A Systems Analysis of Tactical Intelligence in the US Army

By

Jillian Marie Wisniewski

B.S. Operations Research, United States Military Academy, 2006

Submitted to the Systems Design and Management Program
in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Engineering and Management

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2015

© 2015 Jillian Wisniewski. All rights reserved.
The author hereby grants MIT permission to reproduce and distribute publicly paper
and electronic copies of this thesis document in whole or in part in any medium now
known or hereafter created.

Signature of Author.........................................................

Jillian M. Wisniewski
Systems Design and Management Program
May 2015

Certified by.................................................................

Dr. Jayakrishn Srinivasan
Research Scientist, Organizational Studies Group, Sloan School of Management
thesis Supervisor

Accepted by.................................................................

Patrick Hale
Director
Systems Design and Management Program

Disclaimer—The views expressed in this thesis are those of the author and do not reflect the
official position of the US Army, US Department of Defense, or US Government
A Systems Analysis of Tactical Intelligence in the US Army

by

Jillian Marie Wisniewski

Submitted to the MIT Systems Design and Management Program on May 8, 2015 in partial fulfillment of the requirements for the Degree of Master of Science in Engineering and Management

ABSTRACT

This thesis explores drivers of mission performance outcomes through dynamics associated with intelligence and operational processes. System dynamics methodology can provide a foundation for exploration of these processes within the intelligence cycle.

In the Army’s current structure, intelligence capacity falls short of what combat battalions need in the modern operational environment. Is this shortfall a remnant of an archaic design, or has the intelligence process itself changed so significantly that the drivers of intelligence capacity require revision?

There has been a significant structural transformation of Army units over the past two decades. This has also impacted the intelligence community both within and outside of the Army. Advances in information technology have resulted in a prodigious increase in collection platforms, digital data streams, and digital architecture at the tactical level. These transformations have significantly changed the nature of tactical intelligence analysis and therefore necessitate an appreciative update to analyst capabilities.

A scrutiny of the analyst’s role in unit operations reveals four major components of competency that are imperative to analysts’ abilities. Design structure matrices reveal the relationship of these components across 132 competency specifications from Army doctrine, and expose performance challenges from lack of proficiency within information processing methodologies.

A system dynamics model exposes the cost of analyst performance shortfalls. It is proven that increased reliance on shortcut methods erodes analysts’ ability to improve skillsets, which in turn is detrimental to the Army’s intelligence community and may impair overall future US military combat capability. Considered paths to improvement are discussed.

Thesis Supervisor: Dr. Jayakanth Srinivasan

Title: Research Scientist, Organizational Studies Group
(THIS PAGE INTENTIONALLY LEFT BLANK)
Acknowledgements

The unwavering support of my family contributed as much or more to this work than my own words and thoughts on paper. I could not have stayed the task without my husband’s steadfast encouragement and critique, provided despite the time constraints of his equally intense academic workload. I could not have derived more motivation from my daughter’s fascination and intense sessions of questioning about the status and meaning of the “wavy lines” of my models, and my son’s consummate status checks could not have inspired more focus—“Are you getting lots of work done, Momma?” I am especially grateful to my mother—who provided love, care, and stability to our children and our home throughout the challenge of our academic pursuits.

I am immensely grateful to my Army mentors from the 101st Airborne Division (Air Assault) for continuing to push my development, reminding me to reflect, and enabling me through their own knowledge and experiences. I would not have been able to perform field research or create the models and final product without the support of the broader intelligence community, and I am incredibly grateful for the experience and insight gathered at NGIC and other intelligence agencies with thaumatological expertise.

I am thankful for the patience, effort, and time that my thesis advisor, Mr. Jayakanth Srinivasan, put into critiquing my work and helping me process my thoughts, research, and experiences. The work of Prof. John Sterman and J. Bradley Morrison immensely influenced my own, and I am appreciative for their guidance and mentorship in shaping my System Dynamics education. I also would like to thank Mr. Pat Hale for his support in the program and for his faith in my abilities.

To my SDM classmates, friends, and collaborators at MIT—my learning was deepened by your own experiences, and I am grateful for the breadth of application, insights, and perspectives that helped synthesize the intense academic journey.
# Table of Contents

**Introduction: Capability and Intent** 8  
*Army and Intelligence Transformation* 9  
*Problem Statement* 14

**Part I: Tactical Units and Evolving Operational Design** 15  
*Structure of Army Units* 15  
*Structure of Tactical Unit Staff* 16  
*Function of Coordinating Staff Elements* 17  
*Collective Function of Tactical Unit Command and Staff* 18  
*Operational Design* 19  
*Evolving Operational Design* 20  
*Critical Information Requirements* 24

**Part II: System Dynamics Model for Mission Performance** 27  
*Quick Overview of System Dynamics Modeling and Syntax* 27  
*Fundamental Structure of the Mission Performance Model* 29  
*Personnel-Driven Processes* 34  
*Part II Summary* 37

**Part III: Modeling MDMP** 39  
*Rational, Doctrinally Driven Decisions and Processes* 39  
*The Intelligence Cycle in MDMP* 40  
*The Impact of Intelligence and Operations Planning on Mission Outcomes* 41  
*The Complete Model* 45  
*Intelligence for Current and Future Operations* 46  
*Intelligence Effects* 48  
*Part III Summary* 50

**Part IV: Simulations** 52  
*Simulation Settings* 52  
*Baseline Simulation* 52  
*Results of Baseline Simulation with Aligned Capacities* 53  
*Results of Baseline with Unlimited Operational Capacity* 54  
*Test Input for Simulations beyond Baseline* 57  
*Response to Step Function* 58  
*Random Noise* 61  
*Failure Modes for Operations and Intelligence Capacities* 62  
*Intelligence Impact on Mission Performance* 64  
*Part IV Summary* 66

**Part V: Revising the Components of Intelligence Capacity** 68  
*The Analyst’s Role and Intelligence Value* 68  
*Enduring Challenges at the Unit Level* 69  
*Impact of Changes in the Intel Cycle* 72  
*Designers of Intelligence Capacity* 75  
*Part V Summary* 76

**Part VI: Criticality of Intelligence Competencies** 77
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methodology for Assessing Intelligence Competencies</td>
<td>77</td>
</tr>
<tr>
<td>Intelligence Tasks Dependencies</td>
<td>79</td>
</tr>
<tr>
<td>Part VI Summary</td>
<td>81</td>
</tr>
<tr>
<td><strong>Part VII: Cost Analysis</strong></td>
<td>83</td>
</tr>
<tr>
<td>Capability That Adapts to the Evolving OE</td>
<td>83</td>
</tr>
<tr>
<td>The Human-Digital Interface in Tactical Intelligence</td>
<td>84</td>
</tr>
<tr>
<td>Effect of Working over Capacity</td>
<td>85</td>
</tr>
<tr>
<td>System Dynamics Model to Determine Effects of Shortcuts on Skill Building</td>
<td>86</td>
</tr>
<tr>
<td>Associated Costs of Shortcuts</td>
<td>88</td>
</tr>
<tr>
<td>Don’t Defray Costs, Alleviate Them</td>
<td>93</td>
</tr>
<tr>
<td>Part VII Summary:</td>
<td>94</td>
</tr>
<tr>
<td><strong>Part VIII: Closing Thoughts</strong></td>
<td>96</td>
</tr>
<tr>
<td>An Urgent Need for Change</td>
<td>96</td>
</tr>
<tr>
<td>Overcoming Organizational Design Challenges</td>
<td>97</td>
</tr>
<tr>
<td>Improving Tactical Intelligence</td>
<td>100</td>
</tr>
<tr>
<td><strong>Appendix 1: Military Decision Making Process (ADRP 5-0)</strong></td>
<td>104</td>
</tr>
<tr>
<td><strong>Appendix 2: Multi-Domain Mapping Matrix for Staff Tasks in MDMP</strong></td>
<td>105</td>
</tr>
<tr>
<td><strong>Appendix 3: Mission Performance Model Documentation</strong></td>
<td>106</td>
</tr>
<tr>
<td><strong>Appendix 4: Army All-Source Intelligence Analysts’ Competency Task Specifications</strong></td>
<td>113</td>
</tr>
<tr>
<td>Table of Figures, Tables, and Charts</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Figure 1: Relationship between Strategy and Operational Art</td>
<td>11</td>
</tr>
<tr>
<td>Figure 2: The Levels of Intelligence</td>
<td>13</td>
</tr>
<tr>
<td>Figure 3: General Structure of Army Forces</td>
<td>15</td>
</tr>
<tr>
<td>Figure 4: Typical Battalion Decomposition</td>
<td>17</td>
</tr>
<tr>
<td>Figure 5: Co-Evolution of Operational and Design State Objectives, adapted from the “Problem-Design Exploration Model”</td>
<td>20</td>
</tr>
<tr>
<td>Table 1: Elements of Design State in System Design (Military Application)</td>
<td>22</td>
</tr>
<tr>
<td>Figure 6: Operational Design Evolving process, adapted from Army Design Methodology</td>
<td>23</td>
</tr>
<tr>
<td>Figure 7: Decomposition of Commander’s Critical Information Requirements, informed by ADRP 5-0, FM 5-0, and JP 2-0.</td>
<td>25</td>
</tr>
<tr>
<td>Figure 8: Event-Oriented and Feedback Views of the World</td>
<td>28</td>
</tr>
<tr>
<td>Figure 9: Stock and Flow</td>
<td>28</td>
</tr>
<tr>
<td>Figure 10: Components of System Dynamics Models</td>
<td>29</td>
</tr>
<tr>
<td>Figure 11: Mission Performance Model, Fundamental Structure</td>
<td>30</td>
</tr>
<tr>
<td>Chart 1: Mission Performance, All Mission Attempts Successful</td>
<td>33</td>
</tr>
<tr>
<td>Chart 2: Mission Performance, All Attempts Failures</td>
<td>33</td>
</tr>
<tr>
<td>Chart 3: Mission Performance, 50% of Attempts Successful</td>
<td>34</td>
</tr>
<tr>
<td>Figure 12: Mission Performance Model with Additional Structure, Depletion II and Mission Planning</td>
<td>35</td>
</tr>
<tr>
<td>Chart 4: Operational Capacity Utilization</td>
<td>36</td>
</tr>
<tr>
<td>Figure 13: Mission Performance Model’s Baseline Structure for the Intelligence Cycle</td>
<td>41</td>
</tr>
<tr>
<td>Figure 14: PIR and FFIR Model Components’ Impact on Likelihood of Success</td>
<td>42</td>
</tr>
<tr>
<td>Table 2: Effects of Relative Prediction and Readiness Impact on Likelihood of Success</td>
<td>42</td>
</tr>
<tr>
<td>Figure 15: Isolation of Complete Intel Cycle</td>
<td>46</td>
</tr>
<tr>
<td>Figure 16: Links from Intel Readiness Factor</td>
<td>48</td>
</tr>
<tr>
<td>Figure 17: Effects of Intelligence Cycle on Mission Planning</td>
<td>49</td>
</tr>
<tr>
<td>Table 3: Initial Values for Simulation Conditions</td>
<td>52</td>
</tr>
<tr>
<td>Chart 5: Baseline Model Results, Changes in Operational and Intelligence Capacities</td>
<td>53</td>
</tr>
<tr>
<td>Chart 6: Baseline Model, Depletion of Tasks in Higher Level Objective</td>
<td>55</td>
</tr>
<tr>
<td>Figure 18: Test Input Generator and Additional Structure in Model</td>
<td>58</td>
</tr>
<tr>
<td>Chart 7: Results for Each Set of Conditions with Effects of Step Function to Task Requirement</td>
<td>59</td>
</tr>
<tr>
<td>Chart 8: Step Function Effect on Depletion of Tasks in Objective</td>
<td>60</td>
</tr>
<tr>
<td>Chart 9: Results for Each Set of Conditions with Effects of Noise in Task Requirement</td>
<td>61</td>
</tr>
<tr>
<td>Table 4: Summary Results for Simulations of Varying Operational and Intelligence Capacities</td>
<td>63</td>
</tr>
<tr>
<td>Table 5: Unlimited Operational and Intel Scenario Ranges for Likelihood of Success</td>
<td>64</td>
</tr>
<tr>
<td>Chart 10: Results for Simulations within the Intel Cycle</td>
<td>65</td>
</tr>
<tr>
<td>Figure 19: DMM, Tasks to People in MDMP</td>
<td>70</td>
</tr>
<tr>
<td>Figure 20: DSM, People to People Exchanges</td>
<td>71</td>
</tr>
<tr>
<td>Figure 21: Challenges in Modern Intel Cycle</td>
<td>74</td>
</tr>
<tr>
<td>Table 6: Components of Intelligence Competency</td>
<td>78</td>
</tr>
<tr>
<td>Figure 22: MDM, Functional Components and Specifications for Analysts’ Competency Requirements</td>
<td>79</td>
</tr>
<tr>
<td>Figure 23: DSM for Components of Competency</td>
<td>80</td>
</tr>
<tr>
<td>Figure 24: System Dynamics Model for Effect of Shortcuts on Skill Building</td>
<td>87</td>
</tr>
<tr>
<td>Figure 25: Reference Mode for Effect of Shortcuts</td>
<td>90</td>
</tr>
<tr>
<td>Figure 26: Intelligence Spending Overview</td>
<td>92</td>
</tr>
<tr>
<td>Figure 27: Intelligence Compared with National Defense Spending</td>
<td>94</td>
</tr>
</tbody>
</table>
Introduction: Capability and Intent

"Nearly all missions this century will be complex, and the kind of thinking we have called "operational art" is often now required at battalion level."

Brigadier General Huba Wass de Czege
US Army, Retired

When intelligence analysts study threat forces, they ultimately strive to answer whether a threat has the capability to execute operations aligned with its objective. Analysis first examines what components (e.g., people, expertise, equipment) and methods would be enabling to a particular threat force, and then focus on determining the threat force’s current status in obtaining those enabling resources. Tactical intelligence analysts use intelligence collection and analysis techniques to determine the nature of the threat, so that an Army unit can effectively apply its forces with reduced uncertainty and risk to its soldiers.

Wide-ranging advances in information technology have greatly increased the volume, speed, and availability of information to analysts at all levels of intelligence. In the decade between the 9/11 attacks and 2011, the data flow from intelligence gathered remotely by piloted drones and other surveillance technologies rose by 1,600% (Shanker & Richtel, 2011). The increased availability of digital data and information resources, along with a plethora of improved analytical tools and collection platforms, provide a modern intelligence analyst with abundant resources for threat assessment. However, management of such a vast amount of information, and the needed methodologies to filter, process, and interpret data requires processing capabilities beyond even the most sophisticated analytic software. Consequently, the onus of transforming raw data and information into knowledge or intelligence assets relies on the skills and abilities of intelligence analysts who are too often ill-prepared for such an immense task. Analysts may seek to answer whether a threat force has the capability to achieve its intent, but
do the analysts themselves have the required capabilities to provide effective support for Army tactical operations?

Army and Intelligence Transformation

If there is in fact a gap between the current capability and the Army's required capability of military intelligence analysts, then this gap does not exist because of any lack of effort or failure to understand the impact of a changing world. The Army clearly understands the implications of the world's growing digital architecture on military operations, especially considering that much of today's technology evolved from the military's own cutting edge research. It is also fair to say that the Army has solidly proven its willingness to change in order to meet the new circumstances of war that were brought about by the digital age. In fact, the rapid expansion and availability of information technology was a major driver of change behind the Army's transformation into a modular force structure (Johnson, Peters, Kitchens, Martin, & Fischbach, 2012).

A major benefit of modular architecture is that it "allows the firm to minimize the physical changes required to achieve a functional change." The US Army has strived to achieve this benefit through its own transformation (Eppinger & Ulrich, 2004) with a move toward modularization that began in earnest in 2003. A major catalyst for this change stemmed from the challenge of waging war and pursuing long-term stabilization on multiple fronts. The initial concept of modularization had started over a decade earlier, during the military's shift away from a "deterministic and very appropriate scientific approach of the Cold War" to one that would enable the defeat of potential adversaries across a broad range of contexts (TRADOC PAM 525-5, 1994). Among the changes initiated in 2003 was the Army's transformation from a division-based force into a more agile, brigade-based force. These brigades were organized either as combat brigades, including infantry, armor, and Stryker, or as support brigades for
aviation, fires, battlefield surveillance, maneuver enhancement, and sustainment. The new structure of the combat brigades changed them from mere building blocks of their parent organizations into units capable of operating semi-autonomously or integrated with a larger force, depending on specific operational needs. Brigades now include multi-functional capabilities with an integrated internal architecture within the modules themselves. This new architecture provides the Army with an adaptive and flexible force to operate more effectively in a highly fluid operational environment (OE) (Johnson, Peters, Kitchens, Martin, & Fischbach, 2012).

The Army’s blend of modular and integrated architecture affords the flexibility to configure deployed forces to match the operational requirements based on threat and environment, while each unit also acts as a functional element contributing to the Army’s overall strategic capability. This decomposition of military units into smaller, more specialized, elements is not a unique characteristic of the Army. Military units across all services deconstruct into smaller entities, thereby enabling decentralized decision-making essential to accomplishing national security objectives in the modern OE.

The concept of nested military operations, linking actions at the lowest levels to strategic objectives, is the logic behind the Levels of War (ADRP 3-0, 2012) and Operational Art (JP 3-0, 2011) found in the Army Doctrine Reference Publication for Unified Land Operations and the Joint Publication for Joint Operations, respectively. These concepts outline the types of operations and levels of command at the strategic, operational, and tactical levels. Figure 1 represents the relationship between strategy and operational art, as adapted from its depiction in JP 3-0.
Nested operations unify the military efforts of geographically distanced and/or functionally disparate units, and enable decision-makers at each level to examine their operations in terms of the broader objectives they support. From a product and organization design standpoint, the nested operations enable effective coordination of processes without tight coupling of organizational structures. More significantly, while the military still operates as a predominately hierarchical organization, embedded coordination through nested operations exercises the function of 'hierarchical coordination' without the need to continually exercise authority (Sanchez & Mahony, 1996).

