Office of Geospatial-Intelligence Management

National System for Geospatial Intelligence

Geospatial Intelligence (GEOINT) Basic Doctrine

Publication 1-0

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NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

Functional Manager's Message

It is a tremendous honor and privilege to begin my tenure as the Director of the National Geospatial-Intelligence Agency (NGA) and Functional Manager of the National System of Geospatial Intelligence (NSG). I am an avid believer in the power of GEOINT and the benefits that are derived by working jointly to help our nation's decision-makers and warfighters address critical intelligence challenges. Accordingly, I fully support and endorse the NSG GEOINT Basic Doctrine Publication 1-0.

In response to comments from GEOINT users and producers, Publication 1-0 replaces the 2004 Publication 1.0 and provides a more comprehensive description of GEOINT and GEOINT products, systems, and capabilities. Further, a major effort was made to make the document more "reader friendly" by discussing all aspects of GEOINT in layman's terms. A key change is the inclusion of a chapter that discusses the roles and responsibilities of NGA and a description of NSG members and partners.

By working together, we will build on past accomplishments and lessons learned to ensure that we may continue to provide GEOINT on which our national leaders, military, and other valued customers depend. This will ensure even greater security for our nation and our allies.

Robert B. Murrett
Vice Admiral, U.S. Navy
National System for Geospatial Intelligence
Functional Manager

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PURPOSE

The Director of the National Geospatial-Intelligence Agency (D/NGA) serves as the Functional Manager for geospatial intelligence (GEOINT), in accordance with applicable laws, DNI and Department of Defense directives, guidance, and agreements. The National System for Geospatial Intelligence Directive (NSGD) FM 1100 *Roles and Responsibilities of the Functional Manager of the National System for Geospatial Intelligence (NSG) and the Establishment of the NSG*, establishes the NSG and the D/NGA's role as the Functional Manager of the NSG for the purpose of executing the functional management of policy, programs, and organizations.

This publication was prepared under the auspices of the D/NGA. In his role as Functional Manager for both GEOINT and NSG, the D/NGA is referred to as the FM/NSG. The FM/NSG leads the development of GEOINT doctrine to inform and guide NSG activities and interaction with the Department of Defense (DoD), Intelligence Community (IC), civil agencies, and interagency operations. This publication complements doctrine, tactics, techniques, and procedures and guidance outlined in the Joint Publication *Geospatial Intelligence (GEOINT) Support to Joint Operations*, and is intended to provide decision makers, commanders, intelligence users and producers, and civil authorities with a better understanding of GEOINT in order to effectively execute assigned missions.

INTELLIGENCE REFORM & TERRORISM PREVENTION ACT OF 2004

The IC is undergoing organizational and functional changes in response to the Intelligence Reform and Terrorism Prevention Act of 2004. One major change is the establishment of the Office of the Director of National Intelligence (ODNI). The Director of National Intelligence (DNI) is developing Intelligence Community Directives (ICDs) to replace Director, Central Intelligence Directives. ICDs will have a significant impact upon overall IC authorities and budgetary relationships. As ICDs become available, the impact on NSG members and relationships will be assessed and this document will be updated accordingly.

APPLICATION

This publication complements GEOINT doctrine and guidance as it applies to the NSG. It also expands on existing directives, and capitalizes on shared knowledge and understandings to enhance the use of GEOINT in support of assigned missions.

SCOPE

Geospatial Intelligence Basic Doctrine 1-0 supersedes GEOINT Publication 1.0, dated June 2004. It presents an overview of GEOINT, describes the NSG, and summarizes the roles of its members.

EXECUTIVE SUMMARY

This document describes and defines geospatial intelligence (GEOINT) and the National System for Geospatial Intelligence (NSG). The Director of NGA (D/NGA) serves as functional manager for both GEOINT and the NSG. Hereinafter, when referring to the D/NGA as functional manager of the NSG and/or GEOINT, the term FM/NSG will be used.

Title 10 U.S. Code §467 establishes the definition of GEOINT. This document serves as a framework for understanding GEOINT and provides the background necessary for customers to fully leverage GEOINT. The document also provides an overview of the FM/NSG role in leadership, guidance and functional management of GEOINT — as defined in DoD Directive Number 5105.60, Director of Central Intelligence Directive 1/8 and DNI Memorandum E/S 00245 — as well as roles and contributions of the constituent members of the NSG Community.

The NSG is the combination of technologies, policies, capabilities, doctrine, activities, people, data and communities needed to produce geospatial intelligence in an integrated, multi-intelligence, multi-domain environment. The NSG Community consists of Members of the Intelligence Community (IC), Joint Staff, Military Departments (to include Services), and Combatant Commands (COCOMs). NSG Partners include Civil Applications Committee members, International Partners, Industry, Academia, Defense Service Providers, and Civil Community Service Providers.

GEOINT Definition:

The term "geospatial intelligence" means- " the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the Earth. GEOINT consists of imagery, imagery intelligence, and geospatial information." Title 10 U.S. Code §467

The term GEOINT was created to describe and encompass both the standard and the advanced (integrated) capabilities of imagery, imagery intelligence and geospatial information. The full power of GEOINT comes from the integration and analysis of all three capabilities, which results in more comprehensive, tailored intelligence products for a wider scope of problems and customers. For example, GEOINT can incorporate advanced technology to create dynamic, interactive products such as realistic mission simulations that help determine the effects of speed, currents, tides, wind, daylight, etc. on a mission or intelligence problem. These products might be virtual fly-through and walk-through mission scenarios or interactive maps.

GEOINT can also create a Common Operational Picture (COP) of a specific area by effectively using multiple and advanced sensors, multiple types of data and information (including operations, planning, logistics, etc), as well as multiple intelligence disciplines (INTs) to present a comprehensive visual depiction. This capability provides many advantages for the warfighter, national security policymakers, homeland security personnel, and IC collaborators by precisely locating activities and objects, assessing and discerning the meaning of events, and providing context for decision makers.

In short, GEOINT provides innovative, versatile solutions for meeting today's demanding intelligence requirements and predicting tomorrow's future threat environment.
Publication 1-0 is a high-level guidebook that provides an overview and description of GEOINT. Follow-on keystone-level publications will describe GEOINT operations in more detail. This publication contains five chapters, which are briefly described below.

Chapter One - WHAT IS GEOINT?: Chapter 1 describes the four components of GEOINT: The GEOINT discipline, the data from which GEOINT is derived, the primary analytic process used to create predictive GEOINT, and the products resulting from GEOINT.

Chapter Two - GEOINT SYSTEMS: Chapter 2 addresses GEOINT systems including data collection systems and end-to-end support systems. Section A provides an overview of national, commercial and airborne collection systems and a description of the spectral imagery, motion imagery, active sensing technology, and geophysical sensors used on those systems. Section B discusses systems for collection requirements management, exploitation/production management, exploitation workstation and toolsets, map replication, dissemination, and storage.

Chapter Three - GEOINT CAPABILITIES: Chapter 3 describes how GEOINT has enhanced standard capabilities of geospatial data and products by expanding the use of different types of sensors, intelligence sources, and tools. GEOINT capabilities include: use of multiple sensors and advanced sensors; integration of multiple INTs; expanded visualization features; enhanced precision and detail; and improved on-demand global access. Examples for each of the capabilities are provided throughout the chapter.

Chapter Four - GEOINT MISSION SUPPORT: Chapter 4 outlines the ways in which GEOINT supports key missions related to the national security of the United States. The primary missions are: informing policymakers; supporting military operations, intelligence operations, and homeland security (including support to disaster relief operations); and facilitating intelligence collaboration.

Chapter Five - THE NATIONAL SYSTEM FOR GEOSPATIAL INTELLIGENCE (NSG): The final chapter discusses the NSG, its leadership, and the NSG Community. The section identifies members and partners that comprise the NSG Community and outlines the GEOINT roles of the IC, Joint Staff, Military Departments (to include Services), and COCOMs.

CHAPTER ONE: WHAT IS GEOINT?

OVERVIEW

GEOINT is an intelligence discipline and tradecraft that has evolved from the integration of imagery, imagery intelligence (IMINT), and geospatial information.

GEOINT elements:

- Imagery: A likeness or presentation of any natural or man-made feature or related object or activity and the positional data acquired at the same time the likeness or representation was acquired, including products produced by space-based national intelligence reconnaissance systems, and likenesses or presentations produced by satellites, airborne platforms, unmanned aerial vehicles, or other similar means (except that such term does not include handheld or clandestine photography taken by or on behalf of human intelligence collection organizations).

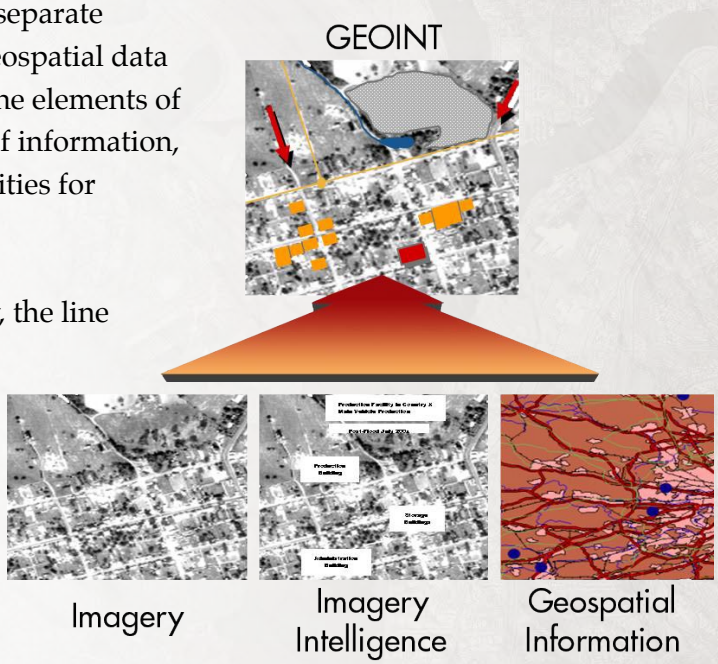
- Imagery Intelligence: The technical, geographic, and intelligence information derived through the interpretation or analysis of imagery and collateral materials.

- Geospatial Information: Information that 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.

