Conceive Potential Solutions – TRIAD Building System…

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INCOSE UK Annual Systems Engineering Conference 2011

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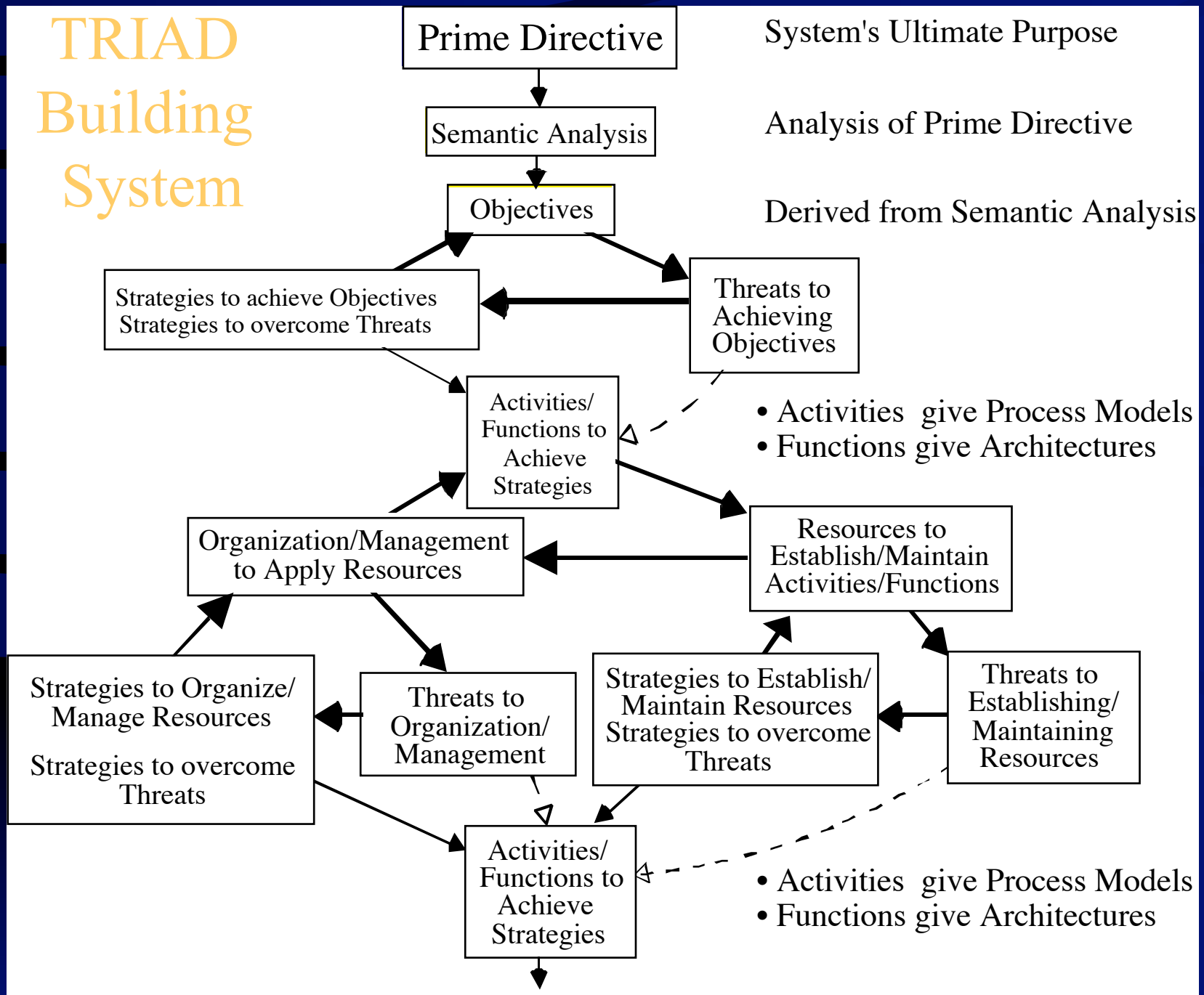
Conceive Potential Solutions (brief)

Derek Hitchins

Concept Development

The TRIAD Building System

TRIAD Building System



Using the TRIAD Building System —the Prime Directive

- Prime Directive = ultimate statement of purpose
- For Mobile Land Force, might be:
  1. To neutralize enemies in open desert and tundra regions around the world
  2. To deter potential enemies from operating in desert and tundra regions
- 1 subsumes 2, therefore 1 preferred
- PD is intentionally bare, with minimal assumptions

Semantic Analysis

- To neutralize …
- enemies in…
- open desert and…
- tundra regions…
- …around the world

- To render ineffective…
- those opposed to the US as identified by UN directive ABC existing and/or operating in…
- open, desolate, largely uninhabited tracts…
- and Arctic plains with permanently frozen subsoil, lichens, mosses, and dwarfed vegetation…
- wherever sanctioned by the UN

N.B. Definitions of desert and tundra areas quite inadequate.

Objectives from Semantic Analysis

Semantic Analysis

- To render ineffective…
- those opposed to the US as identified by UN directive ABC existing and/or operating in…
- open, desolate, largely uninhabited tracts…
- and Arctic plains with permanently frozen subsoil, lichens, mosses, and dwarfed vegetation…
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Implicit Objectives

- To deploy swiftly
- To operate over wide areas radially different environments, temperatures, going, etc.
- To move rapidly to scenes of incursion/activity
- To identify legitimate enemies specifically
- To engage and deter, or overcome
- To operate within a UN mandate at all times

Strategies

Objectives

- To deploy swiftly
- To operate over wide areas radically different environments, temperatures, going, etc.
- To move rapidly to scenes of incursion/activity
- To identify legitimate enemies specifically
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- To operate within a UN mandate at all times

Strategies to Achieve Objectives

- Air transportable
- Air deliverable
- High powered, high speed, all terrain vehicles
- UMAs for remote identification and engagement where appropriate
- Vehicles to operate and fight on the move as an integrated unit, for speed, area coverage, avoidance of detection
- Fleet formation management to reduce enemy threat - open and tight, etc.
- Some vehicles to be self steering, but under control of personnel in nearby vehicle/command post.