The Army's transformation presented significant challenges to the military intelligence community, which was still adapting to a firestorm of changes associated with the end of the Cold War era and more specifically in response to the 9/11 attacks. Significant intelligence reform was initiated in response to fallout from the erroneous 2002 National Intelligence Estimate on Iraq's possession of weapons of mass destruction and subsequent enactment of the Intelligence Reform and Terrorist Prevention Act in 2004. In addition to intense
organizational restructuring, members of the intelligence community launched significant and highly commendable efforts to improve its analytic methodologies. Most of the methods and processes introduced during that time were centered on improving communication across the intelligence communities. That included eliminating cognitive biases, and employing techniques to "combat mindsets, groupthink, and all other potential pitfalls of dealing with ambiguous data in circumstances that require clear and consequential conclusions." (Heuer & Pherson, 2011).

In the following years there was a deluge of publications on best practices for analysis and training, along with a volley of recommendations and assessments of observable critiques and flaws within the overall intelligence community. For the US military, many of these new methods and techniques contributed to revisions of intelligence doctrine. They also helped reshape the nature of intelligence support by the transfer of information across agencies and directly to the level of the warfighter.

As a member of the US intelligence community and as the direct intelligence resource to soldiers in combat, the Army’s Military Intelligence Corps felt intense pressure from both sides. Despite the inherent advantages of the modular force structure to the Army’s operational capability, it introduced new challenges to military intelligence compounded by the complex nature of threat forces in Iraq and Afghanistan and the urgent need for more intelligence capability at the tactical level. In a 2007 publication, the Institute of Land Warfare highlighted these challenges:

"Army modular forces place a high premium on the ability of BCT intelligence (S-2) elements to collect, rapidly exploit and fuse all sources of information into actionable intelligence in response to rapidly changing circumstances and commanders’ operational needs. This has driven significant MI growth at the BCT and battalion levels, establishment of reinforcing MI units within new battlefield surveillance brigades (BfSB), major expansion of Army human intelligence (HUMINT) forces, rebalancing of MI skills across active and reserve components, and new intelligence readiness programs..."
The re-balancing of military intelligence capabilities and the modular military intelligence structure addressed these challenges in a significant way by reinforcing intelligence support to operational levels facing the greatest risks (Institute of Land Warfare, AUSA, 2007). The latest doctrine on intelligence includes the complete structure of support across the Levels of War, which it parallels in outlining the Levels of Intelligence, as depicted in Figure 2 (JP 2-0, 2013).

![The Levels of Intelligence](image)

**Figure 2: The Levels of Intelligence (adapted from JP 3-0)**

Among the intelligence organizations shown there is no mention of the unit intelligence analysts, known as the S2 at brigade and battalion levels and G2 at divisions and above. For the purpose of intelligence doctrine, this omission is logical because the unit intelligence analyst falls directly under the unit composition. S2/G2 staffs have always been organic to the units, even before the Army transformation, and other intelligence assets have a legacy attachment to a parent organization due to that. However, the significance of the intelligence staff itself is lost in representations like this one, as omitting the support provided by military intelligence personnel...
at the unit level makes it easy to overlook how the multitude of changes affected their role as well.

Problem Statement

This paper will focus specifically on the redefined role of the analyst by examining the system of tactical intelligence. This systems analysis approach to enhancing intelligence analysis can in turn help Army units at the tactical level to improve mission performance. Specifically, this analysis will use systems design tools to:

- Examine and model the design of military operations
- Define the analyst's required capability in context of tactical operations
- Explore, revise, and assess components of intelligence competency
- Assess the relative costs of competency gaps
- Recommend improvements
Part I: Tactical Units and Evolving Operational Design

"No sensible decision can be made any longer without taking into account not only the world as it is, but the world as it will be."

Isaac Asimov

Structure of Army Units

As specified in the problem statement, the focus of this systems analysis aims to help Army units at the tactical level improve their mission performance through enhanced intelligence capability. It is imperative to understand the general structure of Army units in the context of individual soldiers since they execute missions as teams or elements of varying in size. Figure 3 depicts the structural configuration of Army units at levels for Division and below, specifically breaking down elements from an operational standpoint.

![Figure 3: General Structure of Army Forces (adapted from DA-PAM 10-1)](image)

The Army's exercise of mission command essentially has allowed the mission-executing unit to take decisive action by doing "whatever the situation required, as they personally saw it" (ADRP 6-0, 2012). In the same spirit of nested operations, the central idea in mission command
requires that elements at all levels understand and work toward achieving the broader purpose of a task. That in turn enables subordinates to act autonomously when necessary to the mission, rather than delaying and potentially missing an action opportunity by waiting for higher level approval first (ADRP 6-0, 2012).

In Figure 3, the elements colored tan depict subordinate units within a typical battalion. Each battalion typically has three to five companies, each consisting of three to four platoons. Each platoon encompasses three to four squads, and each squad has four to ten soldiers. Command and control exists at each level with the respective leadership element coordinating actions and making decisions during mission execution. Companies, platoons, and squads are largely homogenous, with specialization of skills within each combat or support branch. These units are expected to be proficient in executing operations with tactics consistent to doctrinal specifications of their specific area at each command level. The battalion level organization, however, introduces a heterogeneous element of mission support in the form of the unit’s coordinating staff.

Structure of Tactical Unit Staff

The battalion represents the lowest level regular Army unit that employs a staff element, comprised of personnel from across component branches, to assist the commander in the exercise of mission command (FM 6-0, 2014). Staff sections are groupings of staff members by areas of expertise under a coordinating, special, or personal staff officer (FM 6-0, 2014). Figure 4 depicts the composition of a typical battalion, with both the staff element and subordinate units.
Function of Coordinating Staff Elements

The coordinating staff assists the commander in operational planning using the Military Decision-Making Process (MDMP, steps listed in Appendix 2). Members include the following personnel and responsibilities (ATTP 5-01, 2011) (FM 6-0, 2014):

- **S1 — Personnel Staff**: serve as the human resources managers for the unit.

- **S2 — Intelligence Staff**: serve as intelligence analysts in support of a unit’s mission planning; provide timely, relevant and accurate intelligence to support the commander’s decision-making to effectively apply forces and reduce uncertainty and risks. The S2 leads the staff in the intelligence preparation of battlefield process, provides intelligence to support current and future operations, plans and supports lethal and non-lethal targeting operations, ensures that units base targeting priorities on intelligence threat assessments and includes the priorities in the reconnaissance and surveillance plan.

- **S3 — Operations Staff**: serve as the operations management staff with focus on current operations as well as short and long term plans. It assists the commander in managing
the deployment of unit resources and provides recommendations concerning courses of action and tactics.

- **S4 — Logistics Staff**: provides sustainment plans and operations, supply, maintenance, transportation, services, and operational contract support; supports the unit commander in maintaining logistics visibility with the rest of the staff.

- **S6 — Signal/Communications Staff**: serve as principal staff for all matters concerning communications, electromagnetic spectrum operations, and networks within a unit’s area of operations.

**Collective Function of Tactical Unit Command and Staff**

As defined by the concept of nested operations, successful mission performance marks the unit’s contribution to achieving one or more sub-goals in a higher-level objective. Because objectives for tactical operations are nested within those at the operational level, outcomes of tactical missions change the state of the operational objective over time, ideally moving it toward a desired end-state. However, attempting a mission is not a guarantee that its execution will be a success, or that it will produce an intended effect. The tremendous amount of risk and uncertainty associated with missions necessitates prudent judgment and planning at all levels of an operation. Within a battalion, it is the commander’s role to decide what missions the unit will execute and guide when and how the unit will attempt them. It is the staff’s role to provide information, planning, and analytical support to the commander’s decision-making and assist in reducing uncertainty and risk for any mission execution. The commander and staff elements work collectively to determine the design of a unit’s operations, which are based on a set of tactical missions designed to achieve a specific operational objective.
Operational Design

Although a relatively new concept within Army doctrine, operational design is currently defined as a “methodology for applying critical and creative thinking to understand, visualize, and describe complex, ill-structured problems and develop approaches to solve them” (FM 5-0, 2010). The doctrine also provides a general framework for design, which consists of the following processes (FM 5-0, 2010):

- Framing the operational environment (OE) — in what contexts will the design be applied?
- Framing the problem — what problem is the design intended to solve?
- Considering an operational approach — what broad, general, approach will solve the problem?

The Army Design Methodology: Commander’s Resource provides multiple frameworks that offer sets of questions as a starting point in thinking critically about Operational Design (Grome, Crandall, Rasmussen, & Wolters, 2012). Many of the frameworks mention the ability to move or transition from the current state of a desired goal toward or in the intended direction of, a desired end-state. In other words, it questions how a situation can be affirmatively transformed to a desired end-state. This question illuminates the idea that discrete events, such as a specific mission or action in an OE, are singular, finite sub-processes that help direct the continuous process of change. The outcome of each mission affects the objective state, which in turn should update the design of operations, or set of missions, required to propagate change in a desired direction. Figure 5 depicts this co-evolution of the operational objective state and the operational design state.
Objective state is a domain-specific term for problem space. The operational design state is a domain-specific term for solution space and incorporates tactical operations deemed necessary to achieve an objective.

The contingent relationship between actions and outcomes characterizes the reciprocal interdependency of the operational objective and design states as depicted in Figure 5. This type of interdependency emerges at this level because the underlying processes defining the objective and design states consist of dynamic sets of organizational actions and reactions, and "the actions of each position in the set must be adjusted to the actions of one or more others in the set" (Thompson, 1967). In order for a military unit to attain a desired operational end-state, it must evolve its approach in context with the current state of the problem, while also considering that its own actions influence the future state of the problem as well.

Evolving Operational Design

A single mission has the potential to initiate, affect, or catalyze changes in a culture, environment, or threat group. Those changes can be difficult to identify due to delays in their emergence or the nature of the change itself. The complex dynamics related to mission outcomes coupled with the Army's fast-growing reliance on information technology and its own
transformation efforts, put unprecedented emphasis on the importance of the planning and
decision-making processes at the lowest levels of operation.

An earlier Army publication on operational design stated (School for Advanced Military
Studies, 2010):

"Design methodology is not yet frequently applied at lower echelons, and even
divisions often report that they are challenged to use design within a time-
compressed environment. We expect it will take time, further education, and
tailored development of the design methodology before it becomes practicable at
the battalion level, even if there is already an established need for battalion-level
design due to the complexity of current operations."

Even the most recent of the Army's design publications, such as the 2012 *Army Design
Methodology: Commander's Resource*, only explore application through higher levels of
command. At the battalion level, the Army Design Methodology or general concept of
operational design may seem impracticable because of the high intensity and operational tempo
of combat. These conditions even challenge the execution of MDMP, which is thoroughly taught,
trained, and evaluated during Army training exercises.

However, MDMP is not a rigid methodology. Despite the common practice of using and
re-using specific templates to guide staff members through the process during Army training
exercises, adaptive field training and combat operations do not provide opportunities to copy
and paste elements of a higher level order or to fill in a ready-made template (Martin, 2015).
Like most models in doctrine, MDMP provides a foundational process to guide decision-making
in an operational context. It is meant to establish proficiency so that decision-making in combat
would include the most important elements for consideration. These elements include
interpreting higher-level intent in order to conceptualize, deconstruct, develop, analyze and
select a set of activities that will achieve a desired result. In essence, it requires framing a
problem in context of the OE, understanding requirements of an end-state, and determining the
best approach with respect to the resources available—a practical embodiment of Army Design Methodology.

This framework also coincides with system design methodology, wherein the design state at any given point in time is defined by the requirements set, context set, and system set, as related in Table 1.

<table>
<thead>
<tr>
<th>Element of Design State</th>
<th>System Design</th>
<th>Military Application in OE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Context Set</strong></td>
<td>Set of entities that interact with the systems through its external interfaces</td>
<td>Set of operational variables—Physical, Military, Economic, Social, Infrastructure, and information—as respective systems, that comprise the OE specific identity</td>
</tr>
<tr>
<td></td>
<td>Can impact the system as a form of input and be impacted by its outputs</td>
<td></td>
</tr>
<tr>
<td><strong>System Set</strong></td>
<td>Includes the system’s form set as well as the system’s behaviors set</td>
<td>Characteristics, form and behavior, of the operational variables</td>
</tr>
<tr>
<td><strong>Requirements Set</strong></td>
<td>Functional requirements of system</td>
<td>Functional requirements of operational variables that define the desired end-state</td>
</tr>
</tbody>
</table>

Table 1: Elements of Design State in System Design (Military Application)

A battalion essentially executes operational design in real-time as evidenced in the very nature of the co-evolution of operational objective and design state (see Figure 5). This situation requires an interpretation and understanding of the current state of an objective in order to move forward with operations. The model in Figure 6 shows the operational design evolving process, conducted at battalion level and solidly rooted in the construct of MDMP, as a tool that the command and staff use to execute many sub-processes.
The operational design evolving process is the process that evolves the operational design state at time $t$, to a new state at $t+1$. The process includes the sub-processes: conceptualization, decomposition, development, analysis, selection, and execution. With the exception of execution, these processes encompass those defined in MDMP.

The operational design evolving process is specifically defined as a means by which an operational design state at time $t$ moderates to a new state at $t+1$. The higher process includes the sub-processes of conceptualization, deconstruction, development, analysis, selection, and execution. With the exception of execution, all these processes encompass those defined in MDMP.

In product or system design methodology, the final sub-process would be testing, not execution. However, military units cannot truly test their operations because of complex
dynamics related to mission outcomes. The procedure closest to testing is actually a sub-process of analysis, wherein the staff uses war-gaming to simulate potential outcomes of a mission based on the current state of the opposing forces. Unfortunately, it is very difficult to ascertain the state of the opposing force with a fair degree of certainty, adding another layer of difficulty in gauging the potential outcomes prior to launching a mission. The crux of effective decision-making is the unit’s ability to reduce this uncertainty so that it can design operations to achieve a desired end-state.

Critical Information Requirements

Information collection is vital to a commander’s effectiveness and facilitates better decision-making throughout the conduct of operations (ADRP 5-0, 2012). Commander’s Critical Information Requirements (CCIR) are the elements of information that directly impact a commander’s decision process and subsequent successful execution of military operations (JP 2-0, 2013).

CCIR consists of two subcategories of information requirements: Priority Intelligence Requirements (PIR), and Friendly Force Information Requirements (FFIR). An S3 operations officer is the primary staff to recommend a commander’s FFIR, which focus on localized data within a commander's range of control. This information would include specific mission data, troop activity, support needed and time availability (JP 2-0, 2013). More significant in the context of this model are the PIR, for which an S2 intelligence officer is the primary staff responsible. PIRs are intelligence requirements for which a commander has an anticipated and stated priority in his task of planning and decision-making (JP 2-0, 2013). They are used to answer intelligence gaps or identify specific events or activities that indicate what Course of Action (COA) a threat has chosen (JP 2-0, 2013).
CCIR are elements of information required by commanders that directly affect decision making and dictate the successful execution of military operations.

- FFIR focus on information regarding the mission, the troops and support available, and time available.
- FFIR focus on things that the commander has a certain amount of control over.

- PIR focus on the enemy, the elements of time, terrain and weather, and some civil considerations.
- PIR deal with elements characterized by a great deal of uncertainty.
- Getting answers to PIR usually involves the commitment of some kind of limited resource to go and collect information, process it, and analyze it.

Figure 7: Decomposition of Commander's Critical Information Requirements, informed by ADRP 5-0, FM 5-0, and JP 2-0.

Part I Summary

Under the legacy construct, it was more common for higher headquarters to dictate the specific missions in tactical level operations. Tactical intelligence analysts could use a higher headquarters intelligence product to deduce and inform its implications to unit operations. In the modern Army, the decentralized decision-making that characterizes mission command requires more precise tactical intelligence and requires the S2 to be capable of generating the intelligence products from a variety of information sources.

Because objectives for tactical operations are nested within those at the operational level, outcomes of tactical missions change the state of the operational objective over time. The outcome of each mission affects the objective state, which in turn updates the next set of missions required to direct the change in a desired direction. Propagating change in a desired direction relies on the ability of the unit to understand the current conditions of the OE and threat, which are characterized by a fair degree of uncertainty. The crux of effective decision-
making is the unit’s ability to reduce this uncertainty so that it can continually update its operational design toward a desired end state. Operational design then relies on the unit’s ability to conduct missions, based on the capacity of its operational forces, and its ability to reduce uncertainty, based on the capacity of its intelligence staff to identify and answer PIR.
Part II: System Dynamics Model for Mission Performance

“All leaders must consider systems in their organization—how they work together, how using one affects the others, and how to get the best performance from the whole.”

FM 6-22, 10-24
Synchronizing Systems

A unit’s ability to achieve an objective’s desired end-state within an OE relies on its abilities to plan and execute missions effectively. This section provides a system dynamics model of a tactical unit’s mission performance. The purpose of this model is to demonstrate how the structures of a tactical unit’s decision-making system lead to various outcomes. This model provides a foundation for the dynamic complexity of the system that tactical intelligence supports and effects, and will provide insight on why attempts to stabilize the system may generate unanticipated side effects.

Quick Overview of System Dynamics Modeling and Syntax

System dynamics modeling provides a means of representing cause and effect and includes reactions of a system to a decision-maker’s actions.

This type of modeling provides a feedback view of the world, shifting away from the typical event-oriented view, which looks at the goal and current situation to determine how to achieve a desired result. However, as discussed in the “Co-Evolution of Operational Objective and Design States,” represented in Figure 5, actions or decisions toward a solution impact the problem space, which leads to new decisions. In essence, the results of those decisions, in the form of actions of others or as intended and unintended effects, define the future situation. Figure 8 provides a representation of these two views as depicted in John D. Sterman’s Business Dynamics.
The system dynamics model that follows identifies elements of mission performance in terms of their relationships to each other, the flow of the process, and some phenomena that influence the flow. A system dynamics model consists of stocks, flows, and links or connectors of positive or negative polarity that represent the influence of one variable on another. Stocks and flows serve as the basis of the general structure, which as depicted in Figure 9.

The supporting structure within a model consists of feedback loops, which model the relationships of auxiliary variables, and sub-processes of the system. The feedback structure generates modes of behavior such as growth, goal seeking, and oscillations that allow the model to simulate dynamic behavior of the system.
Stocks represent accumulations.

