Common Sense

Improving the Efficacy of Wide Area Surveillance

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Before us stands a great challenge and a great opportunity. Our nation has invested billions of dollars to develop, field, and maintain an array of optical and radar-based wide area surveillance (WAS) systems. The demand for such systems lies in their potential to persistently monitor significant portions of a threat's operating environment. This ability greatly contributes to learning and understanding a threat's key actions, associations, and locations, thus providing decisive knowledge to our nation's leaders. The capability is powerful,

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unique, and indispensable. However, WAS systems on the whole are plagued by inefficient and suboptimal methods of operation. More specifically, this particular type of intelligence, surveillance, and reconnaissance (ISR) asset is often applied improperly and employed without using the full extent of its inherent flexibilities. In addition, no defined or even de facto process exists for extracting progressive, cooperative, or multisource integrated intelligence from WAS systems. The combination of these factors means that the potential synergy and power from multiple intelligence (multi-INT) source collections and analyses using WAS systems are seldom realized. Although this has undoubtedly come at a cost of lost opportunity in Afghanistan, the "embarrassment of riches" there, "with hundreds of [ISR assets] and thousands of analysts," has mitigated the impact.[1] Our nation is unlikely to be so fortunate in the future.

Defense spending has already taken severe cuts, and the prospect of additional reductions looms ominously over the defense community.[2] The final state remains unknown, but our nation's WAS resources probably will be reduced and therefore serve as a catalyst for determining how to "do more with fewer" WAS assets. Some WAS capabilities will atrophy, others will disappear, and still others will not transition to programs of record—all occurring within the context of a changing and unstable world. The United States is expected to continue facing the ever-present danger of terrorist organizations, along with instability in Africa, the Middle East, and parts of Asia. However, it will also confront new issues such as multiple gravitational centers of global power; growing tensions over vital resources; greater conflation of irregular and regular forms of warfare in conflict; and increasingly powerful, organized nonstate actors.[3] This future strips us of the luxury of inefficiency and suboptimal applications of our WAS capabilities. The goal, then, is to attain the greater efficacy that our future demands and to do so with better efficiency.

Setting the Framework

We have an opportunity to refine elements of our surveillance enterprise to maximize the effect of our systems through a more unified and robust operating framework—one with principles and methods common across our WAS sensing resources, one that will guide them toward consistently producing the most powerful information possible for enabling field operations and policy decisions. This article seeks to aid in advancing surveillance tradecraft by defining these principles. Though they apply broadly, it focuses specifically on motion intelligence systems such as wide area motion imagery and ground-scanning moving target indicator radars; consequently, subsequent references to WAS are to these systems. The following principles are founded in accepted military doctrine, expanded to provide WAS-specific guidance, seasoned with adaptations of proven practices from other professions, and blended with practical operational experiences:

- Strong Partnerships
- WAS Economy of Force
- Information Cycle Synchronization
- Harmonious ISR
- Maximum Value Extraction
- Information Orchestration

Concurrent implementation of these principles, systematically detailed below, forms a basic conceptual structure that instigates refinements capable of enhancing the effectiveness and efficiency of our surveillance enterprise. Furthermore, the framework can also impart synergistic value to investments of the current service and intelligence community in standardized formats, searchable data, improved data accuracy, advanced analytic methods, automated exploitation, and large data-management systems by supplying the requisite conditions that each one needs to realize its full potential. Better data management does not mean that concurrent layers of ISR are meaningfully

arranged or integrated; enabling data discovery doesn't ensure that something of value is present; and there is no guarantee that advanced analytic methods and algorithms will have data of sufficient quality to generate actionable intelligence. A precondition to these benefits, though, is to overcome inhibitors like the existing cultures that run counter to the concepts described and the complacency that so easily besets their traditional practices.

Making Collaboration Possible: Strong Partnerships

Understanding a complex enemy extends far beyond the domain of a single discipline. It requires intentional, solicited consultation and collaboration from other perspectives, fields of expertise, and external organizations.[4] Collaboration is by nature a very interpersonal activity insofar as it demands established, positive, and trustworthy partnerships to function well.

The need for cultivating and maintaining strong partnerships is emphasized at the department and international levels as a necessary part of shaping and determining the overall success of military outcomes.[5] That is, strong partnerships are not only a prerequisite for collaboration but also the single most significant, proven factor for attaining desired outcomes.[6] Such partnerships facilitate the type of dialogue necessary for learning the true intent and capabilities of others. They also set conditions for joint planning, effective coordination, and corrective action in a way that faceless spreadsheets, e-mails, or even superficial calls do not allow for. The effort invested in these relationships that pays out in the length of their effectiveness and the ability of in-person interactions and liaisons to facilitate them cannot be overstated.[7]

Selecting, developing, and maintaining stakeholder relationships can genuinely shape every aspect of WAS operations and activities. Therefore, WAS organizations must become intentional and strategic in establishing and nurturing relationships within each key stakeholder

group. Partnerships should span trained disciplines, discrete units, different ISR domains, and governmental departments. They must be established with the focused intent to facilitate more responsive, relevant, timely, efficient, and effective WAS. Partners can be viewed as two distinct groups—customer or collaborator organizations (fig. 1). Together they enable tailored surveillance, a robust multi-INT environment, and the thorough extraction of value from collected data.

Figure 1. Building broad and strong stakeholder partnerships. (Images from http://www.defence.gov; http://www.aqc.osd.mil; http://www.army.mil; and http://www.nsa.gov.)

Customers

Customer organizations are the combat divisions, task forces, brigade combat teams, battalions, and their service or agency equivalents that request ISR. They make decisions or respond in some manner to the information provided by WAS systems. Building strong partnerships with these organizations is how true "command intent" is understood—

not just assumed. It involves learning about their upcoming operations, the existing intelligence that underpins them, current knowledge gaps, concurrently planned ISR collection, and their specific surveillance needs. Obtaining those needs in this manner allows an understanding of them in their truest sense and context, with nothing lost in reduction or from poorly trained attempts of the requesting units to use surveillance parlance. This rich information will enhance the comprehension of WAS operators and analysts, allowing them to respond in the most effective manner. Strong customer partnerships should also include intentional probing of a unit's more distant or emerging needs. Engaging at this stage has the potential to shape future requests for enhancing multi-INT synergy, optimizing the impact of individual WAS collections and evolving collects in synchronization with the operations process.[8] These powerful effects come only through strong working relationships built upon open, frequent, and meaningful dialogue. They cannot emerge from the present common practice of merely calling a unit to verify the task and gather a few minor details.