Definitions from Title 10 U.S. Code §467

The basic capabilities and products of these three areas still exist as the foundation of GEOINT. However, imagery, imagery intelligence, and geospatial information are now considered to be three complementary elements of GEOINT, rather than separate entities. Advances in technology and the use of geospatial data have created the ability to integrate and/or combine elements of any or all of the areas, along with other elements of information, resulting in many new, more sophisticated capabilities for producing products and conducting analysis.

With the evolution of GEOINT and technology, the line between standard and specialized GEOINT is not clear-cut. While some of the following factors occasionally apply to standard GEOINT, they are more commonly associated with specialized GEOINT and may help distinguish between the two.



Specialized GEOINT Characteristics:

- incorporates intelligence analysis into all aspects
- uses multiple types of sensors and advanced sensor technology
- combines multiple types of geospatial data
- uses intelligence and data from other INTs to provide context
- adds more dimensions to standard geospatial products
  - 3rd Dimension: provides the capability to visualize in three dimensions (3D)
  - 4th Dimension: integrates the element of time and movement (allowing for realistic motion to create dynamic and interactive visual products)

GEOINT Components:

GEOINT may be considered to consist of four fundamental components:

A. The **discipline** of GEOINT
B. The **data** that comprise GEOINT
C. The **process** used to develop GEOINT products
D. The **products** derived from GEOINT

The following sections will discuss each of these components in detail.

Section A. THE GEOINT DISCIPLINE

GEOINT is a specialized field of practice within the broader profession of intelligence. The GEOINT discipline encompasses all activities involved in the planning, collection, processing, analysis, exploitation, and dissemination of spatial information in order to gain intelligence about the national security or operational environment, visually depict this knowledge, and fuse the acquired knowledge with other information through analysis and visualization processes.

Advanced technology now provides the capability to use and combine geospatial data in different ways to create interactive/dynamic, customized visual products. It allows the analyst to quickly make more complex connections between different types of data and information than previously possible. Geospatial products can now leverage a wider variety of data, including from other INTs (such as SIGINT, HUMINT, and MASINT), through collaborative processes, to provide more accurate, comprehensive, and relevant products. GEOINT can also be combined with other INTs, such as SIGINT, to develop custom products. The result of these advances is a transformation in the analytic and technical processes used to create geospatial products. It is the cumulative effect of all these changes that propelled the evolution of the GEOINT discipline.

The discipline of GEOINT encompasses more than systems, technology, and processes. The discipline is comprised of highly skilled professionals with a wide range of expertise. Collectively, they possess an advanced body of knowledge and operating principles developed over many years of

experience. These GEOINT professionals represent and are drawn from a wide range of occupations comprising the GEOINT tradecraft. GEOINT tradecraft is the application of skills, leadership, continuing education, mentoring, special experiences, and knowledge of GEOINT in one or more occupational specialties. However, each professional should be considered **a GEOINT analyst first and an expert in a specific occupational specialty second**.

GEOINT Tradecraft specialties include:

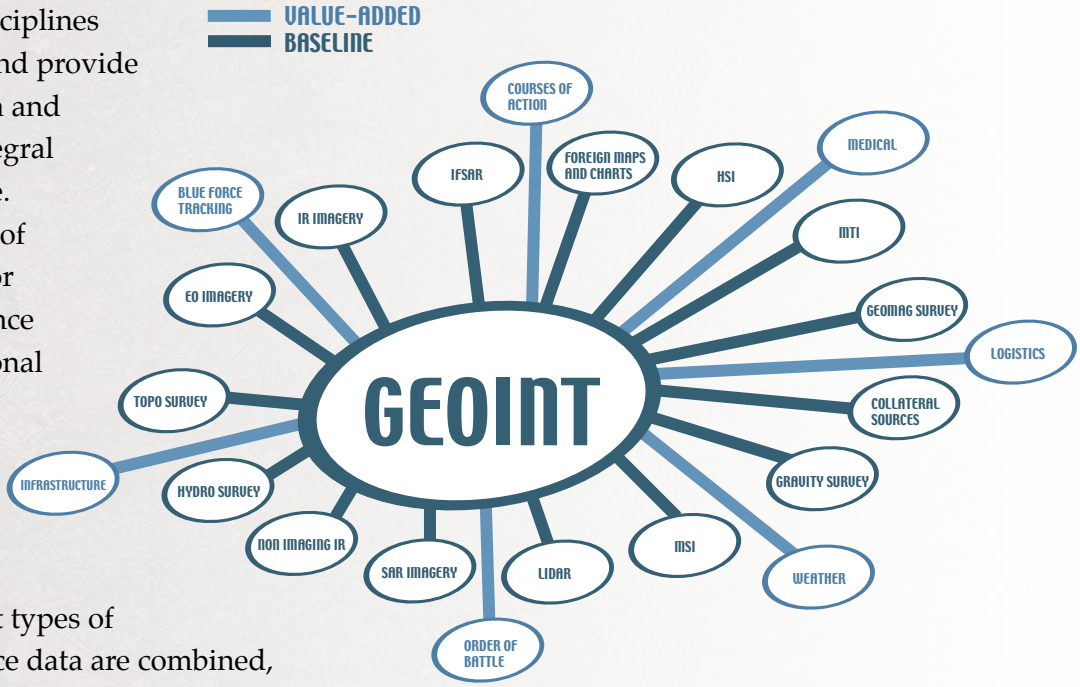
- **Aeronautical Analysis:** The science of developing specialized representations of mapped natural and man-made features of the Earth and supplemental metadata specifically to aid air navigation, pilotage, or planning air operations.
- **Cartography:** The art and science of making maps and charts.
- **Geodetic Sciences:** The sciences of geodesy and geophysics that deal with information or Earth data pertaining to gravity, point positioning, datums, etc.
- **Geospatial Analysis:** The science of extracting meaning from geospatial data and 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 science of converting information, extracted from imagery, into intelligence about activities, issues, objects, installations, and/or areas of interest.
- **Imagery Sciences:** The technical application of remote sensing towards the production of GEOINT products and services.
- **Marine Analysis:** The portrayal of specialized representations of oceanographic, hydrographic, bathymetric data, and supplemental metadata, required for maritime navigation, pilotage, or planning maritime operations.
- **Regional Analysis:** The geographic, geopolitical, or intelligence analysis of a particular country or area of the world.
- **Source Analysis:** Source analysts manage partner relationships, coordinate collection operations with mission partners or other disciplines, perform assessments of collection operations, and support information need brokering activities. Source analysts also proactively develop strategies to identify and deliver sources most helpful to analysts in order to answer specific intelligence problems.

Section B. GEOINT DATA

"GEOINT data" is not a new or special type of data. The term simply refers to any data used to create GEOINT, which can be derived from multiple classified or unclassified sources. Since geospatial data is the primary source for all three major elements of GEOINT—geospatial information, imagery, and imagery intelligence—it is considered the main source of data for GEOINT.

Just as other intelligence disciplines use GEOINT to develop a comprehensive response to an intelligence problem, the GEOINT discipline incorporates data from other intelligence disciplines, such as Human Intelligence (HUMINT), Signals Intelligence (SIGINT), Measurement and Signatures Intelligence (MASINT), and Open-Source Intelligence (OSINT).

These intelligence disciplines are used to corroborate and provide context to geospatial data and information; they are integral to the GEOINT discipline. The consideration or use of all types of intelligence, or multiple-source intelligence (multi-INT), adds additional perspective to ensure a more comprehensive geospatial-intelligence product. The full potential of GEOINT is realized when different types of geospatial and intelligence data are combined, analyzed using intelligence information, and/or integrated into a single geospatial product.



Multi –INT should not be confused with all-source intelligence conducted by other agencies in which all forms of intelligence are considered, fused, and analyzed in order to assess an intelligence problem or issue.

Multi-INT: The activities used to produce information of required accuracy, confidence level, timeliness and clarity not available through the use of single-INT methods.

Data Collection and Processing

Geospatial data is collected by a variety of methods, including systems, platforms, sensors, and other means. Systems, platforms, and sensors are described in the GEOINT Systems chapter of this document. This section will outline the roles of NSG organizations in the collection, processing, analysis, production, and dissemination of data.

The National Reconnaissance Office (NRO) manages all data collection from national satellite systems. NRO and NGA work jointly to process this data. Data collected at the theater and tactical levels by airborne collection systems and through other methods are managed by the military services and COCOMs. The Services and commands are responsible for providing this data to national-level databases. NGA is responsible for overall managing, disseminating, and archiving of data. Commercial and civil entities may also provide services for all phases of this process, as reflected in the chart.

GEOINT DATA PROCESS

Process	Responsible Organization
GEOINT Data Collection:	
-National Satellite	NRO & Commercial
-National Airborne	Government & Commercial
-Theater and Tactical	Services & Commands
GEOINT Data Processing:	
-National Satellite	NRO & NGA/Commercial
-National Airborne	NRO & NGA/Commercial
-Theater and Tactical	Services& Commands, NGA& NRO
GEOINT Data Management & Dissemination:	NGA/Commercial
GEOINT Data Analysis & Product Development	
-National Level:	NGA
-Other:	All NSG

Section C. THE GEOINT ANALYTIC PROCESS

As discussed in the overview, the technical processes used to create and support GEOINT will be described in follow-on, detailed keystone doctrine and technical publications. In this high-level capstone doctrine, only the analytic processes are addressed.

Geospatial products become analyzed GEOINT as a result of the intelligence analysis process. While many methodologies are used to create GEOINT, NGA has adapted one of the most common analytic methodologies for predictive analysis of some intelligence problems. The methodology is based upon – and can be used to support – the military's Joint Intelligence Preparation of the Battlespace (JIPB) process but was modified so that it may be used for non-military intelligence problems.

Given the logic and efficacy of the military analytic methodology so thoroughly documented in doctrine, field manuals, and service technical schools, [1] JIPB has been widely adapted for application across many problem sets including law enforcement, investigative work, and information operations. Geospatial Intelligence Preparation of the Environment (GPE) represents another adaptation, but remains closely aligned with the original military methodology.

[1] Army Field Manual 34-130, Intelligence Preparation of the Battlefield, dated July 1994 ; Army Field Manual 2-01.3, Intelligence Preparation of the Battlefield, draft dated July 2003; Marine Corps' Generic Information Requirements Handbook (GIRH), Dec 2002; National Training Center's Intelligence Preparation of the Battlefield With A Purpose, September 1997; Air Force White Paper entitled Intelligence Preparation of the Battlespace: An Airman's Introduction, dated February 1999 – all are examples of IPB manuals/texts used by the services.

