National System for Geospatial-Intelligence

GEOSPATIAL INTELLIGENCE (GEOINT) BASIC DOCTRINE

GEOINT PUBLICATION 1
June 2004

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

JUNE 2004

OPR: NGA/OGMP/Doctrine Office
Certified by NGA/OGM, Mr. Thomas Ferguson
Cleared for Public Release, Case Number 04-181
Pages: 60
Approved by: JAMES R. CLAPPER, JR., Lieutenant General, USAF (Ret.), Director

FOREWORD

Geospatial intelligence (GEOINT), the complete integration of the nation's imagery and geospatial capabilities, is driving fundamental changes at every level of our enterprise: doctrine, organization, training, materiel, leader development, personnel, and facilities. These changes and the new imperatives for the Intelligence Community of homeland security and the Global War on Terrorism are transforming our business. It is essential for both GEOINT producers and consumers to understand what GEOINT is, how it contributes to the nation's overall intelligence effort, and how it is helping to transform intelligence and defense capabilities to meet the challenges of a new global environment.

As the functional manager for GEOINT, I have launched an effort to develop a formal body of national GEOINT doctrine. This doctrine will provide the conceptual link between the national security strategy and the plans and procedures that guide the use of GEOINT. In 2003, the National Geospatial-Intelligence Agency (NGA) published the *Geospatial Intelligence Capstone Concept* as the first word, but not the last word in understanding GEOINT. With the release of *Geospatial Intelligence Basic Doctrine,* significant steps are taken in recording what is believed to be true about GEOINT. This publication describes the role of doctrine in the National System for Geospatial-Intelligence (NSG), provides a historical context for GEOINT, and outlines its role in support of national security. It describes the nature of GEOINT and the emerging concepts that are shaping its transformation. Most importantly, this publication describes NSG core competencies and highlights the tenets upon which GEOINT, the NSG, and the NGA ultimately stand.

Geospatial Intelligence Basic Doctrine is the introduction to a series of publications that will comprise a body of formal doctrine for GEOINT. Future publications will address the organization, employment, and operational aspects of GEOINT and its members'

roles and missions within the NSG. I encourage you to read and reflect upon the principles outlined in this basic doctrine manual. As might be expected, you will find points of convergence that all can agree upon as well as an occasional point of divergence - that's both healthy and expected. I invite you to share your feedback.

Know the Earth…Show the Way!

JAMES R. CLAPPER, JR.
Lieutenant General USAF, (Ret.)
Director

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PREFACE

PURPOSE

This publication was prepared under the direction of the Director of the National Geospatial-Intelligence Agency (NGA). As functional manager, NGA leads the development of GEOINT doctrine to inform and guide the activities and interaction of the armed forces, DoD, and interagency operations concerning geospatial intelligence. This publication establishes general doctrinal guidance for the application of GEOINT and provides the conceptual framework to guide future operations and systems acquisition, as well as defense concept development and experimentation. It provides the framework for understanding GEOINT and forms the basis from which commanders and decision-makers plan and execute their assigned missions.

APPLICATION

Doctrine and guidance established in this publication apply to the National System for Geospatial-Intelligence (NSG), the Intelligence Community, services, and coalition partners within the NSG. It is based on those shared beliefs that capture the best way to conduct GEOINT. The doctrine in this publication is authoritative but not directive. It is a tool to employ the NSG to its fullest capacity and enhance its ability to accomplish the GEOINT mission.

SCOPE

Geospatial Intelligence Basic Doctrine covers the range of operations at the national, strategic, operational, and tactical levels. This publication provides the conceptual link between the national security strategy and the use of GEOINT.

JOINT DOCTRINE

This publication complements joint doctrine, *Joint Publication 2.0, Joint Doctrine for Intelligence Support to Joint Operations* and *Joint Publication 2-03, Joint Tactics, Techniques, and Procedures for Geospatial Information and Services Support to Joint Operations*; but its purpose is to promulgate the NSG perspective on the employment of GEOINT. It focuses on the nature of GEOINT and its enduring principles, as well as its role and capabilities in support of national policy and military operations.

PROLOGUE

WHAT IS DOCTRINE?

> Doctrine provides...an organization with a common philosophy, a common language, a common purpose, and a unity of effort.
>
> General George H. Decker, former Chief of Staff, US Army

According to the US Joint Doctrine Encyclopedia, doctrine represents those fundamental principles that guide our actions in support of national objectives. Doctrine evolves from many sources to include historical experience and the basic vision, theories, concepts, principles, and beliefs that arise from that experience. Similar to constructing a map, doctrine is never complete and thus represents only a snapshot in time. It must be systematically reviewed and revised to reflect the latest experiences and resultant lessons learned. Some of the characteristics that frame sound doctrine include:

- **Descriptive**: Describes how the NSG should organize, train for, and employ GEOINT. Doctrine describes, but does not prescribe.
- **Well-researched**: Built from a basis in history, demonstrated in exercises and recent operations, and linked to a solid understanding of the art and science of modern intelligence operations. Doctrine is linked to history, but not anchored by it.
- **Forward-looking**: Accounts for current and near-term anticipated realities that affect personnel, resources, operations, and mission effectiveness. Doctrine considers the future, but remains focused on the present.
- **Flexible**: Allows the NSG, its customers, stakeholders, and suppliers the latitude to adapt to changing environments and threats. Doctrine is about what is important, not who is important.
- **Comprehensive**: Conveys a common and concise understanding of how to think about GEOINT while

providing a common language to do so. Doctrine is about how to think, not what to think.

- **Believed**: Is taught, valued, and practiced. Doctrine is valued because it is shaped from a crucible of proven experience, not from imagination and/or unsupported consensus.
- **Dynamic**: Evolves in concert with technology, capabilities, and lessons learned. Doctrine is dynamic, but evolves purposefully.

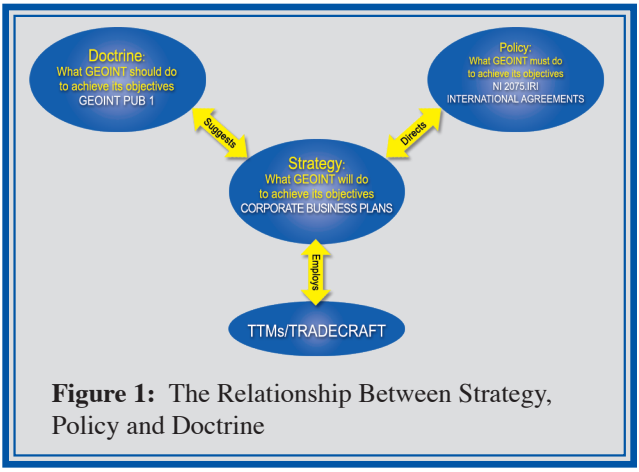

Figure 1: The Relationship Between Strategy, Policy and Doctrine

Though doctrine is authoritative in that it codifies insights gained through experience, judgment is clearly required in its application. This important caveat can best be understood by reviewing the dynamic relationship between doctrine, policy, and strategy. Policy provides a statement of strategic guidance or direction that often describes what *must be* accomplished and the constraints that *must be* considered in pursuit of key objectives. Policy originates from a wide variety of sources to include the national security strategy. Where policy is directive, strategy describes how an organization *will* actually conduct its operations given its policy directions and doctrinal frame of reference. Strategy jointly originates in both policy (*what we must do*) and doctrine (*how we should do it*). Though neither policy nor strategy, doctrine makes both more effective in achieving national interests. Doctrine does this by serving as a source of collective wisdom, which suggests how an organization *should* organize and employ its capability. The foundation of who we are as a profession and how we should operate resides in doctrine.

NSG doctrine represents a system of enduring principles that guide and inform the planning and operations of the NSG at

every level. These principles arise from the shared beliefs that capture what is officially sanctioned and taught about the best way to conduct GEOINT. NSG doctrine does this by describing the proper use of GEOINT, providing a common reference for terms, explaining how GEOINT relates to other intelligence disciplines, and serving as a platform from which to influence joint and service doctrine. It serves to potentially influence not only other bodies of doctrine, but also strategy, future concepts, planning, training, and acquisition. NSG basic doctrine provides a frame of reference for discussions about GEOINT and its ability to positively contribute to national security. Whether read by a policy maker, a warfighter, a program manager, or the NSG workforce, doctrine provides a window into understanding the profession and its many applications.

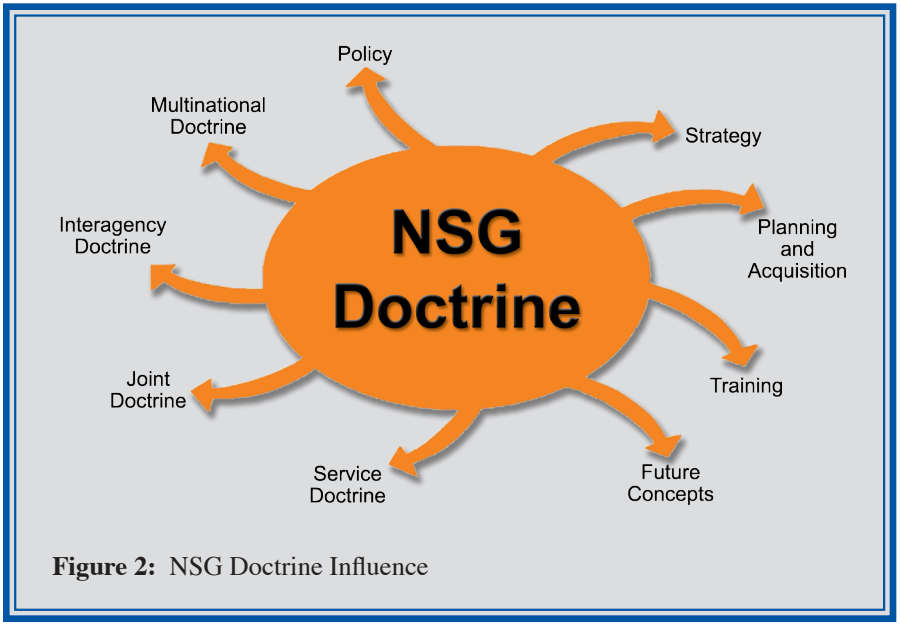

Figure 2: NSG Doctrine Influence

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CHAPTER ONE

A CONTEXT FOR GEOSPATIAL INTELLIGENCE

> From Plato to NATO, the history of command in war consists essentially of an endless quest for certainty - certainty about the state and intentions of the enemy's forces; certainty about the manifold factors that together constitute the environment in which the war is fought, from the weather and the terrain to radioactivity and the presence of chemical warfare agents; and, last but definitely not least, certainty about the stated intentions, and activities of one's own forces.
>
> Martin Van Creveld, Noted Military Historian

Historically it was up to science, enabled by innovation, to analyze, synthesize, and describe the world. As science, technology, and national security interests converged, traditional levels of uncertainty related to geospatial visualization, imagery-derived intelligence, and precise positioning lessened. This chapter provides a context for what is known today as GEOINT. Traditionally, advances that led to GEOINT evolved along three general lines:

> 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.

