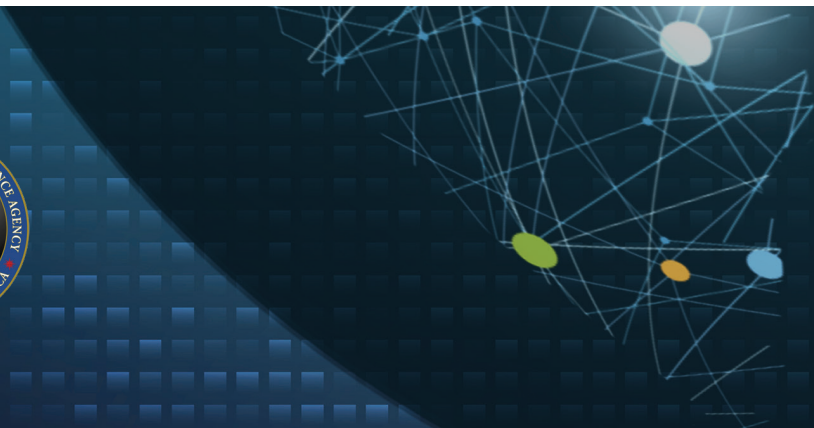




# NGA **GEOINT20** **CONOPS22**





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## Letter from the Director

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Every day the world grows more complex, dynamic, and dangerous. Historically, these threats have been mitigated by our monopoly on technical capabilities that, when interpreted properly, would result in an information advantage. Thus, the demand for geospatial intelligence (GEOINT) to convey content in context has never been more acute or important. The manner in which we execute our mission going forward will make all the difference. However, a caution—what got us here, will not get us there.

The GEOINT discipline has grown beyond the limits of human interpretation and explanation. The explosion of available data diminishes the comparative advantage collection provides. Instead, automated processing, advancing tradecraft, human-machine collaboration, and the ability to anticipate behaviors will provide us a new advantage. To achieve this we must operate on all data that can be located in space and time in a single operating environment that reaches all domains. Automation and machine collaboration will enable analysts to focus their intellectual abilities to understand the physical environment, assess activities and trends, and develop analytic models to anticipate our adversaries' actions. The primary focus of GEOINT, and the application of NGA's exceptional human analytical resources, will be on the generation of knowledge as context for action, insight, and anticipatory intelligence.

The next era of GEOINT will redefine the relationships between our content and customers and our services and providers. We will increase efficiency and efficacy through automated processes and tailored services that directly enable our workforce, customers, and partners. GEOINT operators will increase intelligence value through mastery of our craft and maximization of resources, thereby improving the entire system. Team GEOINT will include and embrace a vibrant marketplace of geospatial content and services across multiple sectors and domains. Models of the world will bring GEOINT providers and consumers together around structured reasoning. Establishing and evaluating hypotheses will formalize our ability to forecast future events and capture the sources and methods that reliably produce results. Advanced automation, professionalized tradecraft, and data interoperability will create space for NGA's workforce to focus on anticipating behavior and delivering insights timed for maximum impact.

The future for GEOINT is exceptionally bright, and we will build the needed capabilities to harness the opportunity. We can only do that if we collectively embrace these concepts and commit to a shared mission. I anticipate the transformation will be challenging and uncertain, but it will ultimately be highly satisfying for NGA and our customers. We deliver on our mission today and always.

A handwritten signature in blue ink that reads "R. Cardillo". The signature is fluid and cursive, with a large initial "R" and a long, sweeping underline.

Robert Cardillo  
Director, National Geospatial-Intelligence Agency

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# 1. Introduction

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The way in which *We provide GEOINT for our Nation's security*<sup>1</sup> is changing. NGA will maintain mastery over the craft of GEOINT, enabling customer success through assured access to and confidence in GEOINT data, capabilities, and insights. As we concentrate on creatively solving the problems that confront us, we find an increasing abundance of complex and sometimes contradictory information that we must rapidly distill into knowledge. We must transition into a new operational model of geospatial intelligence (GEOINT) that improves our enterprise while we retain our customers' confidence.

The NGA Strategy sets four goals to move towards this vision and accomplish this transformation: 1) attract, develop and sustain a more diverse, agile, and expert workforce; 2) expand the team and embrace its contributions; 3) propel excellence in our craft; and 4) drive relentlessly for our customers' success [1]. The NGA Strategy identifies goals consistent with knowledge work—analysis that concentrates on problem solving and requires creativity and the distillation of complex and sometimes contradictory information. NGA must maintain mission assurance while transitioning to the new operational model of GEOINT.

This GEOINT CONOPS<sup>2</sup> is the objective operating model for our enterprise. It builds on progress made to date and incorporates changes and emphasis areas called out in the NGA Strategy. Portfolios and Key Components will use this document to drive action across the agency. The GEOINT CONOPS describes the principles across mission activities, organization, and business processes. This CONOPS does not specify which capabilities are needed for specific mission areas, other than placing an emphasis on incremental gains, partnership, and continuous demonstration of value. Developing the capabilities and culture change required to operate in the model described in this document will take time and deliberate action.

This document provides NGA with the future GEOINT operating concepts. It informs intelligence officers, decision makers, budget planners, engineers, mission managers, developers, and customers of the capabilities needed to achieve the future GEOINT environment. NGA will use these concepts to drive plans and programs to meet its partners' needs.

This CONOPS provides a guide for NGA's approach to future GEOINT (Section 2). This document describes the approach to mission activities (Section 3), organizational changes needed to execute those mission activities (Section 4), and the reinvention of business processes to make that work possible (Section 5). These concepts are mutually supportive and form a comprehensive approach to NGA's future.