Strategies to Overcome Threats

Objectives

- To deploy swiftly
- To operate over wide areas radically different environments, temperatures, going, etc.
- To move rapidly to scenes of incursion/activity
- To identify legitimate enemies specifically
- To engage and deter, or overcome
- To operate within a UN mandate at all times

Strategies to Overcome Threats to Achieving Objectives

- Pre-deployed cadre forces in area
- Some WS/vehicles specialized for hot, wet, cold, ice, etc. conditions
- Use of non-lethal force to neutralize
- Use of armoured UMAs to accelerate ahead of ground force
  - Equipped: psy-ops, loudspeakers, leaflets, stun weapons, non-lethal anti-riot weapons
  - Equipped: fuel-air and thermobaric weapons (to warn as well as neutralize) +short-range electromagnetic pulse (SREMP)
  - Equipped: canon, anti-tank missile, etc., anti-sniper lasers, enhanced remote ethnic/ nationality laser identification

From Strategies to Functions

Strategy

- Air transportable
- Air deliverable
- High powered, high speed, all terrain vehicles
- UMAs for remote identification and engagement where appropriate
- Vehicles to operate and fight on the move as an integrated unit, for speed, area coverage, avoidance of detection
- Fleet formation management to reduce enemy threat - open and tight, etc.
- Some vehicles to be partly robotic, but under control of personnel in nearby vehicle/command post.

Implied Function

- Dedicated air transport
- Palletised low-altitude insertion
- Highly-specialized vehicles
- UMA launch, control, operate and recover—on the move!
- UMA turn-round, repair, refuel, rearm, re-equip—on the move!
- Formation control: reacts to threat, disperses, closes, re-arranges vehicle formations in face of threat from terrain and enemy
- Mobile repair units, operating on the move
- Short-range communications for security, "silent" running

From Strategies to Functions

Strategy

- Pre-deployed cadre forces in area
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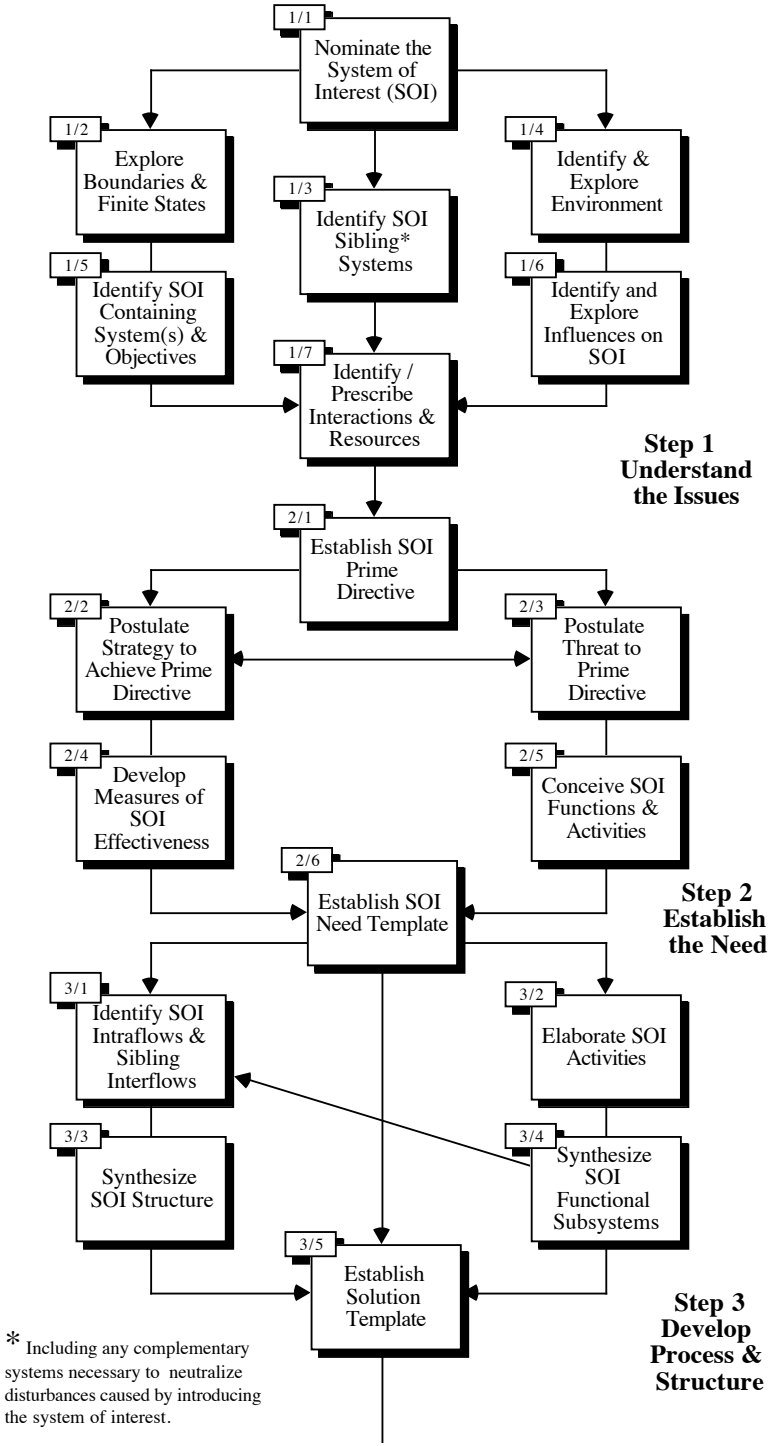
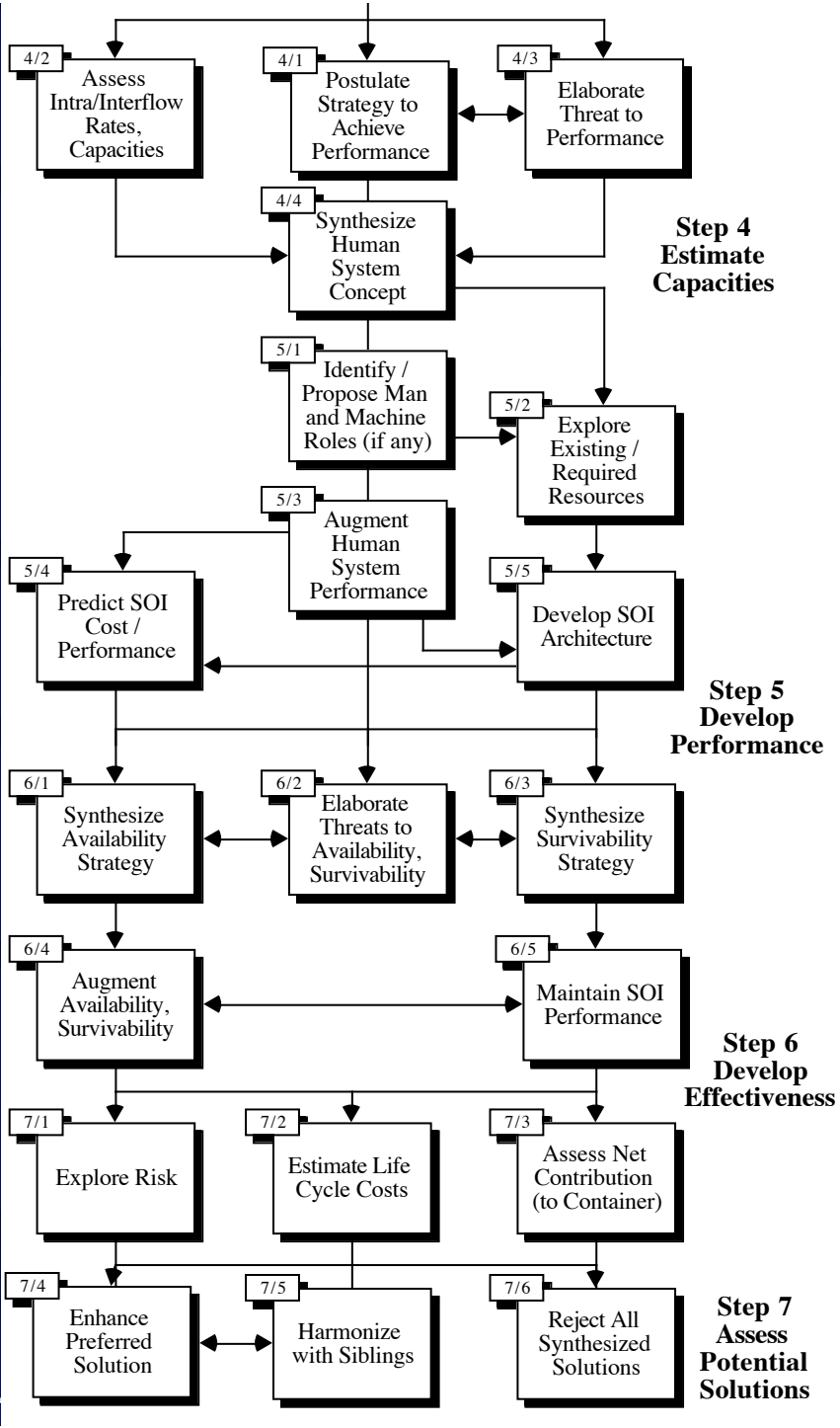
Implied Function

