6	10	6	1		27		3	5	10	5			34	-4	11	7		MSE OP
NDT TECH																5		5	5		NDT TECH
PAO							1	1							1	1					PAO
PLT	9	43	50	57	46	10	31	246	2	36	45	57	45	13	31	287	-17	58	41		PLT
RMS CLK	2	8	7	8	7	3	9	44	4	6	7	8	7	3	9	56		12	12		RMS CLK
SIG OP/ACCIS	1	2	8	9	7		1	28		2	7	9	7	1	1	36	-1	9	8		SIG OP/ACCIS
SUP TECH	4	7	9	9	7	5	1	42	3	7	8	9	8	4	1	59	-2	19	17		SUP TECH
TRG DEV		1					1	2		1					1	3		1	1		TRG DEV
VEH TECH	2	2	9	7	7	2		29		2	7	7	7	1		30	-5	6	1		VEH TECH
W TECH L																2		2	2		W TECH L
Total	68	166	228	247	186	103	75	1073	114	151	199	247	199	92	73	1476	2	401	403		Total
Change									46	-15	-29	0	13	-11	-2	0					Change

# The Tactical Aviation Enterprise (TAE) (a system of systems)



# Questions...



# PLAYING TO WIN: SYSTEMS THINKING AND DESIGN IN CANSOFCOM

**LCol James Chorley**  
**CANSOFCOM**  
**11 April 17**

# OUTLINE

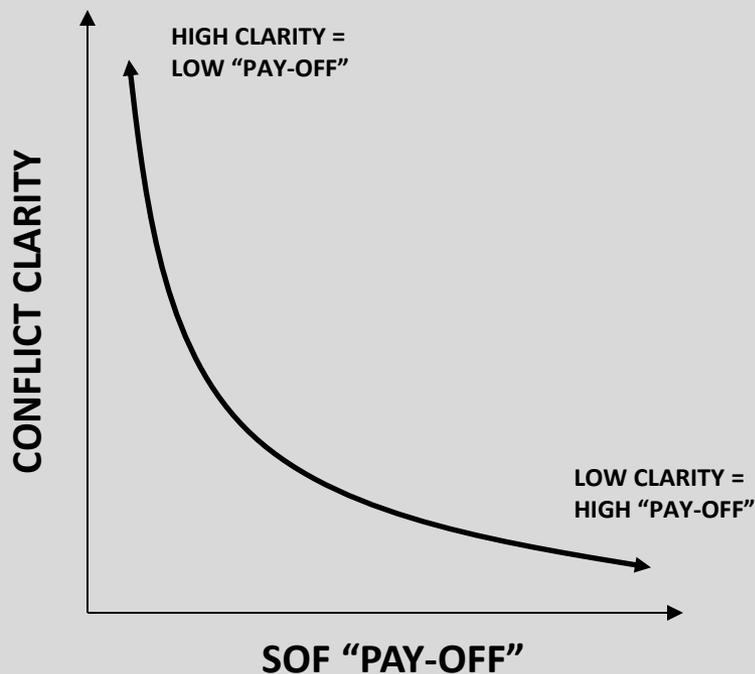
- **CONTEXT (PAYOFF)**
- **HYPOTHESES**
- **TACTICAL /  
OPERATIONAL  
PLANNING**
- **STRATEGIC  
PLANNING**
- **QUESTIONS**