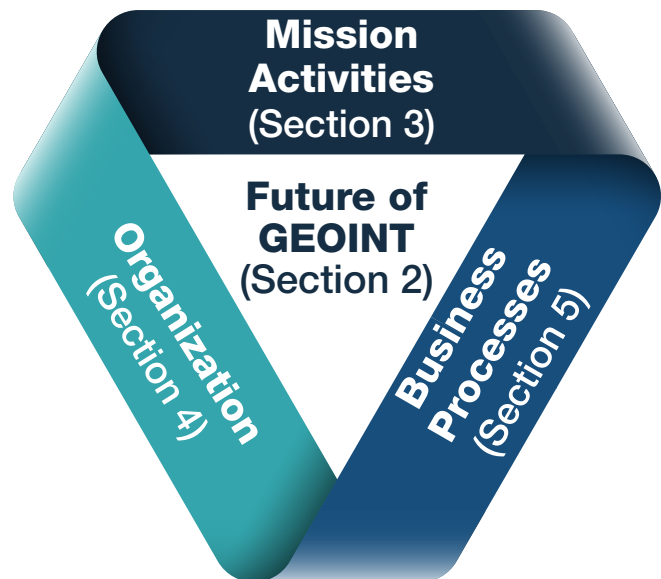


Figure 1 – GEOINT CONOPS 2022 Sections

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1 This is a new mission statement for NGA and the next release of the NGA Strategy will reflect this change.

2 A CONOPS is a verbal or graphic statement that clearly and concisely expresses what the joint force commander intends to accomplish and how it will be done using available resources [17]. This CONOPS is the description of broad application to the whole GEOINT mission, vice solving a specific mission need.

## 2. Future of GEOINT

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GEOINT serves decision-making by putting content and services in the context of space and time in direct support of national leadership, the warfighter, first responders, and all other consumers of GEOINT. Historically, NGA has created GEOINT by interpreting images to create navigation aids and intelligence products. Meeting these needs drove the development of a highly optimized workflow, but the limited number of human analysts constrained growth. Today, GEOINT producers have sources that are more diverse, and consumers have increasingly demanding problems, so this approach is no longer sufficient to address modern GEOINT demands. The future approach to GEOINT will grow with technology, supporting human insight with artificial intelligence and automation. Analysts will have greater flexibility to solve problems in unique ways to meet this growth in demand. GEOINT must answer intelligence questions, forecast adversary behavior, and provide operational information faster, with higher quality, and across a broader range of mission areas. The result will be a more informed GEOINT consumer that is able to operate with a decision advantage. There will be a transition period as NGA changes to new ways of operations; however, mission assurance of essential capabilities will always remain.

NGA's future operational model of GEOINT applies the scientific method and free market principles to the GEOINT domain. The core of the scientific method is observation, hypothesis building and testing, experimentation, and evaluation. The activities that comprise the GEOINT workflow of the future echo this approach. This use of the scientific method complements the art of analysis with a quantitative and qualitative structure for analysis at a large scale. Free market principles—the process by which producers and consumers define the value of products and services through exchange—provide decentralized methods to meet the greatest needs given limited resources. Methods of free exchange will provide the evaluation criteria for acquisition of capabilities and satisfaction of customer needs. Combining these two principles will result in an open exchange of analytic assessments, content, and services that continually creates knowledge, anticipates and conveys answers to customers' intelligence questions, and drives innovation and the creation of more efficient and effective tools and methods. We call this the GEOINT enterprise.

Automation will permeate the mechanics of GEOINT, with subject matter experts providing guidance and context. Exploitation of data and selection of collection assets will predominantly operate as automated systems. Humans will train the systems and research new methods, verifying automated outputs and investigating intellectual nuances machines cannot understand. Additionally, the human role will increasingly emphasize critical thinking, developing specific solutions, and intervening when real-world events are not modeled or anticipated. Automation will initially fulfill the role of executing mechanical and repeatable tasks; however, it will increasingly support human reasoning as artificial intelligence grows in capability. Automation, combined with artificial intelligence, will exist as a servant of GEOINT professionals to scale the impact, increase the speed, and enrich the knowledge they convey to their customers. This approach allows GEOINT professionals to devote more time on higher-order thinking and communication. These changes will shift the focus of GEOINT from products to services.

### 3. Mission Activities

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There are many demands for GEOINT content and services, including statutory requirements, combat support, navigation, and national intelligence. Three perspectives describe how NGA meets these demands to deliver the GEOINT mission: mission areas, mission capabilities, and mission activities.

Mission areas are the topics of concern to GEOINT customers. GEOINT mission areas are informed through Department of Defense (DoD) and IC demands.<sup>3</sup> NGA will manage the GEOINT mission across partners to provide a unified GEOINT operation. The Table of Organization captures the deployment of NGA's workforce against these areas.

Mission capabilities support the needs of NGA in delivering value to customers. The GEOINT Enterprise Capability Document (ECD) describes the requirements for mission capabilities,<sup>4</sup> and the GEOINT Enterprise Architecture captures the designed solutions. The delivery of new capabilities will incrementally transform the agency and the GEOINT enterprise. This transformation will occur over several phases:<sup>5</sup>

- **Phase 1 (2016–2017)—Provide the GEOINT Platform and Close on Analytic Modernization**  
GEOINT content and services are discoverable and accessible through a cloud-based GEOINT services platform.<sup>6</sup> Analysts exploit expansive and diverse GEOINT content through model-driven<sup>7</sup> and advanced analytics.<sup>8</sup>
- **Phase 2 (2018–2019)—Automate the GEOINT Environment and Integrate Intelligence Operations**  
Achieve global persistent coverage through dynamic model-driven, automated collection. Intelligence content from all GEOINT sources is geospatially integrated.
- **Phase 3 (2020–2022)—Anticipate Behavior**  
Persistent GEOINT content couples with machine learning<sup>9</sup> and advanced analytics to increase decision parameters through anticipatory intelligence.

This section of the GEOINT CONOPS details the remaining perspective on mission: the pattern of activity that is applicable to all missions as the basis of organization. The activities described in this section provide a non-linear, more flexible model than the Tasking-Collecting-Processing-Exploitation-Dissemination (TCPED) model.<sup>10</sup>

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3 The DoD places demands on NGA through a variety of means, while IC demands are largely identified through the National Intelligence Priorities Framework

4 The GEOINT ECD is a top-level document and is informed by many other processes that capture and adjudicate day-to-day requirements

5 This is NGA's plan to transform GEOINT. While it is outside the scope of this document to levy these plans on other organizations, partnership and engagement on these efforts will benefit all stakeholders.

6 Technical demands of big data and the desire for cross-INT collaboration motivates this move to a cloud-based platform.

