# *Lessons for C2 Investment from Capabilities-Based Planning*

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**18th International Command and Control Research Symposium (ICCRTS)**
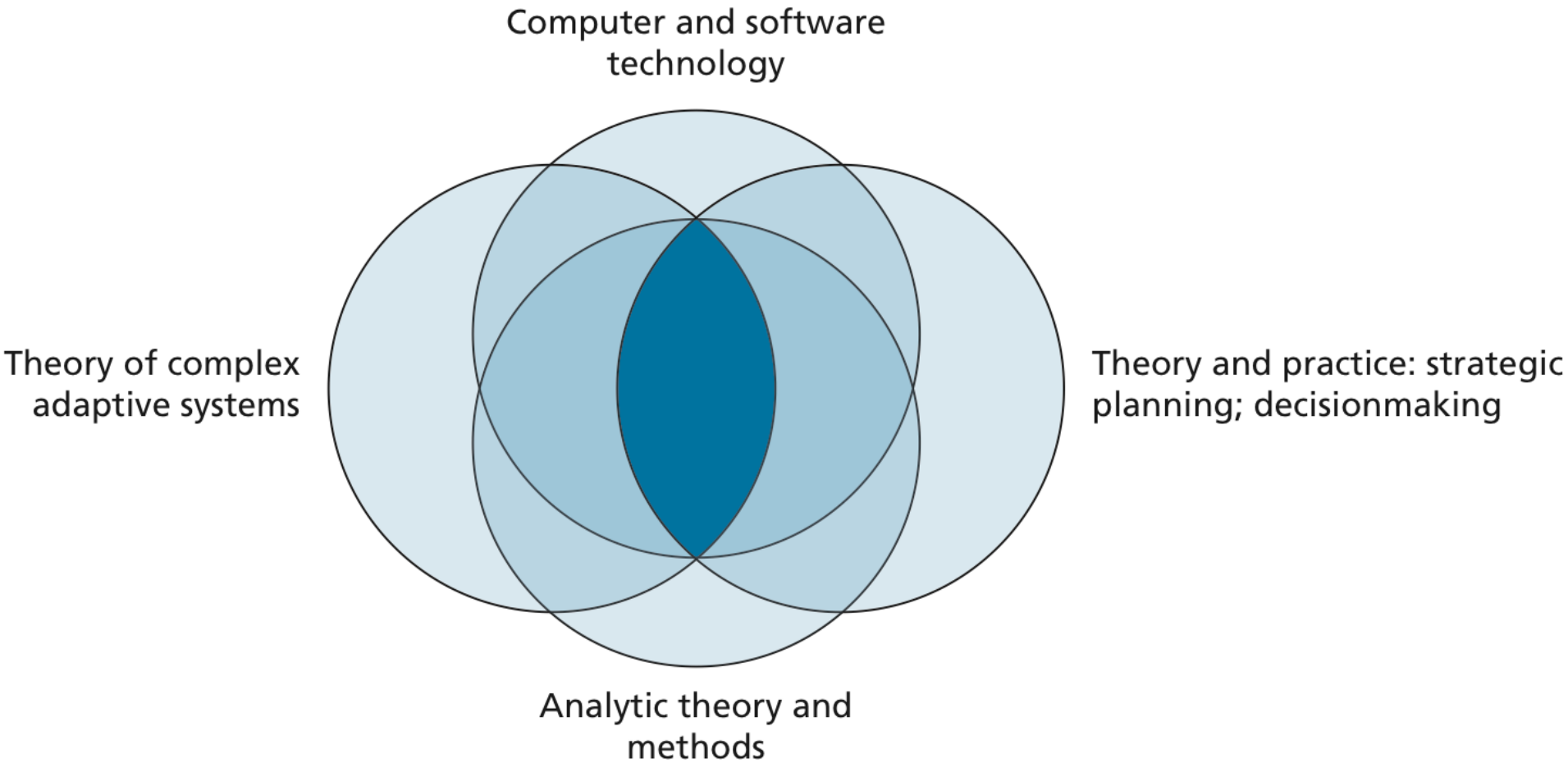**Institute for Defense Analyses, Alexandria, Virginia**