- **Use of New Remote Sensing Platforms to Better Perceive the Earth**: For much of recorded history it was impossible for a collector to gaze beyond the horizon or even to the shadowed side of a nearby hill. Restricted to the ground, commanders used spies, cavalry, towers, and telescopes to extend their line of sight beyond what the human eye could effectively see. Over time, technology enabled a variety of remote sensing platforms to extend man's ability to observe, understand, and measure the surroundings.
- **Use of New Means to Collect, Record, and Manipulate Remotely Sensed Data**: Similarly, advances in science and data automation expanded an analyst's ability to easily record, store, sort, retrieve, manipulate, and shape data into timely and relevant products.

- **Use of New Means to Disseminate and View Emerging Intelligence in a Timely Manner**: Concurrently advances in telecommunications evolved to incrementally reduce the time between the sensing event, the recording, and exploitation of data, and the posting of integrated information or intelligence.

HISTORICAL CONTEXT FOR GEOINT

Over the last 160 years, great strides have been made in overcoming a variety of spatial and temporal challenges that traditionally hindered analysts' ability to provide timely and accurate intelligence to warfighters and policymakers. For example, starting around 1840 photographs were first used in France to make topographic maps[1], thereby allowing a portable record to be taken of known geographic features that could later be transcribed onto a map. Two decades later during the U.S. Civil War, new technologies were slowly converging. Observers on the ground and in hot air balloons were experimentally linked to telegraph transmitters, allowing timely observations of the Earth that could be reported back to map makers, commanders, and policymakers below.[2] Concurrently, balloonists in Boston were experimenting with aerial photography, and the Union Army was developing mensuration techniques to distill measures from photographs and for translation to mapping or intelligence products.[3] By World War I, technology had evolved to the point that pictures were being taken from propeller-driven aircraft and used to build maps that reflected the maze of trenches and associated enemy activity.[4] The intelligence gained from these aerial photos was subsequently integrated into battlefield assessments that enabled commanders to better understand the battle space.

In the years following the war, U.S. government agencies began widely using aerial photography for non-defense mapping purposes. By the 1930s, the U.S. Geological Survey employed aerial photography and advanced mensuration methods to make both topographic and geological mapping products.[5] Such early efforts fueled the beginning of a commercial industry related to meeting the imagery needs of a growing nation.

As the United States inched toward World War II, intelligence had still not received the attention or funding required to drive positive change. From a technological context, intelligence sources were not much different by 1940 than they were 100 years earlier.[6] Diplomatic reports, attaché reports, open press, information from friendly nations, and private individuals remained the primary sources. The only significant new development was radio intelligence.

Against this backdrop, aerial photography for intelligence purposes was continuing to evolve as the traditional barriers of speed, distance to target, and insufficient lighting were gradually overcome in the years leading up to World War II. Technological advances such as the strip camera, telephoto lens, and the flash bomb effectively enabled aircraft to evolve from a tactical reconnaissance role maintained in World War I to the more operational role they would enjoy in World War II. By 1941, the United States had improved the sophistication of its remote sensors but lacked a professional cadre of photo interpreters needed to analyze the collected data.[7]

As the war progressed and commanders like Admiral Nimitz and General Eisenhower demanded a photoreconnaissance capability, developments in analytical tradecraft significantly influenced operations in the European and Pacific theaters of war. Throughout the war, photo interpreters followed a three-phase process that continues today. First phase consists of vital information quickly gleaned from images and rushed to commanders. Second phase is a closer examination, yielding a written report. Lastly, third phase is detailed study and reporting. By the war's end, aerial photography contributed to roughly 75 percent of all Allied intelligence.[8]

> ...the lessons in military photo interpretation which were learned in World War I, but forgotten between wars, were relearned and remembered as a result of World War II.
>
> William A. Fischer, author *History of Remote Sensing*

Following the torturous drawdown after World War II, funding and technology again accelerated as the threat of nuclear war

renewed the interest in intelligence. George Goddard and Richard Leghorn led the establishment of an Optical Research Lab in 1946 at Boston University.[9] This lab took the lead in developing advanced optics that directly supported national security research related to strategic overhead reconnaissance.

> Military intelligence becomes the most important guardian of our national security. The nature of atomic warfare is such that once attacks are launched against us it will be extremely difficult if not impossible to recover...therefore it becomes essential that we have prior knowledge...
>
> Richard S. Leghorn

The 1950s and 60s saw a renaissance in the nation's strategic intelligence capabilities. The historic and ultimately successful use of surprise by U.S. adversaries at Pearl Harbor, the Ardennes, the invasion of the Korean Peninsula, and the crossing of the Yalu River by the Chinese in July 1950 shaped President Eisenhower's thinking about the importance of strategic intelligence.[10] Eisenhower viewed the potential for overhead reconnaissance favorably, particularly as a means to avoid surprise. As a result, by the mid-point of his presidency in 1956, a high-flying U-2 spy plane had imaged the northern tier of the Soviet Union followed by the launch of the first U.S. reconnaissance satellite in 1959.[11] Beginning in 1960, U.S. reconnaissance satellites, under the Corona program, secretly mapped the Soviet Union and established a more accurate geodetic framework for navigation, intelligence, and targeting.[12] Corona significantly contributed to overcoming intelligence challenges and reduced the potential for surprise by[13] identifying military threats, locating potential military targets, and providing surveillance of weapons systems under development.

The arrival of the Vietnam War punctuated new problems in the field of intelligence. Technology had helped spawn an emerging glut of information, yet there were few analysts who knew how that information translated into actionable intelligence. Additionally, what was available was often not readily assessable to those who needed it most:

> *When it came to Vietnam, we found ourselves setting policy for a region that was terra incognita…worse our government*

lacked the experts for us to consult for our ignorance…the foundations of our decision making were gravely flawed.
(Robert S. McNamara)

To address this shortfall, following the Vietnam War imagery intelligence evolved along two complementary tracks, a specialized and a generalized track of knowledge.[14] This combination proved to be an effective means to marry the detailed analysis required of specialists knowledgeable of specific geographic areas, weapon systems, and emerging technologies with the generalized skills of a cadre of professionals that could work a variety of issues across functional and geographic boundaries. Meanwhile, the earth sciences professions were concurrently working to integrate new technologies like commercial satellite imaging (ERTS and Landsat), rocket imaging (Apollo missions),[15] an emerging Global Positioning System (GPS), a standardized World Geodetic System (WGS 84), and computer-assisted mapping techniques.

Operations conducted during Desert Storm, and later in Bosnia, brought additional challenges related to the integration and dissemination of intelligence data. Lessons learned from Desert Storm also highlighted the need to reorganize the intelligence community and determine a more efficient way to handle imagery and mapping products. Much of the DoD's efforts over the last decade focused on addressing these critical issues. Throughout the 1990s, rapid developments in sensors, platforms, image manipulation, and data processing drove change in the cartographic and imagery fields and dramatically shaped how intelligence was acquired, integrated, analyzed, and ultimately displayed.[16]

PRESENT DAY CONTEXT FOR GEOINT

Today, with the advent of modern geopositioning systems, geographic information systems (GIS), and state-of-the-art remote sensing platforms, mapping and imagery intelligence technologies are indeed converging. At the heart of this convergence lies the power of the GIS, which for the first time in history allows for the natural marriage of database management with imagery and geospatial graphics.[17]

The creation and use of maps at the end of the twentieth century were indeed in the throes of revolution. So profound were the changes going on that historians and cartographers looked back as far as the Renaissance...for precedent.

John N. Wilford, *The Mapmakers*

By constructing and displaying spatial relationships, the GIS facilitates the construction of a layered view of the environment and, ultimately, the formation of a common operational picture.

Figure 3: Common Operational Picture

NGA's ability to bridge traditional intelligence challenges by employing a range of remote sensors, then recording, manipulating and integrating data obtained from these sensors, has dramatically altered how information is perceived, shaped, and disseminated into usable intelligence. As a result, GEOINT enables the NSG members to quickly and accurately consider questions regarding:

- Where am I and what does my environment look like?
- Where exactly is my adversary and what does its environment look like?
- What capabilities does the adversary appear to possess?
- Are new situations or capabilities emerging that may threaten national interests?
- What are the adversary's centers of gravity, limitations, and vulnerabilities?
- What is the adversary's intent and how might that be expressed given its location?
- Where are the non-combatants?
- What are the threats to U.S. allies?
- Where are the borders and boundaries of other interested parties?
- What are the inhibitors to and enablers of what my forces can do?

- How do I navigate around, through, over, or under this environment?
- What common operational picture can be provided to maintain situational awareness?

By answering these questions, GEOINT provides users the ability to quickly orient and visualize their mission space - an advantage that directly contributes to new levels of precision, agility, and effectiveness. By combining remote sensing, precise geopositioning, digital processing, and dissemination, GEOINT enables combatant commanders to successfully employ advanced weapons on time and on target in all-weather day-night conditions around the world. Today's warfighting capabilities represent quantum improvements in precision and targeting technologies.