7 Model-driven collection requires a transition of all missions to an object-based production paradigm. Foundational and intelligence objects must be discoverable and linkable in a model, ultimately identifying gaps and driving collection.

8 This technology focuses analytical effort on higher-level thinking.

9 Machine learning is a technique that teaches a computer to automate a repeatable task through human training. Automation in this phase is “smart”, using machine learning to grow in capability as the workforce trains systems.

10 References to the TCPED cycle for the purposes of this document are equivalent to the Planning and direction; Collection; Processing and exploitation; Analysis and production; Dissemination cycle used in some communities.

The approach to mission activities is organized into four groups, supported by technology and business services.

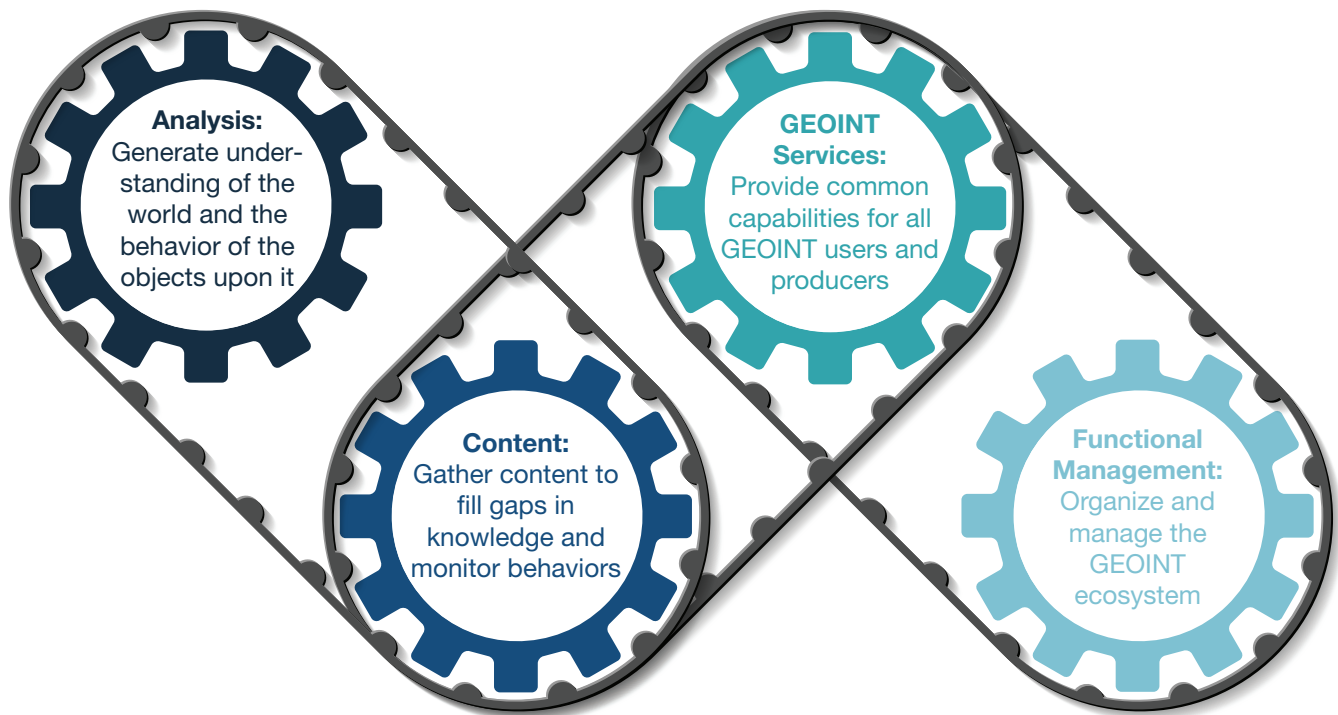


Figure 2—GEOINT Mission Activity Groups

There is a general flow to creating intelligence; however, the series of activities is not strictly sequential. Data is accelerated to answers by finding the most effective and efficient path through these activities for a given problem. Each step operates independently and in connection with several others, allowing each mission area to use only the activities necessary to accomplish its goals. Additionally, capturing the result of work at each step in structured machine-readable forms will expose them for use in any service and by any user.<sup>11</sup>

The mission activities identified in Figure 2 are largely manual in current operations. While the IC has had successes in automating some functions within technical collection systems to increase performance, there is still significant opportunity to establish additional automation for other mechanical tasks. Activities that involve nuance and context are mostly manual and will benefit from machine assistance. To grow the impact of GEOINT under the current system, the entire enterprise would have to increase in staff size, as it is physically impossible for humans alone to handle the volume of content available. Additionally, relying on human processes for information generation, characterization, sourcing strategy, and source orchestration dictates the speed of execution and is inherently limited to the speed individuals can perform tasks.

NGA will automate many activities and services in house or obtain them as services from commercial vendors. Repeatable tasks, such as structuring observations from imagery exploitation and selecting data sources, will run autonomously with human oversight. Individuals will perform more complicated activities that are difficult, if not impossible, to automate<sup>12</sup>,

<sup>11</sup> For instance, if there is a service that requires timely processed data to task follow-up collection, the data will be instantly available to enable this activity.

<sup>12</sup> Examples include characterizing patterns of activity, modeling knowledge, anticipating outcomes, developing insight, creating sourcing

although technology will help structure reasoning and provide efficiencies. Structured reasoning allows incremental introduction of artificial intelligence and will feed directly into flexible, purpose-specific products and services. Ongoing capture of content will provide material for instant discovery through geospatial and contextual search. Additionally, a broad range of potential sources capable of real-time response will provide evidence to fill any remaining gaps.