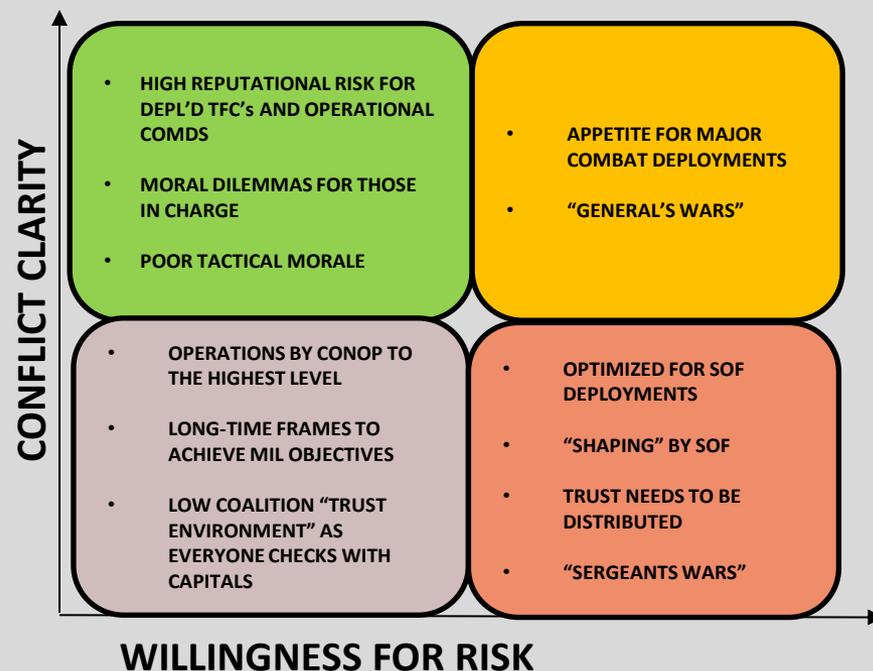
# CONTEXT (PAYOFF)



CANADIAN SPECIAL OPERATIONS FORCES COMMAND



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# TWO HYPOTHESES

CANADIAN SPECIAL OPERATIONS FORCES COMMAND



**HYPOTHESIS #1: CULTURE IS THE PRIMARY DRIVER FOR HOW YOUR ORGANIZATION APPROACHES PLANS AND PLANNING**

**HYPOTHESIS #2: IN LARGE, JOINT, COMBINED OR INTERAGENCY SCENARIOS - PLANNING (TOOLS, PROCESS AND METHODOLOGY) “SINK” TO THE LOWEST LEVELS OF THE DOMINANT CULTURE**

# CANSOF PLANNING

CANADIAN SPECIAL OPERATIONS FORCES COMMAND



- **PROBLEM DEFINITION IS #1 PRIORITY**
- **LEAN BY DESIGN**
- **PRECARIOUS VALUE / NATURE OF HQ**
- **INCREASINGLY MULTI-DISCIPLINARY WRT STAFF COLLABORATION (INTERNAL and EXTERNAL)**
- **DESIGN-LIKE (or light)**