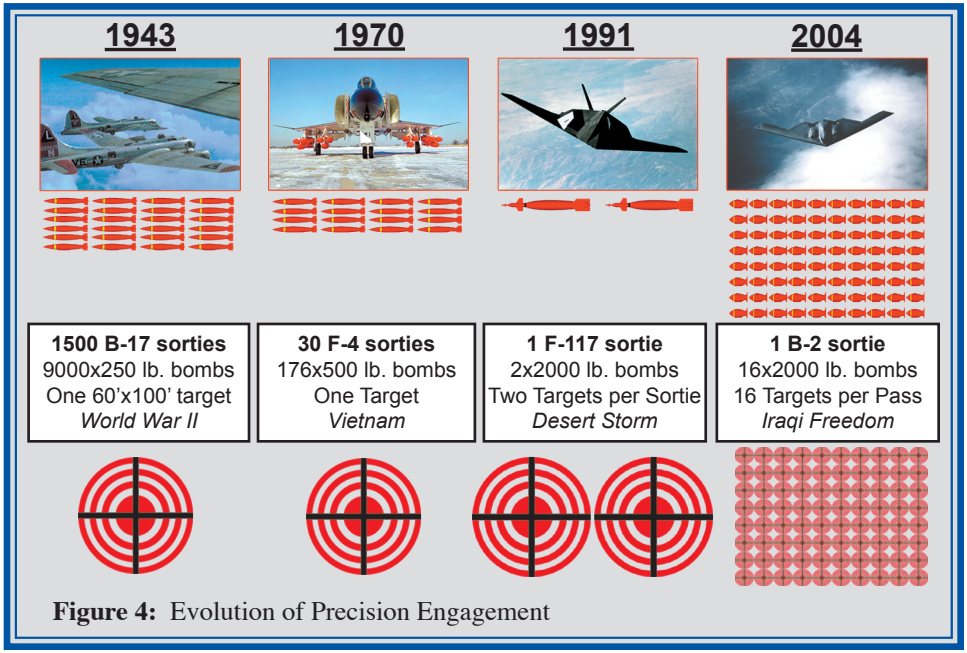

Figure 4: Evolution of Precision Engagement

Though intelligence has done well over the last 160 years in reducing the spatial challenge associated with finding, identifying, and precisely positioning features on the surface of the Earth, GEOINT still faces enormous challenges associated with reducing surprise, locating mobile and deeply buried targets, and synchronizing its efforts to an ever compressing decision cycle. Overcoming the historic challenge of surprise is and will continue to be a critical issue for GEOINT, as new technologies and

methods add to the lethality and transparency of surprise within an increasingly asymmetrical operating environment.

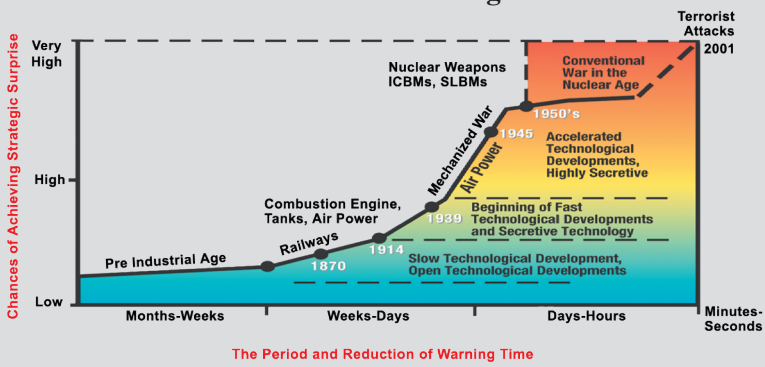

Figure 5: Strategic Warning

Source: ***Intelligence in Historical Perspective*** **by M. Handel in** ***Go Spy the Land*** **edited by Keith Nelson and B.J.C. McKercher, Westport, CT: Praeger Publishing, 1992.**

Contributing to the challenge of diminished warning times is the accelerating decision cycle in which warfighters and policymakers must operate. History is replete with examples where competitive advantage shifted to the person or organization that correctly oriented and decisively acted before its opponents could react. In today's unpredictable world, rapid change requires rapid reaction. The NSG has answered this challenge with the fusion of intelligence and predictive analysis, foundation data, multidimensional modeling, surveillance, and operational pictures. As a result, GEOINT has emerged to provide decision makers at all levels and in all environments with a contextual understanding of the past, an enhanced awareness of the present, and the requisite foresight to shape and influence the future.

Another challenge is the presence of highly mobile and lethal systems that combine and magnify the challenges of surprise and short decision times. Finding, identifying, tracking, and precisely locating such mobile targets in all-weather day-night environments may very well prove to be GEOINT's greatest

hurdle. Multi-disciplinary intelligence collaboration and the full spectrum of collection sources and methods discussed later in this publication may greatly contribute in solving this challenge.

Figure 6: Nighttime SCUD Interception

Throughout history, superior, timely knowledge of the environment and the adversary were key to giving decision makers and military forces the advantage, particularly when operating in foreign lands. Today, GEOINT provides the visual and intellectual framework for analysis, decision-making, and acting to advance national interests. Though many challenges continue to confront the profession, by continuing to leverage innovative technology and processes with an increasingly agile workforce, NGA and other NSG members are uniquely postured to contribute to information dominance and, ultimately, achieve the promise of a more certain world.

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CHAPTER TWO

THE NATURE OF GEOSPATIAL INTELLIGENCE

> The creation of NIMA presupposed a natural convergence of the mapping and image-exploitation functions - as each became 'digital' - into a single, coherent organization organized around the construct of a geospatial information system.
>
> *Report of the Independent Commission on the National Imagery and Mapping Agency*, December 2000

GEOINT—A NATURAL CONVERGENCE OF IMINT AND MC&G

GEOINT has emerged recently as a powerful new intelligence discipline that is providing a foundation for intelligence analysis and achieving information dominance. It unites the complementary fields of imagery intelligence (IMINT) and mapping, charting, and geodesy (MC&G)[18] into a single, integrated intelligence discipline. It combines their strengths, incorporating the dynamic, detailed content of IMINT with the precise methods

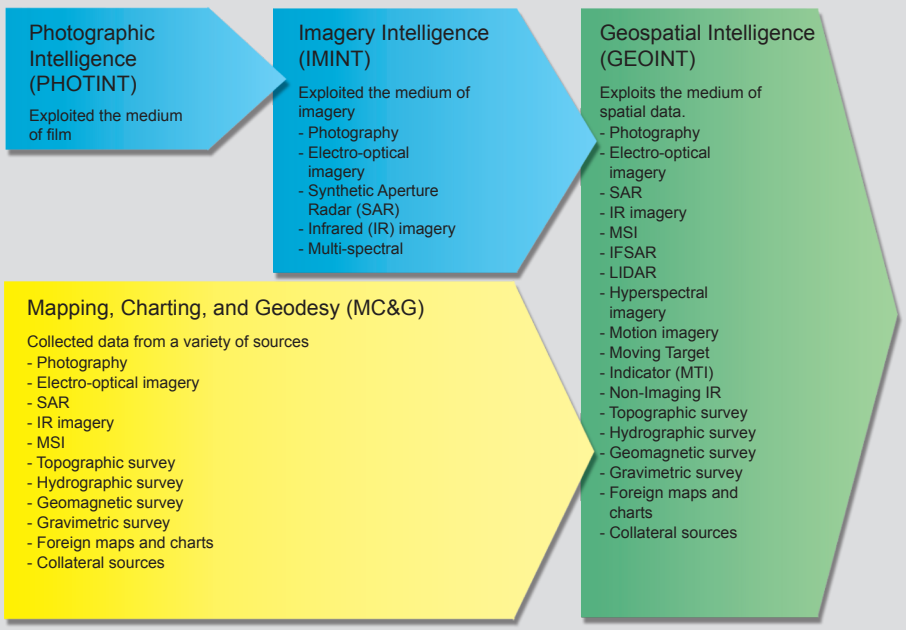


Figure 7: The foundation and evolution of GEOINT.

and models of the geospatial arts and sciences. It merges the imagery analyst's focus on the activities of foreign adversaries with the cartographer's focus on depicting the physical environment. It capitalizes on new sensor types, which provide motion imagery, moving target intelligence (MTI), and light detection and ranging (LIDAR), yielding new forms of spatial data.

This evolution of IMINT and MC&G into the successor discipline of GEOINT has been termed a "convergence." It is more than just the merging of organizations, the collocation of specialists, or the integration of technical architectures. It is a broad cultural, operational, and technological evolution that is driving fundamental changes in doctrine, organization, training, materiel, leader development, personnel, and facilities. The NSG and its customers are capitalizing on evolving digital data processing capabilities and new sensor technologies to maximize GEOINT's capabilities. The result is a digitally integrated intelligence product of unprecedented detail and precision that NSG customers can use as the foundation for all-source intelligence analysis, or for planning, decision, and action. With this convergence, IMINT and MC&G are no longer sufficient terms to describe the broad span of activities now termed GEOINT.

WHAT IS GEOINT?

GEOINT is the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the Earth. The term GEOINT is used in two ways. First, GEOINT is an *activity* or a *discipline*, a specialized field of practice within the broader profession of intelligence. It is the use of remote sensing, spatial data, and analytical methods to understand the global security situation. Second, GEOINT is a type of information, or intelligence *product*, the information and knowledge that is produced as a result of the discipline's activities.

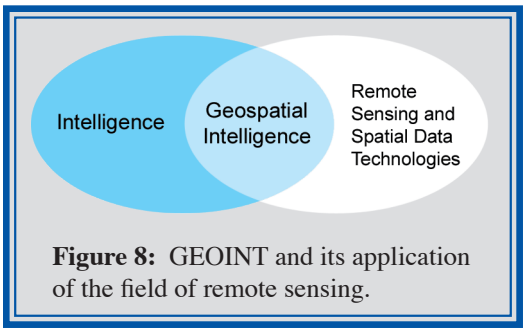


Figure 8: GEOINT and its application of the field of remote sensing.

The etymology of the word "geospatial" connotes the focus of GEOINT on representing natural features and human activities in their place on the planet. "Geo" comes from the Greek for Earth. "Spatial" refers to location. Accordingly, a simple way to describe GEOINT might be to say it shows what is *where* on the *Earth*. As a discipline, however, and as a distinct category of intelligence products, GEOINT goes far beyond answering the question, "Where?" This section describes in detail the nature of GEOINT as a discipline, its sources and its component tradecrafts, and the foundation it provides for analysis. It then discusses the nature of GEOINT as a product or service, and the role of GEOINT in national security.

GEOINT as an Intelligence Discipline

As an intelligence discipline, GEOINT encompasses all the activities involved in the collection, analysis, and exploitation of spatial information in order to gain knowledge about the national security environment, and the visual depiction of that knowledge. The integration of knowledge of both the adversary and the environment provides a better understanding of the security situation, and represents GEOINT's unique contribution to the nation's overall intelligence picture. GEOINT efforts draw from all sources of intelligence and information in meeting the needs of the nation's civilian and military decision-makers by reducing uncertainty.