This set of activities holds all GEOINT missions to a common organization model.<sup>13</sup> This model supports activity-based intelligence as well as object-based production, periodic monitoring to detect change, foundation GEOINT, and any other approach to create and use knowledge. The activities to generate knowledge through analysis and seek additional measurements through sourcing follow the scientific method. Economic exchange of needs, resources, data, and services is coordinated through functional management and GEOINT services, and allows the non-linear execution of activities in all categories, as they are required.<sup>14</sup>

*Between 2013 and 2030 traffic will cost Europeans and Americans \$4.4 trillion. To address this problem traffic apps inform drivers of current and projected traffic. The daunting challenges of four million miles of public roads (US) and 24/7 demand, however, makes this is an enormous GEOINT challenge. To meet that anticipatory traffic challenge, a successful traffic app combines a variety of sensors, rigorous analytic approaches, the assets of multiple partners, and a creative and adaptive approach to data.*

**Analysis** generates understanding of the world and the behavior of objects in time and space. The goal is to provide actionable content for mission operations and decision-making.<sup>15</sup> Analysis consists of five mission activities:<sup>16</sup>

1. **Analytic Modeling**—Describe and reason our understanding of an aspect of the world. Analytic modeling captures and reasons on the understanding of an intelligence problem in a format useful by humans and machines. Analytic modeling represents our hypotheses, assumptions, anticipations, and conclusions.
2. **Characterization**—Combine and explore informative facts to create knowledge, as represented by objects and activities. Objects and activities describe the people, places, and things in the world and the interactions they have with each other.<sup>17</sup>
3. **Information Generation**—Explain and refine data to create discrete informative facts. Statements of purported fact are the basic building blocks to make assertions about the world, and are often attributes of an object or activity.

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opportunities, and identifying gaps.

13 No distinction is necessary to differentiate between foundation and intelligence content in this model.

14 Through the analogy of providing traffic and navigation services, these text boxes will convey how the mission activities provide products and services in a GEOINT context.

15 Many types of content, products, and services can accomplish this goal. All disciplines of GEOINT use these steps, although often with domain specific names, to accomplish this goal.

16 Ordered here by descending level of abstraction, not necessarily order of operation.

17 Objects-based production and activity-based intelligence are two approaches that choose to identify objects or activities first when performing analysis. Both objects and activities are necessary to characterize a scene.

4. **Sensor Processing**—Process measurements taken by sensors to create data. Data is the raw material for information generation, representative of the real world and used to extract signals and indicators of other useful information.
5. **Measurement Capture**—Capture a direct representation of the world, stored as a measurement. Measurements are the direct capture of physical phenomena by sensors and quickly converted to data. Investigation of raw measurement grows our understanding of the underlying physical phenomena.

These mission activities have broad applicability to all sources, apply to any mission, and are capable of implementation flexibility across both human and machine components. They support activity-based intelligence approaches to explore unknowns and structured observation monitoring for known issues. They provide a structure for iterative learning and improvement as additional measurement, data, information, or knowledge becomes available. They continuously build our knowledge from the data up.

Modeling structures thinking in the GEOINT enterprise and contributes to the broader IC's understanding of intelligence and foundational issues to describe interactions and anticipate action. The GEOINT community will provide dynamic modeling of the world, which when combined with community knowledge, will enable analysts across the community to test hypotheses, capture critical thoughts, and coordinate efforts. The analytic modeling effort will learn from and contribute the advance of artificial intelligence over time as well. The ability to forge broad partnerships through modeled understanding will accelerate the growth and consequence of knowledge. Analytic models will be a permanent resource, managed, maintained, and exposed for the entire IC.

***Analytic Modeling:** Transportation analysts create a model of the traffic environment by describing the relationships between road networks, historical traffic patterns, real-time changes, weather conditions, etc. **Characterization:** The traffic app characterizes its data by identifying relevant objects and activities, such as the speed of individual drivers and accidents on specific road locations. **Information Generation:** Traffic algorithms create discrete traffic facts by refining movement data and eliminating anomalous events to report reliable and timely traffic status. **Sensor Processing:** Automated traffic identification systems process the reported measurements by phones, ground sensors, and overflight to create data reporting in the common format of vehicle speed and volume. **Measurement Capture:** Municipalities and cell phone applications measure the traffic environment through a range of emplaced sensors, personal devices, and human witnesses*

**Content** uses sources to provide persistence that enable analysis. It is responsible for identifying information that will increase knowledge and then finding the information. The GEOINT community will formally capture the reasoning used in identifying needs, broaden the range of options for acquiring content, and evolve legacy tasking to dynamic model-driven collection. The result will fill intelligence gaps efficiently and effectively by creatively leveraging all available GEOINT sources to maintain persistent insight. Content is composed of six steps:<sup>18</sup>

1. **Source Modeling**—Model sources and their contribution to generating data, information, and knowledge in order to fill gaps identified in analytic models and collect data to discover unknowns.

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<sup>18</sup> Ordered here by descending level of abstraction, not necessarily order of operation



2. **Sourcing Strategy**—Develop collection strategies to fill knowledge gaps, determine model states, characterize activity, and generate rule sets through the identification of specific, collectable information needs.
3. **Source Orchestration**—Orchestrate the allocation of information needs across all intelligence sources, applying value-based principles to select the most effective and efficient approach for the enterprise. Orchestration will identify the supplier responsible for real-time custody and tracking.
4. **Content Acquisition**—Acquire content from sources outside NGA’s direct influence, including leveraging sources we have not traditionally used before and contracting for content as a service.
5. **Collection Orchestration**—Optimize data gathering techniques within the control of a single supplier.<sup>19</sup>
6. **Command and Control**—Measure the physical world through the command of controlled assets.

GEOINT source analysts will continuously examine and integrate sources into the operational environment. NGA will continue to focus on the value provided by insight, context, and understanding of the Earth and the behaviors of its population. Additionally, GEOINT will be more closely coordinated among partners, with common sharing of sources and methods. GEOINT sources will continuously feed the IC’s body of knowledge through a close partnership between human and automated processes. Achieving anticipatory intelligence will be dependent upon this partnership. The integrated nature of space and time provides an increasing ability to integrate disparate sources of intelligence as the volume and variety of sources grow. Automation in the form of machine intelligence can sift through the vast number of sources to sense shifts in activity patterns and automatically adjust dozens of collections to rapidly characterize the data, inform models, and present the human analyst with new information and knowledge of potential future outcomes.