- Cadre forces maintenance, communications and intelligence
- Special vehicle support
- Lethal weapons training/practice
- Non-lethal weapons training
- Fuel-air and thermobaric weapons training/practice
- Human target identification
- Sniper location
- Real-time control of Rules of Engagement

Putting Flesh on the Bones
The Seven-Step Continuum

A codified approach, ensuring thoroughness, coverage and speed.


1/1
Nominate the System of Interest (SOI)
1/2
Explore Boundaries & Finite States
1/3
Identify SOI Sibling* Systems
1/4
Identify & Explore Environment
1/5
Identify SOI Containing System(s) & Objectives
1/6
Identify and Explore Influences on SOI
1/7
Identify / Prescribe Interactions & Resources
Step 1 Understand the Issues
2/1
Establish SOI Prime Directive
2/2
Postulate Strategy to Achieve Prime Directive
2/3
Postulate Threat to Prime Directive
2/4
Develop Measures of SOI Effectiveness
2/5
Conceive SOI Functions & Activities
2/6
Establish SOI Need Template
Step 2 Establish the Need
3/1
Identify SOI Intraflows & Sibling Interflows
3/2
Elaborate SOI Activities
3/3
Synthesize SOI Structure
3/4
Synthesize SOI Functional Subsystems
3/5
Establish Solution Template
Step 3 Develop Process & Structure
* Including any complementary systems necessary to neutralize disturbances caused by introducing the system of interest.


4/2
Assess Intra/Interflow Rates, Capacities
4/1
Postulate Strategy to Achieve Performance
4/3
Elaborate Threat to Performance
4/4
Synthesize Human System Concept
Step 4 Estimate Capacities
5/1
Identify / Propose Man and Machine Roles (if any)
5/2
Explore Existing / Required Resources
5/3
Augment Human System Performance
5/4
Predict SOI Cost / Performance
5/5
Develop SOI Architecture
Step 5 Develop Performance
6/1
Synthesize Availability Strategy
6/2
Elaborate Threats to Availability, Survivability
6/3
Synthesize Survivability Strategy
6/4
Augment Availability, Survivability
6/5
Maintain SOI Performance
Step 6 Develop Effectiveness
7/1
Explore Risk
7/2
Estimate Life Cycle Costs
7/3
Assess Net Contribution (to Container)
7/4
Enhance Preferred Solution
7/5
Harmonize with Siblings
7/6
Reject All Synthesized Solutions
Step 7 Assess Potential Solutions

dkh©200

SSC - Step 1

1/1 Nominate System of Interest: Mobile Land Force 2010

1/2 Explore Boundaries and Finite States: Complementary set of interacting, all terrain, fighting vehicles operating multiple UAVs after the manner of a land-based aircraft carrier task force. States: training, standby, operational, recovery, turnround & repair

