



**Supreme
Allied
Commander
Transformation**



Morphological Analysis

Big Word: Simple Idea

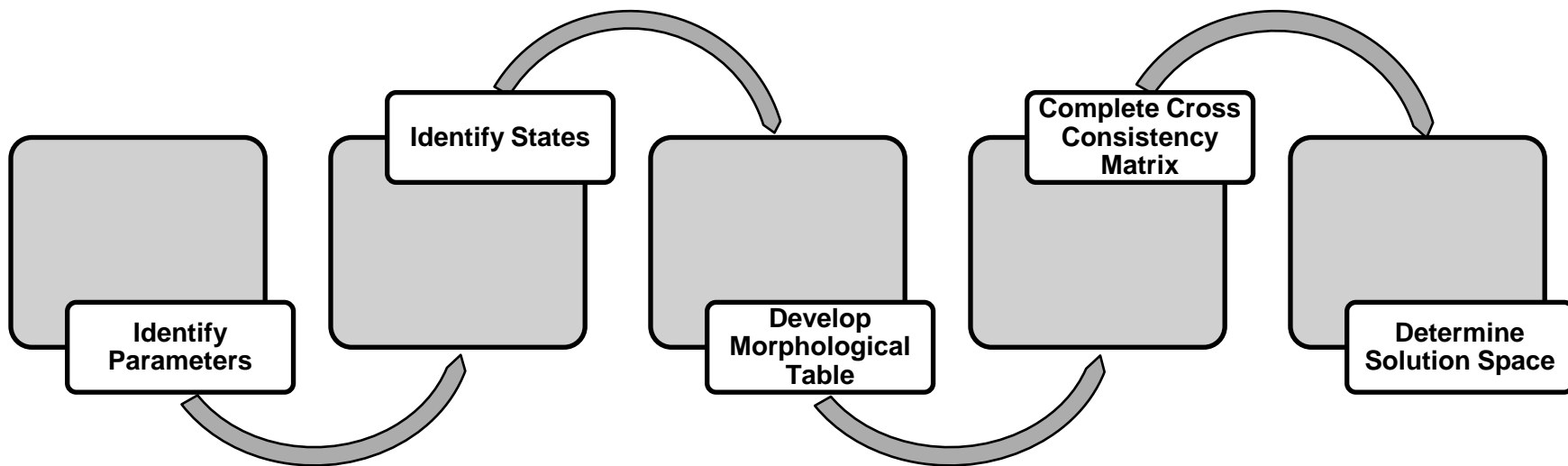
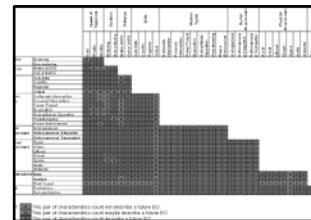
Background

- Matured by Fritz Zwicky (California Institute of Technology)
 - *“to address all relevant interrelations among objects, phenomena & concepts by means of methods which are based on the utmost detachment from prejudice & carefully refrain from all prevaluations”*
- Employed method on: jet engines, astronomical instruments, & law in space
 - Initially applied in area technology engineering design
 - Then as creativity & ideation method
 - Now targeting “wicked problems” & “messes” [Ritchey]

Overview

- Breaks down a problem into key dimensions
- Provides framework in which people consider various solutions
- Systematically explores all possible combinations of a problem
- Typically takes place with a small group of subject matter experts

Components



Speed of Response	Duration	Distance	Scale	Mission Types	Human Environment
Days	Enduring	Within NATO	Sub-state	Deliberate Intervention	Homogeneous
Weeks	Non-enduring	Out of NATO	Country	Focused Intervention	Heterogeneous Integrated
Months			Regional	Power Project	Heterogeneous Segregated
			Global	Evacuation	
				Humanitarian Operation	
				Peacekeeping	
				Peace Enforcement	

Speed of Response	Duration	Distance	Scale	Mission Types	Human Environment	Physical Environment	Infrastructure	Threat
Days	Enduring	Within NATO	Sub-state	Deliberate Intervention	Homogeneous	Rural	Basic	Perimeter
Weeks	Non-enduring	Out of NATO	Country	Focused Intervention	Heterogeneous Integrated	Urban	Advanced	Perimeter
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				Peacekeeping		Urban	Advanced	Perimeter
				Peace Enforcement		Urban	Advanced	Perimeter

Example Morphological Table

Target Environment	Target Size	Target Movement	Target Range	Signature Vector	Signature Reduction	Domain Clutter	Technology
Air	Microscopic	Static	<100m	Acoustic	Acoustic	None	X
Surface	Tiny	Slow	100m	Electro-optic (Visual)	Electro-optic (Visual)	Some	Y
Emitting	Small	Subsonic (<M1)	1km	Infra-red / Thermal	Infra-red / Thermal	Lots	Z
Space	Medium	Supersonic (M5)	10km	Electro-Magnetic	Electro-Magnetic		...
Cyber	Large	Hypersonic (M25)	200km	Other (e.g. Magnetic, UV, chemical)	Other		...
Other (e.g. subsurface)	Huge		2,000km				...
			40,000km				...
			40,000km+				...

Caveats

- Ritchey
 - 7 x 7 (x 7)
 - Subject Matter Expertise role in process
- When “No” doesn’t mean “No”
 - Logical Contradiction – impossible
 - Empirical Inconsistency – practical problem
 - Normative Constraint – self imposed
- Personal Observations
 - Defining Parameters
 - Role of Expertise

Cases

- Technology & scenarios development: AFSC
- Definitions: Expeditionary Operations
- Define initial and full operating capabilities: OLCM
- Scenarios development: NDPP

Alliance Future Surveillance & Control Requirements

- NATO E3 platform retires in 2035
- Follow-on AFSC to determine what (if anything) is required
- Complexity...
- Jointness in future battlespace
 - Air impacted by & impacts surface, cyber, space
- Overlapping / interrelated capabilities
 - JISR system, collect once use many times
 - BMD, AGS, ACCS
- Multirole nature of systems
 - 80s E3 collected against low-fast movers, millennial E3 collects range

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Technologies considered

Gravity Gradiometry

Acoustic Active (Sonar)

Radar Passive Monostatic

Infra-Red Passive

Acoustic Passive

Magnetic Anomaly Detection

Combat Identification

Radar Passive Multistatic

Radar Active Monostatic

Electric-Optic Active (Lidar)

Radio Frequency Receiver

Radar Active Multistatic

Electro-Optic Passive

Sniffer(Biological and Chemical)

Conclusions

- Consolidates views from a range of people
- Brings greater clarity to the dimensions of problem
- Proposes focused solutions
- Can be measured
- Has wide utility

Questions

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