NGA’s unique contribution is no longer exclusive access to classified data.<sup>20</sup> NGA will use all available data sources with geospatial forms, although the pedigree of that data is paramount. By 2022 a diverse range of GEOINT sources will be available to broaden and enrich the Intelligence Community’s content base. Sophisticated and classified technical capabilities will complement this base to resolve the Nation’s hardest intelligence questions. Research and innovation on physical phenomena and new interpretation methods will identify potential investments to increase exquisite capabilities and provide operational value.

**Source Modeling:** *Transportation experts identify the information and knowledge each source can support, with the goal of using complementary sources to identify and confirm traffic states. **Source Strategy:** The traffic app developers use their knowledge of sources to select a set of data providers that will result in robust and real-time traffic information. **Source Orchestration:** The selected sources are organized to gather data from across the range of available providers. **Content Acquisition:** The traffic app company constantly seeks to acquire data from new sensors and partners to improve analytic quality and data timeliness. **Collection Orchestration and Command and Control:** Systems feeding the traffic app constantly interrogate a network of distributed sensors to collect updated measurements.*

<sup>19</sup> E.g., selecting the best order to collect data in to maximize the performance of a particular sensor.

<sup>20</sup> There are already mission areas where the defining feature of NGA’s contribution is not access to classified content; however, nearly all missions will follow this rule, even when NGA’s unique insight relies on the use of classified content as the source.

NGA will continually add, explore, enhance, and understand the mechanisms by which we can sense the world and increase our understanding.

**GEOINT Services** provides common capabilities for all participants. GEOINT Services consists of three activities:

1. **Alerting**—Communication between activities, mission areas, and mission capabilities is critical for partnership, exchange, and to convey meaning.
2. **Manage Content**—Manage content and its pedigree as a shared resource so all contributors and customers that interact with GEOINT content have the ability to discover and access content with confidence.
3. **Provide Answers**—Providing accurate and timely answers to the customers of GEOINT is a primary activity of the enterprise whether through data, products, or services.

GEOINT customers will consume content in their method of choice and at the speed of need. GEOINT producers will expose content as it is created, making all contributions instantly available to the GEOINT enterprise. This content will be available for self-service consumption or packaging into custom products and services. Additionally, the structured capture of knowledge in models will allow customers unprecedented ability to explore and interact with available knowledge. In cases where content is not available, the need will be identified and satisfied through services or recorded to ultimately motivate further improvement in capabilities.

**Functional Management** organizes the GEOINT enterprise. Functional Management consists of three activities:

1. **Manage Cost and Value**—Free exchange in a GEOINT enterprise requires the measurement and identification of cost and value to support decision-making. Business analytics, feedback, and market indicators all contribute to manage cost and value.
2. **Manage Needs**—Capturing and sharing needs allows GEOINT partners to coordinate contributions for efficient and effective use of resources.
3. **Operate Business**—The GEOINT enterprise consists of people and systems that enable operations through logistics, management, strategy, resources, communications, and planning.

***Alerting:** As traffic incidents occur, alerts from the traffic model inform navigation systems to consider alternate routes. **Manage Costs and Value:** Many sources can provide traffic data; however, the traffic identifier only selects those that provide the greatest contribution and with the smallest cost. **Manage Content:** The traffic app developers must manage data from many sources and organize it sufficiently to describe traffic around the world, and provide rapid discovery. **Manage Needs:** The traffic app company constantly interacts with its customer base and partners in order to improve service, add value, and validate core hypotheses. **Provide Answers:** Traffic overlays, traffic aware navigation, and traffic trends are examples of products and services tailored to provide answers to specific problems. Furthermore, providing the data, information, and logic used supports dynamically re-routing traffic to avoid delays. **Operate Business:** The traffic app company provides resources, logistics, and management so that the traffic app is accurate and timely for its customers when they need decision support.*



Partnership is organized cooperation; Functional Management and GEOINT Services organize GEOINT. Partnership will bring the diversity required to establish a thriving GEOINT enterprise. Seamless teamwork and collaboration with the IC, DoD, civilian government, commercial entities, academic, international, and citizen partners brings broad perspectives, contributions, and needs. NGA will continue to supply geospatial intelligence through the Analysis and Content activities to meet demands identified in IC and DoD policy, including assured products for military use. Civilian government, international partners, and the commercial sector have additional demands, growing the range and diversity of GEOINT. Furthermore, research and exploratory analysis will yield insights on how to lower costs or create products customers did not even know were possible. This results in giving our decision makers and military leaders decisive tactical, strategic, and anticipatory advantage while also providing value to the civilian population and the nation's international partners.



**Figure 3—Partnership Produces Greater Results Than Individual Effort**

The result of this set of mission activities is a constantly learning organization that captures measurement, data, information, and knowledge in forms that are useful for human and machine reasoning. The delineation of content into multiple levels allows for self-organization of evidence and provides inherent incentives to implement the most effective and efficient methods of sourcing and analysis. Organizing the environment provides answers at the level of need and exchanges insight among all GEOINT partners. Common intermediate products at each level creates resiliency through institution of interchangeable methods. Automated alerting services ensure any content is instantly available across the system, enabling customized and non-linear workflows.

## 4. Organization

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The creation and conveyance of knowledge will be the measured product of the future GEOINT team, with weight and assurances given to missions essential for national security. The collaborative, interactive process of developing intelligence and updating the living body of knowledge is more important for long-term success than the products that the GEOINT community currently emphasizes.<sup>21</sup> Successful conveyance of actionable and accurate intelligence, however, remains the end goal and relies on the ability to create and make available products and services that meet the fit, form, and function best suited to the needs of the customer. There will be an adjustment as GEOINT consumers and professionals transition to a living body of knowledge; the resulting transformation provides an opportunity for collaborative development of new, more useful methods of consumption. GEOINT personnel are partners with their consumers in developing innovative and effective ways to consume and interact with geospatial content.

The principles for organizing effort in the GEOINT enterprise are purpose, mastery, and autonomy (Figure 4).<sup>22</sup>

**Purpose** is the desire to accomplish a goal in the service of the greater good. Frequent interaction with, and feedback from, customers is essential. The collective business decisions and customer demand for particular intelligence will inform what skills are most needed, and in which mission areas, to ensure proper mission and talent alignment. Support and recognition from management reinforces executing the shared mission in a consequential manner. Instituting, supporting, and assuring expectations and feedback to meet a greater purpose is the mark of effective management. Leadership openly evaluates management performance on successful achievement of mission and engagement of the workforce. Understanding the larger purpose of one's work is important, and all positions will capture this perspective.

