

# The Deterrence Analytic Challenge

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## Introduction

The analytic processes used for Assurance/Dissuasion/Deterrence (ADD) have changed little since the Cold War, when defense analysts focused on mutual deterrence between two nuclear-armed adversaries. Since deterrence proved successful, and bi-polar competition remained relatively stable for decades, each government began to believe that it understood the other's values and motives. If we correctly understood each others values and motives is matter of debate.

Today, we are faced with different types of ADD and policy analysis. Our actions and policies target, or indirectly affect, entities that may or may not be legitimate governments, may or may not be conventional military powers, and may or may not share our cultural norms. The world is now a multi-polar environment, where our objectives against one player may be achieved or thwarted by our actions against another. Our deterrent actions include not only threats of cost imposition, but also the promise of benefit denial and incentives for restraint. The effects of actions propagate through other players whose strategic interests are differently aligned, making the net effects difficult to understand beforehand or measure afterwards.

The Deterrence Operations Joint Operating Concept (DO JOC, 2006), provides the military's doctrinal foundation for deterrence operations. The central idea of the DO JOC taken from the executive summary is shown below.

*"The central idea of the DO JOC is to decisively influence the adversary's decision-making calculus in order to prevent hostile actions against US vital interests. This is the "end" or objective of joint operations designed to achieve deterrence.*

*An adversary's deterrence decision calculus focuses on their perception of three primary elements:*

- *The benefits of a course of action.*
- *The costs of a course of action.*
- *The consequences of restraint (i.e., costs and benefits of not taking the course of action we seek to deter).*

*Joint military operations and activities contribute to the "end" of deterrence by affecting the adversary's decision calculus elements in three "ways":*

- *Deny Benefits.*
- *Impose Costs.*
- *Encourage Adversary Restraint.*

*The ways are a framework for implementing effective deterrence operations.”*

Deterrence operations which deny benefits, impose costs, and/or encourage restraint are focused on influencing an adversary to not do something in a particular circumstance. Specifically, analysts must specify the following three elements:

- 1) Who is the adversary?
  - Identity, values, cultural and historical influences, fears and aspirations, goals and objectives, strategy and doctrine, capabilities, etc.
- 2) What is the decision in question?
  - e.g., Deter nuclear weapons use? Deter attack on U.S. space assets?
- 3) Under what circumstances are we trying to influence the adversary?
  - e.g., Day-to-day “peacetime” ops? Adversary regime at risk?

These elements combine in the form: deter adversary X (#1 above) from doing Y (#2 above) under Z conditions (#3 above). For example, deter country A from using nuclear weapons when their regime is put at risk by a U.S. led coalition’s conventional theater campaign.

### **Characteristics of the Analysis Challenge – providing insight (not answers)**

A recent Military Operations Research Society workshop on deterrence examined in more detail the differences between traditional military analysis problems and deterrence assessment problems. Table one below shows some of these differences (MORS Workshop report, 2008).

***Table One: Characteristics of a Traditional vs. Deterrence Analysis***

<b>Characteristics</b>	<b>Traditional Military Analysis</b>	<b>Deterrence Analysis</b>
Considerations	Military	Diplomatic, Information, Military and Economic (DIME)
U.S. Decision Making Process	Service/Combatant Command (CoCOM)	Inter-Agency
U.S. Decision Making Level	DoD/Service/CoCOM	National Security Council (NSC)
U.S. Decision Implementation	Service/CoCOM	Inter-Agency
Nature	Quantitative/Objective	Qualitative/Subjective
Adversary	Capabilities	Perception/Intent/Capabilities
Decision Making Risk	Reduced capabilities or less effective Operations	Fundamental National and Regional Security Interests
Analysts	Experienced Analysts and well developed education system	Few experienced Analysts and a not well developed education system
Data Sources	Technologists, operators, testers, logisticians, intelligence, budgeters, etc	Adversary and allies (Intelligence interpretation)