# *Background*

- **To many "others," seeking agility is seen as exotic and non-standard**

- **It's actually special case of supposedly official  capabilities-based planning in 2001, with both successes and  problems.**

- **Problems:**
  - **CBP has sometimes been perceived as**
    - **Using only generic scenarios (no threat)**
    - **A blank-check approach (just find shortfalls)**
    - **A luxury**
  - **Modelers, analysts, and budgeteers have often undercut it**

- **Can we carry over lessons learned from larger CBP experience?**

# *Unofficial but Commonly Quoted Definition*

- **Capabilities-based planning is planning, under uncertainty, to provide capabilities suitable for a wide range of modern-day challenges and circumstances, while working within an economic framework.**

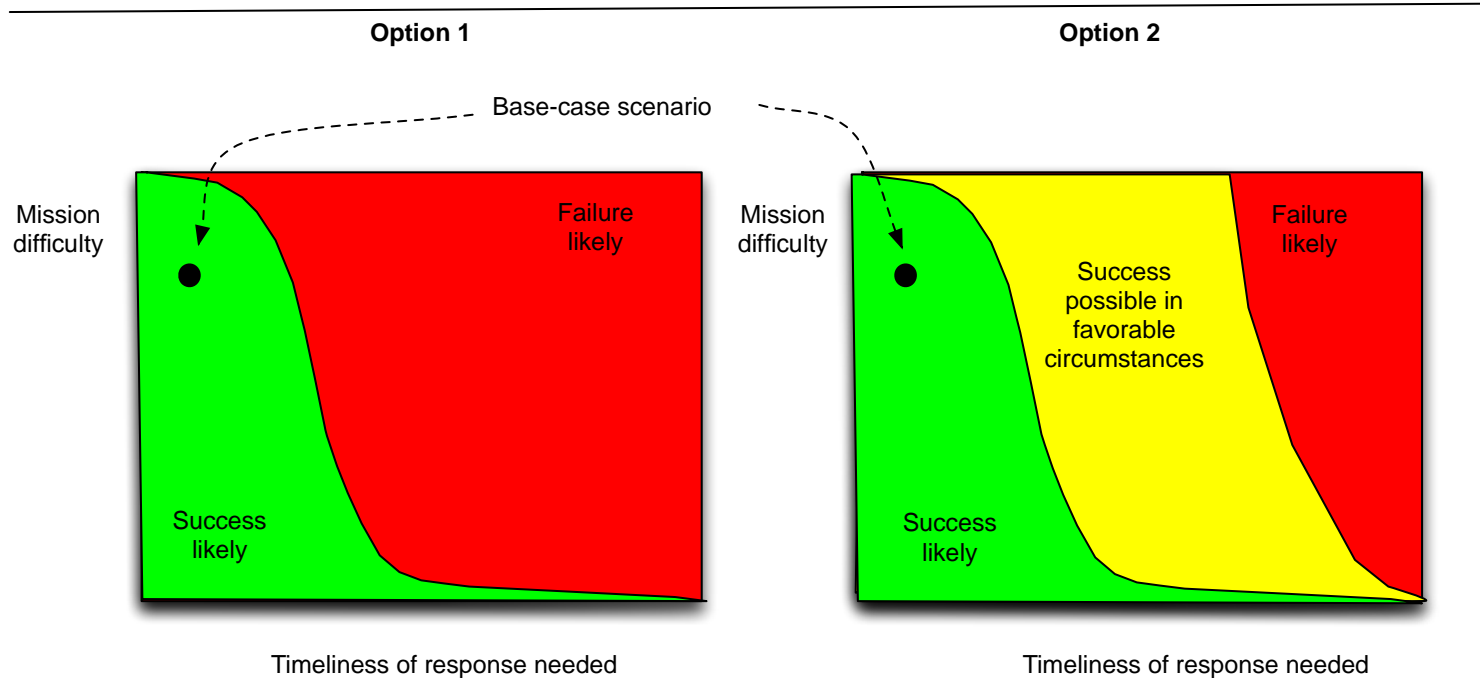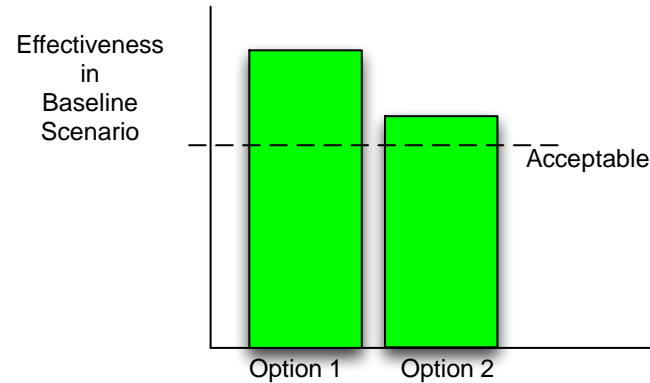# *Better Planning Under Uncertainty Can Be Easier Today Due To Confluence of Influences*