**Mastery** is the achievement of expertise in an area of consequence. Training, experience, and teamwork are the mechanisms by which analysts achieve mastery, both as individuals and in groups. Training will exist in formal, semi-formal, and informal environments and will be available and encouraged to improve individual and collective skills. GEOINT professionals in 2022 will be increasingly data savvy, have more time to think critically, and have the tools to address increasingly difficult problems. Open and honest exchange of ideas, successes, failures, and the lessons they teach will be the norm.

**Autonomy** is the desire to direct one's own activities—to choose important ideas and put them into action. NGA's workforce will form ideas, apply resources, and be accountable to results on the performance of their jobs. Decision-



**Figure 4—Autonomy, Mastery, and Purpose are the Motivation behind Seeking Success**

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21 This is a logical extension over current performance measurements; however, much like traditional product creation, volume does not necessarily equate to value. Establishing new rules and considerations for measuring contributions to the shared knowledge graph will be an important element of cultural change and will require participation of all levels of the organization.

22 These attributes of a work environment produce increased productivity from knowledge workers. Daniel H. Pink describes them in his book, *Drive: The Surprising Truth About What Motivates Us* [5].

making will occur at the lowest applicable level in the organization. Evaluation and rewarding of performance will cover process as well as outcome. Taking calculated risks in order to achieve the mission will challenge status quo and provide opportunity to increase GEOINT value. Risk taking is reckless without mastery; professional certification is the means to recognize sufficient mastery to warrant autonomous action.

These principles of purpose, mastery, and autonomy apply to all levels of the organization. Presenting a clear purpose is a primary responsibility of management, with each level in the organization requiring increased specificity and action orientation. An effective organization must be competent in all actions and therefore the achievement of mastery is not a one-time event but instead continuous learning throughout a career. Finally, autonomy applies within the responsibilities and authorities of a given position, and the corresponding accountability determines when reviews and oversight is necessary.<sup>23</sup>

Customers' needs are paramount and determine the overall organization of the agency. Management roles assign responsibilities to meet those needs. Within an assignment, GEOINT professionals will be free to organize their work to customize products and services that meet these mission needs. The IT services provided universally as the "GEOINT Platform" will enable user customization and tailored capabilities. Formal and informal teams will respond to customers' needs by anticipating and delivering value without barriers, using the strengths of analysts, scientists, developers, and designers working hand in hand. Individuals will increase their impact through teaming and personal responsibility for a particular aspect of the GEOINT mission.

GEOINT mission management will organize interactions to emphasize mastery where it exists, permit autonomy within agreed responsibilities, and work towards a collective purpose. Unified GEOINT operations will occur when mission management and technical systems operate across agency and country lines. NGA will coordinate these interactions, providing the framework for managing the GEOINT mission as a whole.

Serendipity, creativity, and experimentation are necessary to advance the future.<sup>24</sup> Therefore, the methods used to meet customers' needs will be flexible, and creative solutions to mission will be embraced by the organization as avenues for growth. This will include automation to take advantage of the efficiencies machines bring to performing mundane tasks



**Figure 5— Teams Create Value for their Customers through their Ability to Contribute at Reasonable Costs**

23 Autonomy does not equal chaos, nor does it equal bureaucracy. The goal is to allow the freedom to fulfil the needs of the position. For example, the president's daily brief receives significant review and oversight due to the audience while routine monitoring requires virtually no oversight, assuming proper training and responsible practices. Balance is important.

24 In the commercial sector, there have been several notable instances of policies such as "twenty percent time" to create a culture of creativity. In many cases, the policy itself is not explicitly enforced and intends to capture of the mere idea and broad acceptance of the idea that tangential efforts can create great gains. This is the intent—there may or may not be an official sanction of exploratory efforts; however, the culture will encourage the constant drive to seek new opportunities.

while maintaining the flexibility of human intellect. Automation will create space for humans to innovate solutions in an organization focused on taking actions that create customer value. The work environment must be equally nimble to support GEOINT professionals as they adjust to address intelligence problems through collaboration with automation and artificial intelligence to facilitate forecasting and near real-time production. NGA needs new business processes to enable this concept; Section 5 describes those processes.

## 5. Business Processes

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To ensure the decision advantage provided by GEOINT, NGA must reinvent how it does business and drive the GEOINT enterprise to a new approach to delivering customer value. Business processes must work in concert with the mission activities and organizing principles set down in Sections 3 and 4. Self-organization across the enterprise is the key to transforming NGA's business processes. The GEOINT ecosystem is now too large and complex for centralized management to be effective. Incorporating market principles that support self-organizing around customer demand signals can provide effective controls.

Businesses form around needs and operate on the differentiated value they bring to customers through products and/or services. NGA, too, must differentiate itself from the rest of the broader GEOINT community and identify the value NGA provides to customers of GEOINT. NGA's differentiated value is expertise applied to a unique range, depth, and quality of its products and services. Consequently, NGA's value proposition is:

*Mastery of our craft enables customer success through assured access to and confidence in GEOINT data, capabilities, and insights.*

NGA provides assured access to the world's best geospatial intelligence in order to support decision-making, inform navigation, and integrate intelligence through space and time.

Assured access is value provided uniquely by NGA whereby critical national security missions can rely on dedicated support. NGA is committed statutorily to provide assured access and analysis for these missions and organizes accordingly.

Confidence in GEOINT is a guarantee that NGA will deliver quality to all customers. The GEOINT enterprise requires the means to understand the quality of contributions. NGA will play two roles to provide this capability for the GEOINT enterprise: setting quality standards and providing unbiased evaluation of products, services, and content. Furthermore, NGA will continue to provide highly accurate and exquisite products, content, and services as a contributing organization.

NGA's has four groups of mission activities: Analysis, Content, GEOINT Services, and Functional Management. NGA will maintain focus on these groups over time, satisfying the changing needs of its customers by creating original content and developing a global enterprise for GEOINT.