Flows represent activities and control the filling or draining of stocks, causing conditions to change.

An arrow signifies the direction of the flow.

A valve represents the flow regulator.

A cloud represents a source or sink of the flow, which is a stock outside the model boundary.

Positive Link Polarity: All else equal, if X increases (decreases), then Y increases (decreases) above (below) what it would have been.

Negative Link Polarity: All else equal, if X increases (decreases), then Y decreases (increases) below (above) what it would have been.

Balancing Loop denotes a structure of negative feedback. These loops help move a system toward a goal.

Reinforcing Loop denotes a structure of positive feedback. These loops create an exponential growth or decline.

Feedback loops are either positive or negative. The positive (+) and negative (-) signs on the arrows that link one variable to another infer a causal relationship, as defined in the diagram above. A series of links that returns to its origin closes the loop and thus defines the loop's feedback type. If an increase in the origin variable ultimately causes a further increase of the origin variable, then the loop is self-reinforcing and referred to as a reinforcing or positive feedback loop. If an increase in the origin variable ultimately causes a decline to the origin variable, then the loop is self-correcting and known as a balancing or negative feedback loop.

Fundamental Structure of the Mission Performance Model

The mission performance model examines the flow of missions as they move from tasks in the higher-level objective to the subordinate unit, which processes, plans, and performs the missions with the aim of depleting all requisite tasks within a set period of time, or deployment cycle. Figure 11 depicts the fundamental structure of this system.
Figure 11: Mission Performance Model, Fundamental Structure

The stocks are *Tasks in Higher Level Objective*, *Missions to Do*, *Missions in Progress*, and *Missions to Rework*. Each stock value is measured in *missions*. The inflows and outflows to each of the stocks are measured in *missions per day*. The primary variables are listed below, and the complete list of the model's variables, with units of measure and equations, is in Appendix 3.

*Task arrival*: This is a flow that represents the rate at which new tasks arrive to the higher-level objective. This can occur for many reasons, such as adjustments to the higher-level objective, requests from adjacent units, or as orders from the next higher objective. This model will not include the exogenous sources of task arrival, but will build upon this foundational structure to include the endogenous sources of task arrival.

*Tasks in Higher Level Objective*: This is a stock that represents a discrete amount of tasks that cumulatively lead to the accomplishment of the objective. While a predetermination of the number of tasks leading to an accomplishment of some objective is quite unrealistic in the real world, the set of tasks here is necessary to define the objective so that the model may simulate the processes that lead to its accomplishment.
• The accumulation from the task arrival inflow less the successes outflow determines the value of this stock. Successes is the rate of completed missions multiplied by the likelihood of success, which a probabilistic value from 0 to 1 that determines a mission outcome (which will become more significant when it is affected by other aspects of the model).

• The initial value of this stock is 750 missions. This value represents a realistic expectation of the battalion’s workload for the duration of the deployment based on the unit’s ideal capacity for mission performance.

Mission requests: This is a flow that represents the rate that missions, in the form of requests, arrive to the battalion and accumulate in the Missions to Do stock. While tasks from higher headquarters are in the form of orders, the use of the term “requests” suffices because a battalion commander has the ability to discern how and if a unit will perform the mission. Like the task arrival variable, mission requests in this model only account for the endogenous sources of requests.

• The value of mission requests is determined by the amount of missions in the Tasks in Higher Level Objective stock, and the time available to achieve a higher-level objective based on the amount of time remaining in a 365-day deployment. The rate of mission requests arrives in a distribution of tasks meant to simulate a campaign plan. Because leaders account for some amount of uncertainty in mission planning, the Tasks in Higher Level Objective are distributed over 335 days, providing a 30-day planning buffer.

• The initial value of this stock is Tasks in Higher Level Objective/ time available to achieve higher-level objective, which at t0 is 750/335 or ~2.25 missions per day.

Missions to Do: This is the stock representing the amount of work given to a unit in the form of missions.
• The accumulation from inflows, mission requests and re-task rate, less the attempts outflow, determines the value of this stock.

• The initial value of this stock is 5, representing the initial missions waiting for the unit upon its arrival to theater.

Missions in Progress: This is the stock representing the amount of missions that the unit is executing.

• The accumulation from the attempt's inflow, less its completed missions outflow, determines the value of this stock.

• The initial value of this stock is 0.

Missions to Rework: This is the stock representing the portion of missions that exited Missions in Progress stock and did not deplete the Tasks in Higher Level Objective stock because the missions were not successful.

• The inflow to Missions to Rework is failure, which is the rate of completed missions multiplied by \(1 - \text{likelihood of success}\). The accumulation of missions from failure less the re-task rate outflow determines the value of this stock.

• The initial value of this stock is 0.

The blue balancing loop in Figure 11, Depletion I, denotes the negative feedback structure that would lead to the depletion of missions and move the system toward its goal. In an ideal case, a subordinate unit, representing a typical battalion, moves all mission requests through and out of its system as successes, thereby depleting tasks in the higher-level objective at the same rate as mission requests. This behavior would put the system in equilibrium, where the inflow is equal to the outflow, and would ultimately lead to the depletion of the required tasks. The reference mode in Chart 1 below represents the ideal case wherein the likelihood of success is 1; so all completed missions are successful and deplete the Tasks in Higher Level Objective.
The red reinforcing loop, *Rework*, depicts the positive feedback structure that leads to exponential growth or decline of missions in the *Missions to Rework* stock. In a worst-case scenario, wherein all mission attempts fail, they would enter the *Missions to Rework* stock via the *failure* inflow, flow out via the *retask rate* and return to *Missions to Do*. This means that the unit would be unable to achieve any operational success and would remain deployed indefinitely, if it had to stay in theater until the work was done. The reference mode in Chart 2 below represents the ideal case wherein the *likelihood of success* is 0, so all completed missions are *failures* and do not deplete the *Tasks in Higher Level Objective*. 
When the task arrival rate is 0.0 and the likelihood of success is 0.5, the reference mode of the two loops with “equal” chance of influence is depicted in Chart 3. These findings will be discussed throughout the following sections.

![Chart 3: Mission Performance, 50% of Attempts Successful](image)

Personnel-Driven Processes

Comparing the behavior captured in the charts reveals a few key concepts about the underlying structures in the model. First, the amount of missions in progress for each of the simulations stays relatively consistent around a value, meaning there must be a restriction on the amount of missions a unit can perform. Otherwise that unit could freely increase the amount of missions they perform to get its work done in time. Secondly, if a unit is not conducting successful missions quickly enough, higher headquarters would update the requisite campaign plan operational tempo (OPTEMPO), by requesting missions to make up for the gap in progress. Figure 12 shows the model with added structure that will incorporate these processes as represented at the Mission Planning loop (in green) and the Depletion II loop (in blue).
The Mission Planning loop will ultimately encompass the processes that a unit executes during a mission planning cycle\(^1\). It shows that, as the number of incoming missions increases, the unit’s desired production increases, so it increases its capacity utilization to allow attempted missions at a faster rate. As mentioned in earlier sections of this paper, the structure of military units is such that its personnel are its most critical resource, and it is the capacity of the personnel to function as part of the unit that enables the unit to perform successfully. Because each unit has a limit on the number of personnel it employs, and because people have a limit on the amount of work they can perform, there is a limit on the amount of work they can process at a given time. This limitation is represented through the operational capacity variable, which represents the maximum number of missions that a unit can process during a mission planning cycle.

\(^1\)According to the military’s one-third, two-thirds rule, one-third of the available time to conduct a mission should be dedicated to planning and two-thirds should be given to the team tasked to execute the mission. Thus the reference to “mission planning cycle” refers to 1/3 of the total service time, which is approximately 3 days in this model.
operational capacity utilization across all scenarios, when operational capacity is set to 4 missions per planning cycle. Lower rates of success correspond with greater operational capacity utilization during the deployment. This occurs because the model’s rework cycle replicates the effort required to overcome adverse effects of mission failure in an OE.

The Depletion II loop represents the higher headquarters adjustment to the unit’s OPTEMPO. Higher headquarters assesses the depletion of missions in the Tasks in the Higher Level Objectives stock by comparing the rate of successes to the rate needed according to the campaign plan OPTEMPO. The campaign plan simply uses the initial tasks and assigns an average rate of tasks per day over 335 days, which allows an additional 30 days plus the unit’s unused capacity to determine an ideal OPTEMPO for the deployment. The difference between this and the rate of successes defines the OPTEMPO gap.
The gap represents some amount of new work generated when a unit fails to achieve desired effects on time, which can occur for a variety of reasons. The ideal mission window may have passed, a key source or asset may no longer be available, or the effects of not performing a mission may have generated more work than the original mission would have required. These effects become new tasks and arrive to the *Tasks in the Higher Level Objectives* stock via the *task arrival* flow. Since not all missions in the OPTEMPO gap generate the same level of new work, and because planning processes for other missions may also account for some of these effects, the model simplifies the variation and only generates new tasks to cover half of the value of the OPTEMPO gap. In later structural additions, we will explore the effects of the newly introduced tasks and their impacts on the system.

With the reasonable assumption that headquarters gives the unit time to adjust to the OE, it only assesses the gap after the unit has been operating for 30 days and until 30 days before the end of the deployment time. The 30-day buffer at the end of the deployment enables a unit to process working missions while also preparing to exit the OE or prepare the next unit to take over operations.

**Part II Summary**

The mission performance model provides a means to explore the tactical intelligence support to combat operations. The goal of the unit in the model is to successfully perform assigned missions so that all tasks in the higher objective have been accomplished by the end of deployment cycle. The model uses a doctrinal foundation to replicate the desired OPTEMPO and inherent decision processes in mission planning. The 30-day buffer at the end of the deployment gives the unit reasonable, realistic flexibility to help guide the decision processes based on the level of urgency as affected by the passage of time and also accounts for transitions in and out theater. During initial testing of the effects of various likelihoods of
success, it is apparent that likelihood of success drives the amount of operational effort that the unit will have to sustain in order to achieve its objective. Since personnel are the unit’s most critical resource, and it is the capacity of the personnel, both in operations and intelligence, that enables the unit to perform successfully.
Part III: Modeling MDMP

“The commander drives intelligence, intelligence facilitates operations, and operations are supportive of intelligence; this relationship is continuous.”

The Intelligence Warfighting Function
ADRP 2-0, August 2012

Rational, Doctrinally Driven Decisions and Processes

Adding structure, to represent the personnel-driven processes in a unit’s mission performance, stresses the significance of personnel considerations in the unit’s ability to successfully accomplish missions. In considering how to design this model, one of the primary assumptions is that the agents in the system operate with rational behavior. The Army would not knowingly deploy a unit to an OE and give them more work than they could realistically handle without considering some amount of uncertainty. This rationale means that the initial parameter values for Tasks in Higher Level Objective stock, deployment time, campaign plan OPTEMPO, and the unit’s operational capacity must enable feasible accomplishment of the objective. In addition to deploying troops with consideration of the objective and the unit’s abilities, it is also reasonable to assume that higher-level decision makers would make a concerted effort to place troops according to their capabilities and alignment with the needs of the OE. This would mean that the placement of troops, by aligning their skills against those they would face, would be expected to have a higher likelihood of success than failure.

The structure of the model demonstrates that there are at least two major considerations for a unit to consider for mission performance, including the amount of work to do within a set time and a unit’s capacity to do it. However, time to achieve an objective and the capacity of a unit are relatively fixed factors.

There are usually significant and often devastating consequences when military operations fail to achieve an objective within the designated amount of time. Security deteriorates, risk increases, and economic costs soar. Further, if the opportunity to achieve a
desired end-state still were to exist at all, the chance of success would diminish substantially because the military’s methods of operation would by then be understood and more exploitable by an adversary.

There can be negative consequences when the unit operates at a high operational capacity. Revisiting Chart 4, operations in environments with greater uncertainty of success leads to greater capacity utilization. The more likely a unit is to fail at its missions, the more missions it will have to perform in order to achieve the desired objective within the allotted amount of time. While soldiers are highly motivated, physically and mentally fit people, they have a limit to the length of time they can operate at their highest capacity. High activity demand fatigues the body, impairs mental judgment, weakens team cohesion and diminishes performance. So far, the Mission Performance model has not included the effects of working at a high capacity, but it is imperative to incorporate that effect since it ultimately decreases the amount of successful missions and increases the amount of work to do from failed missions requiring re-work. Operating by working harder, as many units and organizations often do, can lead to detrimental effects if it is not supplemented by other processes to help balance the work load.

The Intelligence Cycle in MDMP

The Mission Planning loop is a high level representation of MDMP used by staff and commanders to determine the best way to conduct a mission successfully. As represented in Figure 7, the critical information requirements necessary for the commander’s effective decision-making are the FFIR and PIR. The FFIR exist in the model as the operational capacity constraint and the operational capacity utilization variable in the Mission Planning loop.
The next structure in the model will add the intelligence cycle, which addresses the PIR. Figure 13 depicts the high-level representation of the intelligence cycle, which serves as the baseline structure for intelligence processes in mission planning.

PIR, represented here as intelligence gaps, is a critical element because intelligence provides essential data about the enemy and the environment as part of mission planning, better application of forces and reduced uncertainty and risk (ADRP 2-0, 2012). In short, intelligence products provide units with information superiority, a significant factor in mission success. When a unit can predict adversary actions it can better plan and prepare for a range of possible actions.

The Impact of Intelligence and Operations Planning on Mission Outcomes

The FFIR and PIR are represented in the model as readiness impact on performance and relative prediction of threat. Together the FFIR and PIR, or the readiness levels of the unit with respect to its own forces and its knowledge of the environment, provide the commander
with critical information needed to make effective decisions. Each impact a unit's *likelihood of success* in executing missions, as depicted in Figure 14.

![Figure 14: PIR and FFIR Model Components' Impact on Likelihood of Success](image)

Table 2 depicts the effects of *relative prediction of threat* and *readiness impact on performance* on the *likelihood of success*. In the model, the effects of these variables affect the unit on a sliding scale rather than as fixed values. Ideal ranges for each variable are relatively constant while values outside ideal ranges may vary.

<table>
<thead>
<tr>
<th>Relative Prediction Level and Base Rate p(success)</th>
<th>Mission Success?</th>
<th>Range Category for Capacity Utilization Effect on Likelihood of Success p(success / capacity utilization) @ avg deduction = 0</th>
<th>@ max deduction = .15</th>
<th>@ max deduction = .10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perfect</strong> p = 1.0</td>
<td>YES</td>
<td>1</td>
<td>.85</td>
<td>.9</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td>0</td>
<td>.15</td>
<td>.1</td>
</tr>
<tr>
<td><strong>Strong</strong> 1.0 &gt; p &gt; .7</td>
<td>YES</td>
<td>.85</td>
<td>.7</td>
<td>.75</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td>.15</td>
<td>.3</td>
<td>.25</td>
</tr>
<tr>
<td><strong>Fair</strong> .7 &gt; p &gt; .6</td>
<td>YES</td>
<td>.65</td>
<td>.5</td>
<td>.55</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td>.35</td>
<td>.5</td>
<td>.45</td>
</tr>
<tr>
<td><strong>Weak</strong> p = 0.5</td>
<td>YES</td>
<td>.5</td>
<td>.35</td>
<td>.4</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td>.5</td>
<td>.65</td>
<td>.6</td>
</tr>
</tbody>
</table>

*Table 2: Effects of Relative Prediction and Readiness Impact on Likelihood of Success*

A unit incurs up to a 15% decrease in the *likelihood of success* for operating at high capacity utilization, and up to a 10% decrease for very low capacity utilization. This suggests a
decrease in proficiency for extended durations of inactivity. Ideal capacity utilization is derived from the rationale of the military’s rule of thirds, in which one-third of capacity should be executing, one-third should be preparing to execute, and the other third should be in recovery. Since a unit’s capacity is the amount of work it can perform operating at 100% utilization, an ideal capacity utilization falls in the range of 45% to 75%, assuming that collective capacity includes the staff, operator, and commander roles. The model determines readiness impact by averaging capacity utilization over a period of 28 days, with the most recent data being given more weight. The variable for readiness impact on performance assigns scores that decrease exponentially from the minimum and maximum penalty to the midpoint of the ideal capacity range.

Levels of relative prediction used here were actualized from evaluation of adaptive artificial intelligence performance to predict opponent actions in force on force during imperfect information games (Baakes, Spronck, van der Herik, & Kerbusch, 2007). While the mission performance model does not truly simulate enemy activity, it uses the likelihood of success to replicate uncertain outcomes in mission performance, much like the uncertainty that arises from the impossibility of perfectly predicting enemy actions. While acknowledging that real-world intelligence analysis attempt to predict threat activity and assist decision-making in an imperfect information environment, this model assumes that the unit is operating in a perfect information environment. This means that unlike real-world activity, perfect execution of the intelligence cycle could lead to a perfect prediction of threat activity, which in turn helps to expose weaknesses in the intelligence and operations processes.

To achieve “perfect prediction,” the intelligence cycle must answer all intelligence gaps associated with the missions the unit will perform. This means it is necessary to assume that an analyst not only asks all the right questions to identify intel gaps, but must identify the complete set of intel gaps as well. Thus, a weak relative prediction means that the intelligence analysts
predicted enemy activity no better than a coin toss with a base rate probability for *likelihood of success* no greater than 50%. The *relative prediction of threat* does not fall below 50% in this model. Normal and strong relative prediction means that the analysts correctly predicted threat activity at least 60% and 70% of the time, respectively.

The complete model includes the modified structure to the mission-planning loop, which incorporates the effects of the *relative prediction of threat*. The effects of this variable are not visible in the depiction of the main structures of the model because they are driven by the output of the intelligence cycle, specifically through the cycle's impact on the uncertainty variable. The following sections will show and discuss the complete model.
Intelligence for Current and Future Operations

The complete model shows that the intelligence cycle is not quite as simple as its depiction in Figure 13. The unit's desired production, as determined by the amount in the missions to do stock, represents the initiation of MDMP. The determination of the unit's operational capacity utilization and simultaneous intel gap discovery simulate the FFIR and PIR determinations. Figure 15 isolates the intel cycle from the rest of the model for more convenient reference.