<b>Characteristics</b>	<b>Traditional Military Analysis</b>	<b>Deterrence Analysis</b>
Tools, Models and Simulations	Many legacy models and robust Modeling and Simulation improvements at multiple resolutions	Emerging and Conceptual Models for parts of the problem
Methodologies	Many established methodologies	Emerging Methodologies
Theoretical Underpinnings	Underlying process understood and organized	Competing Theories of decision making and human behavior
Art	Art of Tactical and Operational Warfare	Art of Strategy and Policy
Complexity	Complex	Wicked Problem

The means available to address the deterrence problem of today includes all elements of national power (DIME in the table above). It is not that all elements of national power have not always been used in our relationships with potential adversaries it is that analysts are now actively trying to incorporate all elements in their assessments prior to executing an action and in post execution assessment. In addition, analysts are examining a continuous deterrence campaign that stretches from peacetime through crisis and back to peacetime rather than just crisis. As shown in the table, the methodologies are emerging; the metrics are often qualitative; adversary perception is a key focus; competing theories exist; and the deterrence community is much broader than just the military. The general consensus of the workshop participants was that deterrence analysis is a “wicked problem” (complexity row in above table). According to Ritchey (2007), the ten characteristics of “wicked problems” are:

- 1) There is no definitive formulation of a wicked problem.
- 2) Wicked problems have no stopping rule.
- 3) Solutions to wicked problems are not true-or-false, but better or worse.
- 4) There is no immediate and no ultimate test of a solution to a wicked problem.
- 5) Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial-and-error, every attempt counts significantly.
- 6) Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan.
- 7) Every wicked problem is essentially unique.
- 8) Every wicked problem can be considered to be a symptom of another problem.
- 9) The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution.
- 10) The planner has no right to be wrong (planners are liable for the consequences of the actions they generate).

Deterrence assessment activities can be divided into three very broad categories (within the context of deter adversary X from doing Y under Z conditions):

- 1) Foundational elements (or building the baseline understanding of the adversary)
- 2) Pre-action assessment (or deterrence planning)
- 3) Post action assessment (or examination of the effect an executed action had)

Foundational assessment activities are necessary to provide a detailed understanding of a particular adversary (the individual decision maker, decision making process, their organization, values, cultural characteristics, their country, etc.). The DO JOC describes one key foundational element, the adversary decision calculus as “A prerequisite for planning and executing deterrence operations is a rigorous assessment of the content of their decision calculus of adversary decision-makers and the processes by which they make and execute decisions” (DO JOC, 2006, page 47). These foundational elements are used in pre-action (or deterrence planning) assessment activities to develop and select the “best” course of action. “Best” does not mean proven optimal but it means the course of action that we believe (or anticipate) will favorably influence the adversary with the least anticipated negative consequences. Foundational elements are also used in post-action assessment where analysts assess the effectiveness of an executed course of action.

In the pre-action step, analysts are examining different actions (across the DIME) that might be conducted to achieve a particular effect. The end result of this analysis is a linkage of actions to effects that provide a “play book” of options that decision makers can consider and build upon when considering deterrence activities. A unique challenge in the pre-assessment area is that we are unlikely to know the “threshold” for deterrence failure and therefore we can not know “how much” deterrent effect we have to have to be successful.

The third category is post action assessment. In this stage, analysts are striving to understand and provide insight into the effect of an action. There are two unique challenges of post action assessment. First, because deterrence success is the absence of adversary action we can almost never prove we have successfully deterred and are limited to identifying and examining key indicators of perception change. Second, there is latency from the time when an action is undertaken until visible indications of an effect occur. Assuming key indicators are identified, observable and measurable, the linkage of a change to an indicator to a deterrence action is problematic. Deterrence campaigns are executed over years (not days) a visible change in an indicator may be the result of an action taken weeks, months, a years ago. At best, correlation might be found but decision makers want causation. The linking problem is further complicated by actions taken by other players, changes in the economy and in general changes in the geopolitical landscape. Post-action assessment also includes providing insight into the anticipated status a few months or a year for now in order to provide decision makers information on if a campaign should be adjusted or the current efforts continued.