Analysis and content together create NGA's original contributions. GEOINT Services and Functional Management provide the basis of a robust enterprise for producers and consumers of GEOINT. These four groups support the GEOINT enterprise in providing the means for suppliers and consumers to make educated decisions and minimize waste for all parties involved. An enterprise based on market principles requires a means of exchange to operate, and NGA will provide the mechanisms by which consumers and mission managers can make informed choices about the products and services they require in a transparent and intuitive manner. Additionally, NGA will provide exquisite insight to supply this market with products and services for exchange.



**Figure 6—Evolving the GEOINT Enterprise to a Global Ecosystem**

Customers in the GEOINT enterprise will evaluate the success of contributions to their mission, driving changes through market forces to meet their needs. Individual autonomy and resource authority coupled with customer accountability maintains NGA's focus on meeting customers' needs. Management and acquisition will provide support through agility and the delegation of authority. This concept of the GEOINT enterprise works as a hybrid: in peacetime, operations will behave as a free market, while a command approach will prevail in crisis and war.

There are certain criteria products and services must satisfy:<sup>25</sup>

- |                    |   |
|--------------------|---|
| 1. Timeliness      | <i>Products and/or content are published when I need them.</i>              |
| 2. Responsiveness  | <i>My requests are promptly addressed.</i>                                  |
| 3. Reliability     | <i>Products and/or content are consistent in their level of quality.</i>    |
| 4. Accuracy        | <i>Products and/or content accurately reflect ground truth.</i>             |
| 5. Relevance       | <i>Products and/or content are pertinent to my needs.</i>                   |
| 6. Usefulness      | <i>I can apply NGA products and/or content to my mission.</i>               |
| 7. Discoverability | <i>I can easily find the products and/or content I need.</i>                |
| 8. Accessibility   | <i>I can get products and/or products in the format in which I need it.</i> |

The measure of success for NGA is to provide value to GEOINT consumers. Value is the differential between contribution and cost. Customers directly receive contributions for mission support as well as those made to the IC's collective knowledge for awareness and future use. There are tangible costs to doing business.<sup>26</sup> NGA will initially estimate costs by budget allocations and applied human effort, with fine-grained cost accounting built into enterprise capabilities over time.

<sup>25</sup> These criteria are reported annually to the Office of the Director of National Intelligence and Congress as part of the NGA customer satisfaction survey.

<sup>26</sup> E.g., people, equipment, and facilities

The US government realizes value when a contribution of intelligence makes an impact on mission greater than the opportunity cost of the resources expended. Investments must increase the expected value NGA will provide to our customers and partners. Comfort with the present can no longer be the basis for investment decisions. Value will serve as the common measurement of success for acquisition of capabilities and execution of mission.

Business processes must serve the needs of customers and the operators providing them valuable products and services. NGA will use an approach that teams developers with operators (DevOps) to field new services and applications with minimal barriers to entry to the GEOINT enterprise. This approach will establish resources and procedures that are pre-approved, allowing developer and operator teams to innovate rapidly in the operational environment. These teams will create new products and services and demonstrate their value at the speed they can be developed. Furthermore, these tools, teams, and methods will be open to NGA's partners, so they can also build custom solutions and have the ability to scale the most successful ones to the entire enterprise. This will require the institutionalization of responsive acquisition and will be possible through a technical and decision-making environment that provides the ability to field capabilities continuously.

Agility is necessary to develop custom products, services, and tools on rapid timelines. No process is a guaranteed fit for all capabilities. The development of custom services in a DevOps environment relies on flexibility, while research and emerging capabilities will be able to test utility in a free market. The GEOINT Solutions Marketplace is an initial step towards open exchange, and the current rounds of agile-oriented contracts are a first step towards contract flexibility. GEOINT professionals with the authority to purchase market services will be able to use vehicles like these to support their needs.

The government and commercial sectors will work in partnership, but with different flavors. The commercial sector will provide data, information, and knowledge based on commercial imperative – driving standards and fueling growth. The will to sell geospatial products and services to the US government is a mutual interest when corporate philosophy and public needs align. The government sector will have capacity then to focus on specifics that do not have a commercial imperative. The US government will retain unique and exquisite collection and analysis capabilities, primarily in areas that lack a commercial imperative. In response, the government will either create a market where one did not exist or develop specialized capabilities for strategic advantage. The result is access for the whole of government to relevant geospatial data, information, and knowledge.



**Figure 7—Value is the Difference Between Contribution and Cost**

## 6. Summary

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NGA will align its operations to meet current and future needs and will operate in parallel with tightly honed focus and built-for-purpose teams. It will operate with purpose, mastery, and autonomy to capture, integrate, and convey content in time and space. The GEOINT workforce understands the missions it supports and will own its contribution. All levels of the organization will make decisions with this clear mission context. The combination of these actions will provide the most robust, timely, and thorough understanding of the world possible. When adversaries deny observation or conceal intentions, the GEOINT community will be there with insights to anticipate activities, expose actions, and provide context and consequence for customers.

National leadership, the warfighter, first responders, and all other consumers of GEOINT will find GEOINT content increasingly timely, relevant, anticipatory, accurate, and innovative in the face of their ongoing challenges. The GEOINT community will meet their content needs rapidly and effectively while providing customized fit, form, and function.



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### A-1 Acronyms

ABI	activity-based intelligence
CONOPS	concept of operations
DevOps	developers with operators
DoD	Department of Defense
ECD	Enterprise Capability Document
GEOINT	geospatial intelligence
GIS	geographic information system
IC	intelligence community
IC ITE	Intelligence Community Information Technology Enterprise
ISR	Intelligence, Surveillance, and Reconnaissance
OBP	object-based production
R&D	research and development
SOM	structured observation management
TCPED	tasking, collecting, processing, exploitation, and dissemination
USG	US government

## A-2 Glossary of Terms

**Activity**—A recognizable movement, conducted by a single entity, that is an indicator or has a specific meaning when viewed within a relevant context.