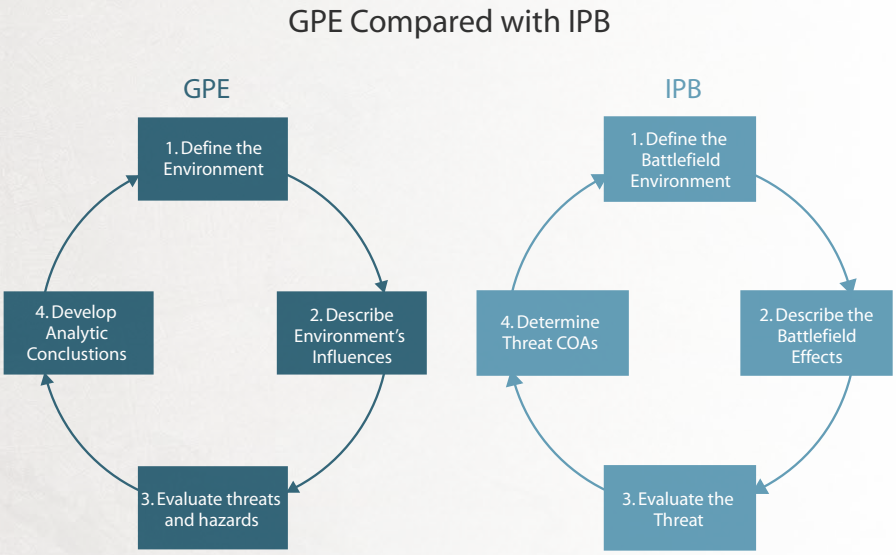
The process has been adapted to include civilian and other non-traditional threat problems. Thus, GPE may be used to aid analysis for military operations as well as non-battlefield actions such as national security special events (NSSE), disaster relief, noncombatant evacuations, and to respond to specific national security requirements. As examples, GPE can be used to support: an impending tactical military operation; a threat evaluation for the Olympics; tsunami relief; an evacuation of embassy personnel; recovery from domestic natural disasters, such as hurricanes and earthquakes; or to answer a question posed by the President.

GPE is a systematic, four-component process. [2] The components help ensure analysts consider all information; however, it is not a rigid checklist. GPE provides the analyst with template for use across the spectrum of intelligence problem sets. With those points in mind, the four components of GPE are described below.

[2] These components are referred to as "steps" in the JIPB process, though NGA uses components to indicate that the process is not necessarily linear.

Component 1: Define the Environment: Gather basic facts needed to outline the exact location of the mission or area of interest. Physical, political, and demographic boundaries must be determined. The data might include grid coordinates, latitude and longitude, vectors, altitudes, natural boundaries (mountain ranges, rivers), etc. This data serves as the foundation for the GEOINT product.

Component 2: Describe the Environment's Influence: Provide descriptive information about the area defined in Step 1. Identify existing natural conditions, infrastructure, and cultural factors. Consider all details that may affect a potential operation in the area: weather; vegetation; roads; facilities; population; language; and social, ethnic, religious, and political factors. Layer this information onto the foundation developed in Component 1.



Component 3: Evaluate Threats and Hazards: Add intelligence and threat data, drawn from multiple INTs, onto the foundation and descriptive information layers (the environment established in the first two steps). This information includes: order-of-battle; size and strength of enemy or threat; adversary doctrine; the nature, strength, capabilities, and intent of area insurgent groups; and possible chemical/biological effects. Component 3 requires collaboration with national security community counterparts.

Component 4: Develop Analytic Conclusions: Integrate all information from Components 1-3 to develop analytic conclusions. The emphasis is on developing predictive analytic conclusions. For example, the analyst may create models to determine likely next courses of action for the adversary, threat, or hazard and then assess the potential impact of those actions. In some cases, Component 4 could include an assessment of potential reactions to friendly operations. Of course, friendly operations and courses of action can also be analyzed and visualized by using GEOINT as a foundation.

Section D. GEOINT PRODUCTS

GEOINT products range from standard geospatial data-derived products, such as maps and imagery, to specialized products that incorporate data from multiple types of advanced sensors and use four dimensions.

GEOINT products usually incorporate intelligence analysis, such as the GPE process, to ensure that the most comprehensive product is developed. However, customers do not always require or want analyzed products. Almost any type of GEOINT product can be produced without using intelligence analysis (e.g. using GEOINT as a base for visualization activities such as a Common Operational Picture).

This section addresses types and categories of GEOINT products and explain the development process. It will also outline the evolution of GEOINT products.

PRODUCT TYPES: Standard & Specialized

GEOINT products are generally categorized as either standard or specialized. Both types of products are described below. Note that, due to the fact that GEOINT products are often tailored for specific needs, they do not always fall neatly into either category.

Standard Products: These include geospatial data-derived products such as maps, charts, imagery and digital raster or vector information. These products may be used alone or with many layers of additional data such as geographic data (vegetation, culture, languages, and weather) and intelligence information. Standard products are primarily derived from electro-optical sensors and existing geospatial data. They can also be derived from radar and multi-spectral sensors, but standard products do not routinely use these sources. The products are normally two-dimensional but can be processed into three-dimensional products, such as anaglyphs.

Standard products satisfy a significant portion of GEOINT requirements that would not benefit from the added capabilities of specialized products. Further, geospatial data and standard products are the foundation for development of specialized products. Thus, standard products will continue to comprise a large portion of GEOINT production.

EXAMPLES OF STANDARD PRODUCTS

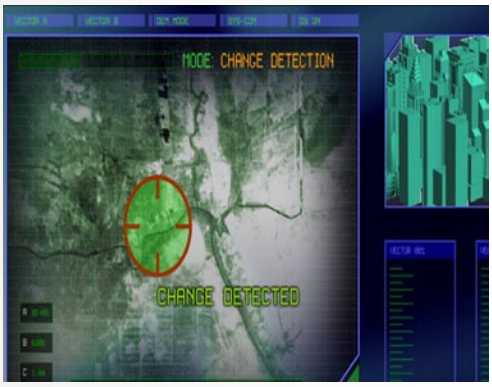
Electro-optical (EO) image

1. **Electro-optical (EO) image** of an area that has been attacked. It includes factual data on the location and number of vehicles and aircraft in the image.
   Analyzed EO image that uses the same factual data as above, but has been interpreted and analyzed, or has incorporated, other intelligence information to provide information on types of vehicles and aircraft activity as well as a battle damage assessment.

2. **Map** that shows information on the topography, infrastructure, vegetation, and enemy locations in an area of interest.
   Analyzed map for which the same map and information above is used; however the map has now been interpreted and analyzed or incorporated other intelligence information to show potential avenues for attack.

Specialized Products: Specialized products can provide additional capabilities to standard products to customize them for a specific purpose. The products may be developed using sophisticated technology to integrate multiple types of geospatial data as well as data from other INTs. The more unique characteristics of specialized products include the incorporation of data from more technically advanced sensors and the use of a fourth dimension – time. The element of time can be used for many purposes, such as introducing motion to create dynamic, interactive products.

These advanced features allow analysts to create a more comprehensive GEOINT product. Examples of specialized products include two-color, multi-view (2CMV), change detection, multi/hyper-spectral, and tailored products such as line-of-sight and fly-through scenarios.



Two color multi-view, change detection

EXAMPLES OF SPECIALIZED PRODUCTS

1. **2CMV image** - shows aircraft parked on an airfield. A simple assessment indicates that two aircraft have departed since the previous day.
   Analyzed 2CMV - same image and information from above, with the addition of an intelligence assessment on: 1) the reason for departure and 2) the known or suspected destination of the departed aircraft. The assessment also notes other significant changes in levels of activity at the airfield.

2. **Unanalyzed 3D fly-through** - shows factual information in three dimensions such as buildings, streets, and topography of an area.

Analyzed 3D fly-through - the same fly-through and information used above that has been interpreted or analyzed and/or combined with intelligence data derived from photos taken by a HUMINT source that show precise details on buildings that might affect collection. It also includes intelligence data from SIGINT, HUMINT, OSINT and MASINT sources that show enemy and threat locations. The simulation allows predictions on where the enemy may be located.

3-D Mission Simulation

GEOINT PRODUCT CATEGORIES & SERVICES

Product Categories

Both standard and specialized GEOINT products fall into seven general categories:

- Aeronautical:
  - Examples - Flight Information Publications (FLIP), Aeronautical Charts & Graphs, Digital Aeronautical Flight Information Files (DAFIF), Digital Vertical Obstruction File (DVOF), and mission fly-throughs.

- Nautical/Hydrographic:
  - Examples - Bathymetric Navigation Plan Chart (BNPC), Notice to Mariners, Nautical Charts, Digital Nautical Chart (DNC) and Littoral Charts.

- Topographical /Terrestrial
  - Examples - Controlled Image Database (CIB), Image City Maps (ICM), Digital Terrain Elevation Data (DTED), Escape and Evasion Charts, Topographic Line Maps (TLM), and mission walk-throughs.

- Precise Positioning & Targeting
  - Examples - Precise Point Mensurated Graphics (PPMG) and Digital Point Positioning Database (DPPDB).

- Geodesy & Geophysics
  - Examples - GPS Precise Ephemeris, Earth Gravity Model '96 (EGM96) and World Geodetic System (WGS).

- Geographic Names
  - Examples - NGA Board on Geographic Names (BGN) Romanization Guide, GEOnet Names Server Reference Source and Gazetteers.

- GEOINT Analysis
  - Examples - NGA Intelligence Briefs, NGA Highlight Cables, First Looks, Imagery Reports

This product category list is helpful in understanding the many uses for which GEOINT products are developed. However, it is important to note that many standard products do not fall solely into one area, and most specialized products are hybrid products that integrate data and information from more than one of these areas.