The inner intel cycle loop, in orange, is the unit's comprehensive intelligence production. The brown outer loop simply represents the production that supports the immediate set of missions. In this way, the model is able to simulate the long-term production toward future operations while fairly accounting for the production that directly supports current operations.
Gap discovery is determined by the number of missions in the unit’s desired production stock and mission complexity, which assigns a number of gaps to each mission according to a random normal distribution (minimum 2, maximum 20, mean 9) that simulates varying amounts of intelligence requirements for each mission. The stock of intel gaps represents the complete set of gaps for the missions contained in the Missions to Do stock. The unit’s allowable mission attempts determine the minimum required intel production to support the unit’s near term missions. Desired intel production considers both sets of gaps (as both are actually contained in the intel gap stock), and will always include the minimum requirement. In parallel to the mission planning loop’s operational capacity, the intel cycle also considers a unit’s capacity to produce intelligence with assumptions that a) units are given an intel staff capable of supporting the unit’s operational capacity of 4 missions per planning cycle, and is c) able to support production that answers up to 36 gaps during the unit’s planning cycle (as derived by multiplying 4, the unit’s operational capacity times 9, the average number of gaps per mission). Unlike operational capacity, there is no direct penalty for operating at the highest intel capacity. That will be discussed in later sections.

The intel products variable is the amount of intelligence gaps that the intel staff is able to fill during the planning cycle. This production depletes the stock of intel gaps via its outflow (filled), and the greater its value, the greater the unit’s intel readiness factor. However, the intel support to mission moderates this influence because it provides a means to ensure that the production needed for a unit’s immediate mission is included in the assessment of the unit’s readiness. The intel readiness factor is determined by the value of intel products divided by the value of intel support to mission. That value is between 0 and 1 when production covers the minimum requirement or less, and above 1 when it covers more than the minimum.
Intelligence Effects

The *intel readiness factor* supports three other processes in the model, as denoted in its links to *uncertainty*, *risk*, and *filterability*, shown in Figure 16.

![Diagram showing links from Intel Readiness Factor](image)

**Figure 16: Links from Intel Readiness Factor**

The section entitled “Impact of Intelligence and Operations Planning on Mission Outcomes” discusses the intel cycle’s effect on the *likelihood of success* for missions, which it causes through this link to the *uncertainty* variable. When the value of the *intel readiness factor* is falls between 0 and 1, it signifies the percentage of intel gap coverage for a specific mission cycle. A value of 1 means that all gaps have been filled through intelligence production. Since this model allows for perfect knowledge, the *uncertainty* variable, calculated as 1-intel readiness factor, would be 0, meaning an adversary’s actions are completely known or predictable. A level of *uncertainty* with a value of less than 1 suggests the percentage of unknowns associated with the order or nature of the opposing force or environment. It follows that the relative prediction for possible outcomes are also unknown, which in an analyst’s real-world role equates to a detriment in the relative quality of products for mission planning, such as enemy course of action development and war-gaming. While uncertainty and risk are typically discussed together, *uncertainty* in this model specifically pertains to actions during mission performance, thereby affecting mission outcomes. In an Army unit’s mission performance, just as in business
practices, too much uncertainty is undesirable while manageable uncertainty provides the freedom to make creative and effective decisions during the execution of a mission.

The other two processes that intel readiness directly affects are prioritization and operational tempo. Figure 17 shows these loops, labeled “Prioritization” and “OPTEMPO”, respectively.

The Prioritization loop captures the value that known information brings to the commander’s determination of which missions to pursue. It is also a high-level representation of the underlying process that a commander should perform, which includes the assessment of which missions will bring the most value as well as determining the order and timing of a unit’s attempts to accomplish them. The prioritization loop controls the discard outflow of the missions to do stock, with the discard variable representing the amount of missions that the commander can eliminate using his own experience and judgment. Without the impact of the intel cycle, the model only allows the commander to discard one-tenth of the missions in the missions to do stock. As previously mentioned, the intel cycle determines the amount of intel products that a unit creates during a planning cycle. A unit’s intel readiness factor determines whether the level
of intel production is above or below the immediate mission needs. When its value is greater than 1, the unit has provided intelligence that not only supports all gaps in the immediate mission, but also supports future missions. The prioritization process replicates this future support by allowing the commander to discard up to 2.5 times more missions than he would through the expertise his experience and training provide. This in turn depletes the missions to do stock, which decreases desired production and intel gaps, reducing the required work in the next planning cycle.

The OP TEMPO loop determines the rate at which a unit attempts missions. The intel readiness factor determines a mission’s risk level, which then impacts the likelihood of approval governing the rate of mission attempts. If the unit’s intel readiness factor is less than 1, then it signifies the unit’s exposure to risk due to a lack of knowledge needed to mitigate risk. Risk refers to the implied cost of conducting a mission, based on the cost of performing it relative to the perceived gain and the potential cost of losing personnel, materiel, or information. This model necessarily simplifies the relationship between risk level and mission attempt rate through the likelihood of success variable, which denotes a unit’s ability to attempt the full value allowable mission attempts. In reality, an increase in risk leads to less precision in a diverse range of factors, such as the amount of forces or type of equipment required for the mission or the alignment of outside resources. Higher risk often leads to a requirement to receive higher echelons of approval, removing the decision from the unit level of command. These factors vary broadly from one unit to another, but they all ultimately delay or prohibit mission attempts. This decrease in mission attempts contributes to accumulation in the missions to do stock.

Part III Summary

To more realistically depict the operations and intelligence processes in mission planning, the model’s additional structure provides essential variables and relationships to
replicate MDMP. The determination of the unit's operational capacity utilization and simultaneous intel gap discovery simulate the FFIR and PIR determinations. Decision processes are coded in the model's design, each solidly rooted in doctrine so that the model uses battalion structure and processes as designed for successful mission performance. The structure of the full model stresses the significance of personnel considerations in the unit's ability to successfully accomplish missions: operations in environments with greater uncertainty lead to greater capacity utilization. The unit’s intelligence capacity includes production toward future operations and current operations, and it is important that a unit be able to allocate capacity to both, since intelligence production affects future and current operations in the model through the filterability, risk, and uncertainty variables. Operating by working harder, as many units and organizations often do, can lead to detrimental effects if it is not supplemented by other processes to help balance the work load.
Part IV: Simulations

Simulation Settings

The finished model provides the ability to simulate the system under a variety of scenarios and highlight the relative impacts of the operational or intel capacity variables on mission performance. In each simulation scenario, we will examine the behavior of the model, holding all variables at their baseline values, while examining three different sets of conditions for the values of operational and intel capacity. These conditions are listed in Table 3.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Operational Capacity</th>
<th>Intel Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aligned Capacities</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>Unlimited Operational Capacity</td>
<td>Unlimited</td>
<td>36</td>
</tr>
<tr>
<td>Unlimited Intelligence Capacity</td>
<td>4</td>
<td>Unlimited</td>
</tr>
</tbody>
</table>

Table 3: Initial Values for Simulation Conditions

For the case of unlimited operational capacity, the effects of under work on likelihood of success are turned off.

Baseline Simulation

The first simulation uses the baseline values for operational and intelligence capacity and does not introduce any new structure or inputs to the system. The baseline model represents operations in a relatively stable situation where a unit’s relative capability aligns with the needs of the OE. Chart 5 provides a quick comparison across each set of parameter values with respect to their effects on a unit’s effort, efficacy, and time in which it accomplished all tasks in the objective.
The vertical line along each graph’s time axis represents the time at which Tasks in Higher Level Objective=0. Each graph depicts the total amount of missions that unit completed (blue line) and the accumulation of successful missions (red line) over the duration of its deployment. The gap between these lines represents the portion of the unit’s effort that did not contribute to depletion of tasks in the objective.

Results of Baseline Simulation with Aligned Capacities

Where operational and intelligence capacities align with each other, a unit is able to meet requirements of a higher level objective in 340 days. As described in a previous section on the model’s fundamental structure, 335 days represents the minimum time for accomplishing the objective because the model assumes a phased campaign plan to achieve best results for the
OE. This plan also provides the unit with flexibility to adapt to, or absorb, the effects of uncertain events, and it acknowledges that not all missions are successful. The graph of the total missions completed and missions successfully completed reveals the gap between the unit’s total effort and its effective effort. Despite having over 100 failing missions, the unit’s mission planning process (in conjunction with the aforementioned doctrinal foundation for its structure and procedures) enables the unit to minimize the effects of the losses. While any organization would want to operate as efficiently as possible, this factor is especially important in military operations because missions risk soldiers’ lives.

Results of Baseline with Unlimited Operational Capacity

With unlimited operational capacity, progress is not as smooth. Focusing on the center graph in Chart 5, the resulting gap depicting the unit’s ineffective effort does not appear to be much larger than that of the case with aligned operational and intelligence capacities. However, it is apparent that the unit struggled to meet the 365-day deadline, depleting its tasks just 3 days shy of it.

It may seem counterintuitive that a unit with unlimited operational resources would not be able to accomplish its tasks at a faster pace. Since the intelligence capacity no longer aligns with operational capacity, the unit is still bound to a limit on the number of missions that it can effectively provide intelligence support for. However, the rational, doctrinally driven processes in the model have not changed from the initial conditions, so the operational campaign plan still only requires an OPTEMPO of a little over 2 missions per day. This means that the rate of mission requests arrive according to that OPTEMPO, unless the unit’s rate of successes requires additional tasks.

Since the introduction of tasks has not changed, the factor affecting the unit’s ability to accomplish missions is the steady accumulation of missions to do that leads to allowable
mission attempts that exceed the intel capacity. When this occurs, the amount of intel products no longer covers the minimum required, which leads to a lower intel readiness factor. This leads to a an increase in risk, which, through the likelihood of approval variable, exemplifies the rationale decision not to allow the unit to attempt the amount of missions that it desires to attempt. Unfortunately, since the intel cycle must support each planned mission, missions that do get approved may face greater uncertainty and less chance of success. Missions that fail enter the missions to rework stock, which arrive as missions to do at a faster rate because the unit has ample capacity to reassign the missions. As these effects stem from the intel cycle's current ops loop, which is also a positive feedback loop, they steadily increase over time. The decreased rate of successes increases the OPTEMPO gap, leading to the arrival of yet more missions to the unit. This increase in tasks is visible around day 325 in Chart 6; the red line shows the depletion of tasks for the unit with unlimited operational capacity.

![Baseline Model Depletion of Tasks in Objective](chart6.png)

The saving grace for the unit in this case comes from the use of the 30-day buffer that represents the inherent decision processes in the military's consideration for a fair amount of uncertainty in the OE. At 335 days, there are no longer adjustments for the OPTEMPO gap, and
new tasks no longer arrive to the *tasks in higher-level objective*. This change is apparent in Chart 6 as the line’s sharp diversion from its trend just after 335 days. With *task arrival* at zero, a unit is able to work on the missions that are already in the system. Without an additional increase in *missions to do*, the intel cycle is still overloaded, but the unit’s unlimited operational capacity allows it to outpace the effects of reduced uncertainty.

Results of Baseline with Unlimited Intelligence Capacity

With unlimited intelligence capacity, it is not surprising that the unit was able to deplete the tasks in 340 days, the same time as in the case with aligned capacities. There was only a slight increase in the additional effort required. That increase largely comes from a reduction in *likelihood of success*, incurred as a penalty from working for some periods outside the unit’s ideal operational capacity.

When operational capacity was unlimited in the previous simulation, the limiting factor was the ability of the intel cycle to support the desired mission attempts. With unlimited intelligence capacity, it would seem that the limiting factor is the amount of missions that the intel cycle can support. However, the limiting factor is actually a bit more complex.

The intel cycle is contained within the mission-planning loop. When the mission planning cycle initiates for specific missions in the immediate horizon, the intel cycle is already lagging behind. Within the intel cycle, there are delays in the time to identify gaps and intel cycle time. This is due to, the time needed to execute the many sub-processes in the cycle that lead to product creation. Delays within the intel cycle mean that, unless it begins production ahead of time, it may not be able to fill the minimum intel requirements within the mission planning cycle. This is particularly important when operational capacity utilization is high. Since the unit designed the operational and intelligence capacities to align, operating at a high operational capacity would require equivalent support from the intelligence cycle, which in turn would make it impossible for intelligence production to support future missions.
A solution to this problem would be to always maximize intelligence capacity utilization as exemplified in the construct of this particular model. Desired intel production consists of the maximum value of intel gaps, which is the amount of in the gaps in the intel gaps stock. The model assumes some flexibility in the intel process. If the number of gaps in the stock is lower than the amount required for the immediate missions, desired production will take on the value of minimum requirements, which are still subject to a delay in production.

It is difficult to get ahead, because the intel cycle can only generate products for knowable future missions. Despite having unlimited intelligence capacity, the unit is not infallible. While the model represents the tasks in the objective is a discrete value, real world OE conditions would not allow a unit to know in advance every task required to complete the objective: such circumstances would contradict the evolving nature of the OE and objective state, as outlined in Part I's section on "Evolving Operational Design." For this reason, the unit only "sees" missions when they are requested and appear in the missions to do stock.

Test Input for Simulations beyond Baseline

The addition of a "Test Input Generator" enables the next two series of simulations. The generator provides simple input patterns that make it easier to explore the model's dynamics under known conditions. Figure 18 shows the generator used in this model and its structure.
The input in this model will represent some amount of additional work required to accomplish an objective in the OE as a portion of the initial tasks. The new amount of tasks is represented in the contingency missions variable, which then determines the contingency OPTEMPO by averaging these tasks over the time remaining in the deployment with a 30-day buffer. The contingency OPTEMPO becomes part of the OPTEMPO gap. When the contingency OPTEMPO is greater than 0, the OPTEMPO gap is the maximum value of [(contingency OPTEMPO + campaign plan OPTEMPO)-successes] or (contingency OPTEMPO-successes).

Response to Step Function

The first of the test input simulations provides a jolt to the system through a step function. This function increases the overall quantity of missions required to achieve a higher-level objective by introducing an amount of contingency missions equal to \(0.25\) of the initial tasks. This equates to an additional 187.5 missions. The step increase occurs at day 150, halfway through the deployment, and requires a substantial increase to the OPTEMPO in order to accomplish the objective before the tour ends.
By looking across the graphs in Chart 7, we can see that the step function created some significant changes in the unit’s mission performance.

The model with aligned capacities was unable to finish within 365 days. This happened because the step function ultimately increased mission requests during a time when the unit was already increasing its operational capacity utilization, resulting in the unit being overworked. Overwork decreases the likelihood of success and contributes mission failures. At the same time, intelligence capacity utilization became completely dedicated to near term missions and could no longer work at reducing future gaps. This led to an increase in uncertainty and a further decrease in the likelihood of success. The combined effects of these overloaded processes
steadily increased mission failures and led to the unit’s inability to accomplish its objective on time.

With unlimited intelligence capacity, the unit still had to operate at maximum operational capacity, but the intel cycle continued to reduce gaps in future missions. This reduction minimized the effects of uncertainty and allowed the unit to accomplish its objective in 357 days.

The graph of the effect of the step function on the unit with unlimited operational capacity shows that it only completed approximately 800 missions, significantly less than the unit’s amount in the baseline. In the baseline simulation, the unit barely completed the missions on time due the effects of overloading the intel capacity and consequently reducing the likelihood of success. By the time the step function was introduced and increased mission request, the gap between successes and failures was already widening. The effects of the increased OPTEMPO overloaded the intel capacity so much that uncertainty reached its minimum value (0.5), and more significantly, the reduced intel readiness factor increased the risk level. The increase in risk level decreased the likelihood of approval. As mentioned previously, high-risk missions require higher authority approval and performance considerations to reduce and manage risk. At 300 days the risk level was so high that the unit was no longer “authorized” to attempt missions!
Chart 8 depicts this effect on the depletion and accumulation of tasks in the higher-level objective.

Random Noise

Introducing random noise through the input variable represents some of the mechanisms, not explicitly modeled that signify changing conditions in the OE. This test input begins at the start of simulation and lasts throughout. It essentially creates instantaneous contingency missions, created by multiplying the instantaneous signal by initial tasks. The noise is determined through a random normal distribution ($minimum = -.15$, $maximum = .25$, $mean = .1$, $standard deviation = .1$, $seed = .01$). The signal is intentionally set to generate contingency missions more often than not in order to introduce differing values for the contingency OPTEMPO over the duration of the deployment.
The effect of noise on the conditions with aligned capacities and unlimited intel capacity is almost exactly the same as the baseline simulation, except that both were able to complete more tasks in the same amount of time. This is because, unlike the step function, the noise input did not increase the rate of mission requests by a constant amount. Instead it provided varying increases that did not overwhelm the system but did increase the visible workload enough to allow the intel cycle to raise production toward future missions. Although difficult to tell from the graphs, the gap between total completed missions and successes is smaller for the unit with unlimited intelligence capacity.

These effects do not occur in the unit with unlimited operational capacity because the unit’s capacity to process the missions makes it too sensitive to variations in the workload, which again deteriorates the ability of the intelligence cycle to provide products toward future missions. The unit also loses its ability to attempt missions, again at around 300 days, until the OPTEMPO gap shuts off at 335 days with resulting minimal attempts and successes until 365 days. At that point the model simulates a deployment extension and allows the unit to continue processing remaining work without adding additional tasks.

Failure Modes for Operations and Intelligence Capacities

Table 4 provides the summary results for the simulations across each set of conditions. Red text highlights failure modes for the model.
The failure modes include the step function with conditions of aligned capacity and unlimited operational capacity and the introduction of white noise to the unit with unlimited operational capacity. Each of the failure mode simulations overloaded the intelligence cycle through accumulation of missions to do, and Table 4 shows that each failure mode had the greatest average values for this stock.