1/3 Identify SOI Sibling Systems: air transport, air insertion, air recovery, satellite intelligence, satellite comm/nav, logistic support, repair facilities, vehicle recovery

1/4 Identify & Explore Environment: desert & tundra, varied, wide temperature variation, plains with rocky outcrops, frozen lakes, little vegetation, v.sparsely populated if at all

1/5 Identify SOI Containing System and Objectives: US Global Peace Command. To neutralize enemy incursions into UN designated global deserts and tundra

1/6 Identify and Explore Influences on SOI: Political desire to operate without loss of US lives. UN desire to operate without loss of any lives. US belief in advanced hi-tech weapon systems. US defense business interest in developing advanced, non-lethal weapons

1/7 Identify and Prescribe Interactions and Resources: Air Transport and Insertion; resupply; intelligence; RoE; fuel, weapons and consumables; UAVs; trained operators; repair staff, logisticians, communications, satellite navigation, etc., etc.

SSC–Step 2

2/1 Establish SOI Prime Directive: to neutralize enemy incursions into UN designated desert and tundra swiftly and with minimal loss of life

2/2 Postulate Strategy to achieve PD: see TRIAD Building System

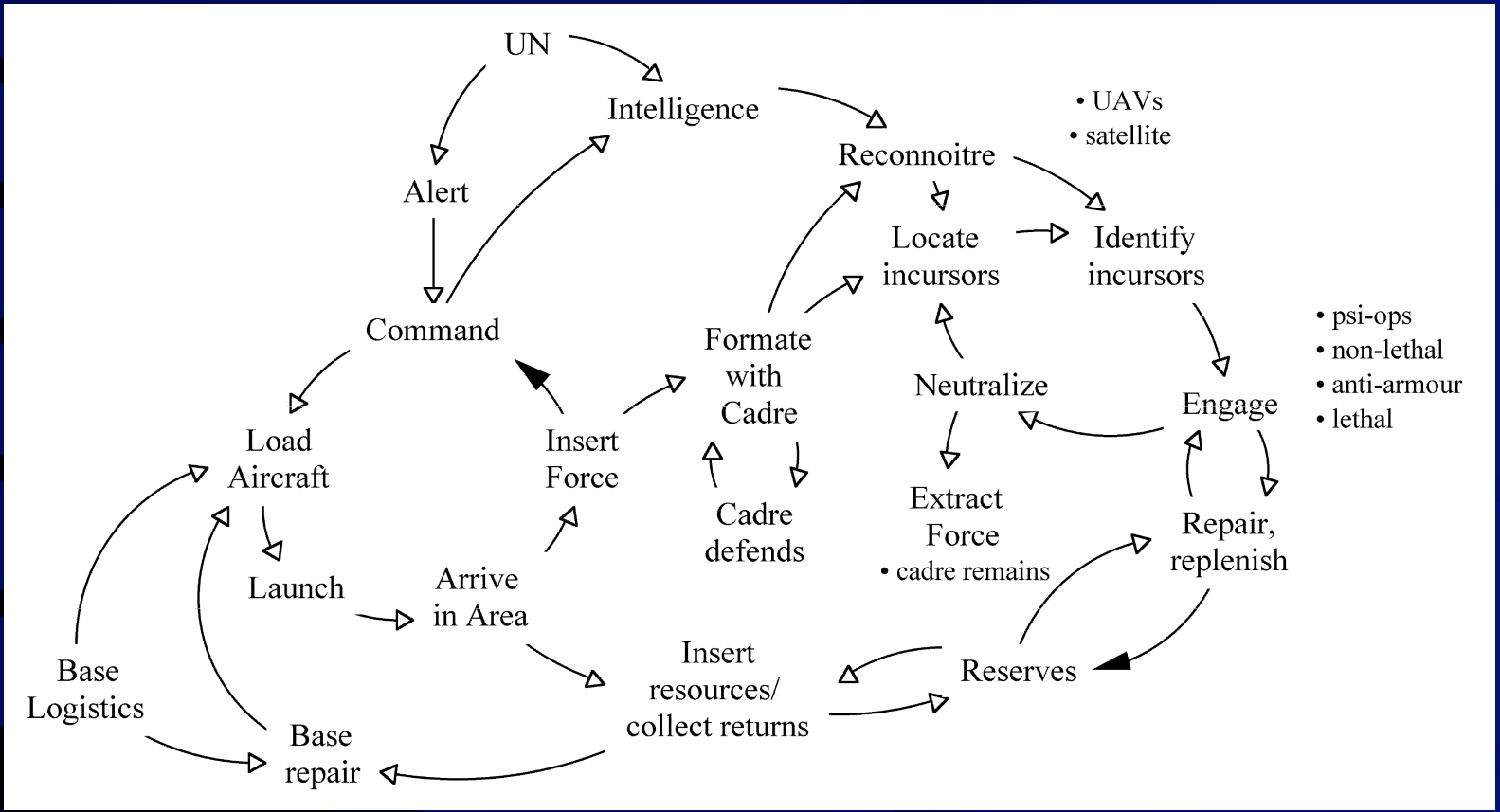
2/3 Postulate Threat to PD: see TRIAD Building System

2/4 Develop Measures of SOI Effectiveness:
a) time to scene b) time to neutralize c) degree of neutralization d) Blue casualties e) Red casualties f) operation costs & cost effectiveness g) cost exchange ratios h) casualty exchange ratios

2/5 Conceive SOI Functions and Activities:Time for CONOPS!

2/6 Establish SOI Needs Template:

Mobile Land Force CONOPS



- Still at high level—we have yet to posit solution options…
- Note continuity of operations: once started, continues until all "incursors" neutralized
- This CLM may be simulated, using a non-linear dynamic modelling tool, to investigate:
  - Time delays • logistics • Effects of operations on reserves, maintenance, and *vice versa*
- Results of simulation (= operations analysis) may invoke changes to CONOPS
  - e.g. should transport aircraft be on airborne QRA to minimize delays?