Collaborators

The benefit of strong collaborator partnerships is that they essentially create de facto multidiscipline teams—the very thing necessary for addressing the complex, diverse threats that our nation faces.[9] They form much of the gears and glue associated with developing and executing plans for synergistic effects. Collaborators are any organization willing or tasked to labor collectively with the shared purpose of delivering an effective final product to a customer organization from WAS collections. They include other ISR platforms, theater intelligence centers, enterprise-level analytic units, strategic reachback sites, domain experts, and even technical advisers. WAS organizations should build strong partnerships across a diverse set of these to enable their personnel to tap into the wealth of contextual information, relevant intelligence, domain knowledge, and technical expertise that exists within them. Doing so empowers WAS operators and analysts to optimize their sensor and platform, develop joint plans for synergistic multisensor sur-

veillance, and define and execute multisource exchanges and integration at levels that would otherwise be unachievable. The potential effects are astounding. Such partnerships can even transform insular cultures, common among WAS units, into open and collaborative ones. They literally can transform units that operate as if they are "the center of the fight" into contributing members of a highly lethal multi-INT collaborative.

Economy of Force for Wide Area Surveillance

The premise of economy of force involves limiting the use of available resources applied to general shaping and sustaining activities so that the preponderance of those resources remain dedicated to key operations.[10] This core military principle has long been embedded in Western defense training and doctrine, and applying it en masse is fairly straightforward. The ambiguity lies in trying to apply the concept to lower-level, individual actions such as specifying what constitutes proper economy of force for WAS.

Economy of force for WAS can be defined as the minimal use of surveillance assets and sensor resources against activities of minor value so that they may be judiciously applied in a manner that produces the most significant impact across the widest area for the largest number of priority objectives and decisive operations. Two components are involved—platform allocation and sensor employment. They translate into having to make difficult choices regarding the servicing of requests and sensor trade-offs, respectively. In large part, this is an issue of properly exercising the tenet of prioritization toward preeminent effects to prevent excess division of platform persistence and sensor resource for the sake of lower-priority surveillance activities.[11] Practically, WAS economy of force becomes a matter of task advocacy—adjusting collection timing and duration, sensor configuration, coverage area, and platform to target geometries. Given that field units and intelligence community analysts are prone to requesting ISR without tem-

perance, higher-level collection managers and surveillance units will likely serve as the concept's vanguards.[12]

Platform Allocation

Primarily, economy of force for platform allocation means conducting surveillance in support of significant operational effects against the key command objectives. Embedded in this statement is the need to concentrate collection on the priority objectives themselves and on the types of ISR support likely to produce the most considerable effects for those objectives. To do so requires minimizing collection on secondary objectives and those with limited effects. It also demands that assets are dedicated to those tasks for durations sufficient for producing the desired effects, though no more. On the one hand, for example, discovering and understanding hard-to-detect mobile threats can consume several weeks or months of persistent collection. On the other hand, learning general patterns of activity for an area often requires only a few consecutive days of collect, with periodic collects thereafter for updates. This procedure seems apparent, but a review of historical resource applications indicates otherwise.[13]

Each type of conflict will have its own set of primary and secondary effects, but the goal is always to minimize the expenditure of limited and unique WAS capabilities on those secondary effects. Consider the United States' recent history with counterinsurgency campaigns. Some of the primary surveillance tasks for this type of mission are finding the key elements of insurgent networks, determining their influences, and assessing their impact on the local populace—all to a degree that allows countering of the networks.[14] Therefore, tasks that offer situational awareness for minor military activities or those to which no response is planned are secondary and should consume only limited surveillance capacity. This principle is especially true when WAS resources are applied to these very tasks while suboptimally functioning as a surrogate instead of a complement for other types of ISR such as narrow-field-of-view full motion video.[15] Examples of this sort of

misallocation include high-resource dedication for persistent traffic volumetric sampling or overwatch of a squad's routine patrol. Both constitute excessive allocation to secondary efforts at a cost to the primary campaign effects. Ideally, robust tools would assist in recognizing these situations and improving allocation decisions.[16] Ultimately, though, decisions are made by collection managers, making it incumbent upon the WAS providers, as knowledgeable and self-interested parties, to engage with them to this end. The privilege of injecting these types of guiding inputs into the planning process is explicitly granted to WAS units through their liaisons.[17] Thus, staffing of the role with effectual individuals is crucial for maximizing an asset's effects.

Sensor Employment

Ultimately, applying economy of force to sensor employment concerns obtaining the greatest impact from the smallest resource pool against a variety of needs by exercising the versatility inherent to many WAS platforms. It entails focusing sensors to satisfy priority surveillance requirements in their entirety and across the broadest extent possible. However, data quality and area coverage are opposing forces competing in a zero-sum game, so trade-offs must be made between them. In addition, the data quality and coverage area necessary for success vary wildly by surveillance activity and environment. Therefore, WAS providers must approach each problem uniquely, determining the requisite data quality and persistence necessary to satisfy the most stringent aspect of each priority surveillance request. In other words, if the essential elements of information include both a need to supply volumetric measures for a specific location and a need to understand the connections and interactions of individuals associated with that location, then the collection must hold to the higher quality and longer duration surveillance requirements of the latter essential element of information. This requirement, in effect, sets the boundary for coverage area, which should not be violated. Nor should the overall collection scheme fail to extend up to the aggregate coverage limits since doing so would constitute waste. If the demands for coverage

and quality are incompatible, then the surveillance provider must ask the supported unit to decide which aspect to favor.

The process takes thought, but its importance cannot be overstated because it determines whether the information derived can be made actionable or is merely interesting. This concept works in conjunction with the activities outlined in information cycle synchronization to form the basis of tailored surveillance. The significance of the whole idea is best understood through examples. For instance, assume that a need for surveillance requires only the observation of motorized traffic for a specific threat. Yet, if the collection platform chooses to configure its sensor to "get better data" and capture dismounts through different optical lenses or radar settings, depending on the sensing domain, then it runs counter to WAS economy of force. The choice comes at the expense of significant loss of coverage area over the threat's known territory. It is counter to economy of force because the allocated sorties could have produced the full scope of necessary intelligence but didn't, either leaving unknowns or requiring additional sorties. Sensor employment aligned with economy of force, though, would guide the collector to optimize the system for monitoring point-to-point movement of discrete vehicles and then maximizing area coverage within the hard constraint created by that need for data quality. Another example: assume that a top-priority task calls for monitoring a threat's detailed activity, but in an effort to simultaneously collect as many tasks as possible, the data quality becomes compromised—often called the "peanut butter spread." The resulting data is too poor to accurately or confidently observe the targets or their key locations.[18] This excessive division of sensor resources comes at the expense of satisfying primary objectives, directly contradicting the principle.