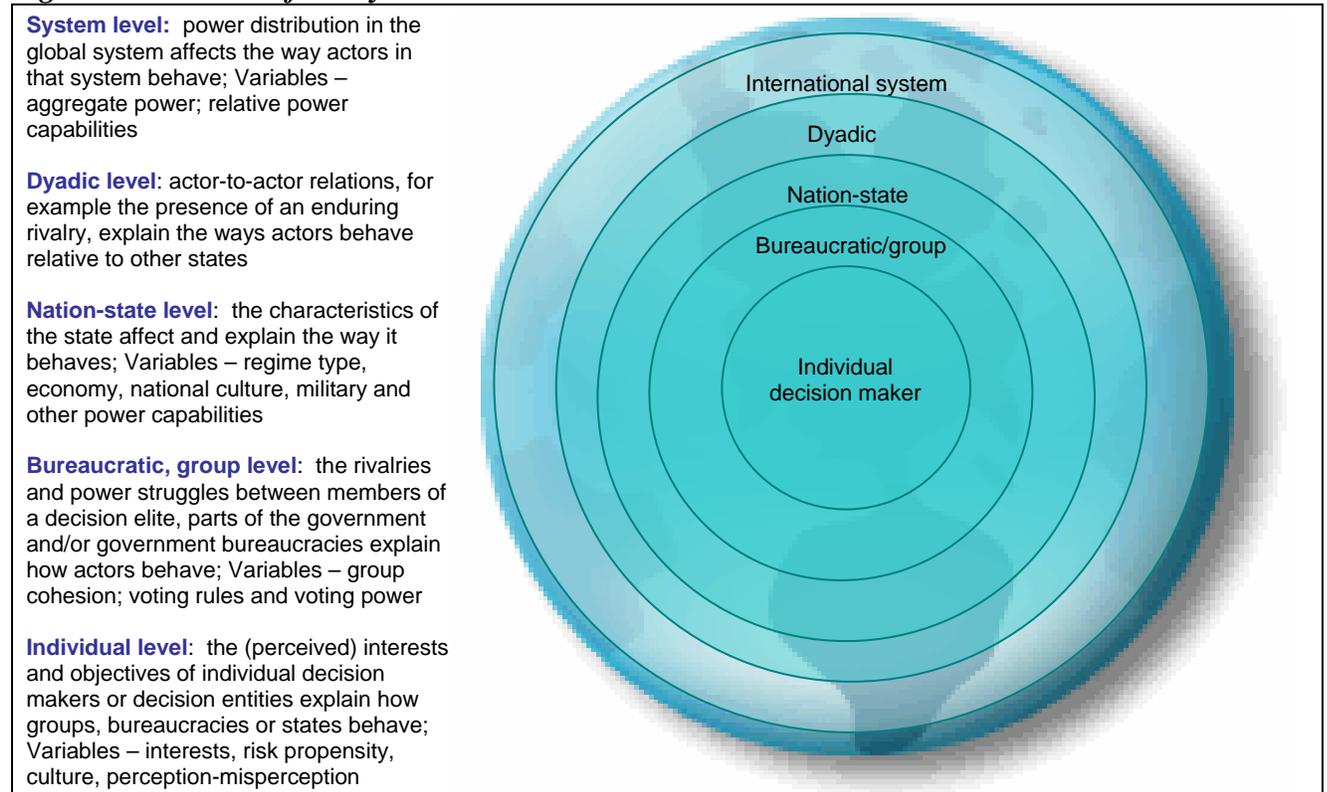
In each of these broad analytic categories analysts are faced with significant complicating factors of level of analysis, uncertainty and n<sup>th</sup> order effects of a proposed action.