2/5 Conceive SOI Functions and Activities

Functions to Achieve Strategies

- Cadre forces maintenance, communications and intelligence
- Special vehicle support
- Lethal weapons training/practice
- Non-lethal weapons training
- Fuel-air and thermobaric weapons training/ practice
- Human target identification
- Sniper location
- Real-time control of Rules of Engagement
- Dedicated air transport
- Palletised low-altitude insertion
- Highly-specialized vehicles
- UMA launch, control, operate and recover—on the move!
- UMA turn-round, repair, refuel, rearm, re-equip—on the move!
- Formation control: reacts to threat, disperses, closes, re-arranges vehicle formations in face of threat from terrain and enemy
- Mobile repair units, operating on the move
- Short-range communications for security, "silent" running

Operational functions from CONOPS

- Intelligence development
- Reconnaissance
- Command & control
- Force extraction
- Base resupply / repair
- Force self defense

- Lists at left and above derived from operational considerations
- Ignore hosts of internal functions essential to establish and maintain any mobile, yet unified, fighting force
- These can be derived using a Generic Reference Model (GRM)

2/6. Requirements Template-Generic

- Now able to develop a Requirements Template
- Generic Version shows what we have done, and what remains…

S-O-I Prime Directive Semantic Analysis of Prime Directive		
Strategy for Achieving Prime Directive		
Behaviour	*Strategy*	*Management Set*
Aggression Discretion Co-operation	Strategy options Unifying concepts Innovative approaches	Mission management Viability management Resource management
Measures of S-O-I effectiveness	*Negative contribution factors*	*Threat to achieving PD*
Performance Availability Survivability	Cost Mass/weight/volume Complexity Failure modes/criticality	External Internal Environmental Political/economic/ social/technical

GRM—Doing

Internal Architecture Generation Table					
Mission Management *Management of…*		Viability Management *Management of…*		Resource Management *Management of…*	
GRM	SOI	GRM	SOI	GRM	SOI
–information	Com. centre Image Centre	–synergy	Formation management C2	…acquisition	CPRM Base Resupply Training
…objectives	CPRM	…survival	Formation management Self Defense System	…storage	Logistic support vehicles Ready use stores
…strategy & plans	Command & Control (C2)	…evolution	Performance Recording Systems	…distribution	Mobile Distribution Fleet
…execution	C2	…homeostasis	Climate control	…conversion	
…cooperation	C2	…maintenance	Mobile maintenance teams	…disposal	CPRM

CPRM: Contingency Planning and Resource Management

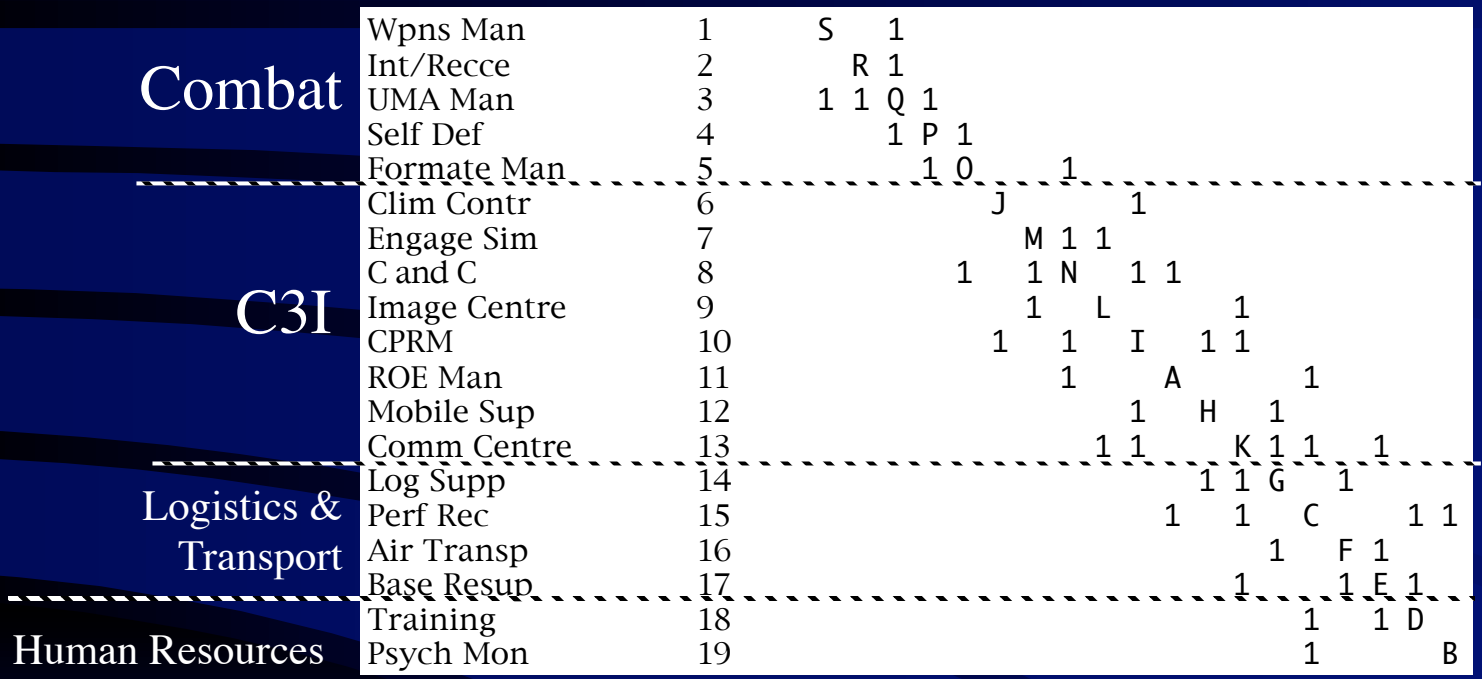
GRM—Thinking

Internal Architecture Generation Table					
Cognition Management *Management of…*		Selection Management *Management of…*		Stimulation Management *Management of…*	
GRM	SOI	GRM	SOI	GRM	SOI
…tacit knowledge	Desert & tundra combat experts OJT	–nature	Psychological monitoring … counselling	…motivation	Command and Control
…world models	Maps, satellite imagery, cultural perception	…experience	"Simulate before activate" practice	…activation	Command and Control
		…constraint	Rules of Engagement Discipline		