Computer and software technology

Theory of complex adaptive systems

Theory and practice: strategic planning; decisionmaking

Analytic theory and methods

# *Special Issues*

- **Deep uncertainty (aka "real" uncertainty, future uncertainty,…)**

- **FARness principle: Plan for**
  - **<u>F</u>lexibility to take on different missions, new objectives**
  - **<u>A</u>daptiveness to deal with different circumstances**
  - **<u>R</u>obustness to deal with adverse (or positive) shock**

> **Akin to planning for "agility", planning for adaptieness, robust planning, etc. (different definitions)**
>
> **But compare to planning with this week's rank ordered priorities**

# *What It Means with Homely Example: Comparing Options in Two Ways*

Effectiveness in Baseline Scenario

Acceptable

Option 1    Option 2

**Option 1**                                    **Option 2**

Base-case scenario

Mission difficulty

Failure likely

Success likely

Mission difficulty

Success possible in favorable circumstances

Failure likely

Success likely

Timeliness of response needed

Timeliness of response needed

# *Conceiving Design Space (Ex. From 2002)*

Step One

**Name-level scenarios**
(semi-specific and generic)

Step Two

For *each* name-level scenario selected, a **design space** for assessing needs and capabilities

Iraq invades Kuwait, Saudi Arabia

North Korea invades South Korea

China coerces or invades Taiwan

Russia coerces or invades Baltics

Stop the killing in "next Kosovo"

China invades unified Korea

Non-state terrorists attack U.S. interests or U.S. itself

U.S. strikes terrorist groupings

U.S. "roots out" terrorist groupings

Other regional-peer competitor emerges

Other problems in Europe, Asia, or Middle East

Problems in Latin America

India and Pakistan fight, with spillovers . . .

**Point scenario(s)** as de facto specifications

Political-military context

Point scenario (case)