In contrast, WAS economy of force always ensures that the appropriate resources are provided to satisfy such tasks, with the implied understanding that scarcity dictates that doing so comes at a cost to lower-priority needs. Therefore, the timing, persistence, coverage area, sensor settings, and geometries necessary for monitoring the detailed

activity of that specific threat would be determined as part of a systematic effort to assess the resource demands of each task or its elements. Given the resource costs of this particular task and others whose accumulative costs do not exceed the WAS resource's capacity, selected in priority order and accounting for constraints, many tasks in a large deck may have to be rejected with an "alibi" of being unfeasible. Consequently, the requirements of highest-priority tasks are genuinely met. It is worth stating that both examples hold true across the spectrum of applications, from counterterrorism activities, through support of policy decisions regarding state-sponsored proxies, to full-scale military operations in contested environments.

Information Cycle Synchronization

If ISR is to provide decisive knowledge, its activities must be synchronized with those of operations. Therefore, the sequencing and timing of ISR collections and production must be informed by and must hinge upon the operations process.[19] This sort of intimate coupling between ISR and operations, along with adaptation, flexibility, and tailoring, makes ISR more effective and relevant for operations.[20] For WAS, the practical application takes shape in several ways.

Surveillance activities need to be fully aligned in purpose and timing with the cycle of learning and responding for the supported field operations or strategic actions.[21] Therefore, WAS providers must develop and execute evolving surveillance strategies directly linked to the cycle of detecting, understanding, and responding to threats. The cycle can include four phases for WAS: planning, initial discovery, focused development, and response (labeled herein as the WAS information cycle) (fig. 2).

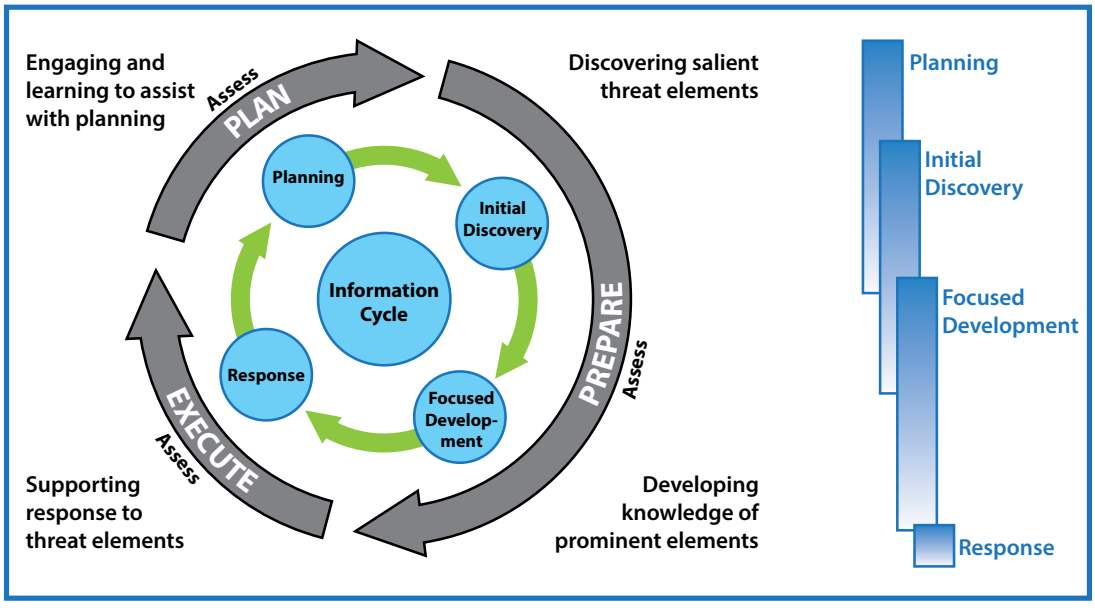

Figure 2. Information cycle synchronization and the operations process

The principle is meant to allow WAS assets to shape US actions onto the most important targets, leading to and thoroughly preparing the WAS unit for direct support of kinetic and nonkinetic operations against those targets and thus embodying the "integration of operations and intelligence."[22] It occurs by progressively building knowledge of and characterizing specific threat activities to enable the selection and development of the most significant targets. For WAS systems, this process begins with a larger surveillance area to map the threat, and then collections are refined into smaller areas to concentrate on the more significant elements as they become apparent, facilitating WAS's assistance in identifying, defining, and nominating objectives at the level of named operations.[23] Quite unfortunately, it is most common for WAS systems to be anchored to one end or the other rather than evolving the surveillance scheme to refine and focus as the needs change.

Good planning sets the stage. Sadly, this part of the cycle is often undervalued and initiated too late. The planning phase can expedite mutual learning among contributing and customer organizations to allow robust,

accurate, and evolving ISR plans to be generated together. Strong partnerships are critical for making this a reality. The next phase, initial discovery, initiates the collection, using surveillance and analysis to contribute to a greater understanding of a threat and thus discover its salient elements. This "find" function precedes every "finish." It is difficult and takes time, but it is an important strength of WAS systems that narrow-field-of-view ISR assets struggle to fill on their own. The initial findings of this phase lead to focused development, which involves further developing information and knowledge pertaining to the prominent threat elements that have been discovered. Once those elements have been understood sufficiently, a response phase naturally follows whereby WAS can directly support the military or policy response to the threat. Execution of this process as part of a multi-INT plan dramatically increases the effectiveness and timeliness of the process, a fact that should not be overlooked.[24] Bringing the power of this principle to life requires (1) aligning and tailoring WAS with the operations cycle for priority-supported units and (2) preparing components and processes for rapidly assembling custom WAS plans.

Matching WAS activities to a supported unit entails aligning a WAS information cycle to the unit's own cycle for a specific operation or suboperation. The phase and cycle durations shrink or expand depending on the complexity of the threat, level of detail required, and priority of the objectives set by the appropriate commands. Meeting the exact surveillance needs present in each phase of the operations cycle can involve adjusting almost every aspect of the collection at each stage—namely, shifting the collection times, amount of persistence, coverage area, orbit, platform-to-target geometries, and sensor configuration. These aspects must be driven by the types of observables, nature, and complexity of activities under scrutiny; the physical features and motion density of the sensing environment; and the precision of detail required. As stated earlier, facilitating effective and progressive plans that truly align at each phase in the cycle will come only by way of a strong partnership that includes engaging units before articulation of their ISR requests.