3/2. Land Force 2010. Omissions Identified

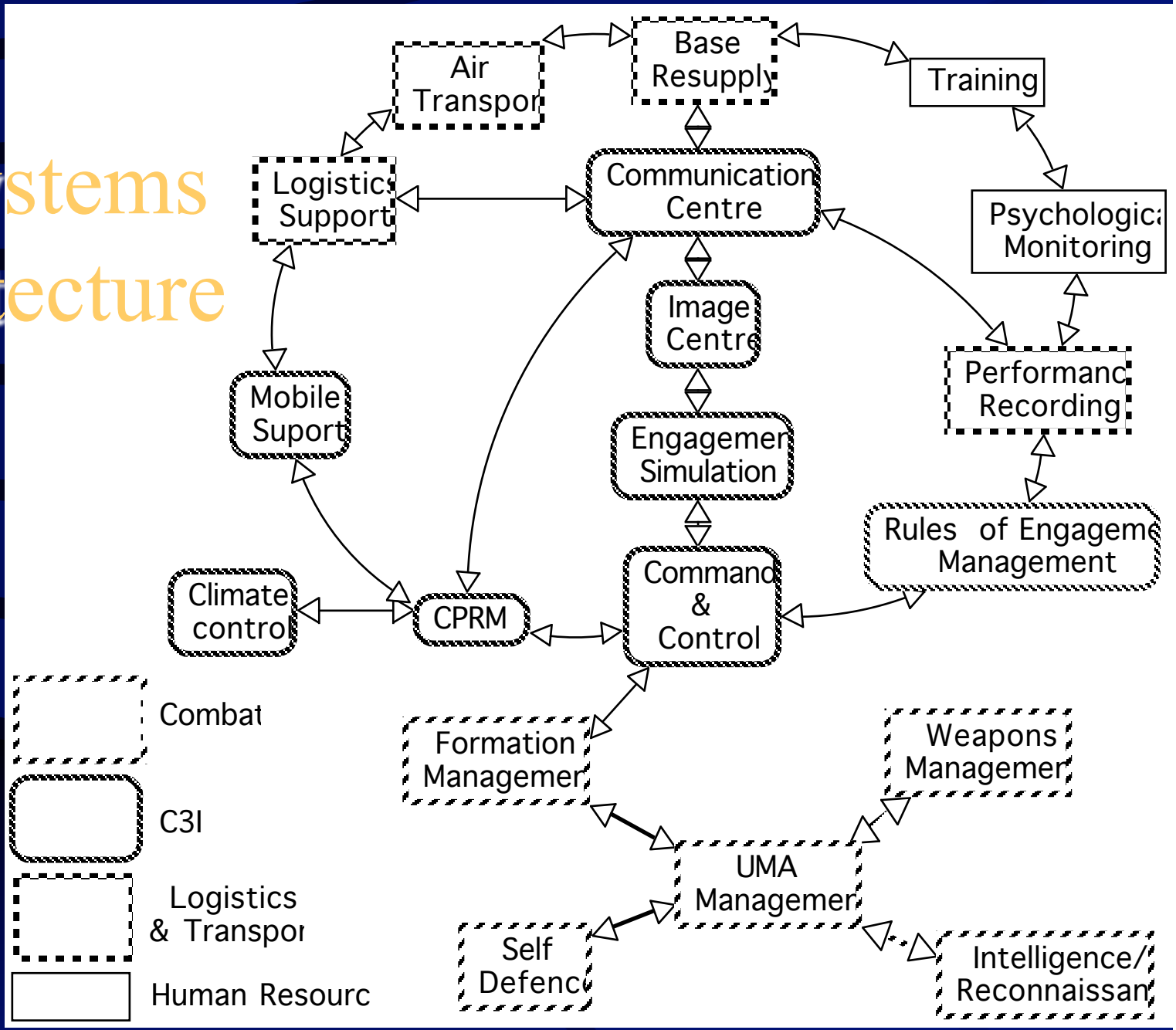
| | | |

3/4. Interacting Subsystems

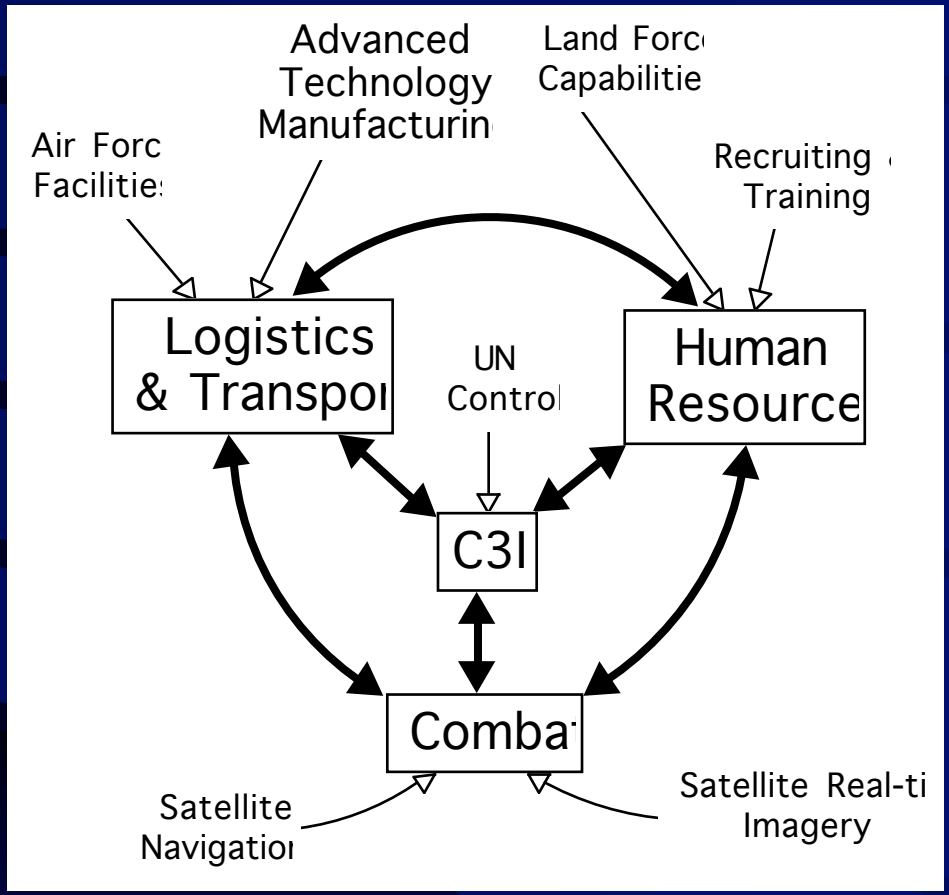


C3I: Command, control, communications and intelligence

3/3.Systems Architecture



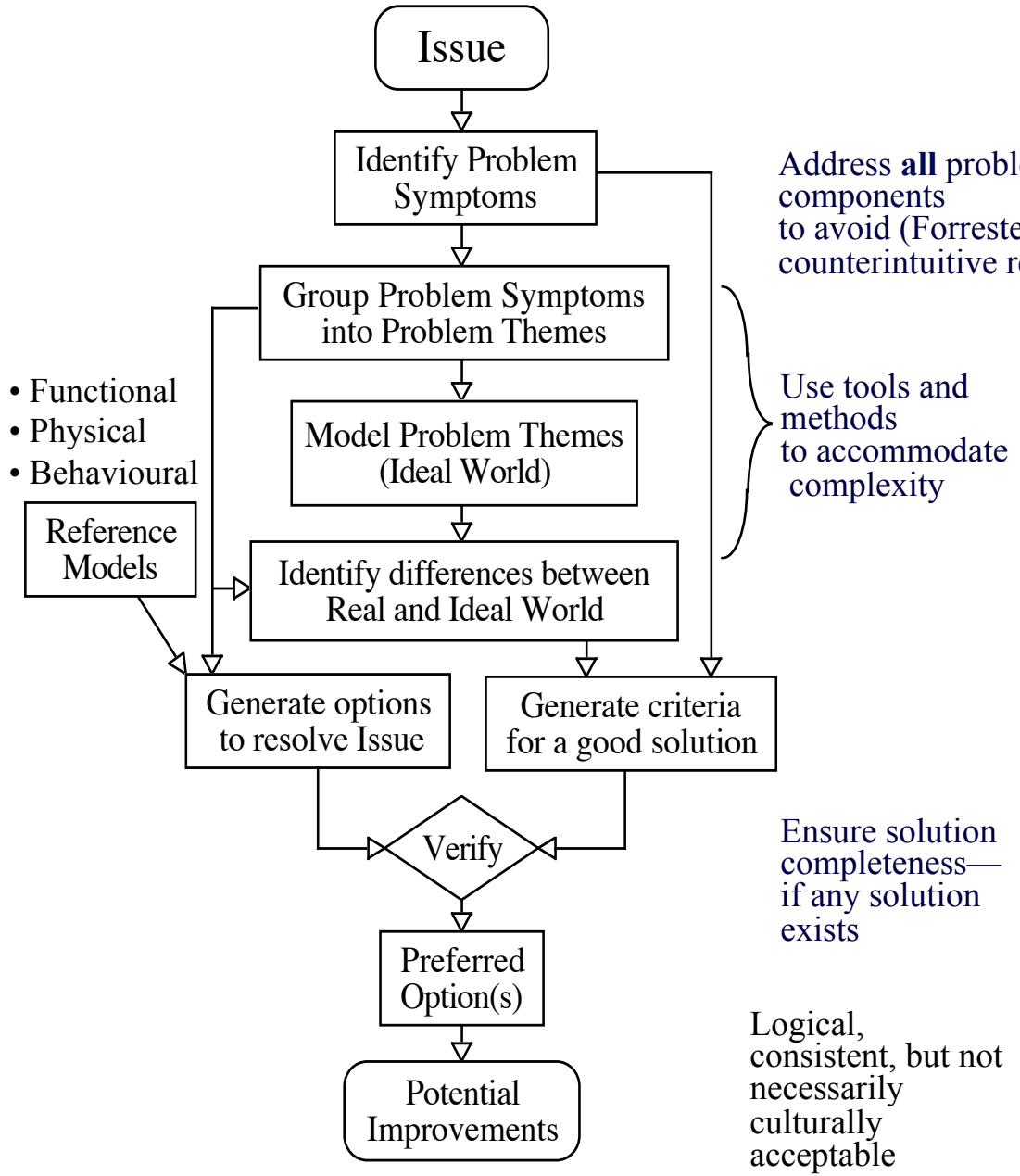
3/1.Systems Overview



3/5. SOI Solution Template (Generic)

		OPTIONS			
		1	2	3	4
EFFECTIVENESS	PERFORMANCE - Container's Objectives - Sibling Interaction - Subsystem Harmony AVAILABILITY - Reliability - Maintainability - Re-Configurability SURVIVABILITY - Avoidance of Detection - Self Defence - Damage Tolerance INTEROPERABILITY USABILITY SECURITY, ETC				
NEGATIVE CONTRIBUTION	COST ADVERSE PARENT MISSION FACTORS FAILURE PATTERNS CONSUMPTION DISSIPATION MASS / WEIGHT VOLUME / SHAPE, ETC				
	NET CONTRIBUTION				

Rigorous Soft Method



- So far, we have
  - identified problem symptoms,
  - grouped them into problem themes,
  - modelled an ideal world (N2 chart, etc.),
  - identified differences - SID.
- We have used *parts* of the GRM, only
- We have yet to generate criteria for a good solution…