Other assumptions

Strategies

Environment

Forces

Force effectiveness

(Also called "scenario space")
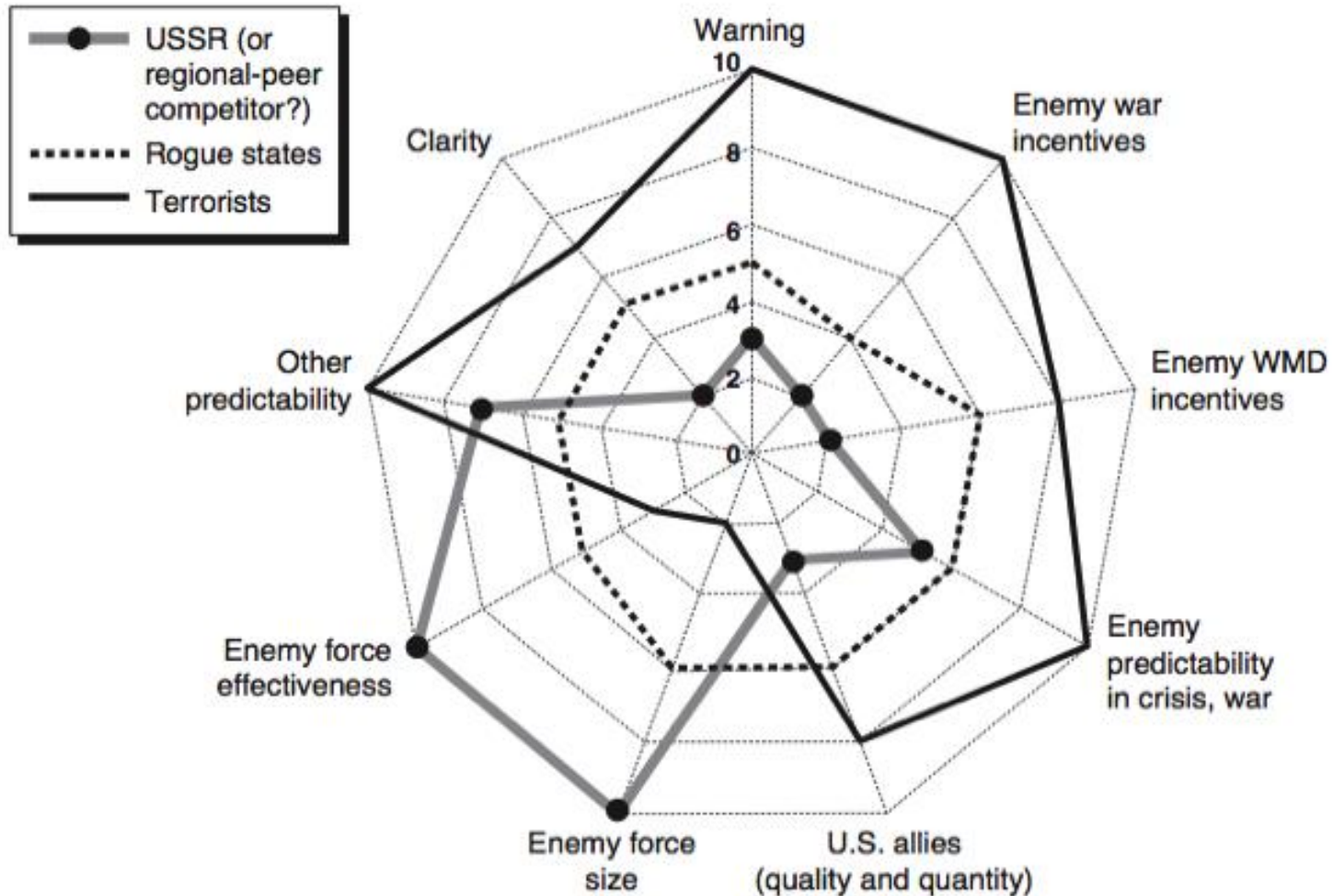