GEOINT Sources. Integral to GEOINT is any source of data that indicates location, spatial relationships, and geographic features or references. Imagery in all its forms across the electromagnetic spectrum by its nature depicts spatial data and therefore is an integral source. But equally important is the full range of geospatial information that derives from other sources, including but not limited to terrain, geodetic, hydrographic, topographic, elevation and aeronautical data. Also relevant are sources of information that provide data related to meteorological, oceanographic, and space weather (METOC) conditions and ecology, as well as geographically referenced data and intelligence about human activity and manmade feature specifications.

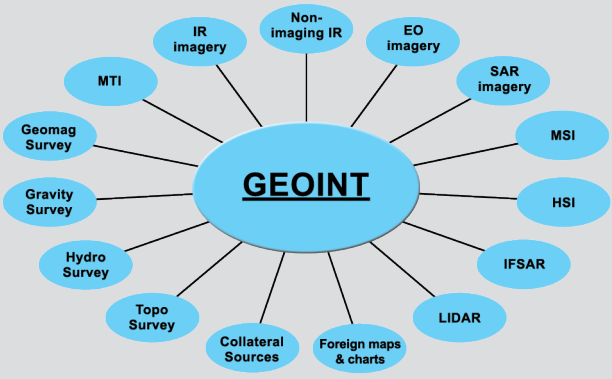


Figure 9: GEOINT exploits all types of spatial data.

The majority of this wide range of data is gained through remote sensing. GEOINT uses multiple remote sensing platforms in order to increase its flexibility to acquire data about a target, allowing on-demand access to denied or hostile areas. While most remote sensing platforms are either space-based or airborne, unmanned aerial vehicles are emerging as an important new platform for remote sensing. Commercially available imagery and spatial information are also becoming widely used, as the NSG seeks more cost-effective ways of providing a full range of GEOINT products to an ever-growing customer base. The high-resolution commercial imagery now available provides an important advantage in multinational coalition operations, as it can be shared with allies without compromising the capabilities and operating characteristics of U.S. reconnaissance systems.

GEOINT also uses multiple types of sensors to expand the analysts "view" of a target. Different sensor types allow the analyst to overcome obstacles such as unfavorable weather, poor lighting conditions, or non-cooperative targets. While electro-optical sensors provide a clear daytime picture of a target, synthetic aperture radar (SAR) may provide a critical view of its activities at night. An infrared image may offer a glimpse into the

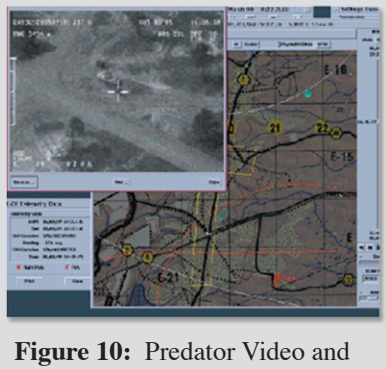


Figure 10: Predator Video and Map

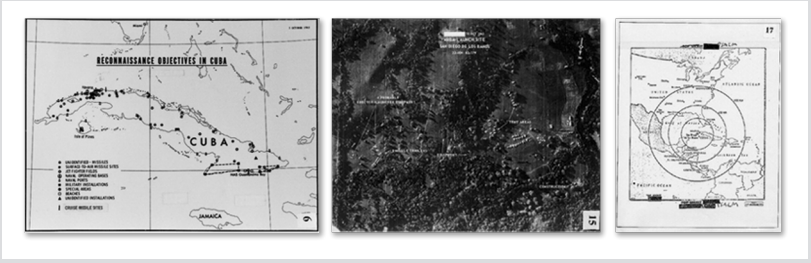
inner workings of an industrial plant. Multi-spectral imagery can provide detailed hydrographic and topographic data that would be unobservable using conventional methods. Motion imagery and moving target intelligence (MTI) technologies have added a new dimension to spatial data, one where movement and change can be instantaneously recorded. New sensor types, such as light detection and ranging (LIDAR), interferometric SAR, and hyperspectral imagery are expanding the scope of what an analyst can *see*, and ultimately, understand, about a particular target.

Though remote sensing provides the majority of the data that GEOINT analysts use, the discipline is increasingly incorporating spatial data collected from non-traditional sources. Source managers (responsible for the discovery, acquisition, delivery, and management of GEOINT data) and analysts are looking to commercial sources, intelligence services, and other intelligence sources such as SIGINT and HUMINT, for spatial information. GEOINT relies on a wide range of data types and sources, all designed to provide the needed characterization or picture of its targets.

Analysis and Production. Analysis and production lie at the heart of GEOINT. Working together, GEOINT analysts from all occupations can develop a more comprehensive view of the security situation. Through analyzing location, spatial and physical characteristics, and spatial relationships, GEOINT analysts can draw conclusions about complex intelligence problems. GEOINT specialists, such as imagery or geodetic scientists, can often assist analysts with elusive targets by introducing new sensor data and innovative analysis techniques. The addition of a relevant SIGINT, HUMINT or OSINT report adds depth and detail, or cues analysts to look in new directions. Taking all of these sources of information in a geospatial context, GEOINT analysts are able to make assessments about future activities. They can depict their assessments in a visual way that is intuitive to their customers. An integrated understanding of the global security situation is guaranteed when the various GEOINT specialties work together to provide in-depth and innovative solutions. The NSG is continually adapting the discipline's methodologies, tradecraft, and technology to support these analysts.

Location, Location, Location
The Cuban Missile Crisis

In the fall of 1962, imagery analysts identified a Soviet nuclear missile base in Cuba, less than 90 miles from the U.S. mainland. Working from HUMINT tip-offs, imagery analysts first discovered surface-to-air missile sites in August. SIGINT confirmed their operational status in October. Further analyzing the location of those sites, imagery analysts were able to pinpoint the location of the nuclear missile site and identify the types and number of missiles, bombers and combat troops present. The visual depiction of this base, using annotated aerial photography and geospatial products, provided irrefutable evidence of Soviet intentions to President Kennedy, the American people, and the world. Using this evidence, the nation was able to meet this threat and avert a larger future crisis.



Source: NIMA, Cuban Missile Crisis 1962-2002, and NSA and the Cuban Missile Crisis, http://www.nsa.gov/docs/cuba/

Distinctive GEOINT Tradecrafts. The component skillsets or tradecrafts of GEOINT services are unique and specialized areas of expertise that are available from, and best provided by, the NSG. They represent the combination of professional expertise and integrated analysis that enables the NSG to meet the intelligence challenges of today, and to remain postured for tomorrow.

- **Imagery Sciences**: The science that deals with the technical application of remote sensing towards the production of GEOINT products and services.
- **Geodetic Sciences**: The sciences of geodesy and geophysics, which deal with information or Earth data pertaining to gravity, point positioning, datums, etc.
- **Cartography**: The science of making maps and charts.
- **Regional Analysis**: The geographic, geopolitical, or intelligence analysis of a particular country or area of the world.

- **Geospatial Analysis**: The process of extracting meaning from geospatial data, using geographic information systems to uncover and investigate relationships and patterns in all forms of geospatial data to answer intelligence or military issues.
- **Imagery Analysis**: The process of converting information, extracted from imagery, into intelligence about activities, objects, installations, and/or areas of interest.
- **Marine Analysis**: The process of developing specialized representations of oceanographic, hydrographic and bathymetric data, and supplemental metadata, required for maritime navigation, pilotage, or planning maritime operations.
- **Aeronautical Analysis**: The process of developing specialized representations of mapped natural and man-made features of the Earth, and supplemental metadata, specifically to aid air navigation, pilotage, or planning air operations.

GEOINT Products and Services

GEOINT products provide unique knowledge—four-dimensional visualization and unprecedented precision and accuracy—not available through other means. In intelligence analysis and crisis response, GEOINT provides a means by which analysts, policymakers, warfighters, and first responders can orient to and visualize their environment. With its common frame of reference in space and time, GEOINT is an essential foundation for all-source intelligence analysis and the common operating picture. It is helpful to think of GEOINT as the layering of *foundation and intelligence data*.

- *Foundation data* provides a spatially referenced baseline. It includes feature data, the Controlled Imagery Base (CIB™), elevation data, and geographic reference and positioning data—essential features that rarely change or change slowly.
- *Intelligence data* consists of more thematic or time-sensitive information, to include safety of navigation, order of battle, and intelligence reports.

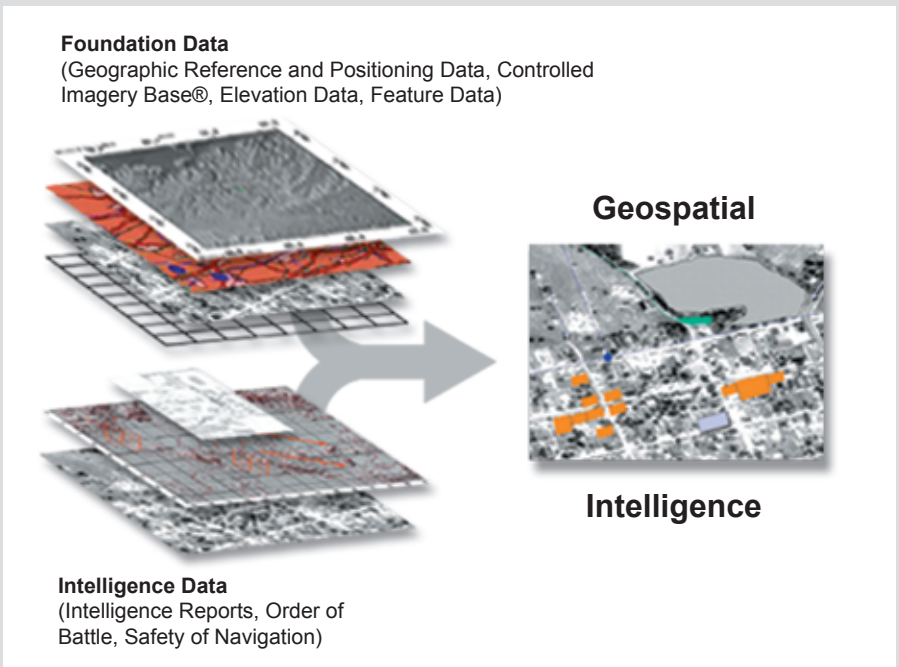


Figure 11: GEOINT as a product

The number of GEOINT products merging imagery with geospatial information is growing rapidly. However, traditional imagery intelligence products, such as indications and warning cables, or predominantly geospatial products, like Digital Nautical Charts (DNC™), will likely remain in use for the near future. **It is not the integration of data that makes a product GEOINT. It is the fundamental spatial character of the underlying source data and analytical methods used.**

Intelligence customers are increasingly relying on digital GEOINT views and derived low-volume tailored hardcopy rather than on traditional high-volume hardcopy paper products. As the NSG and its customers transition to an increasingly digital operating environment, the NSG is transitioning away from a products-based environment to one based on visualization. Customers define the information they view by selecting from a menu of products from a digital portal, and eventually from a menu of foundation and intelligence data sets. Digital products provide several advantages. They have shorter production

timelines and can be updated more rapidly. They require less storage space, can be transmitted over-the-air, and users can more easily tailor them to their Mission-Specific Data (MSD) needs.