### **Analysis levels**

Figure one from the Social Science working group of the MORS workshop displays various levels analysis for deterrence assessment (MORS Workshop report, 2008). At each level, it is likely that assumptions, theories, methodologies and tools will vary. Analysts should look at the deterrence issue from all levels and work to synthesize results into a cohesive assessment. Each level may provide useful insights that might have been missed by selecting a single approach. It

is possible that the insights into the deterrence issue being examined may vary by level and may, in fact, be contradictory. If contradictory results occur, the question of which is correct is not as important as determining why the results are different. The challenge is how to synthesize these insights from different levels into a cohesive assessment.

**Figure One: Levels of Analysis in Deterrence Assessment**



### Uncertainty and dealing with it in deterrence analysis

Uncertainty has numerous dimensions within deterrence analysis. At one dimension it is lack of knowledge about a particular adversary. This can take the form of unknown variables that an adversary considers in the decision process (a potentially worst case) or a known variable having more than one equally viable interpretation about how an adversary views it. In the methodology or tool dimension it is about properly encoding uncertainty into and then interpreting analytic results. Further, uncertainty and its implications must be properly conveyed to the decision maker. The following points highlight activities analysts can do to reduce uncertainty, account for it in assessments, and understand the implications.

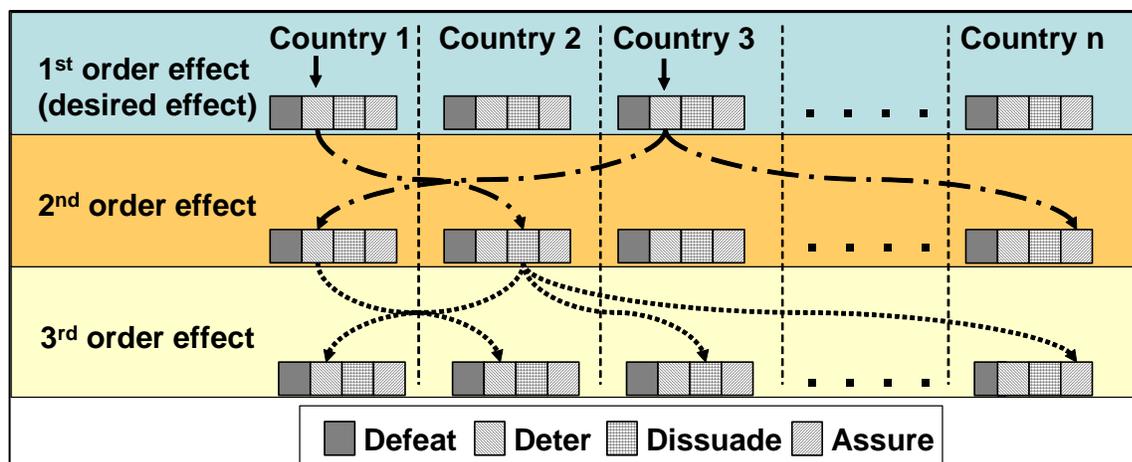
1. Characterize what we don't know (that you think is important) and note lack of data
  - About adversary motivations, objectives, constraints, adversary culture, etc.
  - Note the process uncertainties (e.g., dependence upon causal loop specification accuracy and dependence upon probability specification).
2. Strive to Reduce the amount (of critical insight) that we don't know
  - Capture "all that is known" relative to the adversary that is pertinent to the deterrence objective. For example, what are the variables/entities/processes that influence an adversary's decision and what is the required description of each? There is, of course, no way to know how much we don't know.