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# Pragmatic Simplification: Requirements as Outputs of Analytically Informed Decisions
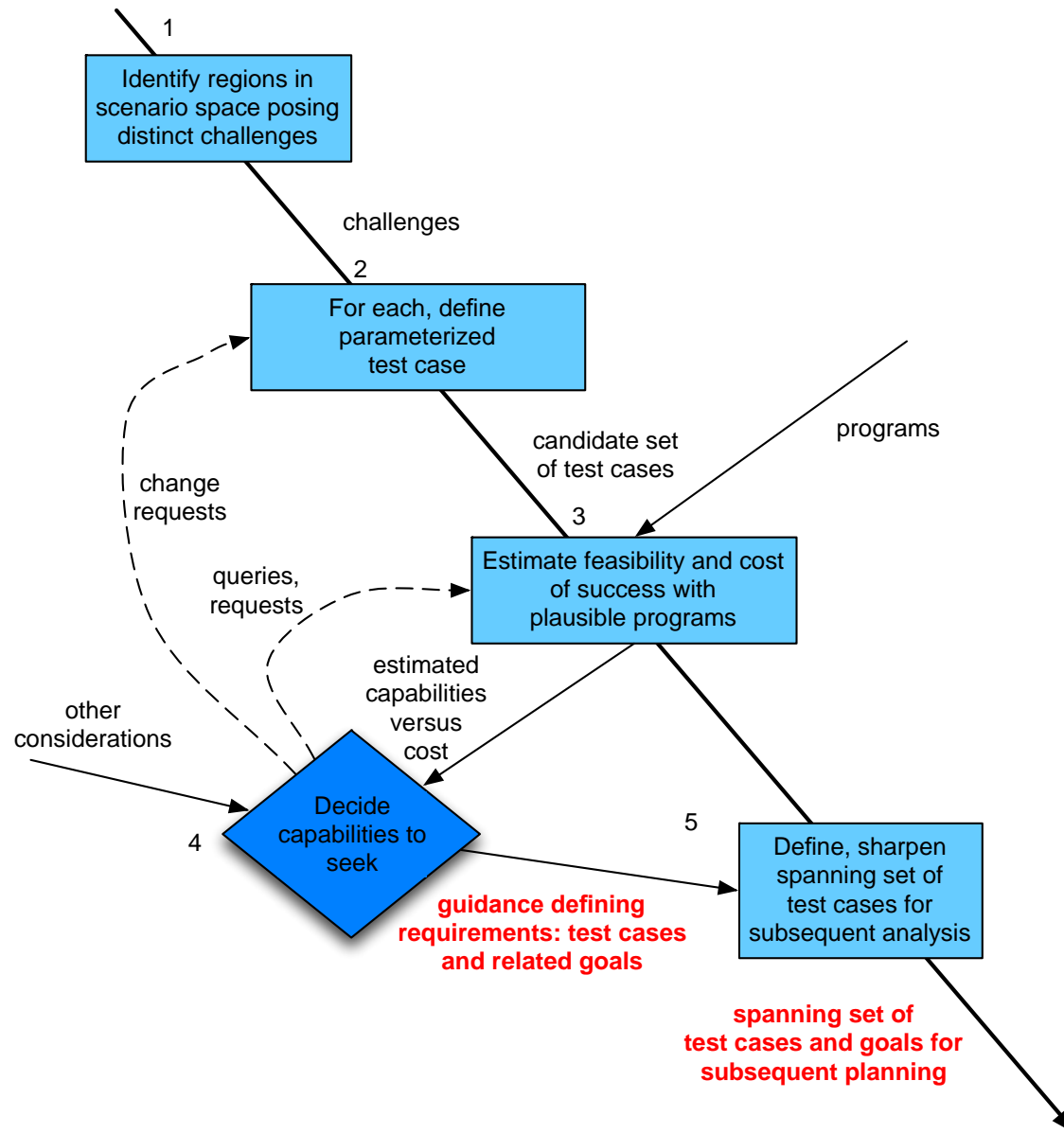