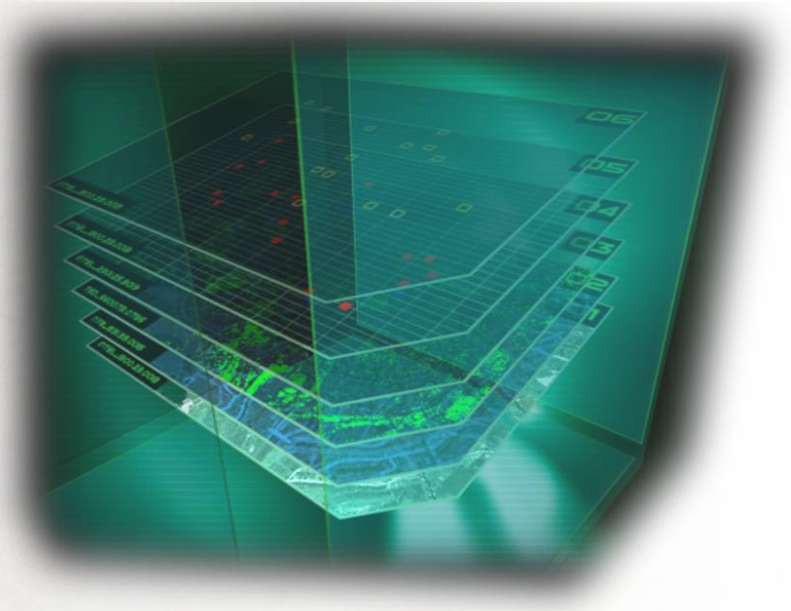
GEOINT products are often developed through a process known as "value added," in which both the producer and the user of GEOINT update a database or product with current information. Human collectors are a key component of this process. This newly-identified data is usually referred to as "feature data." New roads, lines of communication, obstacles, changes in terrain, and seismic activity are examples of activities that require updating due to frequent changes in the area of interest. For example, organic assets, such as Special Operations and Topographic units, use NGA products and then add tactical data of special interest for use by local commanders and operators. This specialized data shall be centrally stored and catalogued. Because of its temporal aspects, this specialized data should be shared and reviewed periodically and either updated or purged.

GEOINT Services

GEOINT services that support the generation, management, and use of GEOINT data and products are essential to an effective NSG. The services include tools that enable both users and producers to access and manipulate data. Examples of GEOINT services are instruction, training, laboratory support, and guidance for the use of geospatial data. Geodetic surveys, software development, tailored geodetic and geophysical products and services to support weapons systems, the calculation of precise locations for targeting of precision guided munitions, training, and on-site technical support are all types of GEOINT services.

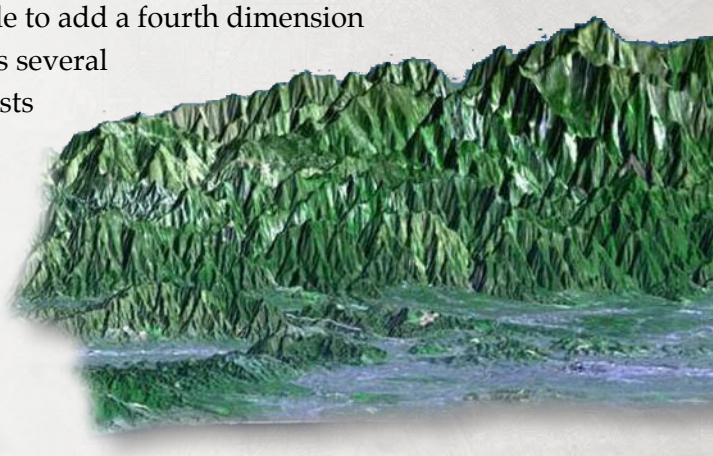
PRODUCT DEVELOPMENT

The initial development process is the same for both standard and specialized GEOINT products. The analyst begins with the foundation of a flat graphic, such as a map, chart, image, or digital representation of the area of interest, or attributed geospatial feature data. Multiple types of geospatial data and information are overlaid onto the foundation to depict visually the natural and man-made characteristics and features of that area. Intelligence information is then overlaid on the graphic for a complete, 2D picture of the area or problem.



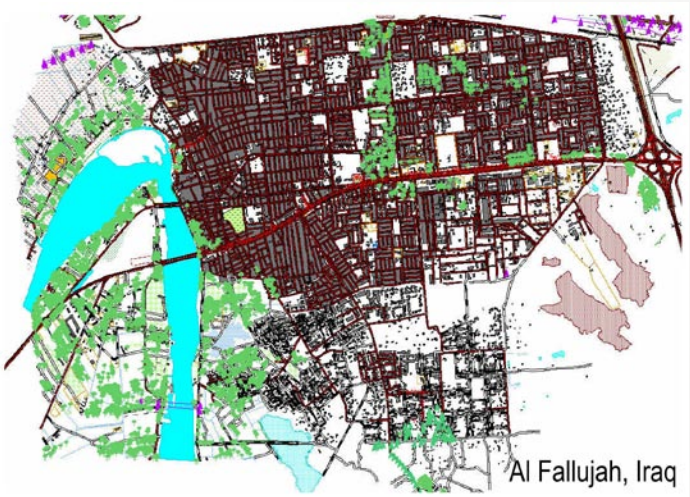
For decades, analysts have used these graphics and layered information to create three-dimensional (3D) models by hand. These 3D models provided a more accurate picture; however, they were time- and labor-intensive to build and thus were usually made only in special circumstances or for a specific purpose. As technology advanced, it became much easier and more practical to create 3D graphics and the routine use of these models has increased accordingly.

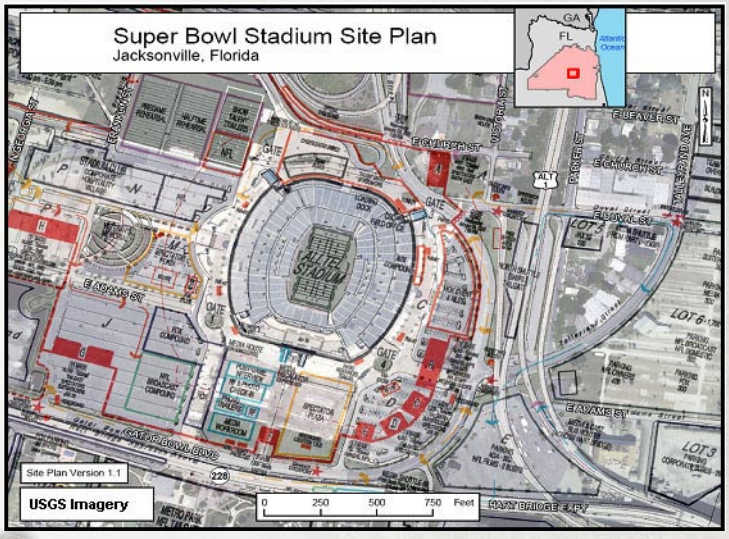
In recent years, technological advances have made it possible to add a fourth dimension to these 3D geospatial products: time. This dimension provides several capabilities. First, it adds motion to a 3D image, enabling analysts to create dynamic, interactive products. This provides the warfighter and intelligence analyst with a more realistic picture of the threat or mission environment, including the effects of factors such as speed, tides, direction, wind, and changing daylight. Second, it is easier to integrate information from other intelligence sources for a more comprehensive picture. Third, the element of time serves as another tool to support predictive analysis.

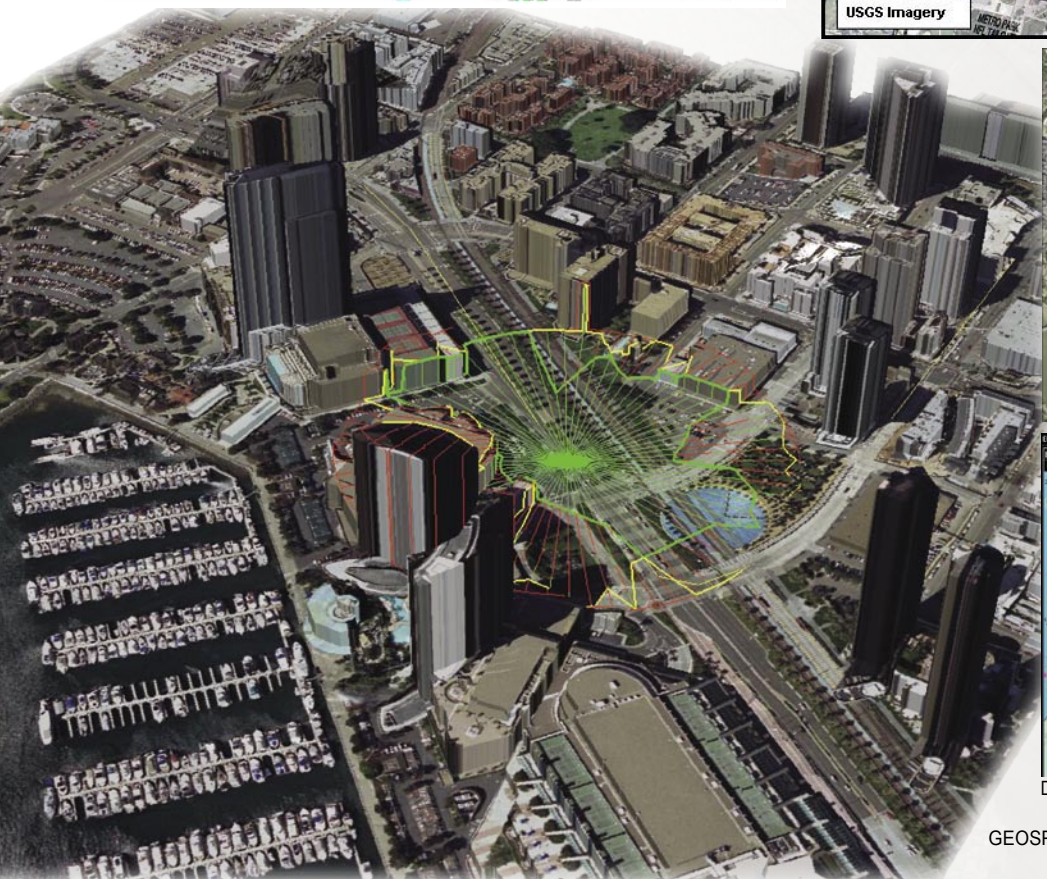


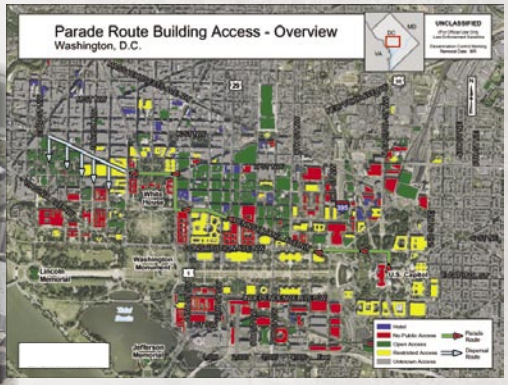
Thus, GEOINT products reflect an evolution of technological capabilities, proliferation of information sources, and advances in analytic techniques.