- Do “qualitative first” systems development of causal relationships and utilize result obtain first order insights into the areas of most importance to the analysis at hand and, hence, the need for in-depth research. The first order representation and should be very broad in detail and in academic disciplines included.
3. Account for what we don’t know and characterize the implications
    - To the extent practicable employ competing methodologies to highlight disconnects or to illuminate deficiencies. Competing methodologies do not result in a “winning approach”. The process is to employ numerous methods and/or tools to provide greater insight to the decision maker. Differing answers highlight where additional information/research may be useful and where different interpretations are equally valid.
    - Conduct parametric analysis to gain insight into the degree to which an unknown or uncertain element affects the resultant “goodness” of a deterrence action.
    - One significant caution is that analysts must not fall into the “... because the model results said ...” trap. Models (or methods or tools) should be used to provide insight not answers.
    - In pre-action analysis, characterize the full spectrum of adversary decision space to include the existence of unintended or undesirable consequences.
    - For post-action analysis, identify/confirm the relationship which exists between an implemented course of action and observed action, be they the desired ones or unintended ones.
    - Plan for and implement feedback nodes which allow for real world observations and updates to foundational elements and models.

### N<sup>th</sup> order effects

A complicating factor within deterrence analysis is 2<sup>nd</sup>, 3<sup>rd</sup>, really n<sup>th</sup> ordered implications of an action. Figure Two is a notional representation of propagation of effects. For example, an action is conducted to deter country 1 from doing Y (e.g., transferring WMD) under Z conditions (e.g., in time of conflict) – shown as a downward arrow under Country 1. This action may then have 2<sup>nd</sup> order effects of dissuading country 2 which then has third order effects of deterring Country 1, dissuading country 3 and assuring country n. The graph only shows 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> order effects; however, it is really an n<sup>th</sup> order problem. This propagation is further complicated by looping back on itself. The propagation of effect can be positive (supporting or additive) or negative (not supporting or subtractive). That is, an action may achieve the primary deterrence effect on one country but act against deterrence for another country.

*Figure Two: N<sup>th</sup> Order Effects*



The analytic challenge is including  $n^{\text{th}}$  order implications and all the uncertainty about the implications. The simplest but requiring the most effort is to merely replicate the analytic activities conducted for the 1<sup>st</sup> order effects for all the 2<sup>nd</sup>, 3<sup>rd</sup>,  $n^{\text{th}}$  order propagations. However, results in merely treating an 2<sup>nd</sup> or 3<sup>rd</sup> order effect as a 1<sup>st</sup> order effect. A robust analysis will include the  $n^{\text{th}}$  order implications implicitly into the assessment. One can visualize an assessment that says action A is preferred in the 1<sup>st</sup> order but due to 2<sup>nd</sup> and 3<sup>rd</sup> order implications the action should not be undertaken.

**Techniques and Models - “... all models are wrong, but some are useful.” (Box, 1979).**

Deterrence strategy over time doesn't require the ability to precisely predict outcomes; rather, it requires an understanding of the factors influencing the decision. In this light, the primary value of techniques and models is to build understanding of the issue to enable better decisions. Analysts must avoid the temptation of jumping to a technique or model too early in a project. First, analyst should strive to understand the problem, address uncertainty and include a diverse set of academic disciplines and professionals on the project. Further, analysts should then select a diverse set of techniques and models to examine the issue. The next three figures link techniques to deterrence assessment areas; however, the figures are not exhaustive (MORS Workshop report, 2008). Figure Three displays operations research techniques. Figure Four looks at Game theory in more detail. Figure Five contains social science techniques. Numerous (but not exhaustive) lists of models exist throughout the literature (see: Air Force Standard Analysis Tool Kit, GISC report 2007, UCF PMESII tool index, MORS Workshop Social Science Working Group model list 2008 as starting points).