<table>
<thead>
<tr>
<th></th>
<th>Obj Achieved?</th>
<th>Time to Complete Obj</th>
<th>Tasks Required to Achieve Obj</th>
<th>Total Effort</th>
<th>Failures</th>
<th>Avg Missions to Do</th>
<th>Avg Missions In Progress</th>
<th>Avg Likelihood of Success</th>
<th>Avg Relative Prediction of Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Y</td>
<td>340</td>
<td>784</td>
<td>913</td>
<td>127</td>
<td>4</td>
<td>5</td>
<td>0.867</td>
<td>0.887</td>
</tr>
<tr>
<td>Step</td>
<td>N</td>
<td>374</td>
<td>889</td>
<td>1068</td>
<td>176</td>
<td>12</td>
<td>6</td>
<td>0.843</td>
<td>0.893</td>
</tr>
<tr>
<td>Noise</td>
<td>Y</td>
<td>349</td>
<td>833</td>
<td>983</td>
<td>149</td>
<td>5</td>
<td>6</td>
<td>0.855</td>
<td>0.892</td>
</tr>
<tr>
<td>Unlimited Baseline</td>
<td>Y</td>
<td>362</td>
<td>784</td>
<td>966</td>
<td>179</td>
<td>5</td>
<td>5</td>
<td>0.828</td>
<td>0.828</td>
</tr>
<tr>
<td>Step</td>
<td>N</td>
<td>over 548</td>
<td>1103</td>
<td>801</td>
<td>191</td>
<td>113</td>
<td>3</td>
<td>0.656</td>
<td>0.656</td>
</tr>
<tr>
<td>Noise</td>
<td>N</td>
<td>over 548</td>
<td>949</td>
<td>1126</td>
<td>338</td>
<td>60</td>
<td>4</td>
<td>0.663</td>
<td>0.663</td>
</tr>
<tr>
<td>Unlimited Step</td>
<td>Y</td>
<td>340</td>
<td>785</td>
<td>926</td>
<td>139</td>
<td>4</td>
<td>5</td>
<td>0.859</td>
<td>0.884</td>
</tr>
<tr>
<td>Noise</td>
<td>Y</td>
<td>357</td>
<td>869</td>
<td>1016</td>
<td>146</td>
<td>5</td>
<td>6</td>
<td>0.861</td>
<td>0.902</td>
</tr>
<tr>
<td>Noise</td>
<td>Y</td>
<td>341</td>
<td>834</td>
<td>970</td>
<td>136</td>
<td>4</td>
<td>6</td>
<td>0.865</td>
<td>0.898</td>
</tr>
</tbody>
</table>

Table 4: Summary Results for Simulations of Varying Operational and Intelligence Capacities

In conditions of unlimited operational capacity, the increase in missions to do led to increases in desired production for the mission planning cycle that generated more intel gaps than the unit’s intel capacity could handle. This caused the intel products to fall short of the minimum required intel production, which decreased the intel readiness factor. Subsequently, risk, uncertainty and filterability decreased while the gap between completed and successful missions widened. This created more missions to rework and more missions to do, and it further deteriorated the unit’s mission performance.
Intelligence Impact on Mission Performance

These simulations were performed under an assumption that perfect information is available, which means that perfect prediction is possible in the model. The simulations eliminated large ranges for *likelihood of success*, the variable that represents the outcome of each mission. Table 5 shows the eliminated ranges for likelihoods of success.

<table>
<thead>
<tr>
<th>Relative Prediction Level and Base Rate p(success)</th>
<th>Mission Success?</th>
<th>Range Category for Capacity Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect p = 1.0</td>
<td>YES</td>
<td>IDEAL @ avg deduction = 0</td>
</tr>
<tr>
<td>Strong 1.0 &gt; p &gt; .7</td>
<td>YES</td>
<td>OVERWORKED @ max deduction = .15</td>
</tr>
<tr>
<td>Fair .7 &gt; p &gt; .6</td>
<td>YES</td>
<td>UNDERWORKED @ max deduction = .10</td>
</tr>
<tr>
<td>Weak p = 0.5</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Unlimited Operational and Intel Scenario Ranges for Likelihood of Success

There is a high possibility of the system entering failure when relative prediction is fair or weak, as occurs when the operational capacity is higher than the unit’s intel capacity. Conversely, failure cannot occur with unlimited intelligence because the unit can minimize uncertainty for every mission undertaken.

Except for the failure mode in the aligned capacities with step function the failure modes occurred when relative prediction fell below .7, or into the fair category. With step function, relative prediction remained in the strong range but operational capacity deteriorated its effects,
Outside of simulations, this level of performance, whether predicting enemy activities or stock market activity, would be remarkable.

Since real world intelligence production often must rely on imperfect information, there is no way to know the true level of mission complexity in an actual OE. In the model, mission complexity defines the number of potential intel gaps for a mission, and changing parameters within the intelligence cycle to include representations for imperfect information and increasing mission complexity provide insight into how these conditions affect the unit’s performance.

Chart 10: Results for Simulations within the Intel Cycle

To represent imperfect information, the model uses equations for uncertainty and risk that use random normal distributions, informed by the intel readiness score, to determine an alternate value that may not exceed the original uncertainty score by more than .05 from the baseline model. It also may not allow for uncertainty or risk to fall below 0.1. Essentially this
means that the intel cycle can reach a maximum prediction of 90%, an acceptably high level. Changes to mission complexity included 25% and 50% increases to the baseline model. Chart 10 shows the results.

It’s worthy of note that the increase in the amount of time it takes to complete the missions underwhelms the significant increase in effort that the unit must exert. The table in top corner of the graph shows the percentage of ineffective effort from each simulation. This value is especially significant because it represents troops’ percentage of time, effort, and exposure to threat that does not contribute to the accomplishment of the objective.

Part IV Summary

The finished model provides the ability to simulate the system under a variety of scenarios and highlight the relative impacts of the operational or intel capacity variables on mission performance. There is a high possibility of the system entering failure when relative prediction is fair or weak, as occurs when the operational capacity is higher than the unit’s intel capacity. Even in cases of successful accomplishment of the objective, limited intelligence capacity increases the amount of effort that a unit must put forth in accomplishing missions. This additional effort is a measure of troops’ additional exposure to risk due to uncertainties in the OE, and demonstrates that intelligence capacity is more than a force multiplier: it is a force preserver.

In the baseline simulation, the unit had the flexibility to overcome the effects uncertain events, but with unlimited operational capacity, the unit struggled to meet the 365-day deadline because it is still limited in its ability to provide intelligence support. The 30-day buffer provided the flexibility the unit needed to accomplish the objective within the time limit because it did not allow the unit to receive any more mission requests. In the absence of further requests, the unit’s unlimited operational capacity allowed it to outpace the effects of reduced uncertainty.
With unlimited intelligence capacity, there was only a slight increase in the additional
effort required, which comes from the reduction in likelihood of success that was incurred as a
penalty from working outside the ideal operational capacity. Effects of delays within the intel
cycle, especially when operational capacity utilization is high, emphasize the importance of
working to reduce gaps in both current and future operations.

For the simulation with a step function input under conditions of aligned capacities, the
effects of an increased OPTEMPO overloaded the intel capacity so much that uncertainty
reached its minimum value, decreasing successes, and significantly increased the risk level,
decreasing mission attempts. These effects do not occur in the unit with unlimited operational
capacity because the unit's capacity to process the missions makes it too sensitive to variations
in the workload, which deteriorated the ability of the intelligence cycle to provide products
toward future missions.
Part V: Revising the Components of Intelligence Capacity

“I absolutely believe that we have got to find a way ahead immediately to improve our information fusion... There is no shortage of data. There is a dearth of analysis.”

Lieutenant General Michael L. Oates
Joint Warfighting Conference, 2010

An unfortunate reality is that units operate with limited intelligence capacity, which implies that their structure is closer to that of the model with unlimited operational capacity than to those of aligned or greater intelligence capacity. In addition to this challenge, these units operate in complex, typically unstable environments where catastrophic events are characteristic. The model shows, significantly, that intelligence capacity greater than or equal to the unit’s operational capacity enabled the unit to overcome the effects of operating under these conditions.

In the Army’s current structure, intelligence capacity falls short of what combat battalions need in the modern operational environment. This shortfall exists because the design of tactical intelligence has not yet caught up to a unit’s needs in the modern era. Intelligence capacity is now driven by the analyst’s ability to process information in a world where information is overly abundant: the tools and techniques are only as good as the foundations the analyst has to apply them to the context of operations.

The Analyst’s Role and Intelligence Value

An analyst for a tactical unit has two very significant roles: be the expert in analytical methods for intelligence, and to be the expert in applying intelligence knowledge to support a unit’s range of missions.

The results of the mission performance model show that the relative value of the intelligence cycle is a reduction in uncertainty and an increase in a unit’s relative performance. With the insight that intelligence products provide, a unit can execute missions with increased
precision and efficiency. This improvement comes from the benefit of higher fidelity task prioritization as well as from the decrease the unit’s exposure to risk, as discussed in Part II. The increase in efficiency derives from a reduction in wasted effort. Ultimately, the intelligence value to unit comes from an analyst’s ability to produce intelligence for both near term and future missions.

Analysts can be proficient at executing tasks in the intelligence cycle yet still not deliver value to a unit if they do not understand the range of operations and inherent mission planning considerations. The continually escalating pace of technical change and rising complexity of tasks exacerbate this effect.

Enduring Challenges at the Unit Level

Even without considering the impacts of increased complexity on an analyst’s ability to deliver value, examining task dependencies in MDMP alone reveal the intrinsic challenges of applying intelligence knowledge to mission planning.

Revisiting the structure of the staff element from Part I, it is possible to further examine each unit member’s function and associate that function with the member’s role in MDMP. This will reveal the relative significance of these exchanges, based on the frequency of contributing information transfers.

This assessment begins with creating a matrix of tasks to people — tasks in MDMP to the unit command, staff, and operators. This type of matrix is a Design Mapping Matrix (DMM), which relates organizations to processes. By squaring the DMM, the resulting matrix is an organization Design Structure Matrix (DSM), which relates the people-to-people interactions comprising a process.
### Tasks in MDMP

<table>
<thead>
<tr>
<th>Task Description</th>
<th>CDR</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alert key staff and participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gather tools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Update running estimates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct Initial Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issue the initial Warning Order (WARNORD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyze higher HQ plan or order</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform initial IPB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determine specified, implied, and essential tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review available assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determine constraints</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify critical facts and develop assumptions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Begin composite risk management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop initial CCIRs and EEFIs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop initial R&amp;S synchronization tools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop initial R&amp;S plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Update plan for use of available time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop initial themes and messages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop proposed problem statement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop proposed mission statement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present the mission analysis briefing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop and issue initial cdr's intent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dev and issue initial planning guidance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify critical facts and develop assumptions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop COA evaluation criteria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issue a warning order (WARNORD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess relative combat power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generate options</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Array forces</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop a broad concept</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assign headquarters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prepare COA statements and sketches</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct COA briefing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select or modify COAs for continued analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gather the tools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>List all friendly forces</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>List assumptions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>List known critical events and decision points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select the war-gaming method</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select a technique to record and display results</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>War-game the operation and assess the results</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct a war-game briefing (optional)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct advantages and disadvantages analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compare COAs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct a COA decision briefing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commander selects COA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commander issues the final planning guidance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deliver/ brief order to subordinate unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 19: DMM, Tasks to People in MDMP**

**The DMM in Figure 19 is matrix A.**

The rows within matrix A represent the tasks involved in each step of MDMP, in accordance with FM 6-0.

The columns within matrix A represent a typical battalion's coordinating staff, commander, and "operators" which reflect the role of any subset of the battalions subordinate unit that might execute the operation.

The values 0 or 1, shown in white and green, respectively, relate the task to the personnel element involved in its execution, allowing more than one element to contribute to any given task.

The values for task to personnel have been assigned using guidance from ATTP 5-01, FM 6-0, ADRP 3-0, ADRP 6-0, JP 2-0, and JP 3-0. The values reflect the general consensus of roles as outlined in these doctrine sources.

Squaring matrix A, the DMM:

\[ A^*A^T = B \]

Where matrix B is the DSM of people-to-people exchanges.

The complete Multi-Domain Mapping matrix (MDM) is in Appendix 2.
The resulting DSM in Figure 20 shows that the roles of the S2 and S3, respectively the intelligence and operations staff, are tightly coupled. This result is not a surprising revelation and is consistent with findings from the model. Intelligence and operations must have a coupled relationship in order to inform each other and allow the operational design state to evolve.

The significance of the resulting DSM is in the degree of task dependency between the S2 and S3 and within the cluster of dependent tasks among the S2, S3, XO, and commander. Of the 39 tasks that require input from the S2, all of them require input and provide input to those of the S3. The cluster of tasks around the S2, S3, XO and commander is largely comprised of information sharing, typically at meetings or earmarks in MDMP. The most significant tasks within this group are those that analyze the higher order, interpret and communicate the intent of the mission, and perform subsequent assessments of the mission based on this intent. This means that these staff elements should communicate frequently, clearly and directly, since intent drives the execution of their respective functional tasks as it evolves.

While doctrine clearly outlines the significance of these relationships, it is not uncommon for communication problems to arise within and between Army units. The formal decomposition of a unit's staff element, in Figure 4 of Part II, would indicate that some transfers of information occur as lateral exchanges while others occur hierarchically. Structural and organizational designs inherent to military culture and hierarchy, including potential disparities among rank and experience, can unfortunately create artificial barriers in communication.
An example of this can be seen in how there exists a substantial variation in personnel authorizations that dictate rank and occupational specialties within military units. It is not untypical for an S2 to have a rank that is one or two levels below that of an S3. This means the S3 could have ten or more years of experience than the S2. This is especially likely at the battalion level, where the S2 officer is likely to be a junior captain with three to four years of experience and the S3 is likely to be a major with ten or more years. This difference is not arbitrary and explainable because the S3 is head of operations for the entire organization and has the requisite training and experience appropriate to that level. Alternately an S2 provides a specialized function to enable the organization to conduct missions, but is still gaining experience needed to progress in the broader context of the Military Intelligence branch. So with respect to their roles within their respective occupational specialties, these ranks and experience levels are appropriate. When they are brought together in a tightly coupled role, however, the S2 must spend significant effort building enough knowledge of the unit’s operations, specific standards, and tactics just to be conversant with the person on whom all of his tasks depend.

While the communication obstacle becomes more difficult to overcome when the unit’s culture varies greatly from that of the S2 or when formalities of rank and rating schemes interfere, it is not impossible to overcome. These barriers also exist in nearly every type of organization and are not exclusive to the military. However, the barriers are significantly greater when an analyst perceptibly lacks competency in his field, which is likely to cause either staff element to communicate less, especially in high intensity or time-constrained environments.

Impact of Changes in the Intel Cycle

The Army transformation, detailed in Part 1, brought far more integrated capabilities to the brigade and battalion level. Many units deployed to combat as part of “Task Forces” that
provided still more integrated operational capability to these levels. While these capabilities are ideal for the warfighter, they added a layer of complexity to the skills required of intelligence analysts. Instead of serving as S2 for one type of unit with a specific range of missions, an S2 now must understand multiple types of operations spanning multiple units.

Mission complexity has increased due a variety of factors including but not limited to the nature of today’s threat forces, conditions within the modern OE, and the now-integrated structure of the post-transformation Army. Combined with constantly changing technology, the intelligence cycle requires significantly greater skill than ever before (see Figure 21). Not only is there an often over-abundance of unfiltered information available; there is also an increasingly diverse array of collection platforms, open source streams of real-time data and radical changes in communications and localized user interfaces.

With greater access to raw data comes an increased potential for the degradation in the reliability of information analysis and forecasting. The more often that information is massaged, translated or replicated by multiple users in multiple locations, the further it can deviate from its original source, and the more difficult it is to verify. Along the same lines, multiple streams of the same type of information may exist, but are susceptible to the same variance and degradation, compounding the complexity of the analyst role. Even under ideal conditions, acceptably reliable data from multiple sources is likely to take significantly longer to process and synthesize into usable intelligence, adding yet another layer of skills required of analysts.

Collection results are comprised of the amount of sub-components within a collection requirement, multiplied by the amount of information available per each of those sub-components. The increase in available information has thus increased the amount of information available per task, which in turn increases the collection results per requirement. This is significant because it potentially provides massive amounts of relevant information that requires a corresponding increase in processing resources. Combined with the effects of complexity and
data reliability, the processing tasks within the intel cycle can take significantly longer and require even greater analyst resource than prior to the digital age.

Figure 21: Challenges in Modern Intel Cycle

It cannot be over-emphasized that the higher demands of analysis and production require improved and enhanced technical skillsets for analysts. A modern analyst must be technically proficient to meet the demands of processing and communicating digital data. This proficiency *must* go beyond button clicking and matching a tool to a product or vice-a-versa. The data complexities require that intelligence analysts understand not only the mechanical but also the conceptual aspects of current technical systems. Regardless of the sophistication of a tool-based algorithm, quality of the final product depends heavily on the competence of the tool users. This is relevant to all aspects of analysis, including data input, choice of output type, application to operational needs and interpretation of the output data.
Designers of Intelligence Capacity

Intelligence capacity is traditionally viewed as the end product of output provided by people and resources dedicated to providing intelligence to a unit’s operations. This view implies that when the OE requires more intelligence capacity, a unit can increase its people, resources, and/or output. This definition of capacity is not inaccurate in assuming that intelligence analysts arrive to a unit with core competencies needed to leverage the intelligence enterprise. The impact of real world changes in the intelligence cycle indicates that analysts cannot adequately provide that level of support.

In providing support to operations, an analyst must be expert in analytical methods for intelligence and in applying intelligence knowledge to inform the unit’s range of missions. However, the enduring and relatively new challenges in this area suggest that there are underlying qualifiers in each area of expertise. Because all of the intelligence tasks are coupled with the operations tasks, the analyst must be proficient in communications in order to integrate intelligence into the unit’s operations. Information technology drives the key tasks within the intelligence cycle thereby necessitating that the analyst be proficient in information processing in order to conduct intelligence analysis. Since the analyst also directs the use of intelligence resources, the unit’s intelligence capacity predominantly rests on the capability of the analyst, and the analyst’s capability relies on three primary entities:

1. The Military Intelligence Corps — must provide people with the requisite capabilities to analyze intelligence.

2. The unit — must provide the context for intelligence application through mentorship, education, training, and experience.