**Activity-based intelligence (ABI)**—An IC analytic method applied to structured data from all sources to discover objects, relationships, or behaviors by resolving significant activity. [2]

**Analytic model**—Representation of our understanding of how aspects of the world work. [3]

**Anticipatory intelligence**—Detect, identify, and warn of emerging issue and discontinuities. [4]

**Autonomy**—The desire to direct one's own life. [5]

**Big Data**—Massive datasets and combinations of datasets with size and complexity beyond the ability of traditional software and tools to capture, store, manage, and analyze.

**Concept of operations (CONOPS)**—A verbal or graphic statement that clearly and concisely expresses what the joint force commander intends to accomplish and how to do so using available resources. [6]

**Content as a service**—Purchasing content from an outside source, such as annotated imagery, change detection services, structured observations, or object identifications.

**Content management**—The technologies, strategies, methods, and tools used to capture, preserve, and deliver content for an organization and its processes. [7]

**Contribution**—The analogue of revenue in private industry; the result of the work performed by GEOINT professionals.

**Contribution of content**—A contribution to the IC's content, often in the form of information or knowledge that can be used for future satisfaction of customer needs or to maintain insight for the IC.

**Contribution to customers**—A contribution that satisfies a customer's need with a consequence to the satisfaction of the customer's mission.

**Cost**—The price associated with doing business (personnel, maintenance, material, etc.).

**Cue**—A semi-automated or, ideally, wholly-automated means to facilitate near-real-time tasking or retasking of collection, processing, reprocessing, or exploitation, augmented with messages or alerts that notify internal or external organizations of the incident that precipitated the rapid cueing response and the response taken to facilitate a rapid multisensor, multi-INT response to a detected entity, emission, activity, or event. [8]

**Customer**—Consumers of GEOINT.

**Data**—A standard description of a measurement in a useful form. Data is in a form that has been calibrated and reported in a well-defined format, allowing downstream consumers to abstract away the details of the measurement process. [3] Data is the processed output from a sensor that makes sense to most consumers (e.g., an image).

**Detection**—Any observation evaluated, prepared, and transmitted by an automated observing system without human intervention; used to record observations where activities and relationships are well understood and where analytic findings having a historical high level of certainty.

**Feature**—The natural characteristics of the Earth or man-made (or constructed) objects, such as facilities, buildings, bridges, and roads. [7]

**Foundation GEOINT**—GEOINT content describing the basic parameters of the geographic and cultural features of geospatially referenced activities on the Earth. It includes aeronautical, controlled imagery, elevation, geodetic, geographic boundary, geographic name, human geography, maritime, and topographic feature data. [7]

**Future GEOINT environment**—An end-to-end environment (system of systems) which brings knowledge, analysis, and collection together simultaneously to discover what we cannot know any other way; synonymous with persistent GEOINT environment.

**Geospatial intelligence (GEOINT)**—The exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the earth[sic]. GEOINT consists of imagery, imagery intelligence, and geospatial information. [11]

**Geospatial information**—Information which identifies the geographic location and characteristics of natural or constructed features and boundaries on the Earth, including statistical data; information derived from, among other things, remote sensing, mapping, and surveying technologies; and mapping, charting, geodetic data, and related products. [11]

**Information**—A statement that purports to present a fact. Information is assessed from data, and while abstracted to be intuitive to a human audience, is directly traceable to its evidence. Information is characteristically deterministic, with the information creation process able to return the same conclusion given identical conditions. Information is stored in a format that allows a downstream consumer to understand the meaning, usually using some degree of natural language. [12] Information is often captured as detections and observations.

**Knowledge**—The accumulation of information with inferred context and intent. Knowledge necessarily takes into account various assumptions and biases on behalf of the creator and, as a result, is not necessarily deterministic, even when there is direct traceability to underlying information. Knowledge is often present in the inferred or implied relationships between information or in sequences and interpreted causality. Knowledge is stored and conveyed often as a story, integrating the actions of objects with intent and relationships to establish cause and effect, motivations, and projected future actions. [13] Knowledge has historically been captured through reporting and kept in notes and within analysts' heads. Analysts capture knowledge in many ways, including through objects for simple representations and through models for broader context.

**Mastery**—The achievement of expertise in an area that matters. [5]

**Measurement**—A direct recording of the world. A measurement is specific to the instrument used to detect a phenomenon and does not necessarily describe the object characteristic in which we are interested. [14] For example, measurements are the direct representation of a scene taken from a sensor.

**Nontraditional sources**—Data assessed to have value to the mission but are currently under-utilized and not fully integrated into the GEOINT enterprise.<sup>27</sup>

**Persistence**—The ability to obtain content with sufficient periodicity and duration to detect change and characterize activity, where the rate of information refresh equals or exceeds the rate of change.

**Persistent GEOINT**—A focused intelligence strategy to detect change, characterize activity, infer behavior, and discover unknowns.

**Purpose**—The desire to accomplish in the service of the greater good. [5]

**Objects**—Representations of physical objects and the activities of physical objects of interest to intelligence consumers, such as equipment, facilities, organizations, activities, events, and issues; [7] also called information objects. [15]

**Object-based production (OBP)**—The act of organizing intelligence around objects of interest—not by collection or data type—which allows users to aggregate intelligence information from across multi-INT domains and associate it with particular objects of interest (i.e., equipment/facility, entity, activity/event, and issue). The premise of OBP is that when known information is well organized and accessible, its usefulness increases. OBP delivers intelligence consumers ‘assembled’ information that reflects real-world objects. [16]

**Observation**—Information gleaned from viewing and interpreting (and ultimately analyzing) a primary source. Includes attributes of an object in the real world (including its location) derived from calculations using sensor measurements.

**Tip**—A message or alert to notify internal and external organizations of the detection, geolocation, and characterization of an entity, emission, activity, or event that likely warrants the time-sensitive application of additional multi-INT collection and/or exploitation capabilities, based on predetermined tipping criteria for events associated with high-interest activities vetted. [8]

**Traditional GEOINT sources**—The commonly understood group of collectors that provide the historical imagery and measurements that are the foundational core of GEOINT—they include overhead persistent infrared; national technical means; commercial overhead; airborne collection systems; and surface and subsurface sources.

**User**—Can be either internal or external; internal users are members of GEOINT analytic teams and external users are our customers—consumers of GEOINT.

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<sup>27</sup> Approved by NGA Content Portfolio Manager 2015

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