*Figure Three: Operations Research Techniques.*

<b><u>Define Scenario</u></b> Seminar games	<b><u>Update and Track</u></b> Content Analysis Bayesian Network	<b><u>Evaluate COAs (Cont)</u></b> Screening Criteria Decision Trees/ Influence Diagrams War Games
<b><u>Identify Objectives and Scenarios</u></b> Alternative Futures VFT/Motives	<b><u>Adversary Characterization</u></b> Value Focused Thinking Bayesian Networks Cognitive Mapping Social Networks Sociological Models Planned Behavior	Value Focused Thinking Game Theory Surveys Expert Opinion MCDA
<b><u>Identify Adversary</u></b> Historical analysis Social Networks	<b><u>Command Structure</u></b> Organizational Chart Social Network Analysis Network Model	<b><u>Evaluate Risks and Pitfalls</u></b> Risk Analysis Fault Trees Bayesian Nets/ Decision Trees/ Influence Diagrams
<b><u>Identify Capabilities</u></b> Optimization Organizational Analysis	<b><u>Develop COAs</u></b> Brainstorm Modeling/ Simulation Strategy Generation Table War Games Doctrine	<b><u>Validation &amp; Verification</u></b> Lessons Learned Historical Case Studies
<b><u>Build Coalition</u></b> Negotiation Game Theory	<b><u>Metrics</u></b> Theory of Measurement	<b><u>Multiple COAs</u></b> MCDA Portfolio Analysis/ Optimization
<b><u>Gather Data</u></b> Data Mining Surveys	<b><u>Evaluate COAs</u></b> Modeling/Simulation Evaluation Bayesian Networks MODA	<b><u>Adaptive Behavior</u></b> Agent Based Modeling War Games Lessons Learned/ Observed
<b><u>Deploy Sensors</u></b> Optimization Search Theory Modeling & Simulation Value of Information Project Management		

*Figure Four: Game Theory Approaches*

<b>Some Deterrence Problems</b>	<b>Possible Game Theory approaches to dealing with the deterrence problems</b>
Disagreement between SMEs	Bayes theory, Multiple parallel games, Negotiation theory
Catastrophic consequences coupled with low likelihood	Prospect theory
Cultural characteristics of actors	Behavioral Game Theory, Preference Ordering, Hyper games, Negotiation theory
Deception	Common Rationality, Screening, Revelation
Incentives, rewards	Side payments, Preemption, Commitment, negotiation theory
Information overload, short available time	Attention economics
Intelligence requirements	Information sets, Pay-offs, Fuzzy games
Internal factions	Embedded games, negotiation theory
Irrational actors	Common rationality, Bounded rationality
Lack of statistically valid data, too few historical cases	SME input, approaches are fundamentally thinking tools, not decision making tools
Long range planning, long time scales	Theory of Moves, Rubenstein bargaining
Multiple competing agendas	Vector payoffs
Multiple iterated engagements with adversary	Evolutionary game theory
Multi-Polar World	N-Person games, Vector payoffs
Threats	Nash bargaining, Theory of Deterrent games
Uncertainty	Information sets, Fuzzy games, Differential games
Unknown unknowns	War gaming
Unsophisticated players	Multiple versions of normal and extensive form game, Attention economics

*Figure Five: Social Science Approaches (and references)*

- **Major themes/messages data: Content analysis (frequency; thematic)**
  - Carley, Kathleen. Coding Choices for Textual Analysis: A comparison of content analysis and map analysis
  - MacKuen, Michael and Courtney Brown. Political Context and Attitude Change
- **Associating leader argumentation with state behavior: cognitive mapping research**
  - Suedfeld, Peter and Philip Tetlock. Integrative Complexity of communications in international crises
  - Suedfeld, Peter, Michael Wallace and Kimberly Thachuk. Changes in Integrative Complexity among Middle East Leaders during the Persian Gulf War,
  - Tetlock, Philip. Integrative Complexity of American and Soviet Foreign Policy Rhetoric: A Time-Series Analysis.
- **Modeling (macro) international (pol) environ: Power Transition, Hegemonic stability models**
  - Modelski and Thompson. “Long Cycles and Global War”
  - Organski and Kugler. “The Power Transition”
  - deSoysa, Oneal and Park. “Testing Power Transition Theory”
  - V. Danilovic. “Modeling Power Transition: An Extended Version”
  - C. Doran. “Power Cycle Theory of Systems Structure and Stability”
  - R. Koehane. “The Theory of Hegemonic Stability”
  - Isabelle Grunberg. “Exploring the ‘myth’ of hegemonic stability”
- **Modeling decision making and preference aggregations: research on voting rules and agenda setting**
  - Zeev Maoz, National Choices & Int’l Processes
  - Bueno de Mesquita, The War Trap