Figure 12: The Use of Digital Products

As a service, GEOINT is an operationally integrated enterprise focused on tailored information sharing, merging and distribution. Intelligence customers, including both policy makers and action takers, often rely on GEOINT experts to provide on-scene, tailored *services* to ensure access to the appropriate GEOINT information and products, and to facilitate information visualization and decision making. GEOINT analysts are integrated in the real-time decision cycles at the White House, the Department of Defense, and the Department of Homeland Security. By enabling tailored services, GEOINT builds a bridge between information and decision, and between intelligence and action.

GEOINT's Role in National Security

GEOINT supports the first and highest obligation of the federal government—the protection of the nation's security. It plays a critical role, informing every aspect of the development and implementation of the nation's security policy from the national to the tactical level. The national security strategy places unprecedented emphasis on intelligence collection and analysis, seeking to leverage an intelligence advantage to mitigate U.S. global security challenges and to expand that advantage for the future.

The national security strategy is outlined in *The National Security Strategy of the United States of America* and its companion document, the *National Strategy for Homeland Security*. Together, they describe an overarching strategy for guaranteeing the sovereignty and independence of the United States and protecting its citizens. This strategy provides unifying direction in the use of every element of

national power—diplomatic, economic, law enforcement, financial, information, intelligence, and military.

Figure 13: Supporting national security objectives

To support the national objectives delineated in the national security strategies, the Director of Central Intelligence (DCI) provides direction to the Intelligence Community (IC). The Director of NGA, as functional manager for GEOINT, implements this guidance through the National System for Geospatial-Intelligence (NSG). The NSG is the integration of technology, policies, capabilities, and doctrine necessary to conduct GEOINT in a multi-disciplinary intelligence environment. It is the horizontal integration of activities and systems that collectively govern how we acquire, share, store, and process GEOINT. It provides a framework in which the intelligence, defense, and homeland security communities can capitalize on advanced technologies and acquire needed knowledge to achieve information dominance in support of their national security objectives.

The objectives laid out in the national security strategies translate directly into four purposes for GEOINT: informing national policymakers, homeland security and civil support, supporting military operations, and intelligence collaboration. These purposes guide the formation and application of the NSG's strategy, the *readiness and responsiveness* strategy. This is a two-tiered strategy that assures that the NSG applies its efforts to meet the nation's national security intelligence requirements: that decision-makers have the GEOINT they need to be ready in peacetime and to respond in times of crisis.

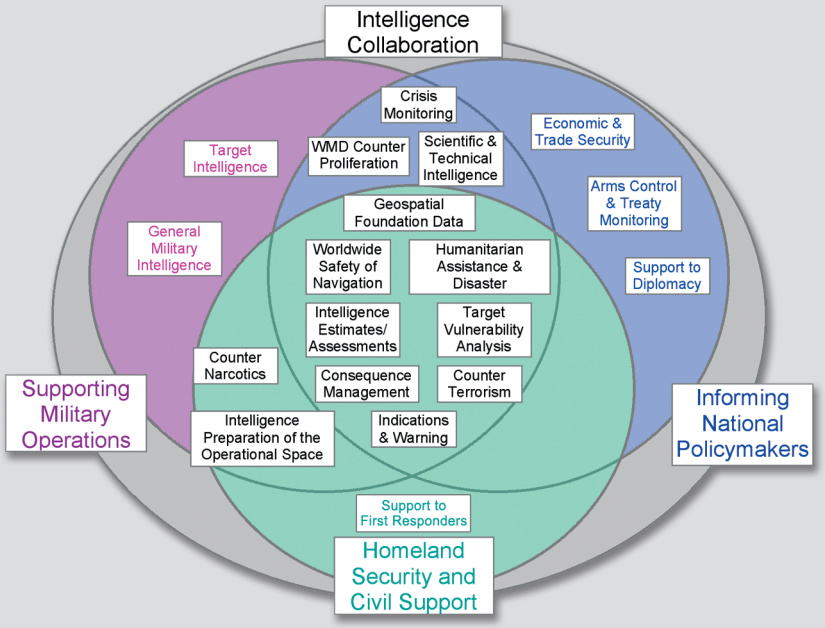


Figure 14: GEOINT serves four main purposes: informing national policymakers, supporting military operations, homeland security and civil support, and intelligence collaboration. Most GEOINT activities support multiple purposes.

The national security strategy rests largely on the ability to provide national leaders and operational forces with the knowledge and foresight to prepare for and respond to threats to vital national interests. GEOINT provides a foundation for the nation's decision-makers to maneuver in the new operational environment at the strategic, operational, and tactical levels. GEOINT serves not only as a foundation on which to collaborate and integrate all sources of information, but also represents a critical capability for understanding the world around us.

CAPABILITIES AND LIMITATIONS

GEOINT has certain inherent capabilities and limitations that shape the way it contributes to the nation's overall intelligence effort. The NSG and its customers, from the national to the tactical level, benefit from an understanding of the strengths and weaknesses GEOINT brings to a multi-disciplinary intelligence

team and what it contributes to a horizontally integrated intelligence architecture.

GEOINT Capabilities and Limitations

Capabilities	Limitations
Visualization	Limited capacity
Precision and detail	Limited insight into plans and intentions
On-demand global access	Limited access under unfavorable conditions
Objective, permanent record	Latency
Multi-source collection	Cannot eliminate uncertainty
Densification and value-adding	

Capabilities of GEOINT

GEOINT is a valuable source of intelligence because it provides certain unique capabilities that other sources cannot provide as effectively—or at all. Because it derives information by directly sensing spatial properties of objects and surfaces, GEOINT is uniquely suited to locating and visualizing features, facilities, and equipment. In intelligence operations, GEOINT is most effective when used in ways that take maximum advantage of its strengths and that compensate for limitations of other intelligence specialties. Competitive advantage must be maximized to achieve and maintain information superiority in the spatial domain.

Visualization. GEOINT allows a user to visualize operational spaces and activity patterns of all sizes and scales, ranging from the global and regional level to cities, and even individual buildings. Spatial analysis techniques can identify patterns in adversary activities. GEOINT products are highly intuitive, allowing the simultaneous display of many complex spatial relationships and visually conveying useful details. GEOINT uses standardized portrayal to ensure the message communicated is the one intended. It is simply the fastest way to communicate spatial information to an intelligence consumer.

Precision and detail. GEOINT can determine precise geographic coordinates and other measurements of objects and features in denied areas more accurately, rapidly, and effectively than is possible by any other means. Using remotely sensed imagery and

other spatial data, GEOINT analysts can characterize natural and man-made features and a host of other objects of interest.

On-demand global access. Near-real-time imaging and high-bandwidth data communications have significantly improved the responsiveness of GEOINT. Because of the speed and perspective afforded by high altitude and orbital flight, GEOINT sensors can cover entire regions in a matter of days. New sensor technologies continue to improve spatial data collection.

Objective, permanent record. Remotely sensed imagery and spatial data provides GEOINT an objective, permanent record of the features and activities in target areas, freezing the infinite details of the scene at a defined instant in time. It provides a continuously updated, objective historical record that can detect changes in both the physical environment and the activities of foreign actors.

Multi-source collection. GEOINT uses multiple sensors, providing flexibility to cope with different target conditions and the ability to characterize targets in more sophisticated ways. While the majority of spatial data at present is collected as electro-optical imagery, GEOINT also makes use of SAR imagery, IR imagery, and multispectral imagery. Newer sensor types include hyperspectral imagery, IFSAR, LIDAR, and an assortment of geophysical sensors.

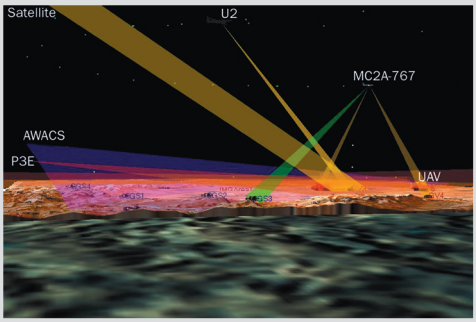


Figure 15: Multi-source Collection

Densification. Digital GEOINT products can be modified to meet the users' evolving needs as circumstances change. Through densification, the product's originators and others continually add detail to the product, increasing its usefulness to the operational end user.

Limitations of GEOINT

Despite its strengths, GEOINT has a number of limitations. Though new technologies are mitigating these limitations in some ways, they remain factors that GEOINT collectors, producers, and consumers must recognize and consider when planning current and future intelligence operations and architectures.

Limited capacity. No matter how robust or numerous the nation's GEOINT collection and production assets may be, the nation's need for GEOINT will always outstrip the capacity to produce it. The nation has a finite number of collection platforms, each with a finite field of view and a limited persistence in the target area. At the tactical level, though much progress has been made in recent years, organic collection assets remain limited. Access to imagery collection is not universal. Production capacity is also limited: the nation has a finite number of trained GEOINT analysts and workstations to process and analyze the data. Finally, the ability to disseminate GEOINT is constrained by limited communications capacity and the large amount of data that comprises just a single image.

Limited insight into plans and intentions. While GEOINT contributes to understanding the plans and intentions of adversaries, it is generally not the dominant source for such information. The utility of GEOINT in discerning plans and intentions is generally limited to observing large visible indicators.

Limited access under unfavorable conditions. Poor weather conditions, unfavorable lighting conditions, and hostile air defense action can limit the collection of GEOINT. For example, IR imaging, LIDAR, and others are ineffective during periods of cloud cover. Electro-optical is only feasible in daylight conditions.