# CANSOF PLANNING

CANADIAN SPECIAL OPERATIONS FORCES COMMAND

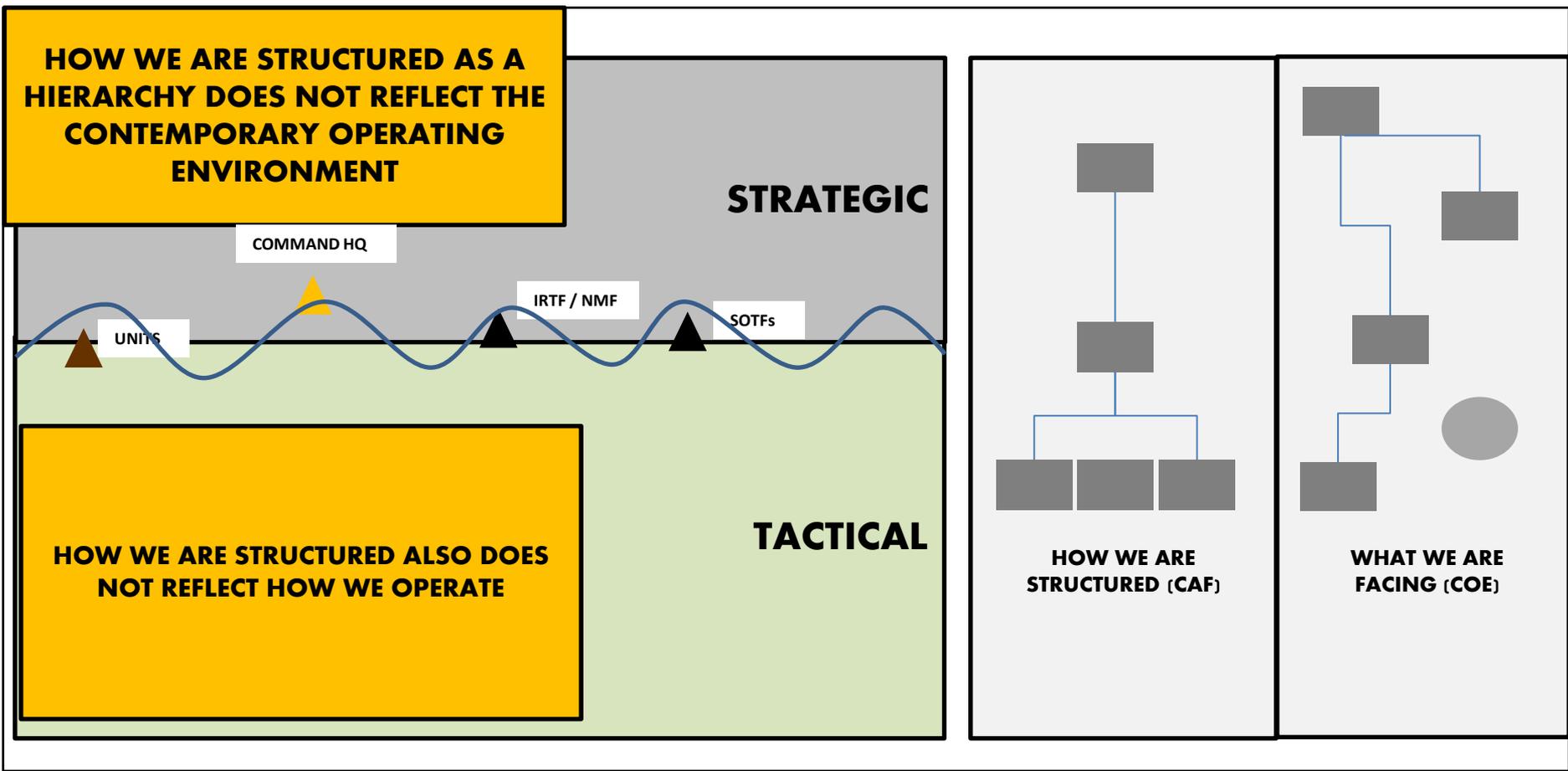


- **EMPHASIS ON COMMANDERS (AT ALL LEVELS) AND PRESERVING COMMANDER'S DISCRETIONARY SPACE**
- **UNDERSTANDING ARAs (AUTHORITIES, RESPONSIBILITIES AND ACCOUNTABILITIES)**
- **ARTICULATING AND MITIGATION OF RISK IS MOST IMPORTANT OUTPUT**
- **MAXIMIZING ACCEPTABLE CHAOS IN PLANNING AND EXECUTION**
- **IF IN DOUBT, DEVELOP THE SITUATION...(BIASED TOWARDS ACTION)**

# STRATEGIC PLANNING



CANADIAN SPECIAL OPERATIONS FORCES COMMAND



# CANSOF PLANNING

CANADIAN SPECIAL OPERATIONS FORCES COMMAND



- **THE SPACE BETWEEN MIL/POL/STRAT**
- **THE VIRTUAL OPERATIONAL LEVEL (PLANNING BUT NOT EXECUTION)**
- **SUPPORTED / SUPPORTING COMMAND, CONTROL AND PLANNING RELATIONSHIPS but....**
- **DEFINITION OF OPERATIONAL RELATIONSHIP IN COALITION ENVIRONMENT IS CRUCIAL (ADCON v OPCON for example)**