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# Analogue: Contrasting Cases in a C2 Endeavor



RANDMR1513-3.1

Legend:
- USSR (or regional-peer competitor?)
- Rogue states
- Terrorists

Axes: Warning, Enemy war incentives, Enemy WMD incentives, Enemy predictability in crisis, war, U.S. allies (quality and quantity), Enemy force size, Enemy force effectiveness, Other predictability, Clarity
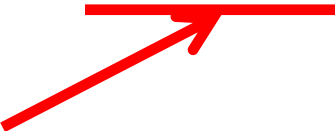
# *Models for Exploratory Analysis*

- **Need relatively simple, parametric models permitting exploration across space**

- **Concept seems foreign to many used to big computer models and big, authoritative data. Lost art that must be regained**

- **Models can be:**
  - **Built from scratch**
  - **Designed in as special cases of larger models (multiresolution modeling or model families)**
  - **Developed as motivated meta models**

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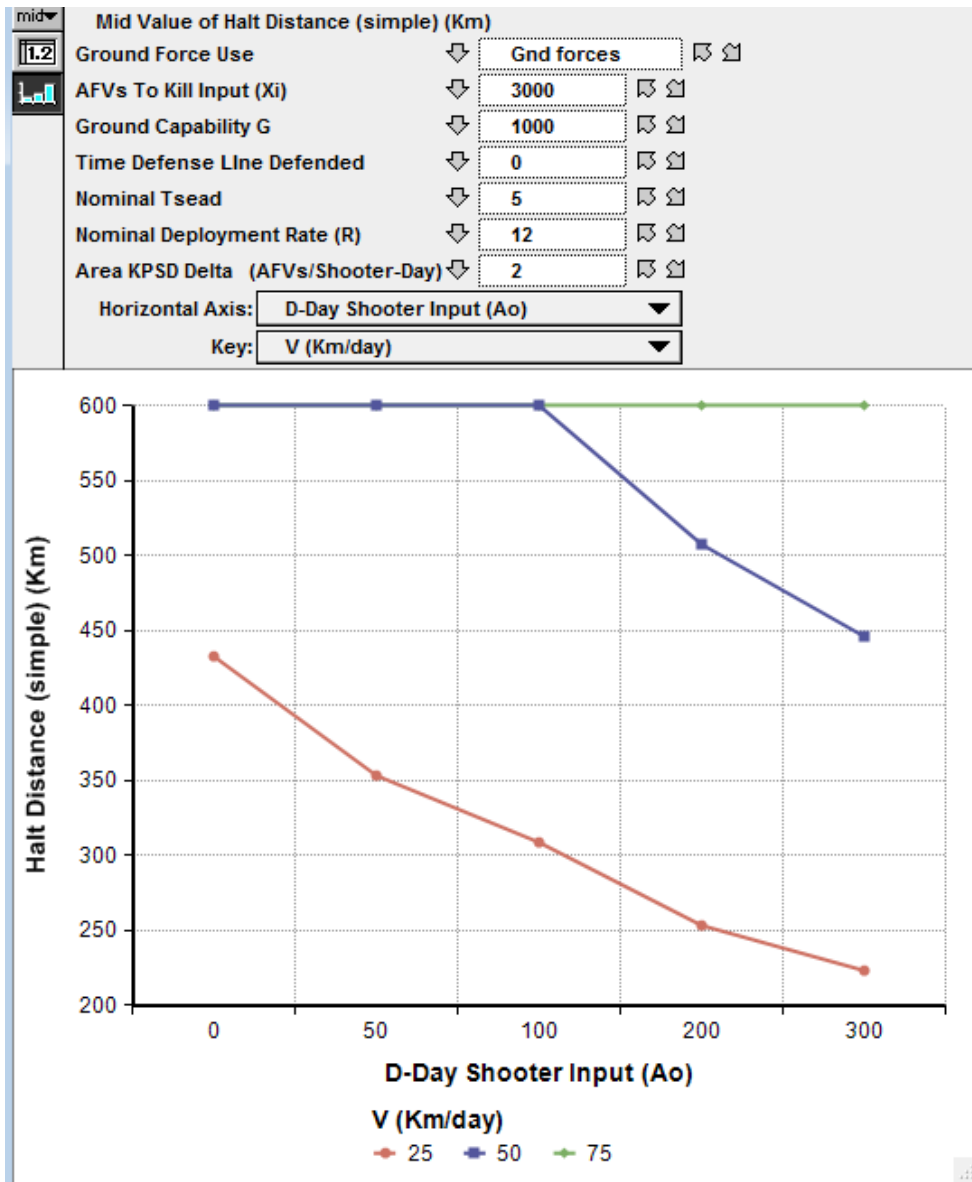# A Notional "Motivated Meta Model" To Use In Statistical Analysis

$$Q = C_1 \frac{XY^2}{W} e^{-aZT} \{1 + C_2 X + C_3 Y + C_4 W + C_5 Z + C_6 a + C_7\}$$