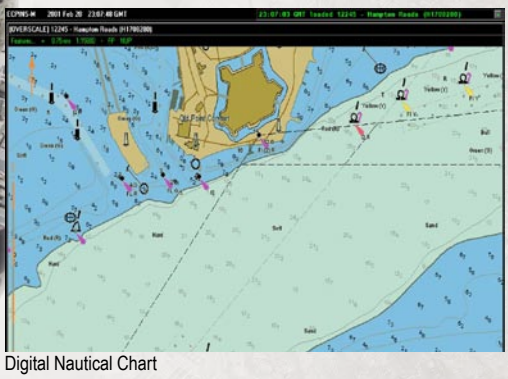
GEOINT Product Examples











Digital Nautical Chart

CHAPTER TWO: GEOINT SYSTEMS

A wide range of systems are used for GEOINT. In this chapter, for the purpose of discussion, the systems are split into two broad categories: A. data collection systems, which include two major types of collection platforms and a robust array of sensors; and B. end-to-end GEOINT support systems, which include systems for collection requirements management, exploitation/production management, exploitation workstation and toolsets, map replication, dissemination, and storage. While this chapter only addresses technical systems, it should be noted that human collectors of GEOINT also provide significant information and are increasingly important to the collection process.

Section A. DATA COLLECTION SYSTEMS

The evolution to GEOINT was primarily driven by the development and use of sophisticated, advanced sensors, as well as the ability to use multiple sensors simultaneously.

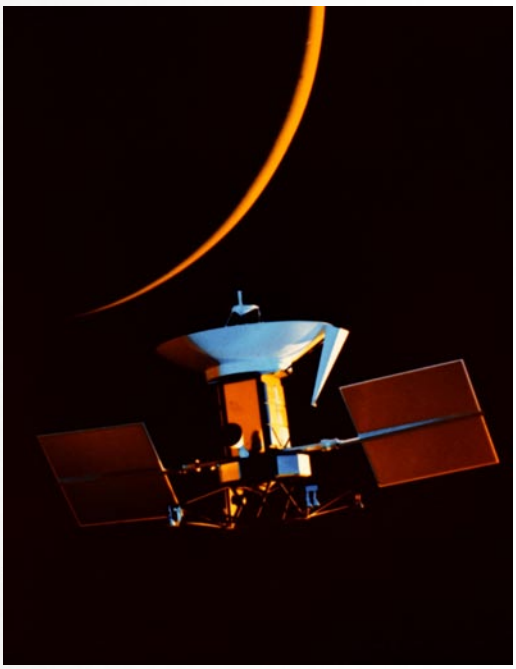
GEOINT unites a broad range of evolving and emerging remote sensing capabilities including standard imagery systems; sources associated with gravimetric, geomagnetic, and hydrographic surveying data; and advanced sensors that provide hyperspectral, polarimetric, enhanced gravimetric, and high-definition data. There are two major categories of systems that carry sensors used to collect data for GEOINT: satellite and airborne. Those systems and the range of sensors they carry are described below.

SATELLITE AND AIRBORNE SYSTEMS

As discussed in the GEOINT Data section in Chapter One, GEOINT can be derived from multiple types of geospatial data. The majority of this data comes from sensors on satellite and airborne collection systems that are described below:

SATELLITE SYSTEMS

National Systems: Developed by the NRO in coordination with elements of the NSG, as appropriate, national systems are a primary source of imagery used to produce GEOINT.



Commercial/Civil Systems: These systems can provide a range of information and products for NSG requirements. Commercially available imagery and geospatial information are becoming more widely used, as the NSG Community 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. national reconnaissance systems. However, there are many situations in which commercial/civil systems cannot be used.

AIRBORNE SYSTEMS

Government Systems: Normally operated, controlled, and managed at the theater and tactical level, Airborne Intelligence Surveillance Reconnaissance (ISR) assets provide a critical GEOINT source. Unmanned aerial vehicles such as the Global Hawk, Predator or smaller tactical vehicles are increasingly important as their ability to remain airborne for long periods of time contributes to persistent surveillance capabilities.

Commercial Systems: These systems provide yet another source of GEOINT. Due to their flexibility and resolution capabilities, commercial airborne collectors are increasingly relied upon to augment satellite collection. For example, commercial airborne imagery systems are used for planning support to NSSE's like the Olympics and national political conventions.

SENSORS

Often, the first step in developing GEOINT is remote sensing, which is defined as "acquiring information about an object or target using a device that is not in physical proximity with the object under study." Remote sensing occurs through an interaction between some form of electromagnetic energy (natural or man-made) and objects and phenomena on or above the earth or below the earth's surface. Remote sensors can employ a number of technologies including electronic, optical, electro-optical, chemical, or mechanical systems, either individually or in combination. The information can be recorded or analyzed in either imagery or non-imagery formats using digital or analog means.

Satellite and airborne systems can be configured to carry a variety of sensors that provide GEOINT data. This data can be used to support national defense, environmental monitoring, land use planning, site surveys, etc. Outlined below are brief descriptions of sensor capabilities.

Still Imagery

Still imagery is collected throughout the electromagnetic spectrum from the ultraviolet to the radar (microwave). Below are examples of certain types of imagery that can provide analysts with representations of specific areas or objects at varying levels of detail.

- **Panchromatic imagery (Visible)** can be thought of as a black and white picture. It renders literal depictions and scenes. Panochromatic imagery has been the mainstay of IMINT for years and continues to be an important source of GEOINT data.

- **Infrared imagery,** including thermal and overhead non-imaging infrared (ONIR), enables analysts to detect and identify activity based on thermal signatures. It can be used to characterize foliage, detect camouflage, assess crop health, and analyze coastal hydrography.

- **Multi, Hyper, and Ultraspectral imagery** combines multispectral bands. This capability provides additional types of signatures that allow analysts to identify a wider range of activities, such as distinguishing between real aircraft and decoys, characterizing substances of various types of emissions, and detecting vehicles based on their unique signatures.

Motion Imagery

Motion imagery sensors, such as the real-time video capability of the Predator unmanned aerial vehicle (UAV) system, may be visible, IR, or radar and may be recorded either by digital or analog means. Collection of motion imagery is a valuable tool for ongoing operations and persistent surveillance. Motion imagery sensors include imaging sensor/systems that generate sequential or continuous streaming images at specified temporal rates. The sensors may be mounted on endurance airborne platforms (aircraft that can stay in the air in one area for an extended period of time such as a Predator UAV). This allows analysts to monitor high-interest activities in the mission space, to include tracking moving, fleeting, and emerging targets. It also allows observation of rapidly developing events.

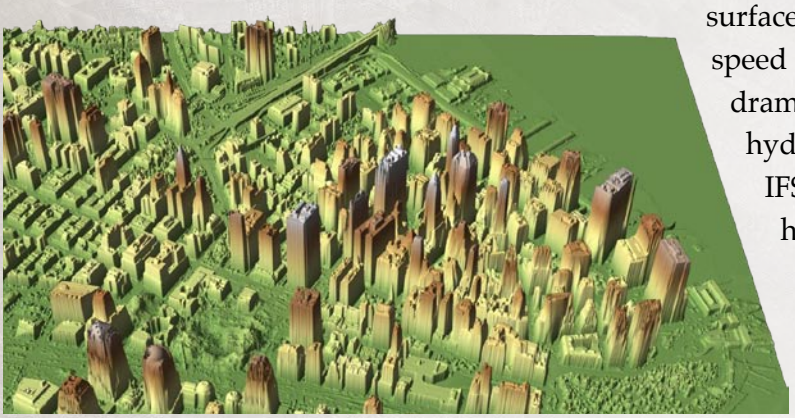
Realtime motion video from UAV

Active Sensing Technologies

A growing range of active sensing capabilities, which includes Synthetic Aperture Radar and laser imaging systems, serve as a powerful complement to standard spectral imagery.

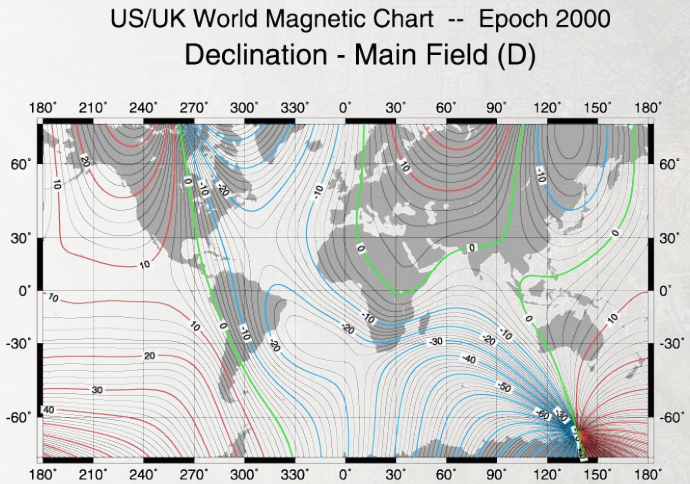
- **Synthetic Aperture Radar (SAR)** is essential for imaging in poor weather and lighting conditions that prohibit electro-optical collection. It is useful for countering denial and deception and can provide a moving target indicator (MTI) capability for detection and tracking of mobile targets.

- **Light Detection and Ranging (LIDAR)** and Interferometric SAR (IFSAR) sensors can be integrated into airborne or space-based platforms. They enable characterization of the Earth's surface elevation and hydrography with unprecedented speed and precision. Airborne LIDAR has dramatically increased the ability to collect precise hydrographic survey data over large areas. LIDAR and IFSAR systems have made possible the production of high-resolution digital elevation data on a large scale. Such data can be used to generate highly detailed and accurate three-dimensional models of structures and terrain for detailed operational planning and mission rehearsal.



Geophysical Sensors

Advances in geodetic and geophysical remote sensing provide new dimensions of knowledge. This enables analysts to characterize the earth in unique ways.



- **Gravimetric Sensors** reside on airborne platforms, satellite systems, and survey ships. They measure changes in the earth's gravitational field for a variety of applications, from long-wavelength global mapping to detailed analysis of underground features. These sensors also collect precise geomagnetic data for developing world magnetic models.