Without preparation, developing tailored surveillance schemes for evolving requirements can be burdensome. Fortunately, the commercial sector has already created a transferrable approach called "build-to-order" production for meeting shifting and timely needs. This well-established method of building all components in advance and performing custom assembly at the moment of need allows for the highest level of variability in the least amount of time, providing flexibility and responsiveness to shifting requirements with minimal burden.[25] Using this method to create build-to-order surveillance involves predefining the full array of collection components that best suit each of the surveillance activities and conditions that a system may be asked to perform against. For example, a unit should define and label orbits optimized for a primary need of persistent observation, maximizing coverage area or nonpersistent observation mapping. Similarly, common standoff distances should be specified for ideal detection of certain types of targets, achieving discrete coverage-area sizes and meeting geolocation accuracy requirements. Furthermore, sensor configuration presets should be defined based on the type of target, activity density of the target environment, and type of surveillance activity sought. Because details of these components will vary substantially, depending on sensing domain and sensor model, they must be defined at the individual system level. After creation of the components, a set of processes for tailored assembly with adjustments for area-specific flight constraints must be established. WAS providers will then have a broad repertoire of surveillance employment schemes at their fingertips, each prepared in a manner that enables thoughtful, customized, collaborative, and dynamically evolving surveillance solutions constructed for unique, phased problems within a high-tempo environment. This situation will offer a far more potent capability for meeting the idiosyncratic needs of a given operation than the standard model of using "off the shelf" collection schemes based upon a very limited set of solutions that inevitably become stagnant.

A Culture of Fusion: Harmonious Intelligence, Surveillance, and Reconnaissance

Fusion is the process of generating a more complete intelligence assessment from the evaluation of all accessible sources. It is a core principle of joint intelligence, and achieving desirable results from it relies on thoughtful ISR collection and the skillful output of several specialized disciplines.[26] However, when one is inundated with data and information amidst a high operations tempo, the thorough execution of this principle becomes challenging. For WAS, whose front-end operations are very often trained to be fixed upon their single source, this makes timely fusion stunted or outright elusive. It is a state that will persist until the emergence of a deep ideological soak among WAS organizations that is designed to create a culture of fusion. A well-defined concept, the beginnings of which are addressed below, can guide and facilitate its absorption and eventual execution.Fusion is complicated. Creating a reasonably complete assessment of any detectable activity involves countless variables and interdependencies. Consequently, WAS providers and exploiters must labor to cultivate a deep fusion culture within their units. The ethos of this culture must drive and empower unit representatives to directly engage all contributing elements of the ISR process. It is necessary to underpin the ethos with a robust and well-trained multi-INT collaboration framework—a far cry from the limited interaction and data ingestion that currently passes as fusion within the greater WAS community. Sadly, much of WAS's potential power is squandered under these conditions.

Timely and accurate fusion demands a comprehensive, unifying framework of coherently arranged, individually guided, and concurrently executed ISR activities designed to weave an inseparable body of knowledge—here labeled harmonious ISR. The latter seeks to produce optimal effects from the available and applied resources through a holistic and collaborative approach to fusion that inspires unity of effort.[27] It becomes possible through the cooperative, intentional, and thoughtful collection and analysis of multiple synergistic sources.[28]

Harmonious ISR envelops the entire process, from planning to collection and data analysis, for each organization involved in producing information about a specific threat, actually producing an integrated intelligence picture that empowers decision making. The concept implies (1) that every aspect of the ISR operation is considered and then planned with the intent of attaining unity of effort across all contributors, (2) that the elements are ordered and set into a logical arrangement in advance, (3) that ISR activities like multisource collection, cross-pollinating analyses, knowledge synthesis, and information distribution are conducted concurrently, and (4) that the component processes and automated systems are very explicitly and intentionally guided toward producing a truly fused product.[29] For WAS units, this has several practical implications:

- Planning must extend beyond the immediate collection tasks and outside the individual unit.
- Broad collaboration is required across the tasking, collection, and analytic stakeholders.
- Genuinely tailored surveillance is necessary for making the most significant contribution.
- Predefined systematic cueing is indispensable for efficient and highly effective layered ISR.
- Iterative analyses with cross pollination from multiple data sources and analytic disciplines are necessary for developing the deepest threat understanding.

The statements above acknowledge that fusion is both end-to-end and collaborative in nature. Although it appears overwhelming, practice has proven it possible. Unit culture and training must embrace that truth, driving their members to intentionally plan their contribution at each point, from ISR request to the production of actionable intelligence. This shift should also combat the stifling "center of the universe" view and move coordination, planning, and collaboration expressly toward the purpose of realizing complete and multi-INT

knowledge of a specific threat—the essence of fusion. Until this happens, fusion will remain a principle that many people talk about but few truly put into action.

Achieving Unity of Effort: Maximum Value Extraction and Information Orchestration

Attaining a unified effort calls for close, continuous coordination and cooperation with clearly defined objectives and a common interest.[30] This is especially true when participants are not subject to the same immediate command structure because attempts to create unity of effort can easily become smothered by differing perspectives, dissension, lack of formal procedures, and bureaucratic limitations.[31] The WAS community is loosely connected and disparate with little overarching management or obligation among members, making unity of effort difficult. It is, nevertheless, critical to ensuring that the greatest value is obtained from each asset and every single collect. As with other loosely connected cooperatives, though, realizing that objective will be "more art than science."[32]

Maximum Value Extraction

WAS is powerful because it allows for monitoring and learning the physical activities, interactions, and influences associated with an entity, human network, or population. However, if WAS data is rarely subjected to something more than a simple analytic triage, then this potential becomes nothing more than lofty ideals that are seldom realized. Unfortunately, that is near the state of reality for most WAS collections, which are conducted and supported in a generally fragmented manner. The collection assets are commonly connected only to a short-term analytic process, which in some cases may merely cover near-real-time analysis. This fact alone challenges the possibility for extracting all potential information from WAS collects. However, the most significant obstacle is the absence of a mechanism, formal or

informal, that threads the initial analytic efforts into more thorough multi-INT analyses.[33] In reality, this deficiency renders the vast majority of value from WAS systems locked up, leaving the ISR equivalent of "cash on table" and potential gains unexploited.[34] In the business of intelligence, though, the result is missing key information or unnecessarily duplicating collections.[35] Unity of effort can and must be achieved to press the greatest potential value from our nation's substantial WAS investments. Maximum value extraction is a concept designed to address this situation by creating a unified effort to exhaust every possible means for extracting value from priority surveillance collections. The benefit is increased operational significance and greater efficiency from WAS collections.[36]