**Structure of Notional Idealized model**

**Compare to using standard linear or polynomial regression**
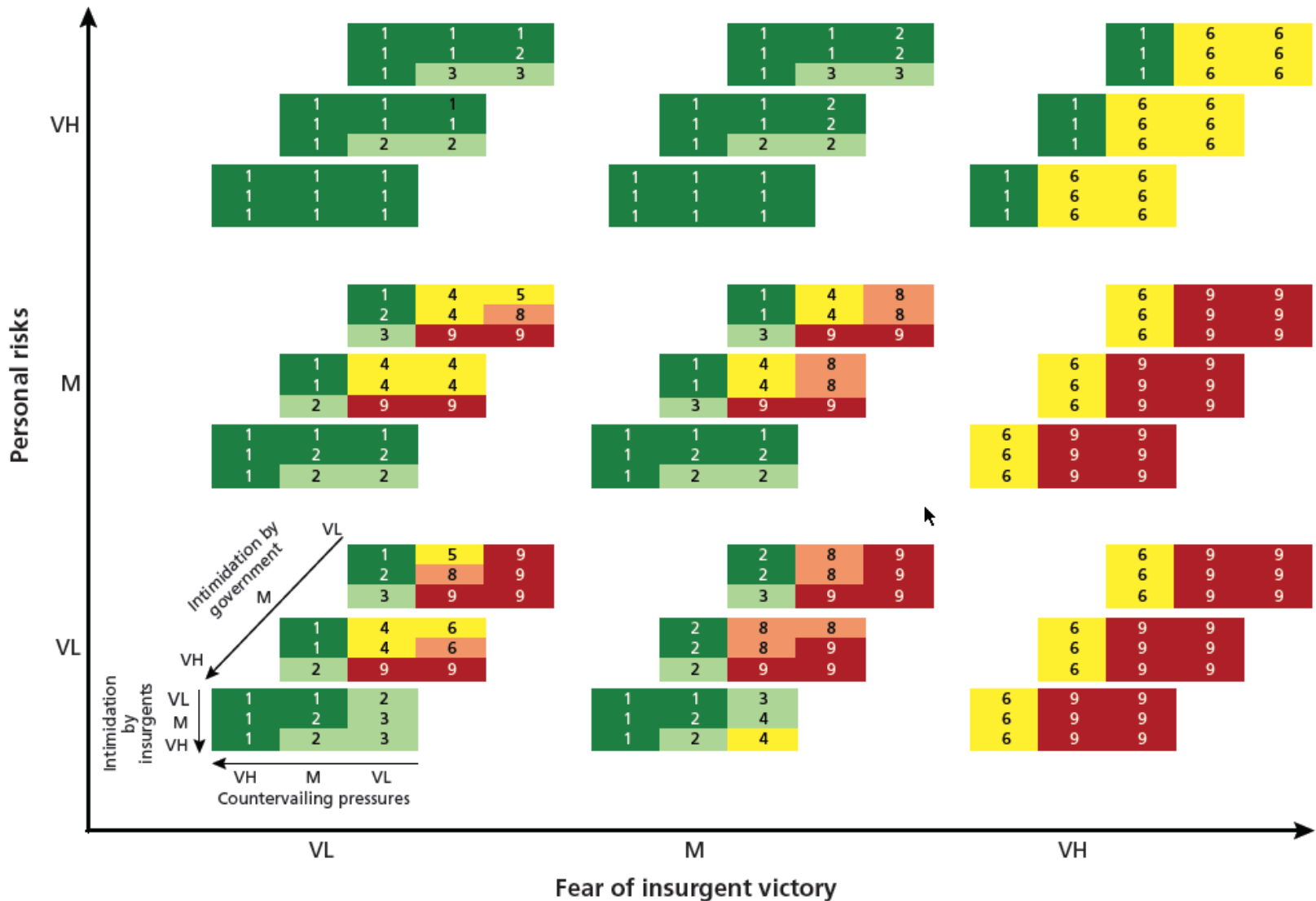
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# Interface for Exploratory Analysis



**Shows results as function of 9 variables varied simultaneously**

**Essence of "capabilities analysis" is parametric results rather than point results**

Example from Davis, et al. (2002) on interdiction with long-range fires

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# Illustrative Output of Exploratory Analysis: Result versus Five Variables



Example: public support of terrorism versus fear of inurgents, personal risks, intimidation by government, intimidation by insurgents, and countervailing pressures (Davis and O'Mahony, 2013)