## **Diversity – A Guiding Analytic Principle**

Earlier in the paper deterrence analysis was described as a “wicked problem”. The discussion about the problem characteristics, uncertainty, analytic levels and  $n^{\text{th}}$  order effects has described several of the challenge areas and some concepts to address them. A summary finding of the MORS workshop on Deterrence and Policy analysis was that “diversity” is the key to addressing the challenges. Diversity is required in disciplines, techniques & models, subject matter experts and level of analysis.

Academic Disciplines: Each academic discipline brings a unique perspective and interpretation of data, information and problems/circumstances. In deterrence assessments, no discipline is complete by itself. Bringing multiple disciplines together poses new challenges. The greater the number of disciplines engaged, the better the understanding but potentially longer the time required to complete an assessment. Disciplines have their own terminology for the same concepts, or worse, the same words have completely different meanings. For example, to an operations research analyst a “model” is large simulation but to a social scientist a “model” could be the equation resulting from linear regression. Tolerance is required in multi-disciplinary teams. An engineer likely won’t have even the basic (or undergraduate) knowledge of political science (and the reverse is true).

Techniques and Models: As with academic disciplines, each technique and model used may provide unique insight into the deterrence issue being examined. Analysts should draw from a diverse “tool kit” of techniques and models. As discussed in the Uncertainty section above, employing competing approaches is one way to ensure a more robust analysis. Analysts will desire confirming results (or agreement in results) from the different approaches used. However, conflicting results from different approaches highlight areas needing further exploration and may also facilitate describing the implications of uncertainty. Further, agreement among tools does not necessarily mean the results are correct. If two models share the same incorrect assumptions or include the same factors maybe they are just two different models of the same theory (i.e., they are not “competing” techniques). Or, more simply the models are just wrong. Tool/methodology agreement or determine which tool is “correct” is not required. The results should be used to inform not make decisions and any differences in the assessment resulting from using different tools/methods should be conveyed to the decision maker.

Subject Matter Experts: Much of the assessment conducted in deterrence analysis will be qualitative in nature and thus will involve elicitation of information from subject matter experts (SMEs). Having a diverse SME group will help to ensure a wide variety of viewpoints is included in the assessment. As with model output, complete agreement among SMEs is not required. Unconventional (or fringe) views bring as much if not more value than SME’s with similar backgrounds and qualifications. Specifically, disagreement among SMEs can help expand the problem space, identify areas that are analytically interesting and help understand the uncertainty in the problem. Resolving SME disagreements is not necessary. What is necessary is that the disagreements and their implications are captured and presented to decision makers.

Levels of Analysis: As discussed in the Levels of Analysis section, analysts should look at the deterrence issue from all levels and work to synthesize results into a cohesive assessment. Each

level may provide useful insights that would have been missed by selecting a single approach. The challenge is how to synthesize these different levels into a cohesive assessment.

## **Summary**

The MORS workshop labeled deterrence analysis a “wicked” problem. It always has been. Analysts today are assessing a complex environment and are striving to include all elements of national power into their assessments. The assessment can be broken down into three broad categories: building foundational elements, conducting pre-action assessments, and conducting post action evaluations. The analytic challenges include level of analysis, uncertainty implications, n<sup>th</sup> order effects, and latency issues. Diversity in academic disciplines involved, subject matter experts, methodologies, tools, and techniques is the key to tackling these challenges. The analytic goal is to provide insight to decision makers.

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