Maximum value extraction involves enhancing and threading the existing discrete processes and disparate organizations using a value-added model (fig. 3). The concept is held together by mutually agreed upon and systematic processes initiated and constrained by a priority task, effectively creating an analytic cooperative that focuses on and guides the various platform and analytic units. Pulling such a construct together relies upon strong partnerships, frequent coordination, and cooperation as well as defined expectations and objectives.[37] Even then, however, it is still a bit of an "art." By contrast, common practice is to haphazardly engage other ISR organizations and combat units to exchange what amounts to minimal direction. The rest is left to a string of disconnected requests for information.

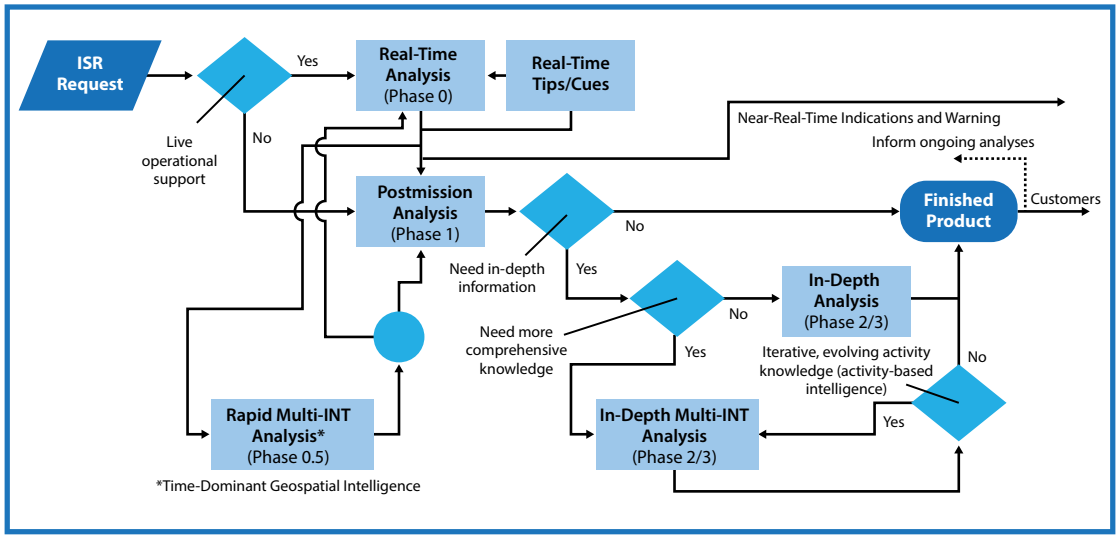

Figure 3. Threading and enhancing discrete processes for full-value extraction

Maximum value extraction involves moving content through the analytic phases and different organizations according to explicit expectations to create a progressive and concentrated accumulation of knowledge related to the original task. It requires individual units to establish procedures that ensure the right content is captured and made easily accessible to the other organizations. The foundation of this value-added model is quality real-time analysis. For WAS, this can be as simple as observing and reporting motion or as complex as collaborative multisource tipping to build knowledge of a deceptive threat. The yield for each is quite different, but the need to accurately capture the mission-relevant information as time-referenced (as applicable) geospatial content is the same. Each detail of the phase zero activities must be captured—the analysis, cues, associated reporting, and original intelligence that drove the task—thus forming the baseline intelligence, which should inform subsequent analyses. At present, very little of this information is captured or distributed. Similarly, organizations that conduct rapid multi-INT historical analysis for near-real-time emerging points of interest—time-dominant geospatial intelligence—need to capture and distribute all content.[38] These value layers must

then be passed after each collect to an analytic group charged with discovering and building new information in the context of current value layers and tied to the original task. Doing so focuses phase one analysis on filling information gaps left by the necessary haste of the phase zero work. The threading continues in this manner, connecting the content and intent from the earlier phases to phase two/three, building successive degrees of value using the increasing resources of time and intelligence accesses to more fully satisfy the initial unit's priority task. Finally, the threaded chain of actions must feed information back into itself to increase the effectiveness of WAS planning, operations, and future analyses. It should go on until the full measure of the need defined by the task has been met, each phase providing an off-ramp for value to be cycled out to the action units. These actions are laid out in a series of phases, but that is for the sake of the conventional analytic construct. The greatest effects actually come from running these functions concurrently, allowing the constant building of knowledge while feeding it back into the other processes—both shortening the timelines and improving the final intelligence.

Both automation and multi-INT analyses should be incorporated as much as possible. Automation will alleviate some of the workload, expediting the processes, and rich multi-INT data environments enable a greater understanding of the threat and its context.[39] Further, full satisfaction of many of the more demanding operational needs will require use of the activity-based intelligence methodology. This type of approach involves the integration of iterative, evolving, transactional, and focused multi-INT collections and analyses.[40] The value resulting from the method is often substantial, especially for revealing the most deceptive and complex mobile threats although it requires well-trained or clearly guided individuals.

Information Orchestration

The entire purpose for investing in and deploying ISR assets is to deliver capabilities that support operational and strategic requirements.[41]

Therefore, the most fundamental question for all WAS activities asks how to make certain that the surveillance outcomes match the operational need. On the surface, the answer seems simple enough, but deeper consideration reveals the enormity of the challenge. A few major points of consideration include (1) the complications in understanding the actual WAS need that underpins a task description, (2) the way it is translated into a plan that offers significant information at each stage in the operations process, and (3) the means of producing the desired information from a collection using a disjointed and unaffiliated exploitation and analysis process. This is simply too complicated, so organizations do what they can and move on. Better outcomes are achievable, but they call for a unified effort.