Latency. While GEOINT collection and exploitation systems are capable of supporting near-real time exploitation of remote sensing data, latency remains a factor. It may take days or weeks of additional collection and analysis to fully understand an intelligence problem. Producing maps and charts is also time-consuming, requiring considerable lead time and collection and analysis of a wide range of additional sources. While digital

technology has streamlined this process in many ways, it has exacerbated it in others, by permitting the collection of larger, higher-resolution spatial data sets.

Cannot eliminate uncertainty. Penetrating the secrecy of adversaries or predicting future events remains a profound challenge. While GEOINT provides an undeniable knowledge advantage, it cannot always overcome an adversary's efforts. GEOINT cannot completely eliminate uncertainty nor forecast with perfect accuracy.

GEOINT is more than just systems and technology. It is a discipline made up of highly skilled, educated professionals with a wide range of expertise. Collectively, they possess an advanced body of knowledge, tradecraft, and operating principles developed over long years of experience. In the new international environment, these GEOINT professionals provide the nation the information advantage it needs. GEOINT capitalizes on innovative approaches for collecting and exploiting new remote sensing technologies and rapidly integrating data from all sources of information. This allows decision-makers, analysts, and other users to augment their understanding of a given situation. GEOINT represents an expansion of our profession, our sources and our capabilities that will renew and sustain our information advantage.

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CHAPTER THREE

THE GEOSPATIAL INTELLIGENCE PERSPECTIVE

> If there is one attitude more dangerous than to assume that a future war will be just like the last one, it is to imagine that it will be so utterly different that we can afford to ignore all the lessons of the last one.
>
> Sir John C. Slessor, former marshal of the Royal Air Force

GEOINT is continuously shaped by strategic concepts that help guide thinking within the NSG. These strategic concepts work hand-in-hand to shape the NSG's GEOINT strategy and operations today, as well as its concepts and ideas for future employment. GEOINT *tenets* provide a foundation on which strategic vision and goals are based. Focus on these strategic concepts will help build an organization that is continually adapting to meet the intelligence challenges of the twenty-first century.

THE TENETS OF GEOINT

The tenets of GEOINT reflect a doctrinal evolution of GEOINT while also aligning with the NSG's vision for the future. They represent the shared beliefs that frame the current understanding about GEOINT. There is always a danger of omission or over-simplification in distilling tenets from the sweeping generalizations that characterize any profession. There is also great value if such enduring truths can be successfully captured and modeled.

> Tenet: a principle, belief, or doctrine generally held to be true; especially one held in common by members of an organization, movement, or profession.
>
> Merriam-Webster

Centralized management and decentralized operations **ensure GEOINT remains highly responsive to a diverse set of customer needs, even as those needs change over time**. NGA has established a framework for GEOINT operations, which allows interoperability and efficiency within the NSG. In this framework, analysts, warfighters, policymakers, and first responders are free to acquire, access, analyze, and tailor GEOINT data to produce

any number of unique information views relevant to their special mission needs. Through this system of centralized management and decentralized operations, GEOINT remains flexible and adaptable to each customer's specific intelligence needs.

Timely, relevant, and accessible GEOINT is the *foundation for planning, decision, and action*. GEOINT provides unique knowledge—four-dimensional visualization and unprecedented precision and accuracy—not available through other means. This provides a foundation from which analysts, policymakers, warfighters, and first responders can visualize and orient to their environment, and make decisions rapidly.

GEOINT is *continuously evolving* through the thoughtful interplay of technology, ideas, and emerging national security challenges. GEOINT is dynamic and will continue to adapt as purposeful concepts shape how the NSG acquires, analyzes, stores and shares data. By thoughtfully considering the interplay between people, technology, process, and requirements, the NSG is migrating to an all-digital environment that unites a diverse cadre of specialized professionals.

GEOINT *capitalizes on all sources* and forms of traditional and non-traditional data. Twenty-first century technology is dramatically increasing available data sources. New sensor types are reaching across the visual and electromagnetic spectrums and beyond. The NSG will continue to systematically exploit these sources to produce and deliver information that adds ever new dimensions to the understanding of the security environment, while remaining timely, relevant, and accessible to customers.

Tenets of Geospatial Intelligence

1. Centralized management, decentralized operations
2. Foundation for planning, decision and action
3. Continuously evolving
4. Capitalizes on all sources
5. Foundation for multi-INT and all-source analysis
6. Advanced through collaboration and partnerships
7. Deliver ubiquitous access
8. Postured for tomorrow, focused on today
9. Stronger than the sum of its parts

GEOINT creates a *framework for the conduct of multi-disciplinary intelligence collaboration and all-source intelligence analysis*. GEOINT provides a structure for viewing, fusing, understanding, and acting on other intelligence data. It provides a foundation for the horizontal integration of multi-disciplinary intelligence data in an all-digital environment. With its common spatial and temporal frame of reference, GEOINT is an essential foundation for all-source intelligence analysis.

GEOINT *advances through collaboration and partnerships*. The knowledge required to solve complex problems may reside beyond the traditional bounds of the culture. Adaptive memberships in expanding communities of interests, both within and outside the NSG, must continually evolve in response to intelligence demands.

The NSG must *provide an ubiquitous GEOINT portal* for stakeholders, customers, and partners. GEOINT services are shaped by the analyst's and customer's need for access to required data. This requires a data and communications infrastructure that allows the NSG to support its analytic workforce and its worldwide customers with guaranteed access to the full set of GEOINT data. This seamless enterprise gives any analyst, customer, or co-producer anywhere on the Earth the means to retrieve, update, add value, or provide his or her own perspective to data.

The NSG is *postured for tomorrow, and focused on today*. For the NSG to succeed, it must purposefully plan for the present and project for future states of operations. By synchronizing real-time readiness needs with long-term transformational issues, the NSG can support its analysts and customers today, while leaning forward and designing the leading-edge concepts needed to expand that support for tomorrow.

The GEOINT culture is *stronger than the sum of its parts*. GEOINT is more than a discipline—it is a culture composed of numerous distinct people, professions, and communities of users within the NSG, each contributing unique knowledge, skills, and ability to the whole. The convergence of cultures, particularly the geospatial and imagery tradecrafts, has fostered depth and detail in analysis, making possible an integrated understanding of the global security situation.

These tenets collectively represent shared beliefs about the GEOINT profession. They are enduring, applicable to the past, present, and future. They remain flexible enough to consider the application of new concepts and emerging lessons learned from exercises, experiments, and operational experiences. They provide a solid foundation for GEOINT professionals, and form a springboard for personal, organizational, and operational transformations to meet the challenges of the future.

NSG CORE COMPETENCIES

Core competencies allow an organization to achieve its strategic focus. The NSG recognizes three core competencies: *developing people, integrating processes and operations, and advancing technology*. These core competencies maximize the value of the NSG's distinctive GEOINT tradecrafts. They allow the enterprise to remain on the leading edge in analyzing, producing and managing GEOINT[19]. These three areas transcend all of the NSG's organizations and business segments, and affect the heart of the organization's ability to provide GEOINT support to national security.

Core Competencies

Developing People. People are the NSG's most important resource. The ultimate quality of the NSG's output is dependent on the quality of its people—military government civilian, and contractor—who take part in its operations. All organizations within the NSG seek to recruit, develop, train, and retain high-quality individuals with the

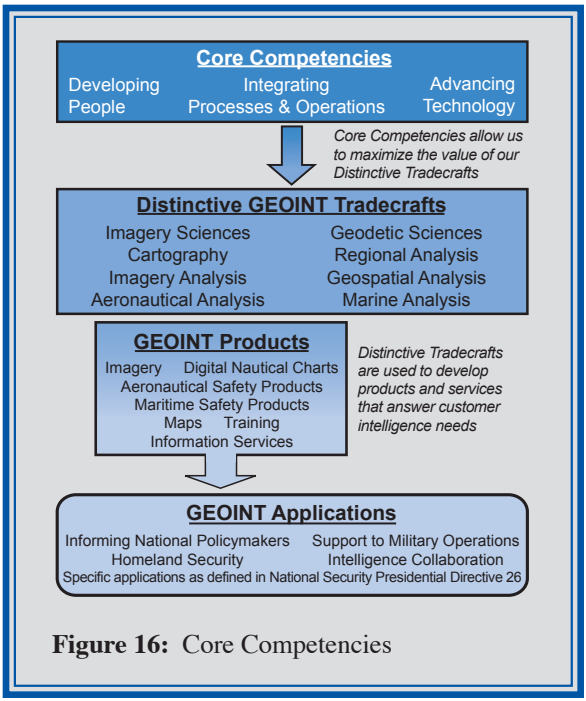

Figure 16: Core Competencies

knowledge to meet current and future mission requirements. They empower and motivate their personnel to instill a climate of professionalism, and offer an exciting and challenging environment in service to the nation. Additionally, the NSG seeks to develop future leaders and prepare them to meet the dynamic operational environment that promises to emerge as the twenty-first century progresses.

Integrating Processes and Operations. The NSG continually seeks to develop seamless, efficient, and effective processes and operations, in order to maximize the value of GEOINT to its customers. Effective integration requires more than just applying new technology to current problems. It requires a sound foundation of best business practices in the application of GEOINT capabilities against current challenges, and the vision to develop operational concepts to meet perceived future challenges. The NSG integrates processes and operations both vertically, along functional lines, and horizontally, across functional boundaries. Its unique structure enables its partner organizations to integrate processes and operations vertically and horizontally, using a myriad of commercial and proprietary sources and across varied intelligence production organizations, to develop a wide range of products for a diverse customer base. The operational efficiencies realized through integration, in particular through horizontal integration, are key in answering the increasingly dynamic intelligence challenges faced in the current operational environment.

Advancing Technology. Advances in digital technology allow the intelligence and defense communities to realize the true power and potential of GEOINT. NGA and the NSG are leading the application of geospatial and imagery sciences while continuously expanding the nation's information edge. The NSG works to incorporate new technologies quickly and spirally develop emerging technologies to enhance operational performance across the enterprise. An ever-expanding range of data sources and sensors, such as the UAV, is assisting intelligence producers in providing a new dimension of knowledge to their customers. Increasingly, NSG partners and customers will operate in an all-digital environment, facilitating multi-disciplinary intelligence collaboration and dynamic response to customer needs. The rapid

advance of digital processing capabilities is revolutionizing the ability to respond to the needs of customers in an emerging network-centric environment.