# TWO HYPOTHESES

CANADIAN SPECIAL OPERATIONS FORCES COMMAND



**HYPOTHESIS #1: CULTURE IS THE PRIMARY DRIVER FOR HOW YOUR ORGANIZATION APPROACHES PLANS AND PLANNING**

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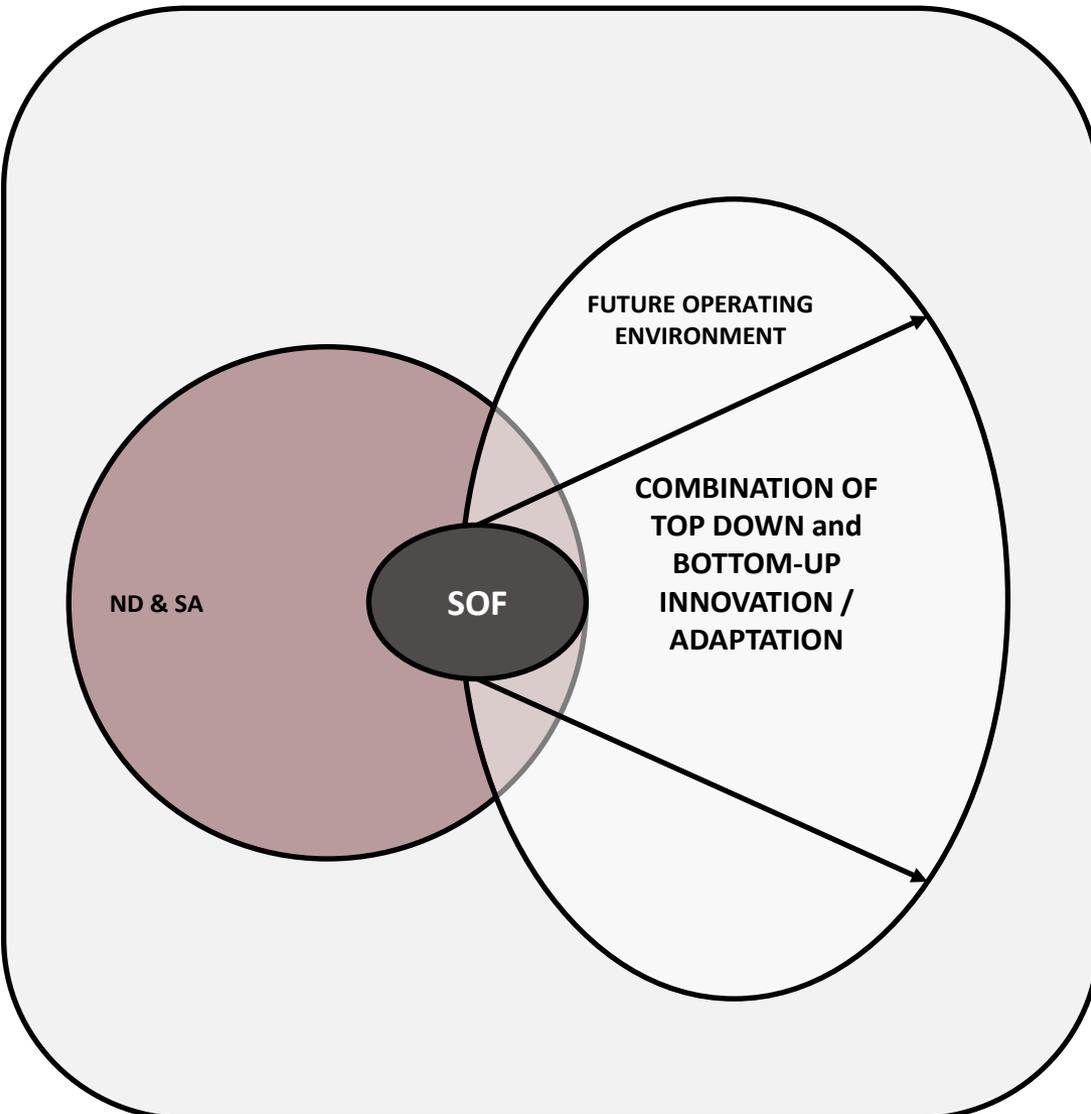
# STRATEGIC PLANNING



# RESTRAINT as CRITICAL



CANADIAN SPECIAL OPERATIONS FORCES COMMAND



Δ WARFARE	= INNOVATION + ADAPTATION
LEGITIMACY	= EXISTENCE WITHIN ND&SA ARCHITECTURE
CONVERGENCE	= CULTURE AS KEY

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# STRAT PLANNING



## CANADIAN SPECIAL OPERATIONS FORCES COMMAND

- **Future by CONOP**
- **Future by Moonshot**
- **The Imitation Game**
- **The 5-Year Plan**
- **The Hedge**

# QUESTIONS & DISCUSSION