Realizing a unified effort that produces the most desirable outcomes from WAS demands an orchestrated process for creating information. Such efforts become increasingly necessary as the need for details or the complexity of a threat increases. Information orchestration involves linking and integrating WAS activities throughout the entire process by guiding colocated and disparate people, processes, and machines to labor with a unified purpose to create specific, defined knowledge. The explicit intent of the collaboration is to produce threat knowledge of sufficient accuracy, precision, breadth, and timeliness to enable the operational or policy decisions sought by each request, ensuring that the final information delivered to a supported unit accurately matches its core surveillance need. The principle is inherently end-to-end or cradle-to-grave, requiring very intentional engagement and cooperation with key stakeholders. There are two aspects to information orchestration: the actions themselves and the requisite capacity for collaboration necessary to execute those actions.

Process. The actions of information orchestration are designed to vertically integrate the fragmented, nonaligned, and disparate efforts and organizations tied to WAS collections to ensure that the outcomes match the needs (fig. 4). The process begins by investigating the true root of the surveillance requirements, followed by developing optimal

employment plans, defining platform interactions, setting data-exchange expectations, and specifying how the data must be exploited to fully satisfy the requirements. No single organization takes on the entire process although one must purposefully guide it.

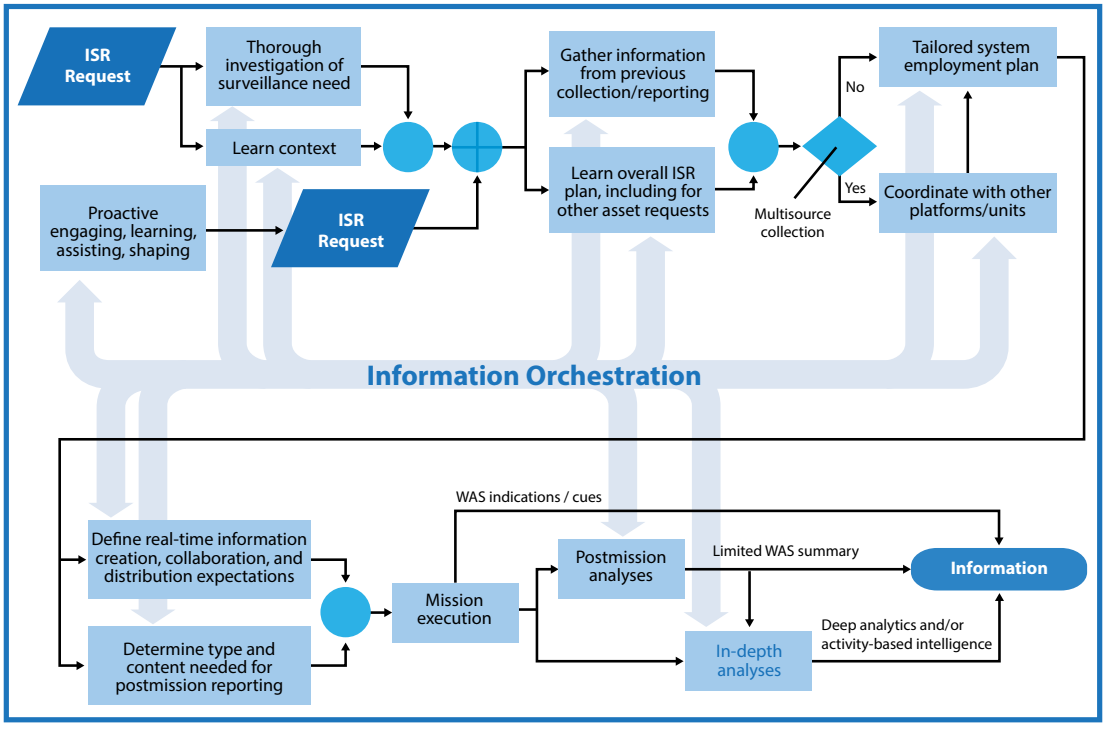

Figure 4. Activity diagram for ensuring that WAS results match the needs

Data providers perform the front end of the process, actively engaging the supported unit to understand the underlying surveillance requirements driving their task. Through close partnerships and a good understanding of theater priorities, this step can and should occur before tasking to allow for planning assistance. This type of engagement is necessary since task descriptions are often recycled to save time and are written by people with a limited understanding of the systems they request, making them generally insufficient on their own. Adapting a set of accepted steps from other professions permits mission planners and the liaisons who assist them to acquire a thorough under-

standing of the fundamental requirements and of the best way to satisfy each. The necessary steps are as follows: (1) define the primary mission and the core needs associated with it, (2) translate the needs into surveillance criteria, (3) enlighten customer units on potential surveillance solutions to satisfy the needs, (4) maintain flexibility for direct input for customization of key aspects, (5) link the surveillance requirements directly to sensor strategy and data utility, (6) account for sensing-environment factors, (7) define the necessary duration for the surveillance activities, and (8) provide clear feedback mechanisms to measure effectiveness.[42] Digging deeply into customer requirements will reveal that many of them will benefit from the formation of a multi-INT collection scheme and that they will rely upon collaborator partnerships for successful creation and execution.

After establishment of the collection plan, the data exchanges and analyses must be defined. The first step entails guiding the reporting expectations for planned information exchanges between platforms and analytic groups. Providing sufficient detail is important, especially for the more complex, collaborative multi-INT collections. Continual interaction between these organizations must then be instigated with the express intent of enabling the degree of informed, iterative, multidisciplinary analyses necessary to satisfy the request. This process produces a robust plan that is well coordinated in execution and that thoroughly exhausts the data's potential through analyses.

Capacity. Actions alone do not ensure effective collaboration. There are indispensable qualities and conditions that facilitate creation of a unified effort from a cooperative group, especially for the voluntary cooperatives that information orchestration would create. Personnel must have the proper skills, knowledge, and attitudes to foster effective collaboration—specifically, robust interpersonal skills, the ability to effectively manage projects, and the expertise to set up cooperative infrastructures. Members also must be strongly committed to the purpose of the collaboration, perceive it as more valuable than the cost of cooperation, and view contributing stakeholder inputs as enhancing

final solutions.[43] The inputs themselves come from effective partnerships, which are built through interpersonal investments of time and attention.[44] When unit culture and training incorporate these elements and when unit representatives that embody them are rewarded, then inspiring voluntary partners to unify in effort will come naturally.