Section B. GEOINT SUPPORT SYSTEMS

NGA, through its acquisition authorities, provides NSG customers with GEOINT information technology capabilities (hardware and software) in direct support of intelligence and operational missions. NGA programs resources for and provides GEOINT generation and management capabilities in partnership with the Military Departments, DoD, and civil agencies. NGA is responsible for installation, testing, integration, and life-cycle support for NSG systems and capabilities developed through NGA programs. NSG members also program resources to develop hardware and software capabilities to exploit data and information and to produce GEOINT on a case-by-case basis.3 To ensure interoperability, Service and Agency procurements must meet NSG standards established by the FM/NSG, in coordination with the community.

NSG capabilities provide support for accomplishing the following functions:

- Requirements management
  - Requirements Management System (RMS) The primary resource used to manage and request imagery collection, exploitation, and production/distribution assets within the National and DoD environments.
  - Production Management Alternative Architecture (PMAA) Provides an integrated geospatial requirements and production management system.
  - Transitional ONIR Requirements System (TORS) The system used to manage and task ONIR collection, exploitation, and production/distribution assets within the National and DOD environments. (RMS cannot be used to task ONIR.)
  - Planning Tool for Resource Integration, Synchronization and Management (PRISM) A web-based application that provides users, at the theater level and below, with the ability to conduct Integrated Collection Management (ICM). Integrates all intelligence discipline assets with all theater requirements.

- Exploitation/production management
  - Imagery Exploitation Support System (IESS) DoD-standard system that provides near-real-time support for imagery exploitation, requirements, and dissemination management at 40 locations.
  - National Exploitation System (NES) Imagery exploitation management and reporting system.

- Exploitation workstations and tool sets
  - Integrated Exploitation Capability (IEC) An NGA capability that procures, delivers, and integrates NSG softcopy imagery exploitation and information production capabilities within the GEOINT community.
  - Commercial Analyst Workstation (CAWS) A commercial system that integrates intelligence applications for use at the analyst workstation/desktop level.
  - Remote Replication System (RRS) A suite of commercial hardware and software that provides timely crisis and operational support by providing low volume reproduction of standard or specialized products from hardcopy and/or digital data.

- Access, Dissemination, and Archiving
  - Information Dissemination Services- Direct Delivery (IDS-D) NSG program that disseminates time-dominant/time-critical and near-real time data to operational users worldwide. Also sends National Technical Means (NTM) data directly to the NIL for long-term storage.
  - Broadcast-Request Imagery Technology Environment (BRITE) NSG program that disseminates critical NGA GEOINT data via Military Satellite (MILSAT)/Secret Internet Protocol Routed Network (SIPRNET) to communications-limited tactical users worldwide.
  - Web-based Access and Retrieval Portal (WARP) NSG program that provides discovery, access and dissemination of NTM, commercial, airborne, geospatial intelligence products from the NGA Gateway, and a variety of specially tailored products to registered operational users worldwide over Joint Worldwide Intelligence Communications System (JWICS), SIPRNET and the internet.
  - NSG Warfighter Imagery Library (NWIL) Image library at the Joint Warfare Analysis Center (JWAC) that provides increased availability of NTM to warfighters.
  - Image Product Libraries (IPL) Scaleable, deployable libraries below Command Information Libraries in complexity and capacity.
  - Command Information Libraries (CIL) Intermediate image library between the NIL and IPL; at command and agency locations.
  - National Information Library (NIL) Central repository of national, tactical, and commercial imagery, imagery products, geospatial information, video and metadata.
  - Unclassified National Imagery Library (UNIL) Archive and dissemination of commercial imagery. Will eventually replace the Commercial Satellite Imagery Library (CSIL) as the hub for this activity.
  - MC&G Information Library (MCGIL) Mapping, Charting, and Geodesy Information Library.
  - Commercial Remote Sensing (CRS) Ground Receiving/Processing Stations Facilities (e.g., Eagle Vision) that generate actionable GEOINT from CRS data. These stations enhance the operational utility of CRS data to operational commanders.

Finally, it is important to mention the Distributed Common Ground/Surface System (DCGS) which is a family of systems designed to provide airborne system-derived, multi-intelligence discipline, ISR task, post, process and use capabilities at the theater and tactical levels. This support is accomplished through a combination of reachback, forward support, and collaboration. DoD and Service architectures are integrated components of this net-centric joint force intelligence processing and dissemination system.

CHAPTER THREE: GEOINT CAPABILITIES

Each of the three GEOINT elements — imagery, imagery intelligence, and geospatial information — have historically provided a strong foundation of GEOINT capabilities. However, the combination of the three elements creates a synergy which allows us to enhance those capabilities. The box below lists enhanced capabilities that have evolved with the GEOINT discipline. While some of the capabilities may have existed for years, they were not usually combined with other capabilities or were not used routinely due to technology constraints. Advances in commercial technology improved the ability to use and combine capabilities. The integration of these capabilities maximizes the accuracy, effectiveness, and potential of GEOINT products. Moreover, the combination of these enhanced GEOINT capabilities provides the foundation for the IC goal to achieve persistent surveillance.

The key GEOINT capability, however, is the expert NSG workforce that is trained to develop, use, and manage all of the GEOINT capabilities described below.

ENHANCED GEOINT CAPABILITIES:

- Uses Advanced Sensors
- Employs Multiple Sensors Simultaneously
- Uses Multiple INTs
- Expands Visualization Features
- Enhances Precision & Detail
- Improves On-Demand Global Access

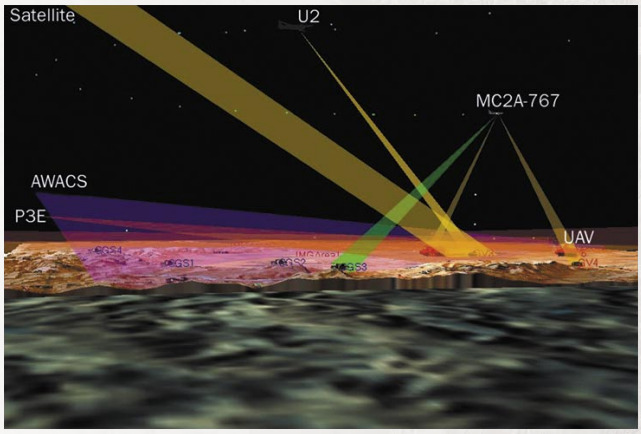
USE OF MULTIPLE & ADVANCED SENSORS

Traditionally, electro-optical sensors have been used to collect the majority of geospatial data. In some cases, geospatial data was obtained from SAR, IR, and multi-spectral imagery sensors that provide the ability to characterize targets in different ways and in different conditions. GEOINT increasingly integrates use of those sensors with more sophisticated sensors that provide hyper-spectral imagery, LIDAR, and IFSAR, as well as an assortment of geophysical sensors.

The use of multiple sensors provides flexibility to cope with different target conditions and the ability to characterize targets in more sophisticated ways.

EXAMPLE:

- **Persistent Surveillance:** Multiple and advanced sensors provide the capability to monitor a target more often and in different conditions. The long-dwell and loitering capabilities of ONIR and airborne Advance Geospatial Intelligence (AGI) platforms provide the NSG with a good foundation for persistent surveillance. For example, ONIR has provided continuous worldwide satellite-based surveillance and warning of ballistic-missile launches for over 30 years.



MULTI-INT COLLABORATION

GEOINT better enables incorporation or collaboration with other INTs such as SIGINT, HUMINT, MASINT and OSINT. Consideration of other INTs has always occurred to some degree. However, the GPE analytic methodology which may be used to develop predictive GEOINT helps ensure

that all areas of GEOINT and other INTs are considered in the analytic process to provide the most comprehensive GEOINT product. Additionally, technology is improving automated, electronic collaboration between INTs.

EXAMPLE:

Multi-INT Products: GEOINT Subject matter experts (SMEs) collaborate with SMEs from other INTs, either on an individual basis or as part of a team, to develop multi-INT products that provide more multi-layered, comprehensive information for commanders and decision makers. These products are unique and reflect the combined expertise and technology from the multiple INTs. Multi-INT products will usually display the seals of all participating elements.

VISUALIZATION

A primary purpose of geospatial products has always been to provide visualization of operational spaces and activity patterns of all sizes and scales, ranging from global and regional level to cities and even individual buildings. Spatial analysis techniques can identify patterns in adversary activities. It uses standardized portrayal to ensure the message communicated is the one intended. A picture is simply the fastest way to communicate spatial information to a customer.

GEOINT products make better use of three- and four-dimensional products. Three-dimensional products allow visualization that is closest to the ability of the human eye, and exceeds the human capability to view all three sides at once. The fourth dimension, time, allows for the creation of moving scenarios for accurate and realistic depictions of speed, pattern recognition, and velocity and the effects of time, activity, tides, wind, etc.

EXAMPLES:

- **Common Operational Picture (COP):** GEOINT provides the ability to integrate precise location and terrain data to create a foundation of information about a specific area. This information is then turned into a picture of the area that multiple, diverse customers and organizations can access simultaneously to ensure they are working with identical data and are referencing the same information. Additional data can be added to the picture from multiple contributors. This common operational picture provides users the ability to quickly orient and visualize their mission space. The COP provides a means by which analysts, policymakers, warfighters, and first responders can rapidly orient to and visualize their environment. It displays the required information in a fashion that supports situational awareness and rapid decision making.

- **Mission Visualization:** GEOINT can be used to create a realistic, interactive scenario that accurately depicts the mission area in four dimensions. The simulated air, land, or sea environment prepares personnel for factors they may encounter on a real mission.

PRECISION & DETAIL

Geospatial data-derived products can determine precise geographic coordinates and other measurements of objects and features in denied areas more accurately, rapidly, and effectively than is possible by other means. Using remotely sensed imagery and other spatial data, GEOINT analysts can characterize natural and man-made features and objects of interest. The advanced sensors, technology, and methodologies used for GEOINT can provide even greater accuracy in precision and detail, in part because they allow for greater use of geodesy and geophysics capabilities.

EXAMPLES:
Precision

- **Global Positioning System (GPS):** The Global Positioning System is the only fully operational system that allows users to determine their exact position on or above the Earth anytime, in any weather, anywhere. The precise locational information provided by the GPS is critical to safety of navigation for air, land, sea and space. The NSG provides global coordinate frame and global orbit data that are critical to the success of the GPS. For example, information on NGA's reference frame is stored within all GPS user equipment. Receivers combine the parameter and reference frame data input via the GPS satellite signals with the stored reference information to calculate positions on Earth. GPS technologies have revolutionized the collection of geophysical and geodetic survey data by allowing a wide range of sensors, including radar, imaging, and seismic sensors, to be precisely positioned anywhere on the globe.