3. The analyst — must maintain and evolve proficiencies as information technology and operational requirements change.
Part V Summary:

The components of intelligence capacity are defined by capabilities across intelligence methodology, integration with unit operations, communication, and information processing. Since the analyst also directs the use of intelligence resources, the unit's intelligence capacity predominantly rests on the capability of the analyst, but it also requires that the organizational culture facilitate integration of intelligence into operations. The cohesive roles and efforts of the Military Intelligence Corps, unit, and analyst provide the foundation of the tactical analyst's competencies.

Analysts' competencies must sufficiently equip the analyst to overcome the organizational design problem that exists because of the experience differential between the S2 and S3. The organizational challenges are the first barrier the S2 will face in integrating the intelligence function with the unit's operations. Technical competency supports the S2's role as a force multiplier, and enables the S2 to focus communication on aspects of the unit's tactics that are most vital to PIR development and execution of the intel cycle. Higher demands of analysis and production require improved and enhanced technical skillsets for analysts, which will give the S2 the technical proficiency to meet the demands of processing and communicating intelligence.
Part VI: Criticality of Intelligence Competencies

"Building competence follows a systematic and gradual approach, from mastering individual competencies, to applying them in concert and tailoring them to the situation at hand."

FM 6-22, 2-19
The Foundations of Army Leadership

Methodology for Assessing Intelligence Competencies

Building on the assessment from the previous section, this section examines the redefined functional components of analysts' competencies across the specifications defined in Army doctrine.

The functional components of analysts' competencies are intelligence methodology, integration, communication, and information processing. They are outlined in Table 6.

<table>
<thead>
<tr>
<th>Intel Doctrine</th>
<th>Information Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning &amp; Direction</td>
<td>Data building: determining needs and required structure of locally generated data</td>
</tr>
<tr>
<td>Collection</td>
<td>Data mining: finding the data that brings value</td>
</tr>
<tr>
<td>Processing &amp; Exploitation</td>
<td>Data validation: ensuring data is suitable for use (clean, correct, relevant)</td>
</tr>
<tr>
<td>Analysis and Production</td>
<td>Information network mapping: understanding the digital infrastructure and its impacts</td>
</tr>
<tr>
<td>Dissemination and Integration</td>
<td>Interpretation: drawing appropriate conclusions from data; employing logical and quantitative reasoning; identifying significant relationships among relevant entities</td>
</tr>
<tr>
<td>Evaluation and Feedback</td>
<td>Critique: identifying sources of uncertainty, associated uncertainty, originator reliability, and fidelity of data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Integration</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations doctrine</td>
<td>Clarity: articulating significance of assessment in context of unit operations</td>
</tr>
<tr>
<td>Unit-specific mission, tactics, SOPs</td>
<td>Cohesion: maintaining operational context, assertive in recommendations and war gaming</td>
</tr>
<tr>
<td>Unit level decision processes</td>
<td>Delivery: understanding unit's communication formal and informal networks and protocols</td>
</tr>
</tbody>
</table>

Table 6: Components of Intelligence Competency

The category of intelligence methodology includes the sub-processes of the intelligence cycle, which provide the foundation for all other intelligence methods. The sub-processes are planning and direction, collection, processing and exploitation, analysis and production, dissemination and integration, and evaluation and feedback. Integration includes components of operations
knowledge at the Army and unit level. These components are operations doctrine, unit-specific mission, tactics, and standard operating procedures (SOP), and unit-level decision processes. The addition of the following components provides an essential supplement intelligence methods and integration.

Communication:

- Clarity: articulating significance of assessment in context of unit operations
- Cohesion: maintaining operational context, assertive in recommendations and war gaming
- Delivery: understanding unit's formal and informal networks and protocols

Information Processing:

- Data building: determining needs and required structure of locally generated data
- Data mining: finding the data that brings value
- Data validation: ensuring data is suitable for use (clean, correct, relevant)
- Information network mapping: understanding the digital infrastructure and its impacts
- Interpretation: drawing appropriate conclusions from data; employing logical and quantitative reasoning; identifying significant relationships among relevant entities
- Critique: identifying sources of uncertainty, associated uncertainty, originator reliability, and fidelity of data

In determining how the revised competencies align with specifications for intelligence analysts' competencies in doctrine, I examined the competencies across the holistic analyst identity on a battalion staff, which includes the analyst's role as an intelligence officer, staff member, and leader. The specifications also include the lists of intelligence core competencies, published in January 2014 as part of the most recent Army Intelligence Training Strategy (Maher & Poon, 1996). In total, the functional components of analysts' competencies were assessed across 132 competencies specified by the Army. (The complete list with references is in Appendix 4.)
Intelligence Tasks Dependencies

Using a similar matrix methodology as in Part V, the functional components of analysts' competencies formed the columns of a matrix while the competency specifications formed the rows. A value of 0 or 1 was given across all rows to relate a competency specification to a functional component. Squaring the matrix revealed the degree of dependence that the functional components hold across all competency specifications. Figure 22 shows the full MDM, and although it is difficult to see any text, the most significant aspect is the pattern of the matrix, which serves as a density map for the degree of dependence. For example, the critical task list for all-source analysts (military occupational specialty 35D) is highlighted in orange. Its rows and columns have dark shading, representing that these competencies share dependencies throughout all other sets of competency specifications for battalion intelligence analysts.
The DSM in the top left corner of MDM in Figure 22 represents how each component contributes to each of the 132 tasks and to each other component. Unlike the DSMs produced through simple matrix multiplication in Part V, this one does not immediately reveal all insights, so the resulting component DSM in Figure 23 displays it after partitioning analysis using clustering. Aside from revealing that intelligence support to operations is a highly integrated process, the clusters show how the revised components of competency support the intelligence enterprise in unit operations.

Figure 23: DSM for Components of Competency

The partitioning process required breaking apart the components; so the colored row and column labels help keep their integrity intact. Clustering seemed to emerge naturally in the sequence with which these competencies would be required to execute a mission, most likely because the processes of intelligence and operations are just as systematic as they are
continuous. The sub-processes support each other in such a way to build depth for the execution of the next process. The partitioned DSM makes this clear by revealing a pattern of squares nested within each other along the diagonal.

The light orange squares highlight the clusters of competency components that form sequential functions leading from cluster 1, containing planning and collection, through the processing and analysis in cluster 2, to the decision making process contained in cluster 3, which has strong elements of communication and unit-specific operations knowledge. Each of these clusters is supported by competencies in the others, which is easiest to see by focusing on the clusters highlighted with white boxes. Cluster A contains the competency components of broader operational knowledge and the information network mapping, which is a general understanding of the digital architecture used in the OE or at the unit level. A competency in this cluster enables the exercise of competencies contained in cluster 1, and so on.

After the partitioning process, a few components remain on the outer edges, signifying their importance throughout all competency specifications found in the doctrine references. These include cohesion in communication and interpretation and critique within information processing. Although it is the innermost column, information network mapping could also fall among the outer group, but I chose to place this particular task at the top left corner because of its significance as an enabling element in the initial phases of any intelligence or operations process.

Part VI Summary

The capability of the analyst is the lynchpin for unit intelligence capacity. The DSM reveals that competence in information processing is extremely important in early phases of intelligence analysis and endures throughout. A lack of competency in information processing would degrade planning and collection, which would in turn degrade processing, or at a
minimum greatly delay it. Since analysis and production rely on efforts in the preceding steps and also on components of information processing, the intelligence cycle fails to provide timely and relevant intelligence to support the decision-making tasks. As demonstrated in the model in Parts II through IV, when timely and relevant intelligence does not support the unit’s missions, the risk and uncertainty do not reduce to manageable levels, and missions are far less likely to succeed.
Part VII: Cost Analysis

“The goal is to turn data into information, and information into insight.”

Carly Fiorina
Former CEO of HP

Components of the production cycle, such as cost per unit produced, translate relatively easily to a monetary value in non-military domains. A determination of monetary value allows managers to assess what kind of solutions are worth implementing, as calculated by comparing the value of the relative gain in productivity against the cost of the improvement effort. It would be ideal to have the same type of assessment available for intelligence to enable the Army to assess the relative cost of a resource’s ability to decrease uncertainty with respect to the value it provides. However, it is nearly impossible to determine a military resource’s effectiveness because there is no real ratio of success to failure in intelligence analysis (Betts, 1978). Instead, the value of intelligence is often assessed by its quantity and rate of production, which would make digital platforms clear intelligence multipliers. However, these digital platforms will not deliver nearly to their potential if tactical analysts lack competency in information processing.

Capability That Adapts to the Evolving OE

In today’s challenging economic climate, the Army cannot afford to increase the amount of resources provided to its forces. In fact, the Army cannot afford to sustain the amount of resources currently provided to its forces, which is apparent in the continuing reduction in forces and budget allocation. However, operational environments, technology, and nature of national security threats will continue to change and will always require the Army to adapt, ideally in anticipation of these changes rather than in reaction to them.

An enduring change for the foreseeable future is the world’s increasing reliance on digital infrastructure. Despite knowing this, the Army is still largely in reactive mode in
determining the human to digital interfaces that maximize the information transfer for combat operations. Tailored information systems, hardware and software suites, and analytics packages will always have to evolve with improvements in technology. However, incremental changes should not always require specialized supporting architecture or intensive training programs for users. Instead of focusing only on the perpetually changing tools as a resource multiplier, the Army should consider turning its attention to the users. Building competency across the fundamentals of information processing and data analysis methodologies will provide enduring knowledge that can deliver value across a broad range of technological dependence as well as in an analog environment.

The Human-Digital Interface in Tactical Intelligence

Intelligence information systems and tools provide a resource to greatly expedite processes within the intelligence cycle, yet even the best algorithms and user interfaces cannot provide this capability if end users do not understand the underlying concepts and processes involved. In order to extract value from these systems, analysts need the ability to communicate the significance of the output to a unit’s decision-makers.

Optimal decisions require both quantitative and qualitative analysis that will help to clarify conditions of the OE. These assessments can reduce some degree of uncertainty and provide critical information to a commander’s own calculation of the operational timeline and decision points. Essentially, this leads to an estimate of the relative value of specific missions at a given time as well as opportunity costs associated with mission attempts, failures, delays, or inaction. If an analyst does not understand how a system or application was used to collect and filter raw data to generate a specific product, then that analyst will find it difficult to convey key insights needed to focus operations.
As discussed in Part V, “Enduring Challenges at the Unit Level,” communication can become a barrier between the processing and analysis of information and appropriately leveraging it in operations. While intelligence information systems and tools generate products that provide specific insights about activities in the OE, it is an analyst’s challenge to convey the significant implications for a unit’s operational considerations. Communicating that significance is already challenging because analysts must concisely summarize key insights that likely took a wealth of time and work to discover. While tools expedite the process, they also remove the analyst from tasks that provide contextual depth to insights, as well as information about the scope, limitations, and reliability of the output.

Effect of Working over Capacity

The mission performance model demonstrated that when the amount of required intelligence production exceeds a unit’s intelligence capacity, an intelligence cycle is at most able to support the unit’s immediate missions. However, combined with the effects of operating with imperfect information in a complex OE, increasing intelligence production makes it difficult to support immediate missions and nearly impossible to utilize remaining capacity for non-immediate missions. Without competency in information processing, analysts cannot leverage supporting tools to their fullest potential and available resources cannot be maximized to substantially alleviate workloads. Lack of adequate analyst training could in fact have a rebound effect of contributing to a workload rather than reducing it.

To meet mission demands in a time-constrained environment, analysts must find faster and more efficient ways to deliver more intelligence products. To do the best they can under the circumstance, analysts too often make do with what they have available to perform tasks. This can mean that analysts will rely on templates from previous analyses for a similar mission, use outdated assessments from other analysts, or outsource some of their workload to supporting
intelligence partners (intelligence reach). The issue with taking shortcuts is that while they may increase short-term production, this immediate benefit comes with significant opportunity costs (Morrison, The Problem with Work Arounds Is That They Work, 2009). An over-reliance on these methods is counterproductive to the analysts, the over Army intelligence community, and future warfighters.

System Dynamics Model to Determine Effects of Shortcuts on Skill Building

The model that follows adapts process improvement research (Sterman & Repenning, 2002), and its application, to the learning curve theory to improving the performance of tactical intelligence analysts (Morrison, Putting the Learning Curve in Context, 2008). The purpose of the model is to examine the dynamics of experiential learning in the context of implementing analytical methods in combat operations. Morrison’s research applies the learning curve theory to implementation by developing a system dynamics model that includes two extensions to classic learning curve theory: a) a required output level for the individual, and b) a choice between a current way of working (sometimes called the as-is state) and a new way (sometimes called the desired state), both of which are means to accomplish the target production (Morrison, Putting the Learning Curve in Context, 2008). During the process of learning, analysts must achieve a targeted rate of production based on a unit’s operational needs. They also have a choice in how to accomplish that target production. The central concept in learning curve theory is that accumulating experience leads to improved performance, but the feedback structure that characterizes experiential learning under constraints reveals two competing modes of behavior. Figure 24 depicts the model for the effect of shortcuts on developing analysts’ capabilities.
The first mode of behavior is when learning begins and then stalls (Morrison, Putting the Learning Curve in Context, 2008). When missions and associated complexities increase the arrival rate of intelligence production requirements, the analyst is under greater schedule pressure to accomplish tasks. This pressure leads to an increase in using shortcuts that despite short-term productivity gains will ultimately contribute to a decrease in uncertainty for a unit’s missions. If blind application of tools is the shortcut, then the analysts’ efforts are essentially prejudicing the organization against trusting the intel capability of their officers.

Figure 24: System Dynamics Model for Effect of Shortcuts on Skill Building (Morrison, Putting the Learning Curve in Context, 2008)(Sterman & Repenning, 2002)

An ideal mode of behavior would be one in which properly learned skills, not shortcuts, become the preferred procedures used for accomplishing tasks (Morrison, Putting the Learning Curve in Context, 2008). Unfortunately, even well intentioned shortcuts can have negative effects. By their nature, shortcuts decrease processing time because they employ alternate
methods to reduce the amount of tasks in the process. This reduction, however, can also lead to a decline in learning proper procedure, which is reinforced by experience and repetition. Slowing the rate of learning decreases analyst proficiency and short-term productivity. The net result can be a detrimental increase in uncertainty for a unit and an unwanted recycling of shortcuts in future tasks.

The ideal mode of behavior would be that in which learning dominates so that the new skill becomes the preferred manner of doing (Morrison, Putting the Learning Curve in Context, 2008). Unfortunately, even well intentioned shortcuts have negative effects. By nature, shortcuts decrease processing time because they employ alternate methods to reduce the amount of tasks in the process. The reduction leads to a decrease in learning, which happens through experience and repetition. Slowing the rate of learning decreases the accumulation of capabilities required to give the analysts proficiency in performing intelligence analysis. Without gaining this proficiency, the analysts’ short-term productivity decreases, which slows the rate of requirements fulfillment and contributes to an increase in uncertainty. Moreover, the lack of skill building contributes to the accumulation of intelligence production requirements and ultimately leads to further pressure and reliance on shortcut methods to meet production goals.

Associated Costs of Shortcuts

Military intelligence, like other branches in the Army, relies on experiential learning in key developmental positions to develop critical capabilities that will qualify the analyst for more senior positions in the future. In fact, the notion that organizations continually improve their existing capabilities with time and experience is one of the most central to organizational theory (Sterman & Repenning, 2002). The premise of this notion is that learning by doing empowers the organization to improve the execution of its core tasks and processes (Sterman & Repenning, 2002). These are the same premises that support the Army Learning Model
TRADOC PAM 525-8-2, 2011) in its initiatives to build technological competencies through a balanced combination of institutional schooling, self-development, realistic training, and professional experience (FM 6-22, 2006). However, as Repenning and Sterman point out, “capability traps arise from interactions between judgmental biases and the physical structure of work processes” (Sterman & Repenning, 2002). Essentially, the intelligence production shortfall leads to use of methods that reduce the time available to put toward learning and improving. Productivity gains are immediate, while “costs are distant in time and space, uncertain, and hard to detect” (Sterman & Repenning, 2002).

Since productivity gains do increase in the short term, the analyst’s apparent productivity during his initial assignments enables him to progress to higher-level positions within his career field. Because the Army’s career progression model relies on experiential learning, expectations for an analyst’s competency in a new and higher role may be higher than the analyst is trained for. This may lead the analyst to resort to short-term methods to accomplish tasks, and would also set a negative example for subordinates. This situation further propagates skill deterioration across the organization. The reference mode in Figure 25 contrasts the ideal ability level against the ability level that shortcut methods cause to analysts over the progression of their careers. Note that the double S-curve of the ideal ability comes from intense periods of transition, through education and experience, during progression to each analyst level.
The effect of decreased competency across the organization negatively affects the warfighter two-fold. The first and more obvious way is that increasingly higher levels of the organization lack the requisite capabilities to effectively perform intelligence functions. The nested nature of military operations means that the lowest level derives its missions from the operational objective established at the next higher level and so on. Since the next highest level relies on sound intelligence to make operational decisions, unreliable intelligence would lead to increased uncertainty in the operational objective and increase confounding factors, such as mission complexity, imperfect information, and likelihood of catastrophic or unintended effects. The net impact could then be to increase the amount of work to do and potentially increase the instability of the OE rather than manage or decrease it.

The warfighter incurs a cost when the effects of overloaded analysts and complexities of combat operations lead to an increased reliance on intelligence reach. While intelligence reach partners provide a range of direct support components, the component that provides a mechanism for submitting RFIs, tasking, and managing ISR assets is available for intelligence officers at any level “to request information that is beyond what is available at his location”
Instead of limiting support requests only to such times as resources are not available locally, workload pressure and time constraints cause analysts increasingly to rely on partners such as the National Ground Intelligence Center (NGIC),

The effect of relying on intelligence reach capability helps the analyst escape the negative effects of being stuck in the current ops loop, as discussed in Parts III and IV, and allows intelligence production to fill gaps toward missions in the less immediate future. This decreases some of the workload per mission and intelligence cycle so that the uncertainly level decreases and contributes to mission planning that is more likely to lead to successful outcomes.