From Talk to Transformation

For most of the past decade, our nation has enjoyed the twin luxuries of ease of surveillance over enemy territory and a seemingly limitless funding source to support legions of ISR collection assets.[45] However, this paradigm is in decline and will continue to degrade until a new one replaces it. Inevitably, the new paradigm will require greater efficiency and efficacy from the ISR programs that survive the ongoing budget reductions. This article has sought to provide a set of guiding principles that address this shift for our nation's WAS investments, especially regarding resources such as moving target indicators and wide area motion imagery. These principles are primarily a decomposition of fundamental doctrinal elements like collaboration, economy of force, synchronization, unity of effort, and fusion that are synthesized into specific and directly applicable statements for WAS. They are based on a thorough application of flexibility, cooperation, and efficiency. This type of approach should make the concepts look and feel comfortably familiar yet offer a level of clarity and detail that has been absent thus far.

With greater clarity comes the opportunity for WAS organizations to reduce the inefficiencies and suboptimal employment that have long plagued them. It also should increase cooperation, enhance our nation's threat knowledge, and reduce the "find, fix, finish" loop. The specific benefits of shifting to a more efficient, multi-INT, and highly customized framework for conducting surveillance will vary. Certainly, they will be clear and pronounced when WAS resources are applied to finding, monitoring, and responding to difficult-to-detect and complex mobile threats. The need to understand both tactical and strategic

threats of this nature in lawless regions and denied areas alike will only expand in volume and significance for the United States, making a framework that better suits them all the more necessary.

The most significant challenge moving forward will be transforming the principles into practice within WAS units. Practitioners will have to work through making nuanced adjustments to fit their organization's unique structure and roles. Without a doubt, these efforts will be met by critics who will too quickly dismiss the ideas as "something we already know and do" due to some vague resemblance to a current practice or its derivation from familiar high-level doctrine. We can expect such resistance because change is seldom well received. However, we are facing an inevitably more complex threat and policy environment, coupled with reduced defense budgets. Such reality must drive us to both negotiate the inhibitors and embrace the opportunity to unleash the maximum operational potential from the WAS resources that remain available. ✪

Notes

1. Air Chief Marshal Sir Peach Stuart (keynote address, GEOINT [Geospatial Intelligence] 2012, Gaylord Palms Hotel, Orlando, FL, 10 October 2012).

2. Brad Plumer, "America's Staggering Defense Budget, in Charts," *Washington Post*, 7 January 2013, http://www.washingtonpost.com/blogs/wonkblog/wp/2013/01/07/everything-chuck-hagel-needs-to-know-about-the-defense-budget-in-charts/.

3. National Intelligence Council, *Global Trends 2030: Alternative Worlds* (Washington, DC: US Government Printing Office, 2012); National Intelligence Council, *Global Trends 2025: A Transformed World* (Washington, DC: US Government Printing Office, 2008); and National Intelligence Council, *Global Governance 2025: At a Critical Juncture* (Washington, DC: US Government Printing Office, 2010).

4. Joint Publication (JP) 2-0, *Joint Intelligence*, 22 October 2013, II-12; and Dr. Lee Fuell Jr., "Understanding the Enemy as a Complex System: A Multidisciplinary Analytic Problem Requiring a Multidisciplinary Team Approach," *Air and Space Power Journal* 23, no. 2 (Summer 2009): 19–24.

5. JP 1, *Doctrine for the Armed Forces of the United States*, 25 March 2013, II-20, II-21; JP 2-0, *Joint Intelligence*, 22 October 2013, V-4, V-5; Curtis E. LeMay Center for Doctrine Development and Education, *Volume I, Basic Doctrine*, 14 October 2011, 29, https://doctrine.af.mil/download.jsp?filename=Volume-1-Basic-Doctrine.pdf; and House of Representatives, *"National*

Security, Interagency Collaboration, and Lessons from SOUTHCOM and AFRICOM," Hearing before the Subcommittee on National Security and Foreign Affairs of the Committee on Oversight and Government Reform (Testimony of James Schear), 111th Cong., 2nd sess., 28 July 2010, http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg64927/html/CHRG-111hhrg64927.htm.

6. Branda Nowell, "Profiling Capacity for Coordination and Systems Change: The Relative Contribution of Stakeholder Relationships in Interorganizational Collaboratives," *American Journal of Community Psychology* 44, nos. 3–4 (December 2009): 196–212.

7. Ibid.

8. Army Doctrine Reference Publication (ADRP) 5-0, *The Operations Process*, 17 May 2012, 1-2–1-4. When surveillance organizations understand a maneuver unit's operations process and learn the nuances of its implementation, then they are able to best tailor and evolve collections to align with it.

9. Fuell, "Understanding the Enemy," 19–24.

10. ADRP 3-0, *Unified Land Operations*, 16 May 2012, 4-2; and Curtis E. LeMay Center for Doctrine Development and Education, *Volume I, Basic Doctrine*, 53–54. The most descriptive definition for economy of force occurs in Field Manual (FM) 3-0, *Operations*, 27 February 2008, A-2. This document precedes ADRP 3-0, *Unified Land Operations*.

11. JP 2-0, *Joint Intelligence*, xi, II-6.

12. It is common for individuals requesting ISR collection to ask for all potentially applicable systems for as long as may be possibly relevant without constraint; therefore, collection managers and the system liaisons that aid them will be left imposing most aspects of WAS economy of force.

13. Based on a review of ISR requests for ground moving target indicators (GMTI) and wide area motion imagery (WAMI) in Afghanistan during 2011, 2013, and 2014 compared to actual collection durations and data-quality levels.

14. FM 3-24 / Marine Corps Warfighting Publication (MCWP) 3-33.5, *Counterinsurgency*, 16 December 2006, 3-27–3-32.

15. Some assets like VADER, Gorgon Stare, and Blue Devil have at times been almost notorious for their use as surrogates for full motion video (FMV). The evidence is apparent in how the systems are requested to operate and can sometimes be seen in the ISR requests. The most obvious instance occurs when a unit requests FMV, is not allocated a line, and therefore resubmits the requests replacing WAMI or GMTI for FMV.

16. Sherrill Lingel et al., *Methodology for Improving the Planning, Execution, and Assessment of Intelligence, Surveillance, and Reconnaissance Operations* (Santa Monica, CA: RAND Corporation, 2008), 41–61, http://www.rand.org/content/dam/rand/pubs/technical_reports/2008/RAND_TR459.pdf.

17. JP 3-08, *Interorganizational Coordination during Joint Operations*, 24 June 2011, IV-20.

18. This example is most often seen in the WAS radars although certain future imaging systems will run the same risk. When collection resources are spread too thin, sampling of the target is too poor to monitor target activity with actionable confidence. In addition, optimum target-to-platform geometries are almost always compromised, providing degraded-quality data for the priority surveillance areas.