- **Targeting:** GEOINT data and products are critical to assuring precision in targeting and battle damage assessment. GEOINT-related target materials include standard imagery products, air target materials, specialized targeting products, and mission-specific data sets. Additionally, GEOINT is used in national and theater level target vetting processes. The NSG provides quality assurance for DoD and the IC for targeting including tool validation, mensuration certification, and metric assessment for target location error.

Detail

- **Densification:** Digital GEOINT products may be modified to meet mission needs by adding more layers of information. Each layer can provide additional data, details, features, and intelligence information to the product. This layering process is known as densification. Densification allows the product originators and others to continually change or update the product to meet evolving needs and changing circumstances.

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, sensors that provide data for GEOINT can cover entire regions in a matter of days. New sensor technologies continue to improve spatial data collection and provide the capability to turn information around more quickly. On-demand global access to GEOINT is enabled through the use of electronic tools such as portals, imagery libraries, and databases. This capability increases timeliness and allows quicker value-added response to the tactical user.

EXAMPLE:

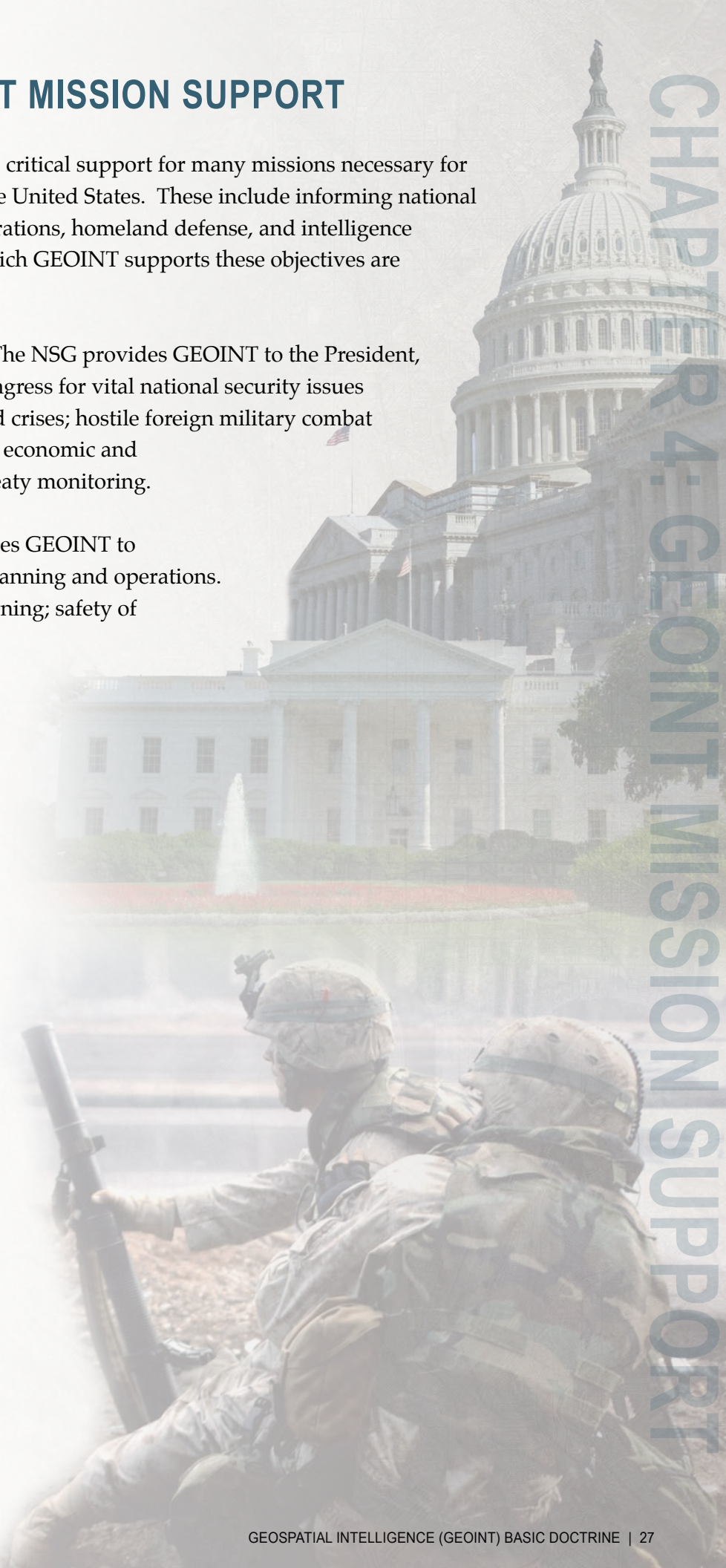
- **Mobile Integrated Geospatial-Intelligence System (MIGS):** The NSG deploys personnel and systems during crises to assist military and customers in using GEOINT products and services. NGA teams use the MIGS, a robust, deployable system that provides organic communications including classified computer systems, video teleconferencing, and phone service. MIGS has contracted bandwidth to provide coverage throughout Europe, Africa, the Middle East, Asia, and Australia. This mobile system resides on a high mobility, multipurpose, wheeled vehicle, known as a "Humvee," and contains a fully self-sustaining suite of equipment, life support, and transportation. The MIGS can be unpacked and producing geospatial intelligence within two hours. MIGS can withstand harsh environmental conditions and move with the warfighter.

CHAPTER FOUR: GEOINT MISSION SUPPORT

The NSG produces GEOINT to provide critical support for many missions necessary for the protection of the national security of the United States. These include informing national policymakers and supporting military operations, homeland defense, and intelligence collaboration. Examples of the ways in which GEOINT supports these objectives are provided below.

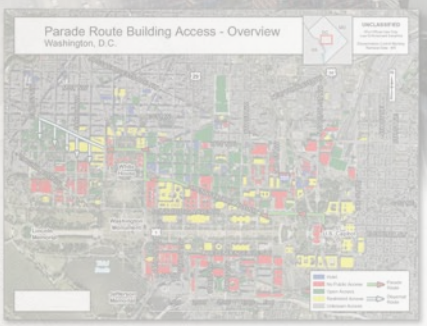
- **Informing National Policymakers** — The NSG provides GEOINT to the President, National Security Council, and the Congress for vital national security issues such as: terrorism; regional conflict and crises; hostile foreign military combat capabilities, operations, and intentions; economic and trade security; and arms control and treaty monitoring.

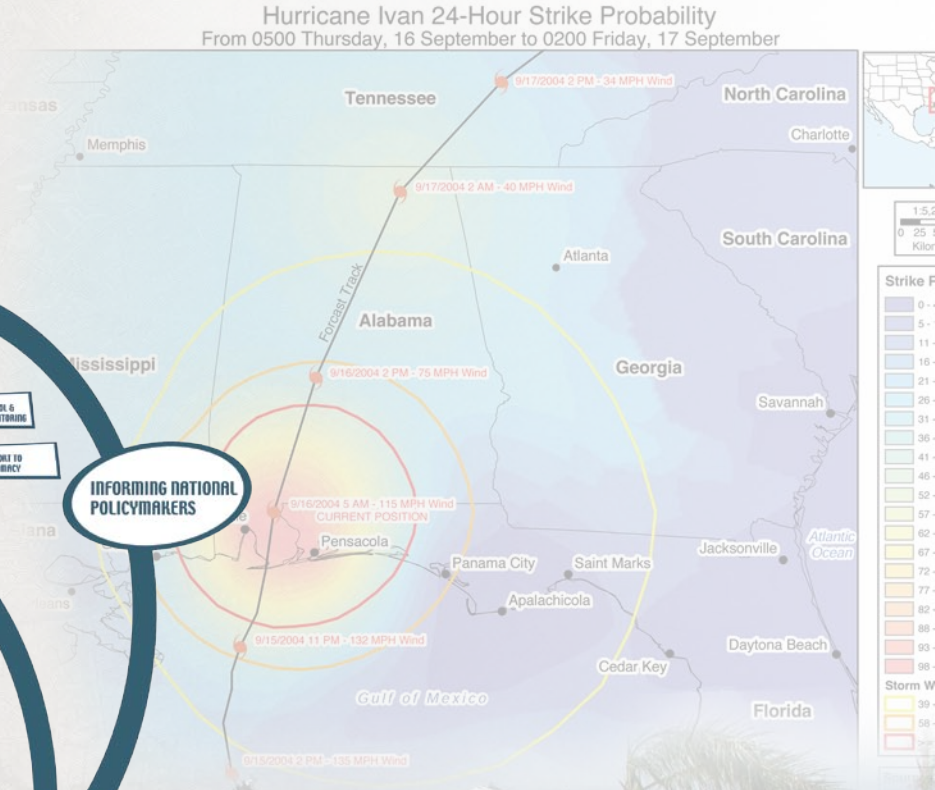
- **Support to the Military** — The NSG uses GEOINT to support military readiness as well as planning and operations. Examples include: indications and warning; safety of navigation; general military intelligence assessments; and targeting and intelligence exchange programs across the COCOMs and military departments (to include the Services). GEOINT also supports the military departments by supporting future force structure, force protection, and weapons development and acquisition.