The immediate benefit comes at a high cost. Ominously detrimental outcomes are likely to result from over-working the intelligence reach capability, as may occur during military operations on multiple fronts, as well as in unstable and complex OEs where analysts must work over capacity and without competency in information processing. For instance, NGIC is one of the primary supporting partners in intelligence reach and is the primary recipient of requests for information (RFI) from analyst’s supporting combat operations. NGIC is the “major component that provides all source, imagery, general military, scientific and technical capabilities tailored to focus on opposing forces ground capabilities on an hour a day, day a week basis during a crisis of war” (FM 34-37, 1991). The Global War on Terror brought requests for support that required substantial extension to this role (NGIC, 2015). To support the volume of requests, NGIC, like many other intelligence organizations, received a budget increase via Overseas Contingency Operations (OCO) funding that nearly doubled NGIC’s pre-war budget for contractor support and other capacity building components (NGIC, 2015). However, NGIC’s increased support to the warfighter remained even after funding and personnel began their return to pre-war levels. Figure 26 shows intelligence spending since 2007.
Total intelligence spending can be understood as the combination of (1) the NIP, which covers the programs, projects, and activities of the intelligence community oriented towards the strategic needs of decision makers, and (2) the Military Intelligence Program (MIP), which funds defense intelligence activity intended to support tactical military operations and priorities. The MIP is highlighted in the orange box, and the nominal figures include OCO funding across MIP organizations (Erwin & Belasco, 2013). NGIC was one of the organizations whose funding steadily declined to pre-war levels.

NGIC’s mission predominantly consists of the tasks that led to its creation, which include the following (FM 34-37, 1991):

- NGIC has DoD-wide responsibility for the exploitation, analysis and production of system capabilities and parametric data for all foreign ground and ground related systems, to include helicopters, AAA air defense, infantry, armor/anti-armor, fire support, engineer, mines and C3 systems.

- NGIC is the Army's executive agent for acquisition and exploitation of foreign ground systems as part of the DoD Foreign Material Acquisitions and Exploitation Program.
Since the support to troops shifted resources so substantially to the warfighter, requests continued to come in to the organization well after it lost the majority of its additional resources. Naturally, combat operations remain a high priority to the organization, so despite not having the additional resources, it remained committed to supporting the warfighter in combat. Unfortunately this means that the support comes at the cost of pulling resources from the mission sets listed above, which provide technological and survivability equipment to the future warfighter. The process of analyzing the future threat landscape, discovering and acquiring new or developing technologies from potential adversaries, rebuilding, analyzing, and using the discoveries to then design, test, and field new combat equipment across all DoD military organizations can take more than a decade from start to finish. Pulling resources from processes that already require significant cycle time at each phase will only further delay the significant benefit these technologies provide to national defense. Furthermore, the lengthy time delays within the acquisition and exploitation processes mean that without substantial levels of current work in process, much of this loss is not recoverable, and future efforts to adjust the program are likely to be wrought with the effects of demand shock throughout the system (Sterman J. D., 2000).

Don’t Defray Costs, Alleviate Them

Intelligence analysts, the intelligence community, warfighters, and all resources allocated to protect national security interests share the costs associated with overworked tactical intelligence staff. While some effects are more apparent than others, there is no argument that national defense at all levels requires intelligence capacity to exceed that of operations, which is the US approach to its National Defense Strategy, as depicted in Figure 27.
Limiting the capability of tactical intelligence analysts across the components of information processing significantly decreases intelligence capacity. Increasing analyst competency and capabilities in information processing can alleviate some of these costs. Components of information processing fall largely in the academic domain and are already included in the critical task list for analysts. As such, training can be implemented with minimal cost or disruption. This effort would have the added benefit of enabling users to better articulate their needs to developers of intelligence information systems, which in turn would enhance usability of tools and further increase intelligence capacity at the tactical level.

Part VII Summary:

The Army is still largely in reactive mode in determining the human to digital interfaces that maximize the information transfer for combat operations, and it is finding that the tools are only as good as the foundations the analyst has to apply them to the context of their operations. If blind application of tools is the shortcut methodology, then analysts’ efforts are essentially prejudicing the organization against trusting the capability of its intelligence officers. Moreover,
shortcuts reduce the amount of tasks in the intel cycle, leading to a decrease in learning that affects the analyst's qualification for intelligence positions of greater influence and further propagation of skill deterioration across the organization. The effect of relying on intelligence reach capability helps the analyst escape the negative effects of being stuck in the current ops loop, as discussed in Parts III and IV, and allows intelligence production to fill gaps toward missions in the less immediate future. This decreases some of the workload per mission and intelligence cycle so that the uncertainty level decreases and contributes to mission planning that is more likely to lead to successful outcomes; however, this support may come at a high price to the future warfighter.

The effect of decreased competency across the organization negatively affects the warfighter two-fold: increasingly higher levels of the organization lack the requisite capabilities to effectively perform intelligence functions, and the effects of intelligence reach partners' re-allocation of resources to the immediate mission means that they dedicate less of their capacities toward preparing the warfighter for the future combat.
Part VIII: Closing Thoughts

“Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.”

H. G. Wells

An Urgent Need for Change

The intelligence warfighting function allows units to more precisely direct their mission efforts and achieve the operational objective with increased efficiency. The intelligence analyst’s capability is the cornerstone of a tactical unit’s intelligence capacity. However, intelligence capacity falls short of what combat battalions need in the modern OE, where intelligence capacity is driven by the analyst’s ability to process a high volume of information at a rapid pace. This shortfall is debilitating to the Army’s ability to accomplish operational objectives. It generates more work for troops, unnecessarily increases their exposure to risk, and erodes future warfighting capability.

As a team, the Army needs to revise training for tactical intelligence analysts in order to align analysts’ capabilities with the current and future needs of tactical operations. Tactical intelligence analysts need to possess more than the traditional set of capabilities across intelligence methodology and its integration with unit operations. In order to deliver valuable intelligence insights to the unit, analysts must be competent in information processing and in communicating key intelligence insights to decision-makers.

Today’s modular force structure and the decentralized decision-making that characterizes mission command require the unit to determine the needs and capabilities of its own forces within the context of the OE. Most importantly, it requires the unit to integrate intelligence into its operations so that the intelligence directly informs decisions pertaining to the unit’s unique set of missions and tactical capabilities. In the era of the Army’s legacy design, a
higher headquarters mandated tactical unit operations, and provided the unit with personnel, materiel, and intelligence it needed to execute its missions. Under the legacy construct, tactical analysts could take a higher headquarters intelligence product and brief its significance to the unit. In the modern Army, the tactical intelligence analyst must be capable of generating the intelligence products for the unit.

An enduring fundamental of military operations is that the commander with the highest cumulative knowledge of his opponent and his own forces possesses the information advantage required for operational success. This advantage not only reveals an adversary’s critical vulnerabilities, but it also enables the commander to reveal only what he wants his opponent to know so that he can manipulate his actions. However, in the modern OE, the amount of data involved in such analysis can sometimes prove overwhelming, and failing to either collect or filter properly leads to unreliable results and is a poor foundation for decision-making.

Without the ability to effectively interpret the conditions of the OE, including the state of the adversary and the results of specific military operations, the ability to achieve an operational objective erodes rapidly. As the cost analysis shows, the lack of competency also deteriorates the military’s future readiness and the abilities of the military’s future senior analysts who must continue to serve in a rapidly changing digital world.

Overcoming Organizational Design Challenges

Analysts’ competencies must also sufficiently equip the analyst to overcome the organizational design problem posed by the experience differential between the S2 and S3. The communication between these two staff elements is essential in conducting effective MDMP. This and other organizational challenges are the first barriers the S2 will face in integrating the intelligence function with the unit’s operations. Technical competency supports the S2’s role as a force multiplier and enables the S2 to focus communication on aspects of the unit’s tactics that...
are most vital to PIR development and execution of the intel cycle. When analysts do not possess the appropriate competencies, it not only inhibits effective communication, it makes the analysts more reliant on alternate methods to support operations. If the analyst applies tools blindly or relies on similar shortcut methodology, then analysts’ efforts are essentially prejudicing the organization against trusting the capability of its intelligence officers. During garrison operations, it is especially important not to allow such distrust to proliferate. Over time, it can contribute to a culture wherein S2 participation in training or mission planning steadily declines, delaying or disabling the analysts’ skill development, and greatly reducing the potential capability of the unit. Analysts have a responsibility to set the conditions for future analysts, and the unit leadership has the responsibility to create a culture that promulgates professional growth and cohesion across functions.

The personal vignette that follows provides a glimpse of a new S2 arriving to the unit for the first time, and may promote discussion on a number of social dynamics at play in defining organizational culture.

After working just shy of a year as an assistant on a brigade’s intelligence staff, I received a phone call informing me to pack my things and immediately report for duty as a squadron S2. Although I thought it was a bit strange to receive such instructions via phone, I was anxious to get started. I knew that this would be the unit I would go to war with. This fact shaped everything I did. War, to me, and so many others, was more than fighting for our national security interests. It was serving to protect soldiers, many personal friends, classmates, my husband, and my brother. I had known since the day of the 9/11 attacks that I would serve in the war, but I never realized how personal it would become for me, for all of us.

My brother, an infantryman, had just returned from Iraq—via Walter Reed. A female suicide bomber detonated her suicide vest and maimed every single member of his squad while they were out on patrol. He had called me some months before to let me know he was going into combat. I flew across the country with my 9-month-old daughter, wanting him to meet his niece before he left. When he returned no more than 2 months after deploying, I felt something steel itself inside of me, bracing for the unknowns that I couldn’t imagine. I couldn’t help my brother. I couldn’t even visualize his scenario—and it was my job to visualize enemy scenarios. I worried I wouldn’t be able to realistically break down the layers of war into the more complex layers of human actions that
comprise each attack. I needed to understand. I needed practice. I needed to learn as much as possible before I felt at all prepared to fulfill my role.

When I reported for duty as a squadron S2, the outgoing S2 met me at the headquarters building and took me to his office. We walked past the hub of activity in the S3 shop, past the large room with connected offices for the other staff elements (S1-personnel, S4-logistics), and around a dark corner. The corridor led to two doors, behind one was a room where the members of the S2 section worked. Two soldiers were working there, and they greeted me cordially. I was excited to work with them, having heard nothing but positive accounts about intelligence soldiers—they were among the brightest and typically required minimal disciplinary action. Behind the next door was the...err utility closet? It had no windows, was full of old file cabinets, WW2-era map chests and piles of cardboard boxes. The boxes concealed a desk, which I only recognized by the computer screen sitting on a small part of its surface and an open bottle full of spat tobacco. The S2 proceeded to tell me how exciting his job was and how incredible the commander was. He was sad to be leaving the unit but was glad he was doing so before the change of command. I asked him what he was working on, pointing to a map on the wall. He thought I pointed to one of the many boxes and said, “Oh I’m selling wine for the squadron. Here—I can show you how to do it.”

While a variety of perfectly legitimate reasons could have led to the intelligence analysts’ role as a wine salesman in the above vignette, if an organization becomes prejudiced against trusting the capability of its intelligence analysts, its culture can create a default mode wherein tasks, like selling wine, define the S2’s contribution to the unit.

Shirking garrison and stateside opportunities to train and develop intelligence competencies can deteriorate intelligence capacity in similar ways that shortcuts do because they push back the capability building process. However, the effects of organizational culture can cause negative effects of greater magnitude. The analyst will have an even steeper learning curve to ascend during combat operations, leading to greater uncertainty, worse mission outcomes, and increasing reliance on shortcut methods. The reputation (or perception thereof) the analyst established, or fell into, may further complicate learning because of strained communication networks between intelligence and operations. The effects of a steeper learning curve would deteriorate operational efforts earlier in the deployment, leading to a worsening rather than an improvement in OE conditions.
Improving Tactical Intelligence

In order to improve, it is essential for the military intelligence community to consider the future of the tactical intelligence analyst. The analyst’s role centers on turning information into insights that affect human actions. While the sources of information will increase in volume, speed, and complexity, the fusion and integration are left to the cognitive facilities of the analysts. However, if the intelligence analyst is to continue deriving operational insights from intelligence information, then the analyst’s capacity to do so will be defined by his competency to process information across continuously-evolving intelligence information systems. In order to reach the level of proficiency required in future operations, the military intelligence community needs to focus on developing core skills of its analysts, starting with the analyst's mind.

There are currently a myriad of completed and ongoing research efforts focused on how to extract value from large sources of data, how to leverage tools to optimize their utility, and how to identify and understand sources of uncertainty. As a community, we need to unify these efforts and identify ways to enhance analyst training in both the near and long term. In the near term, we should be able to incorporate aspects of information processing, such as fundamentals of data analysis or statistical methods, into analysts’ initial entry and career developing curriculums as enablers of existing learning objectives. Meanwhile, we should assess in depth the skills and teaching methods that provide the most value. These findings should then be guide the development of a new curriculum and culture in military intelligence that provides and enduring foundation for intelligence capacity required in the modern OE.
Works Cited


ADRP 6-0. (2012). ADRP 6-0: Mission Command. Headquarters, Department of the Army.


Appendix 1: Military Decision Making Process (ADRP 5-0)

<table>
<thead>
<tr>
<th>Key inputs</th>
<th>Steps</th>
<th>Key outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Higher headquarters' plan or order or a new mission anticipated by the commander</td>
<td>Step 1: Receipt of Mission</td>
<td>• Commander's initial guidance</td>
</tr>
<tr>
<td>• Higher headquarters' plan or order</td>
<td></td>
<td>• Initial allocation of time</td>
</tr>
<tr>
<td>• Higher headquarters' knowledge and intelligence products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Knowledge products from other organizations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Army design methodology products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mission statement</td>
<td>Step 2: Mission Analysis</td>
<td>• Problem statement</td>
</tr>
<tr>
<td>• Initial commander's intent, planning guidance, CCIRs, and EEFIs</td>
<td></td>
<td>• Mission statement</td>
</tr>
<tr>
<td>• Updated IPB and running estimates</td>
<td></td>
<td>• Initial commander's intent</td>
</tr>
<tr>
<td>• Assumptions</td>
<td></td>
<td>• Initial planning guidance</td>
</tr>
<tr>
<td>• Updated running estimates</td>
<td></td>
<td>• Updated IPB and running estimates</td>
</tr>
<tr>
<td>• Revised planning guidance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• COA statements and sketches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Updated assumptions</td>
<td></td>
<td>• Assumptions</td>
</tr>
<tr>
<td>• Updated running estimates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Revised planning guidance</td>
<td>Step 3: Course of Action (COA) Development</td>
<td>• COA statements and sketches</td>
</tr>
<tr>
<td>• COA statements and sketches</td>
<td></td>
<td>• Tentative task organization</td>
</tr>
<tr>
<td>• Updated assumptions</td>
<td></td>
<td>• Broad concept of operations</td>
</tr>
<tr>
<td>• Updated running estimates</td>
<td></td>
<td>• Revised planning guidance</td>
</tr>
<tr>
<td>• Revised planning guidance</td>
<td></td>
<td>• Updated assumptions</td>
</tr>
<tr>
<td>• COA statements and sketches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Updated assumptions</td>
<td>Step 4: COA Analysis (War Game)</td>
<td>• Refined COAs</td>
</tr>
<tr>
<td>• Revised planning guidance</td>
<td></td>
<td>• Potential decision points</td>
</tr>
<tr>
<td>• Updated running estimates</td>
<td></td>
<td>• War-game results</td>
</tr>
<tr>
<td>• Updated assumptions</td>
<td></td>
<td>• Initial assessment measures</td>
</tr>
<tr>
<td>• Updated assumptions</td>
<td></td>
<td>• Updated assumptions</td>
</tr>
<tr>
<td>• Updated running estimates</td>
<td>Step 5: COA Comparison</td>
<td>• Evaluated COAs</td>
</tr>
<tr>
<td>• Refined COAs</td>
<td></td>
<td>• Recommended COAs</td>
</tr>
<tr>
<td>• Evaluation criteria</td>
<td></td>
<td>• Updated running estimates</td>
</tr>
<tr>
<td>• War-game results</td>
<td></td>
<td>• Updated assumptions</td>
</tr>
<tr>
<td>• Updated assumptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Updated running estimates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Evaluated COAs</td>
<td>Step 6: COA Approval</td>
<td>• Commander-selected COA and any modifications</td>
</tr>
<tr>
<td>• Recommended COA</td>
<td></td>
<td>• Refined commander's intent, CCIRs, and EEFIs</td>
</tr>
<tr>
<td>• Updated assumptions</td>
<td></td>
<td>• Updated assumptions</td>
</tr>
<tr>
<td>• Commander-selected COA with any modifications</td>
<td>Step 7: Orders Production, Dissemination, and Transition</td>
<td>• Approved operation plan or order</td>
</tr>
<tr>
<td>• Refined commander's intent, CCIRs, and EEFIs</td>
<td></td>
<td>• Subordinates understand the plan or order</td>
</tr>
<tr>
<td>• Updated assumptions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CCIR commander's critical information requirement
COA course of action
EEFI essential element of friendly information
IPB intelligence preparation of the battlefield
Appendix 2: Multi-Domain Mapping Matrix for Staff Tasks in MDMP

<table>
<thead>
<tr>
<th>COA Name</th>
<th>COA Comparison</th>
<th>COA Analysis</th>
<th>COA Development</th>
<th>Mission Analysis</th>
<th>Receipt of Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 1</td>
<td>Task 2</td>
<td>Task 3</td>
<td>Task 4</td>
<td>Task 5</td>
<td>Task 6</td>
</tr>
<tr>
<td>Task A</td>
<td>Task B</td>
<td>Task C</td>
<td>Task D</td>
<td>Task E</td>
<td>Task F</td>
</tr>
</tbody>
</table>