Figure 17: UAV

The unique perspective and capabilities GEOINT professionals bring to the Intelligence Community and the national security establishment are the ultimate source of value to customers. By focusing on the tenets that underlie this profession and the core competencies that drive strategies, value is added to the unique services provided to customers through the analysis and production of GEOINT. This ensures the highest quality of analysis and production methodologies. Through thoughtful and adaptive applications of analytic services against current and future intelligence requirements, GEOINT remains responsive, accurate, and relevant across the full spectrum of national security challenges. This guarantees that the NSG will continue its success in meeting a wide range of intelligence needs from its diverse customer base.

CHAPTER FOUR

TRANSFORMING TO MEET TOMORROW'S CHALLENGES

> Power is increasingly defined not by mass or size but by mobility and swiftness. ...This revolution perfectly matches the strength of our country, the skill of our people, and the superiority of our technology.
>
> President George W. Bush

Today the United States faces the challenges of terrorism, drug trafficking, ethnic and social strife, sectarian conflict, regional instability, transnational crime, the proliferation of weapons of mass destruction, humanitarian assistance, environmental disaster and relief, peacekeeping, peacemaking, and issues of economic globalization that strain the viability of long-practiced approaches to intelligence production. As a result, the U.S. can no longer predict with confidence the nations, combination of nations, or non-state actors that pose threats to its interests, allies, and friends. To mitigate uncertainty, the United States is transitioning from a requirements-based approach to force planning to a capabilities-based approach. Such an approach is centered on the concept of full spectrum dominance outlined in *Joint Vision 2020*.

> A capabilities-based approach focuses more on how the US can defeat a broad array of capabilities that any adversary may employ rather than who the adversaries are and where they may engage joint forces and US interests.
>
> *Joint Operations Concepts*

TOMORROW'S OPERATING ENVIRONMENT

Full spectrum dominance (FSD) is based on the ability to sense, understand, decide, and act faster than any adversary in any situation.[20] FSD-based operations are centered around four operational concepts and two enabling concepts (See Box). Tomorrow's FSD environment will be joint, interagency, and multinational in nature while reflecting a variety of attributes to include: adaptable, decentralized, fully integrated, networked,

lethal, expeditionary, and designed around the ability to achieve decision superiority.[21] These attributes will enable the joint forces to organize, plan, conduct, and support actions consistent with the following core capabilities:[22]

JOINT VISION 2020

Full Spectrum Dominance (FSD): the ability to defeat any adversary or control any situation across the full range of military operations.

Operational Concepts	Enabling Concepts
Dominant maneuver	Information Superiority
Precision Engagement	Innovation
Focused logistics	
Full dimensional protection	

- Achieve common understanding of all dimensions of the battlespace
- Make joint decisions and take action through the joint force faster than the opponent
- Adapt in scope, scale, and method, as the situation requires
- Rapidly deploy portions of the joint force and immediately transition to execution
- Create and sustain continuous pressure through the battlespace
- Overcome any opponent with a combination of lethal and non-lethal means
- Support multiple simultaneous, distributed, and decentralized battles and campaigns
- Operate in an interagency and multinational context

The NSG recognizes this joint vision, the conceptual roadmap needed to get there, and the challenges that transformation poses for GEOINT.

GEOINT AT THE CROSSROADS

Through transformation, the NSG systematically addresses the complex array of intelligence demands levied upon GEOINT. Consistent with the drivers outlined in *Joint Vision 2020*, the

> Transformation is a process of change that involves developing new operational concepts, experimenting to determine which ones work and which do not, and implimenting those that do.
>
> *DOD Transformation Study Report*

future demands change to respond to rising customer expectations and demands to:

- Capitalize on the powerful growth in remote sensing capabilities
- Actively participate in the accelerating rate of technological change
- Contribute to operations anywhere and at anytime
- Operate within compressed planning, operating, and decision cycle times
- Provide focused knowledge on demand in a data-rich environment
- Fully integrate to form collaborative relationships within and outside the NSG
- Counter asymmetrical threats and mitigate surprise
- Concurrently monitor traditional threats, non-state actors, and rogue states
- Respond to an expanding consumer base

At the crossroads of today's challenges and tomorrow's expectations lies the promise of information dominance and, ultimately, GEOINT. Today, that promise is expressed through a series of visionary concepts that are maturing and shaping how GEOINT may be employed.

EMERGING GEOINT CONCEPTS

- **Elegant Intelligence**: The purposeful fusion of past and present knowledge into a context that supports actionable judgments about future events. This approach to intelligence correlation provides the basis for achieving two other complementary concepts that combine to achieve a level of reach (elegance) never before realized:
    - o Global foresight: the ability to anticipate events *before they* unfold
    - o Situational intent: the ability to comprehend events *as they* unfold
- **Full Spectrum Collection**: A strategy for collection that leverages a wide variety of remote sensors operating under, on, and above the surface of the Earth in support of GEOINT requirements.

- **Persistent Surveillance**: Collection that enables one or more remote sensors to observe a target or area of interest more frequently than changes commonly occur. This includes the integration of satellite, airborne, ground-based, as well as multi-disciplinary intelligence collection capabilities.

- **Universal Situational Awareness**: The idea that decision-makers should be able to quickly observe and assess an emerging situation anywhere in the world, at anytime using GEOINT. Specific orientations are graphically presented in the form of a Common Operating Picture or a more specific and tailorable user-defined information view.

Figure 18: Universal situational awareness

- **GEOINT Knowledge Base (GKB)**: The virtual repository for all GEOINT holdings (data, information, and knowledge) hosted by NGA. The GKB will provide the GEOINT framework for any mission-specific Common Operating Picture, by allowing selective fusion of tailored foundation and intelligence layers from the GKB.[23]

- **Dynamic Operations-Intelligence Database**: As customers plan and execute their missions, they need intelligence about their adversaries placed in the context of their operational assets. The concept of a dynamic operations-intelligence database enables a fully integrated operations and intelligence view, built on the GKB, necessary for responsive action within an uncertain environment.

- **Horizontal Integration**: GEOINT is most useful when it is part of a coordinated, collaborative, and highly interoperable system of multiple disciplines and skills that provides the

foundation on which all other intelligence rests. It is an analytical methodology focused intently on intelligence problems as part of a national solution.

- **Customer Value Adding**: In customer value adding, NSG partners or customers themselves provide new details, corrections, or updates to the geospatial database to improve content already provided or to keep pace with dynamic events and rapid changes in the environment. In value adding, customers become partners with the originator in improving and updating the product.

- **All-digital Operating Environment**: The requirement that GEOINT transition from a paper-centric environment to a layered data-rich network-centric environment that effectively integrates networks, databases, systems, and applications so that content can be retrieved, manipulated, displayed, and delivered electronically. The content must be structured so that it allows intuitive knowledge transfer, shared situational awareness, and, in turn, actionable intelligence. Hardcopy, as required, can be generated at or near the site of need from digital renderings of content.

Figure 19: All-digital operating environment

- **Ubiquitous Access to Appropriate Data**: The seamless and secure access to GEOINT data and services from virtually anywhere, at anytime. This shifts the focus from product delivery to the delivery of on-line real-time intelligence and information services. These services would provide consumers the content they need, when they need it, at a location of their choosing.

- **Next-Generation Analytical Tools**: Tools that process data upstream from the analyst while concurrently enabling a host of functions at the analysts' and customers' workstations. These tools monitor disparate sources of collection, cross-cueing, and tipoffs, engage in change detection, and assist in target recognition, tag data for prioritized exploitation, extract surfaces and features, recognize events, and facilitate moving target intelligence. Such tools will build information views from Mission-Specific Data (MSD) needs of the warfighter, policymaker, or first responder.

Emerging GEOINT concepts provide windows into the future and suggest a means to overcome the ever-increasing *volume* of data, the widening *variety* of collection sources, and the unparalleled *velocity* of requirements that the Intelligence Community faces. Based on these concepts and other promising ideas still under consideration, the NSG is exploring and synchronizing the development of next-generation technologies and work roles that directly stimulate global foresight and situational insight.

ENVISIONING TOMORROW, TODAY

Today, GEOINT data can be divided into two basic categories: a foundation layer and an intelligence layer.[24] The foundation layer includes topographic features, imagery of fixed features or facilities, and elevation and terrain data—essential features that rarely change or change slowly. The intelligence layer contains a variety of other themes to include weather, safety of navigation, order of battle, intelligence reports, and multi-disciplinary intelligence features that can be very dynamic. To comprehend how the NSG

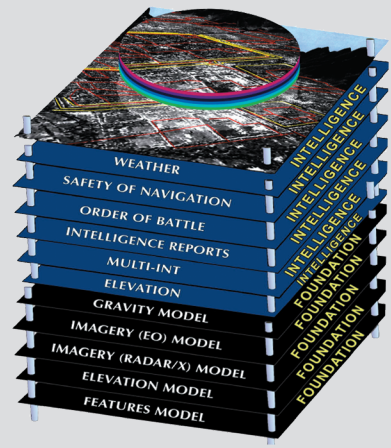

Figure 20: The GKB

can incorporate both layers to create GEOINT products, NGA introduced the concept of the GEOINT Knowledge Base (GKB). In the GKB, the foundation layer provides a spatially referenced baseline. It consists of several geospatial models each representing unique aspects of the Earth's surface and each systematically refreshed. As currently conceived, the foundation layer will include at least five Earth reference models: terrain elevation, imagery, feature, gravity, and potentially others such as geophysical and spectral models.[25] Analysts throughout the NSG could use this baseline to establish thresholds for registering and cueing changes. They could then overlay it with tailored and constantly updated intelligence layers and their own mission-specific layers to enable further in-depth analysis. The GKB forms the framework for any mission-specific Common Operating Picture.

In the future, GEOINT will continue to play a fundamental role in the emerging multi-disciplinary, all-source intelligence environment. This fully collaborative construct envisions the GKB as a major component of a universal operations-intelligence database that would one day provide access to virtually all information available from persistent surveillance and comprehensive collection.[26] This database would be at the heart of an innovative set of tools that could transform the Intelligence Community into a dynamic, agile, fully integrated enterprise capable of near-instantaneous information sharing, merging, and distribution. Information in the operations-intelligence database would be organized and tagged according to a number of common frameworks such as time, geospatial location, electromagnetic spectrum, cyberspace, or topic. Every data set would be tagged to one or more of the frameworks and cross-referenced to subject areas standardized throughout the Intelligence Community.[27] Applying advanced retrieval and collaboration tools to the operations-intelligence database will streamline analytical tasks, allowing analysts to focus on the most challenging problems. This capability would permit analysts to access information tailored to their specific problem-solving needs through an "information view."