# Analogous Graphic in C2 Agility



Agility Map of Organization -Approach Options

Organization Approach Options

Required Timeliness: Low / Medium / High

**Twice the Noise** — Required Shared Understanding

| | IA | c | C | CE | IA | c | C | CE | IA | c | C | CE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High | - | - | - | - | - | - | - | - | - | - | - | - |
| Med | C | C | C | - | C | C | C | - | - | - | - | - |
| Low | C | C | C | E | C | C | C | - | - | - | - | - |

**Normal Noise** — Required Shared Understanding

| | IA | c | C | CE | IA | c | C | CE | IA | c | C | CE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High | E | E | E | E | E | E | E | E | - | - | - | - |
| Med | E | E | E | E | C | E | E | E | - | - | - | - |
| Low | E | E | E | E | C | E | E | E | H | - | - | - |

**No Noise** — Required Shared Understanding

| | IA | c | C | CE | IA | c | C | CE | IA | c | C | CE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High | E | E | E | E | E | E | E | E | E | - | - | - |
| Med | E | E | E | E | E | E | E | E | C | C | C | - |
| Low | E | E | E | E | E | E | E | E | H | C | C | - |

Required Timeliness: Low / Medium / High

**Legend:**
- E = Edge
- C = Collaborative
- c = Coordinated
- H = Hierarchy
- - = None

- IA = Industrial Age
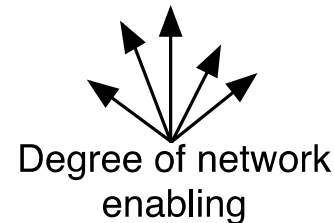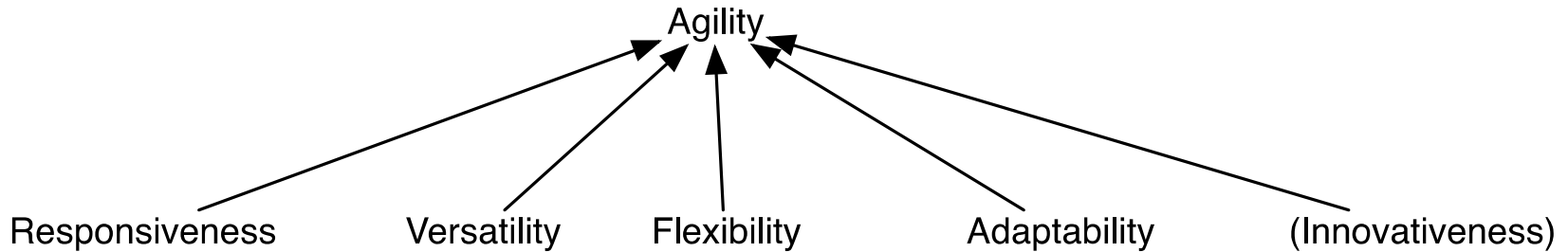- c = Coordinated
- C = Collaborative
- CE = Complex Endeavor

**From Alberts (2011), *Agility Advantage***

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# *Alternative Characterization In Terms of Attributes Rather Than Test Cases*



Agility

Responsiveness     Versatility     Flexibility     Adaptability     (Innovativeness)

Agility-supporting policies and practices

Degree of network enabling

# Impediments and Tactics

1.  **Allergies to Going Beyond Standard Cases**
    – **Show value, common-sense nature, and affordability of hedging options**
    – **Find champions (top leaders are most natural allies)**

2.  **Costs, in a Time of Austerity**
    – **Embed low-cost hedges inobtrusively (R&D, open architecture, M&S)**
    – **Demand life-cycle costing under uncertainty**

3.  **Analysis by Consensus with Big Models and Data Bases**
    – **Create small cells that do simpler more agile analysis**
    – **Task development of simpler, more agile models**

# *Obstacles (2 of 2)*

4. **Demands for "Requirements"**

   – **Urge that R's be expressed for capabilities over entire operational space, and that proposals show parametric analysis, coverage, and tradeoffs**

5. **Planning Merely To "Wing It"**

   – **Use M&S, games, and case histories …to show folly**

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