- Gather tools
- Update running estimates
- Conduct initial assessment
- Issue the initial warning order (WARNORD)
- Analyze higher HQ plan or order
- Performance initial OPP
- Determine specified, implied, and essential tasks
- Review available assets
- Determine constraints
- Identify critical tasks and develop assumptions
- Begin composite risk management
- Develop initial CoRs and EFIs
- Dev initial R&S synchronization tools
- Dev initial R&S plan
- Update plan for use of available time
- Develop initial themes and messages
- Develop proposed problem statement
- Develop proposed mission statement
- Present the mission analysis briefing
- Develop and issue initial CTPL
- Dev and issue initial planning guidance
- Develop COA evaluation criteria
- Issue a warning order (WARNORD)
- Assess relative combat power
- Generate options
- Army fires
- Develop a breadth concept
- Assign headquarters
- Prepare COA statements and sketches
- Conduct COA briefing
- Select or modify COAs for continued analysis
- Gather the tools
- List all friendly forces
- List assumptions
- List known critical events and decision points
- Select the war-gaming method
- Select a technique to record and display results
- War-game the operation and assess the results
- Conduct a war-gaming briefing option
- Conduct advantages and disadvantages analysis
- Compare COAs
- Conduct a COA decision briefing
- Commander selects COA
- Commander issues the final planning guidance
- Issue warning order (WARNORD #)
- Deliver brief order to subordinate unit.
Appendix 3: Mission Performance Model Documentation

Variable values:

allowable mission attempts = operational capacity * operational capacity utilization
Units: missions

attempts = ACTIVE INITIAL (
max(0, (allowable mission attempts * likelihood of attempt)/planning cycle time), 0)
Units: missions/Day

average wait = ACTIVE INITIAL ( IF THEN ELSE( Missions to Do > 0 , Time Waited/Missions to Do , 0), 0)
Units: Day

campaign plan OPTEMPO = initial tasks / (deployment time - 30)
Units: missions/Day

completed = ACTIVE INITIAL ( IF THEN ELSE( Missions In Progress > 0 :AND: Tasks in Higher Level Objective > 0 , Missions In Progress / mission execution time, 0), 0)
Units: missions/Day

contingency missions = Input * initial tasks
Units: missions

contingency OPTEMPO = contingency missions / ((deployment time - 30) - Step Time)
Units: missions/Day

deployment time = 365
Units: Day

desired intel production = IF THEN ELSE( minimum required intel production > Intel Gaps , minimum required intel production , max(0, Intel Gaps))
Units: gaps

desired production = IF THEN ELSE( Tasks in Higher Level Objective > 0 , max(0, Missions to Do), 0)
Units: missions

discard = ACTIVE INITIAL ( IF THEN ELSE( Tasks in Higher Level Objective > 0 , (Missions to Do * filterability) / filter time, Missions to Do / filter time), 1/10)
Units: missions/Day

failure =
IF THEN ELSE ( Tasks in Higher Level Objective > 0, max(0, completed-successes), 0 )
Units: missions/Day

filled =
max(0, intel products/intel cycle time)
Units: gaps/Day

filter time =
1
Units: Day

filterability =
IF THEN ELSE (intel readiness factor > 1, MIN (intel readiness factor * (1/10), 2.5*(1/10)), 1/10 )
Units: Dmnl

FINAL TIME = 548
Units: Day
The final time for the simulation.

gap discovery =
max(0, (desired production * mission complexity) / time to id)
Units: gaps/Day

initial tasks = INITIAL (750)
Units: missions

INITIAL TIME = 0
Units: Day
The initial time for the simulation.

initial waiting = INITIAL (5)
Units: missions

Input =
STEP (Step Height, Step Time) + STEP (1, Noise Start Time) * RANDOM NORMAL (-0.15, 0.25, 0, Noise Standard Deviation, Noise Seed )
Units: Dimensionless

intel capacity =
36
Units: gaps

intel capacity utilization = ACTIVE INITIAL (}
MIN(1, desired intel production/intel capacity),0) 
Units: Dmnl

intel cycle time=
1 
Units: Day

Intel Gaps = INTEG ( 
gap discovery-filled, initial waiting*mission complexity) 
Units: gaps

intel products = ACTIVE INITIAL ( 
intel capacity*intel capacity utilization,0) 
Units: gaps

intel readiness factor= 
intel products/max(1,intel support to mission) 
Units: Dmnl
intel products/max(1,intel support to mission)

intel support to mission= 
DELAY FIXED( minimum required intel production , intel cycle time, minimum required intel production 
) 
Units: gaps

likelihood of attempt= ACTIVE INITIAL ( 
IF THEN ELSE( Tasks in Higher Level Objective>0, RANDOM NORMAL( 0, 1 , 0.9 , 0.05 , 1 )- 
risk,0),0.9) 
Units: Dmnl

likelihood of success= ACTIVE INITIAL ( 
relative prediction of threat-readiness impact on performance,.9) 
Units: Dmnl

minimum required intel production= 
mission complexity*allowable mission attempts 
Units: gaps

mission complexity = ACTIVE INITIAL ( 
RANDOM NORMAL( 2, 20 , 9 , 2 , 9 ),9) 
Units: gaps/mission

mission execution time= 
(2/3)*service time 
Units: Day

mission requests = ACTIVE INITIAL (
IF THEN ELSE(Tasks in Higher Level Objective>0 \text{ AND} \text{ Tasks in Higher Level Objective}<12, 2, \text{max}(0, (\text{Tasks in Higher Level Objective})/\text{time available to achieve higher level objective}),0)

Units: missions/Day

Missions In Progress= \text{INTEG} (\text{attempts-completed},0)
Units: missions

Missions to Do= \text{INTEG} (\text{retask rate+mission requests-(attempts+discard)},\text{initial waiting})
Units: missions

Missions to Rework= \text{INTEG} (\text{failure-(retask rate)},0)
Units: missions

Noise Seed=
0
Units: Dimensionless

Noise Standard Deviation=
0
Units: Dimensionless

Noise Start Time=
5
Units: Day
Start time for the random input.

operational capacity=
4
Units: missions

operational capacity utilization= \text{ACTIVE INITIAL} (\text{MIN}(1, \text{desired production/operational capacity}),0.5)
Units: Dimnl

\text{OPTEMPO GAP}=
IF THEN ELSE( \text{contingency OPTEMPO}=0 \text{ ,IF THEN ELSE( campaign plan OPTEMPO-succesess}>0 \text{ AND} \text{ NOT} \text{ Time}<30 \text{ AND} \text{ NOT} \text{ Time}>335, \text{campaign plan OPTEMPO-succesess} , 0 ),\text{IF THEN ELSE((contingency OPTEMPO+campaign plan OPTEMPO)}-\text{succesess}>0 \text{ AND} \text{ NOT} \text{ Time}>335, (\text{contingency OPTEMPO+campaign plan OPTEMPO)}-\text{succesess} , 0 ))
Units: missions/Day

period of measure=
28
Units: Day
Duration over which to average the unit's capacity utilization.
planning cycle time = 
1/3 \times \text{service time} 
Units: Day 

readiness impact on performance = 
table reference for readiness impact (SMOOTH (operational capacity utilization, period of measure)) 
Units: Dmnl 

relative prediction of threat = 
table reference for uncertainty and relative prediction (uncertainty) 
Units: Dmnl 

retask capacity = 
(1 - operational capacity utilization) \times 2.5 
Units: Dmnl 

retask rate = 
\text{IF THEN ELSE} ( \text{Tasks in Higher Level Objective} > 0, \max (0, \text{(retask capacity} \times \text{Missions to Rework})/\text{time to retask}), \text{IF THEN ELSE} (\text{Missions to Rework} > 0, \text{Missions to Rework}/\text{time to retask}, 0) 
Units: missions/Day 

risk = 
\text{IF THEN ELSE} ( \text{intel readiness factor} < 1 , 1 - \text{intel readiness factor} , 0) 
Units: Dmnl 

\text{with IMPERFECT INFO: IF THEN ELSE} (\text{intel readiness factor} < 1 , \text{RANDOM NORMAL} (0.1 , \text{IF THEN ELSE} (1 - \text{intel readiness factor} + 0.1) < 1 , 1 - \text{intel readiness factor} + 0.1 , 1 - \text{intel readiness factor}) , 0.9^* (1 - \text{intel readiness factor}) , 0.15, 0.9 - \text{intel readiness factor} ), \text{RANDOM NORMAL} (0.1 , 0.2 , 0.15 , 0.05 , 0.1 )) 

SAVEPER = 
\text{TIME STEP} 
Units: Day [0,?] 
The frequency with which output is stored. 

service time = 
\text{standard service time} 
Units: Day 

\text{standard service time} = \text{ACTIVE INITIAL} (\text{RANDOM NORMAL} (0.5 , 5 , 3 , 0.5 , 3 ), 3) 
Units: Day 

Step Height = 
0 
Units: Dimensionless
Step Time = 150
Units: Day

successes = IF THEN ELSE( Tasks in Higher Level Objective > 0, max(0, completed * likelihood of success), 0)
Units: missions/Day

table reference for readiness impact:
[(0,0)-(1,0.15),(0,0.1),(0.0625,0.05),(0.125,0.025),(0.1875,0.0125),(0.25
,0.00625),(0.3125,0.00375),(0.375,0.001875),(0.4375,0.000938),(0.5,0),(0.5625
,0.001172),(0.625,0.002344),(0.6875,0.004688),(0.75,0.009375),(0.8125,0.01875
),(0.875,0.0375),(0.9375,0.075),(1,0.15))
Units: Dmnl

table reference for uncertainty and relative prediction:
[(0,0)-(1,1),(0,1),(0.3,0.7),(0.4,0.6),(0.5,0.5),(1,0.5),(0,1),(0.0101833
,0.985714),(0.0224033,0.971429),(0.0346232,0.961905),(0.0509165,0.947619,
(0.0651731,0.928571),(0.0875764,0.895238),(0.11609,0.861905),(0.150713,0.828571
),(0.181263,0.8),(0.215886,0.77619),(0.246436,0.757143),(0.276986,0.695238
),(0.321792,0.642857),(0.372709,0.595238),(0.417515,0.557143),(0.464358,0.519048
),(0.5,0.5),(1,0.5))
Units: Dmnl

task arrival = ACTIVE INITIAL ( IF THEN ELSE( contingency OPTEMPO = 0, max(0, 0.5 * OPTEMPO GAP), max(0, OPTEMPO GAP)), 0)
Units: missions/Day

Tasks in Higher Level Objective = INTEG ( task arrival - successes, initial tasks)
Units: missions

time available to achieve higher level objective =
IF THEN ELSE( ((deployment time - 30) - Time) > 0, (deployment time - 30) - Time, IF THEN ELSE
((deployment time - Time) > 0, (deployment time - Time), FINAL TIME - Time + 1 ) )
Units: Day

TIME STEP = 1
Units: Day [0, ?]
The time step for the simulation.

time to id = 1
Units: Day

time to retask = 1
Time Waited= INTEG ( 
wait-time wait departing,
1/3*service time*Missions to Do)  
Units: missions*Day  

uncertainty= 
IF THEN ELSE(intel readiness factor<1 ,1-intel readiness factor, 0)  
Units: Dmnl  
Imperfect Info Value: IF THEN ELSE(intel readiness factor<1 , RANDOM NORMAL( 0.1 , IF THEN ELSE( (1-intel readiness factor+0.1)<1 , 1-intel readiness factor+0.1 , 1-intel readiness factor) , 0.9*(1-intel readiness factor), 0.15, 0.9-intel readiness factor ) , RANDOM NORMAL( 0.1 , 0.2 , 0.15 , 0.05 , 0.1 )) Perfect info value: IF THEN ELSE(intel readiness factor<1,1-intel readiness factor, 0)  

daunting=  
average wait*attempts  
Units: missions  

waiting=  
max(0,Missions to Do)  
Units: missions
Appendix 4: Army All-Source Intelligence Analysts’ Competency Task Specifications

All-Source Analyst’s Critical Task List from Army G2
- Conduct Information Collection in Support of Operations
- Conduct Intelligence Support to the Military Decision Making Process (MDMP)
- Prepare an Intelligence Annex
- Lead Battalion Intelligence (S2) Section
- Activities
  - Lead Intelligence Platoon or Multi-Functional Team Operations
  - Conduct Intelligence Support to Targeting
  - Integrate Intelligence with the other Army Warfighting Functions.
- Conduct Analysis
- Organize a Unit Intelligence Architecture

ATTP 5-01: Staff Functions
- Support the commander.
- Assist subordinate units.
- Inform units and organizations outside the headquarters.

FM 6-22
- Prioritize tasks
- Adapt to fight the enemy
- Apply critical thinking to examine a problem in depth
- Assess situations or circumstances shrewdly and to draw feasible conclusions
- Be able to juggle facts, questionable data, and gut-level feelings to arrive at a quality decision.
- Think methodically to consider the consequences of potential courses of action
- Adapt to new environments.
- Effectively interact with others
- Learn the strengths and vulnerabilities of different technologies that support the team and mission
- Identify the problem.
- Gather information.
- Develop criteria.
- Generate possible solutions.
- Analyze possible solutions.
- Compare possible solutions.
- Make and implement the decision.

AT 2-01 Collection Tasks in MDMP
Develop initial CCIR
Review initial information collection resource availability and status
Obtain commander's guidance for information collection
Create initial planning requirements tools
Update planning requirements tools
Update information collection plan
Define PIR
Develop indicators
Develop specific information requirement

**FM 2-01.3 Intelligence Preparation of the Battlefield**

- Identify Significant Characteristics of the Environment
- Identify the Limits of the Command's Area of Operations
- Establish the Limits of the Area of Influence and the Area of Interest
- Evaluate Existing Databases and Identify Intelligence Gaps
- Initiate Collection of Information Required to Complete IPB
- Analyze the Environment
- Describe the Environmental Effects on Operations and Threat and Friendly Courses of Action/Describe the Battlespace Effects on Operations and Adversary and Friendly Capabilities and Courses of Action
- Evaluate the Threat/Adversary
- Update or Create Threat/Adversary Models
- Identify Threat/Adversary Capabilities
- Identify the Threat's/Adversary's Likely Objectives and Desired End State
- Identify the Full Set of Courses of Action Available to the Threat/Adversary
- Evaluate and Prioritize Each Course of Action
- Develop Each Course of Action
- Identify Initial ISR Requirements
- Produce IPB products that support the staff's preparation of estimates and the MDMP/MCPP.

- Identify characteristics of the area of operations (AO), including civil considerations, that will influence friendly and threat/adversary operations.
- Identify mission sensitivities to weather, continuously forecasting and monitoring weather conditions and associated effects on
planned or potential operations.
Establish the area of interest (AOI) in accordance with the commander’s guidance.
Identify gaps in current intelligence holdings.
Determine multiple threat/adversary courses of action (COAs) by employing predictive analysis techniques to anticipate future threat/adversary actions, capabilities, or situations.
Establish a database that encompasses all relevant information sets within and related to the operational environment/battlespace environment.
Identify characteristics of the information environment that will be influenced by friendly and threat/adversary operations.
Determine the threat characteristics/order of battle doctrine and tactics, techniques, and procedures.
Identify any patterns in threat/adversary behavior or activities.
Identify and report hazards within the AO, including the medical threat/adversary and toxic industrial material.
Identify threat/adversary capabilities, high-value targets (HVTs), and threat/adversary models.
Integrate IPB information into the MDMP/MCPP.
Assess the effectiveness of friendly operations and update IPB products as information becomes available.

**TC 2-33.4 Analytic Techniques and Tools**

**Predictive Analysis:**
Compare bits and pieces of raw info
Synthesize findings into an intelligence product

*Use Automated Tools to:*
Track and cross-cue reports.
Incorporate data extraction technology, retrieval, automated data organization, content analysis, and visualization.
Share analytical decisions with other units and other analysts in real time.
Apply multidimensional technologies, content analysis techniques, and web-based collaborations.
Display analytical results and view operations in real time.
Share resources such as models, queries,
visualizations, map overlays, and tool outputs through a common interface. Apply clustering (a nonlinear search that compiles the results based upon search parameters) and rapid spatial graphical and geographic visualization tools to determine the meaning of large informational streams. Rapidly discover links, patterns, relationships, and trends in text to use in predictive analysis. Capture analytical conclusions and automatically transfer them to intelligence databases and systems.

Leverage databases to:
- Support time event charts, association matrices, link analysis, and other analytical tools.
- Verify the metadata for accuracy and completeness. Without accurate metadata, databases cannot be easily searched for their information.
- Compartment (protect) source-sensitive, operational database segments, files, records, and fields.
- Create, update, and maintain databases from locally generated information.
- Import complete or partial databases from larger, or peer databases.
- Share databases between peers, subordinates, or higher with appropriate access authorization.
- Provide systematic processing and automated parsing, using intelligence operations standardized forms, into appropriate databases for information storing, sharing, retrieval, and analysis.
- Allow query functions for decision-making, as well as operational and analytical support.
- Use analytical programs to correlate data that facilitate information retrieval from any data repository.

Military Decision Making Process
- Alert key staff and participants
- Gather tools
- Update running estimates
- Conduct Initial Assessment
- Issue the initial Warning Order (WARNORD)
- Analyze higher HQ plan or order.
- Perform initial IPB.
- Determine specified, implied, and essential
tasks.
Review available assets.
Determine constraints.
Identify critical facts and develop assumptions.
Begin composite risk management.
Develop initial CCIRs and EEFIs.
Dev initial R&S synchronization tools.
Develop initial R&S plan.
Update plan for use of available time.
Develop initial themes and messages.
Develop proposed problem statement.
Develop proposed mission statement.
Present the mission analysis briefing.
Develop and issue initial cdr's intent.
Dev and issue initial planning guidance.
Develop COA evaluation criteria.
Issue a warning order (WARNORD).
Assess relative combat power.
Generate options.
Array forces.
Develop a broad concept.
Assign headquarters.
Prepare COA statements and sketches.
Conduct COA briefing.
Select or modify COAs for continued analysis.
Gather the tools.
List all friendly forces.
List assumptions.
List known critical events and decision points.
Select the war-gaming method.
Select a technique to record and display results.
War-game the operation and assess the results.
Conduct a war-game briefing (optional).
Conduct advantages and disadvantages analysis.
Compare COAs.
Conduct a COA decision briefing.
Commander selects COA.
Commander issues the final planning guidance.
Issue warning order (WARNORD #3).
Deliver/ brief order to subordinate unit.