19. ADRP 5-0, *Operations Process*, 1-2–1-4, 1-13; and JP 2-0, *Joint Intelligence*, II-2.

20. Curtis E. LeMay Center for Doctrine Development and Education, *Volume I, Basic Doctrine*, 11, 61; and Curtis E. LeMay Center for Doctrine Development and Education, "Annex

2-0, Global Integrated Intelligence, Surveillance & Reconnaissance Operations," 6 January 2012, 5–7.

21. JP 2-0, *Joint Intelligence*, x, II-2.

22. Curtis E. LeMay Center for Doctrine Development and Education, "Annex 2-0," 5.

23. JP 2-0, *Joint Intelligence*, I-4.

24. A rich multi-INT environment provides identifying, characterizing, and contextual information about an entity. Its actions and locations reveal the most important elements with more thoroughness, confidence, and speed than are possible through single or limited sources. It includes various forms of still and motion imagery, signals collection, measurements and signatures, human collection, cyber activity, document exploitation, cultural information, location history, publicly available content, and so forth.

25. Angappa Gunasekaran and E. W. T. Ngai, "Build-to-Order Supply Chain Management: A Literature Review and Framework for Development," *Journal of Operations Management* 23 (2005): 423–51; Matthias Holweg and Frits K. Pil, "Successful Build-to-Order Strategies: Start with the Customer," *MIT Sloan Management Review* 43, no. 1 (Fall 2001): 74–83; and Andreas Reichhart and Matthias Holweg, "Creating the Customer-Responsive Supply Chain: A Reconciliation of Concepts," *International Journal of Operations & Production Management* 27, no. 11 (2007): 1144–72. The concept of build-to-order (BTO) surveillance is based on BTO production, so it is beneficial to investigate the original concepts first before proceeding with creating the elements described for BTO surveillance.

26. JP 2-0, *Joint Intelligence*, II-12.

27. Ibid., II-4–II-6. The purpose and effects described are perfectly applicable although for WAS they must be achieved through a cooperative because adjacent organizations may not be subject to the same command.

28. Desired information sources will change, based on the target and theater availability, but a mixture of collection sources must exist to provide insight into the full scope of activity and to eliminate ambiguity. An effective collection must be conceived with great thought to actually gain synergy and obtain integrated, actionable intelligence—a process that differs from simply "stacking" resources and accepting their standard output.

29. Smart automation can expedite the analytic process; however, more complex tools may have requisite conditions. For example, WAS-centric multi-INT fusion systems will deliver limited value only if applied outside the type of framework described because their success hinges upon the related and quality data provided by it.

30. JP 1, *Doctrine for the Armed Forces*, xv, II-13–II-14; and JP 2-0, *Joint Intelligence*, V-4–V-5.

31. JP 1, *Doctrine for the Armed Forces*, xv, II-13–II-14.

32. The interagency process often is described as "more art than science" in the now-superseded JP 1, *Doctrine for the Armed Forces of the United States*, 20 March 2009, xxi, VII-1.

33. In some instances, ad hoc agreements have been made to temporarily create an effective chain of analyses, but they are generally neither pervasive nor long-standing.

34. Robert H. Frank and Ben Bernanke, *Principles of Macroeconomics*, 3rd ed. (New York: McGraw-Hill/Irwin, 2007), 83–84.

35. By not fully exploiting collected WAS data and by doing so within a multi-INT construct, one will fail to discover valuable and relevant intelligence within the volumes of content. When information is not perceived as available-—perhaps a result of inadequate exploitation of existing data—then more collection is tasked.

36. Increased significance occurs by producing more actionable intelligence and improved efficiency due to a reduction in collections based on resolving the need through more thorough exploitation.

37. Given that units will not be subject to a unified command or even prescribed agreements, achieving success toward this end must take place through cooperatives. Doing so, among other things, requires the attributes listed.

38. This form of support has generally been provided only by selected analytic groups that support special operations.

39. House of Representatives, *Testimony of Alan Shaffer to the Committee on Armed Services, Subcommittee on Terrorism, Unconventional Threats and Capabilities*, 111th Cong., 1st sess., 20 May 2009; Col Jon Kimminau, "ISR Focus: A Culminating Point for Air Force Intelligence, Surveillance, and Reconnaissance," *Air and Space Power Journal* 26, no. 6 (November–December 2012): 113–29; and Hugh McFadden, "Building Batman's Belt: Considerations for Automated Processing in Support of Manual Analysis" (paper presented at National Air and Space Intelligence Center conference, Wright-Patterson AFB, OH, August 2009). The congressional hearing states that "without improving our ability to process data and extract actionable intelligence, we run the risk of becoming data bound and information starved." Kimminau's article cites a US Air Force report that says we need "automation to reduce the time that analysts spend on mundane . . . and routine [tasks]" (p. 123), and McFadden advocates for WAS automation that provides small pieces of useful information to analysts instead of trying to produce a complex final solution.

40. A series of sensitive documents regarding activity-based intelligence (ABI) was released in 2010, providing significant detail on the subject. See also Mark Phillips, "A Brief Overview of ABI and Human Domain Analytics," *Trajectory Magazine*, September 2012, http://www.trajectorymagazine.com/web-exclusives/item/1369-human-domain-analytics.html. ABI tradecraft was originally developed to support counterterrorism but has expanded to cover a broad spectrum of defense applications.

41. Curtis E. LeMay Center for Doctrine Development and Education, "Annex 2-0," 6; and ADRP 3-0, *Unified Land Operations*, 2–6.

42. Benjamin S. Blanchard and Wolter J. Fabrycky, *Systems Engineering and Analysis*, 4th ed. (Lebanon, IN: Prentice Hall, 2006), 59–69; and Holweg and Pil, "Successful Build-to-Order Strategies," 74–83. The process listed is mostly a direct adaptation from systems engineering principles but includes elements from BTO production.

43. Pennie G. Foster-Fishman et al., "Building Collaborative Capacity in Community Coalitions: A Review and Integrative Framework," *American Journal of Community Psychology* 29, no. 2 (2001): 241–61.

44. JP 1, *Doctrine for the Armed Forces*, II-22; and Curtis E. LeMay Center for Doctrine Development and Education, *Volume I, Basic Doctrine*, 134.

45. Combat commanders may argue that they did not have the luxury of ISR, but the facts show that our nation now possesses more such systems than at any other time in history—and in numbers that would baffle any other nation.

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