An information view is a highly responsive, highly adaptable Common Operating Picture.[28] Each information view would contain the content desired by the customer to meet the specific

mission planning or execution information requirements for which the view is designed. Information views will be designed to present information and intelligence in any combination of textual, graphic, audio and video forms. Information views are not tied to a particular sensor architecture or collection discipline, but rather combine ALL relevant data from the operations-intelligence database and include real-time updates. Analysts could construct their information views so that they can cue collection from multiple sources, adjust change detection parameters, and respond to the specific needs of any customer. Decision-makers and warfighters would ultimately receive intelligence so compelling that they are able to anticipate events and respond with confidence.

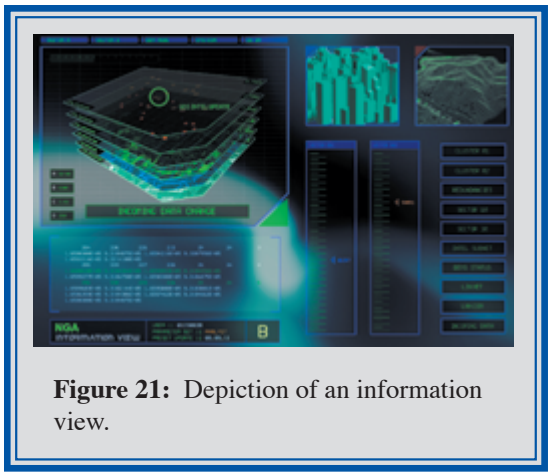

Figure 21: Depiction of an information view.

TRANSFORMATION AS A BRIDGE TO THE FUTURE

Built on solid foundations, the NSG is poised to lead the transformation of our nation's intelligence capabilities. To achieve such a vision, the NSG's transformation must deepen and broaden the NSG's analytic expertise, allow the NSG to operate more collaboratively, and facilitate wider sharing of its knowledge.

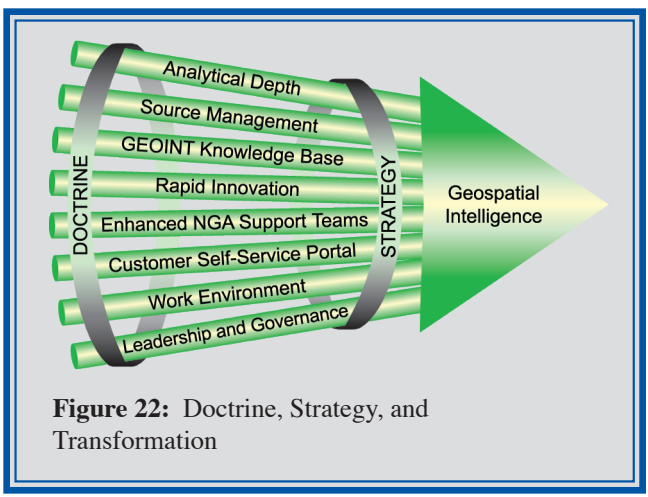

Figure 22: Doctrine, Strategy, and Transformation

Today, NGA is leading change in the NSG community by setting a transformation example. NGA is integrating its legacy cultures, establishing agile reach back capabilities for its deployed personnel, and transitioning to an enterprise operating framework that will serve as a springboard for many of these concepts. Through its corporate business plan, an instrument of strategy, NGA has charted a course that will better position itself within NSG to achieve the level of information dominance needed for its customers to succeed in tomorrow's FSD environment. The implementation is underway within NGA and over time will affect NSG's doctrine, organization, training, materiel, leadership and education, personnel, and facilities. By describing how to train, plan, procure, organize, and, ultimately, employ geospatial intelligence, doctrine helps guide the community's transformational strategy. Doctrine helps show the way while shaping thinking consistent with the changing context of the environment and our profession.

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EPILOGUE

The doctrinal maxims of this document are based on experience and shared beliefs of the professionals within the NSG. *Geospatial Intelligence Basic Doctrine* is the capstone publication in the NSG doctrine hierarchy and the premier statement of principles that guides the employment and use of geospatial intelligence. This publication is not the complete or last word on GEOINT, but it is a work in progress. The nation must remain alert and receptive to the lessons of the past and technologies of the future that may alter how we do business. The best approach is an institutional commitment to learn from experience and to exploit relevant ideas and new technologies so we may be poised for the future.

As part of the ongoing transformation process, this publication will help communicate who we are and what we do—produce GEOINT. It will also help introduce the GEOINT discipline to the Intelligence Community and others. So far, GEOINT has demonstrated the power of fusing imagery and geospatial expertise to provide products that are greater than the sum of their parts. Using GEOINT is the first step in understanding the world – so we can Know the Earth and Show the Way.

GEOINT: A Force Multiplier – Saving Lives and Protecting the Nation

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GLOSSARY

Common Operating Picture (COP)- A single identical display of relevant information shared by more than one service or agency. A common operational picture facilitates collaborative planning and assists all echelons to achieve situational awareness. Also called COP. (DoD Dictionary)

Electro-optical (EO) imagery intelligence- Intelligence information derived from the optical monitoring of the electromagnetic spectrum from ultraviolet through infrared. (DoD Dictionary)

Foundation data- Specific information on essential features that change rarely or slowly, such as point positioning data, topographic features, elevation data, geodetic information, and safety of navigation data.

Foundation layer- See Geospatial Intelligence Knowledge Base (GKB).

Geodesy- The science concerned with determining the size and shape of the Earth, the Earth's external gravitational field, the locations of points above, on or under the Earth's surface, and, to a limited extent, the internal structure of the Earth. (Glossary of the Mapping Sciences, 1994)

Geographic information systems (GIS)- An orderly compilation of information about a specific geographic area. It includes the computer hardware and software needed to access, manipulate, analyze, and manage spatially defined data such as those derived from maps or remote sensing. (Manual of Photographic Interpretation, 2nd Ed., pg 35)

Geospatial information- Any information that is referenced to a location on the Earth.

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.

Geospatial Intelligence Knowledge Base (GKB)- An NGA data environment composed of two content layers. The first foundational layer consists or gravity, imagery, elevation, and features Earth reference models. The second intelligence layer includes themes such as weather, order of battle, intelligence reports, features, multi-intelligence, and elevation.

Geospatially referenced information- Data that is tagged (marked) with location (three dimensional position in space) and time. (Defense Science Board Task Force on NIMA, April 2000)

Hyperspectral imagery (HSI)- Imagery derived from subdividing the electromagnetic spectrum into very narrow bandwidths. These narrow bandwidths may be combined with, or subtracted from each other in various ways to form images useful in precise terrain or target analysis. (DoD Dictionary)

Imagery intelligence (IMINT)- The products of imagery and imagery interpretation processed for intelligence use. (Consumer's Guide to Intelligence, 1999)

Infrared imagery- A likeness or impression produced as a result of sensing electromagnetic radiations emitted or reflected from a given target surface in the infrared portion of the electromagnetic spectrum.

Intelligence layer- see Geospatial Intelligence Knowledge Base (GKB).

Interferometric Synthetic Aperture Radar (IFSAR)- The technique used to generate height difference information of the Earth's surface by observing a location from two separate positions with a synthetic aperture radar (SAR) sensor. (NASA)

Light Detection and Ranging (LIDAR)- An instrument capable of measuring distance and direction to an object by emitting timed pulses of light in a measured direction and converting to the equivalent distance the measured interval of time between when a pulse was emitted and when its echo was received.

Measurement and signature intelligence (MASINT)- Scientific and technical intelligence obtained by quantitative and qualitative analysis of data (metric, angle, spatial, wavelength, time dependence, modulation, plasma, and hydro-magnetic) derived from specific technical sensors for the purpose of identifying any distinctive features associated with the target, source, emitter, or sender. (DoD Dictionary)

Mensuration- The act, art, or process of measuring. (Glossary of the Mapping Sciences, 1994)

Mission Specific Data- Mission specific data consists of intensified foundation data encompassing greater detail or additional features and/or attributes to meet specific mission requirements. May also include the "tailoring" or analysis of available geospatial information to support the information needs of a decision maker.

Multispectral imagery (MSI)- The image of an object obtained simultaneously in a number of discrete spectral bands. (DoD Dictionary)

National System for Geospatial Intelligence (NSG)- The integration of technology, policies, capabilities, and doctrine necessary to conduct geospatial intelligence in a multi-intelligence environment.

Photo interpretation- The act of examining photographic images for the purpose of identifying objects and judging their significance. (American Society of Photogrammetry)

Remote sensing- Acquiring information about an object or target using a recording device that is not in physical proximity with the object under study.

Spatial data- Synonymous with geospatial data and geospatial information.

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[14] Peter S. Usowski, "The Craft and Evolution of Imagery Intelligence," *Geospatial Intelligence Review* (July 2002): 6.
[15] Colwell, 46.
[16] Ibid, 25.
[17] John D. Bossler, "Introduction," in *Manual of Geospatial Science and Technology*, Eds. John D. Bossler and others (London: Taylor & Francis, 2001), 6.
[18] Mapping, Charting, and Geodesy (MC&G) has been replaced by the term Geospatial Information & Services (GI&S). However, MC&G is still the more commonly used term.
[19] Adapted from C.K. Prahad and Gary Hamel, "The Core Competencies of the Corporation", *Harvard Business Revew* 68 (May - June 1990): 79-91.
[20] Ibid. 9-10.
[21] Ibid. 9-10.
[22] Ibid. 11-14.
[23] NIMA, GEOINT, Cornerstone of Information Dominance, 6-15.
[24] Ibid, 6.
[25] Transformation Memo, 2.
[26] NIMA GEOINT, Cornerstone of Information Dominance, 8.
[27] Ibid. 9.
[28] Ibid. 10.

APPENDIX

ADMINISTRATIVE INSTRUCTIONS

1. USER Comments

Users in the field are highly encouraged to submit comments or feedback on this publication to the NGA Doctrine Office (NGA/OGMP).

2. Authorship

The lead agent for this publication is the NGA. A special thanks to the NGA doctrine development team (Lt Col Lacy Ingram, Jr., Ms. Diana Hughes, Mr. Ted Barco, Mr. Dennis Ebersole, and Ms. Wendy Walbrun) and the United States Air Force Doctrine Center.

3. Distribution

Additional copies of this publication can be obtained through Service and Organization publication centers.

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