Solution Concept Options

- Only GRM (Function) and GRM Behaviour) used so far: GRM (Form) outstanding—identifies power, structures…
- Now able to posit optional (physical) solution concepts
- Idea is emerging of a highly mobile and transportable land force
- May be air-inserted near scene of activity
- Makes extensive use of UMAs
- Concept not dissimilar to a naval task force formed around an aircraft carrier
- Carrier aircraft recce., defend fleet, mount attacks ahead of fleet.
- Carrier vulnerable, however - considerable effort expended to defend it

Solution Concept Options

- Land force 2010 could be:
- Formed around a "carrier" able to launch and retrieve UMAs while on the move. Other fighting vehicles/aircraft needed to defend carrier
- Or, could comprise several vehicles, some able to launch, others able to retrieve, with yet others able to control - functional split. Other fighting vehicles to defend UAV core force.
- Or, could comprise a number of semi-autonomous vehicles, each able to move, fight, launch, control and retrieve own UAVs.

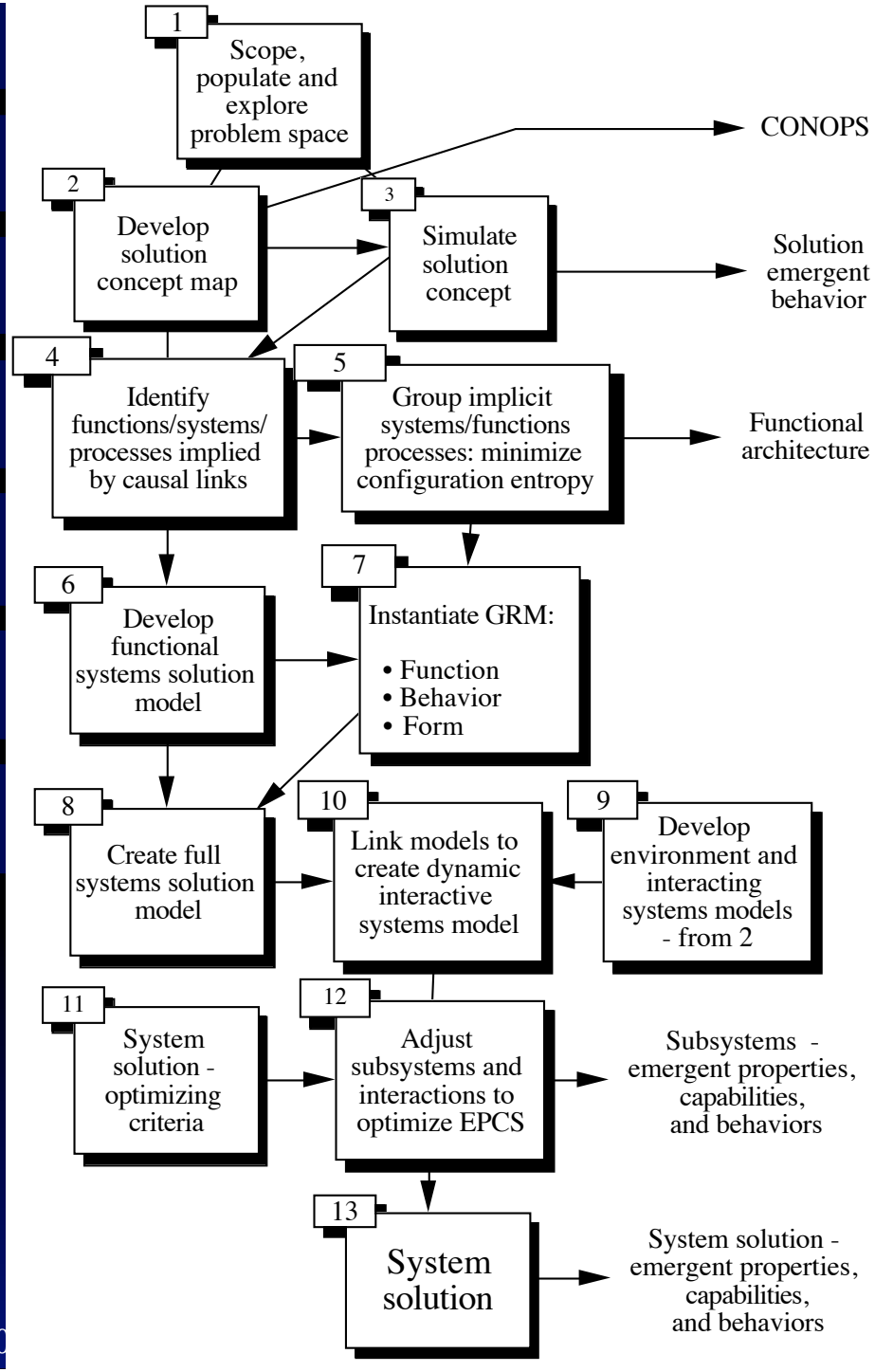
Solution Concept Options (Cont.)

- Many more options to consider.
- What if the UMA's cannot get airborne, cannot see, get shot down? Can the terrestrial vehicles find the enemy, engage and defend themselves?
- What about survivability?
  - Avoidance of detection?
    - stealth, camouflage, terrain following, passive radars, "noise" CNI radios
  - Self defence?
    - New CIWS: new guided-energy weapon–multiple simultaneous engagements, doubles as attack weapon, beams reflected off mirrors on Blue UMAs
  - Damage tolerance?
    - Light-weight active armour, multiple redundancy at vehicle and systems levels, self-healing systems, 0n-the-move damage repair teams…

Task

- Consider each of the optional solutions, and one other of your own
- Develop a distinct CONOPS for each, highlighting any differences.
- Are you able to identify the relative strengths and weaknesses of the options
  - How well? How sure are you?
- Are you able to choose which you prefer?
  - How firm is your choice?
  - Could you *prove* (e.g. to your boss) that your choice is the best?
- Could there be much better, quite different options? How would we know? How could we find out?

Codifying Conception



Route Map

- From problem space to system solution