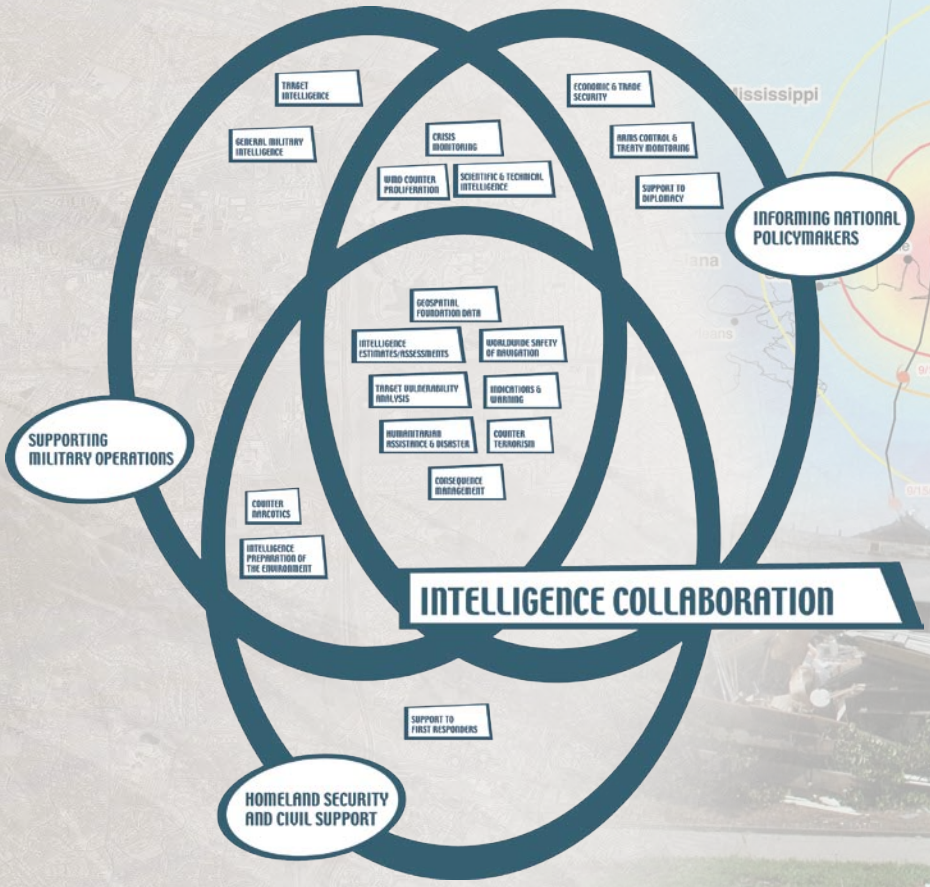


- **Supporting Homeland Security Agencies, Civil Support Organizations, and Law Enforcement —** GEOINT is critical in supporting first responders, counterterrorism efforts, safety of navigation and the planned usage of airspace in the National Airspace System, indications and warning, disaster assistance, emergency management, counternarcotics, and target vulnerability analysis.

- **Intelligence Collaboration —** GEOINT is a key tool in tackling "hard" intelligence problems by providing in-depth and comprehensive GEOINT while engaging other NSG members and using multi-source intelligence activities.







CHAPTER FIVE: THE NATIONAL SYSTEM FOR GEOSPATIAL INTELLIGENCE

This chapter has two sections. The first discusses the leadership and governance of the NSG and outlines the role of the Director of NGA as Functional Manager for GEOINT and the NSG (FM/NSG). The second section is focused on the NSG Community, including a breakout of NSG members from the IC, Military Departments (to include the Services), and COCOMs. The Chapter also outlines the roles that the members and partners play in GEOINT.

The National System for Geospatial Intelligence (NSG)

THE NSG is the combination of technology, policies, capabilities, doctrine, activities, people, data, and communities necessary to produce geospatial intelligence in an integrated multi-intelligence, multi-domain environment.

THE NSG COMMUNITY consists of Members and Partners. Members include the Intelligence Community (IC), Joint Staff, Military Departments (to include the Services), and Combatant Commands (COCOMs). NSG Partners include Civil Applications Committee Members, International Partners, Industry, Academia, Defense Service Providers and Civil Community Service Providers.

Section A. NSG LEADERSHIP AND GOVERNANCE

The FM/NSG manages the end-to-end GEOINT process, which includes the cycle of activities for: tasking national imagery and geospatial information collection; advisory tasking for theater and tactical assets when under the control of a Military Department or COCOM; processing raw intelligence data from national and commercial satellites; exploiting geospatial information and imagery intelligence; and analyzing and disseminating information, knowledge, and intelligence to consumers in the form of GEOINT data and products. The FM/NSG is chartered to set standards for end-to-end architecture related to GEOINT; geospatial information products; career and training programs for imagery analysts, cartographers, and related fields; and to provide technical guidance for systems using GEOINT.

The FM/NSG has delegated operational responsibility and management for functional GEOINT areas (e.g., Analysis and Production, Source Collection Management) to senior NGA leadership and knowledgeable staff managing the same or similar activities for NGA. This allows these individuals and their organizational resources to better manage and lead the NSG Community and develop related planning, policies and guidance. The Unified GEOINT Operations strategy will align GEOINT analysis and production resources and requirements and centralize functional management for GEOINT production activities across the entire NSG.

The NSG is the combination of technology, policies, capabilities, doctrine, activities, people, data, and communities necessary to produce GEOINT in an integrated, multi-intelligence, multi-domain environment. The NSG community consists of members and partners, and is a collegial enterprise that is managed through a number of governance processes. These include:

- **Functional Management and Program Management:** The FM/NSG, acting in Functional and Program Manager capacities, works hand-in-hand with oversight and legislative authorities (DNI, USD (I), and Congress) to provide management and resource guidance and direction to the NSG.

- **Councils, Boards, and other Fora:** The NSG uses a system of councils, boards and other fora to coordinate community activities. Membership in each varies by level of the participants and subject matter. At the highest level, the FM/NSG chairs a council, which serves as the NSG's central oversight and policy implementation body. NGA, as the chief GEOINT sponsor in the IC and DoD, also participates in source collection, production and other DoD and IC collaborative fora that coordinate acquisitions as well as identify, develop, improve and enhance capabilities.

- **Doctrine:** The FM/NSG develops and disseminates GEOINT doctrine, policy, and guidance in coordination with the NSG. This doctrine provides principles that define and support the creation of GEOINT as a unique intelligence discipline.

- **Directives:** Matters of policy affecting the NSG will be articulated in a series of NSG Directives. These directives, developed in close coordination with NSG Members and Partners, will provide structure and process to a wide range of policy issues and operating procedures affecting the NSG Community.

- **Enterprise Needs Management:** The FM/NSG assists members of the NSG in acquiring and sustaining the GEOINT resources needed to accomplish their respective missions, in accordance with the July 2003 Memorandum of Agreement (MOA) between NIMA and the DoD Military Services, while promoting common GEOINT standards and interoperability across the NSG community and within the national security community. To do this, the FM/NSG works with other NSG members to forecast changes to the operating environment, determine future needs and requirements, establish investment plans, and champion customer requirements to oversight organizations.

- **Architecture-Based Planning and Decision Making:** The FM/NSG uses architecture-based planning and decision making to address key development and investment questions. Architecture-Based Analysis (ABA) is the methodology by which this is done. The Enterprise Architecture (EA) has four components: the Baseline Architecture, the Programmed Architecture, the Objective Architecture, and the NSG Capability Roadmap. Together, the components of the EA provide the foundation for NSG enterprise capability planning, solution development and investment decision. The FM/NSG, in close coordination with NSG members, develops future concepts and scenarios and uses community information needs forecasts, integrated requirements review, modeling and simulation, and studies and analyses to support architectural-based planning. The FM/NSG serves as the custodian of the EA for the NSG members.

- **System Acquisition:** The FM/NSG , in close coordination with NSG members, ensures that NSG systems are developed in compliance with standards that support GEOINT and works with national security community entities to ensure interoperability of systems. The Functional

Manager will continue to develop NSG systems and software necessary to produce and manage GEOINT. NSG members participate in appropriate national security community joint acquisition efforts and execute NSG-defined executive agency roles.

- **Standards:** The FM/NSG, in close coordination with NSG members, develops, adopts, prescribes, mandates, and ensures compliance with GEOINT standards for the NSG. Standards are documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics to ensure that materials, products, processes, or services are fit for the analysis and visual representation of physical features and geographically referenced activities.

Section B. THE NSG COMMUNITY

The NSG Community consists of Members and Partners. The Functional Manager of the NSG oversees member activities related to GEOINT in accordance with applicable laws, DNI and DoD Directives, NSG Directives, guidance, and agreements. NSG Members include the organizations, agencies and people responsible for prioritizing, planning, programming, budgeting, acquiring, collecting, analyzing, producing, sharing, storing, and processing GEOINT.

NSG Partners are the organizations, agencies, and people who influence or indirectly participate in GEOINT prioritization, collection, production, or related programming and budgeting.

NSG Members include the IC, the Joint Staff, the Military Departments (to include the Services) and Combatant Commands (COCOMs).

NSG Partners include Civil Applications Committee members, International Partners, Industry, Academia, Defense Service Providers, and Civil Community Service Providers.

NSG MEMBERS

<u>List of NSG Members</u>

Intelligence Community:

- Office of the Director of National Intelligence (ODNI)
- Central Intelligence Agency (CIA)
- Defense Intelligence Agency (DIA)
- National Geospatial-Intelligence Agency (NGA)
- National Reconnaissance Office (NRO)
- National Security Agency/Central Security Service (NSA/CSS)
- Army Intelligence
- Navy Intelligence
- Air Force Intelligence
- Marine Corps Intelligence
- Coast Guard Intelligence
- Department of State/Bureau of Intelligence and Research (INR)
- Federal Bureau of Investigation/Office of Intelligence

- Department of Treasury/Office of Intelligence Support
- Department of Energy/Office of Intelligence
- Department of Homeland Security/Directorate of Intelligence & Analysis
- Drug Enforcement Administration/Office of National Security Intelligence
- DoD offices for collection of specialized national intelligence through reconnaissance programs. Other elements of any other department or agency as may be designated by the President, or designated jointly by the DNI and the head of department or agency concerned as an element of the IC.

The Joint Staff

Military Departments (to include the Services):

- Department of the Army (US Army)
- Department of the Air Force (US Air Force)
- Department of the Navy (US Navy and US Marine Corps)

Combatant Commands (COCOMs):

- US Pacific Command (US PACOM)
- US Central Command (US CENTCOM
- US Strategic Command (US STRATCOM)
- US European Command (US EUCOM)
- US Joint Forces Command (US JFCOM)
- US Transportation Command (US TRANSCOM)
- US Southern Command (US SOUTHCOM)
- US Northern Command (US NORTHCOM)
- US Special Operations Command (US SOCOM)

The IC

Members of the IC are important to the GEOINT process. The Office of the Director of National Intelligence (ODNI) provides leadership, management, and oversight of the IC. The ODNI is responsible for managing interagency committees to coordinate all aspects of intelligence, including GEOINT.

While IC members represent a wide array of missions and intelligence capabilities, one of the common threads among members is the need to analyze, assess, and produce predictive intelligence in support of national objectives. IC analysts fuse multiple intelligence sources to provide the best possible, most comprehensive, analytical judgments. The IC analyst considers, when available, Human Intelligence (HUMINT), Signals Intelligence (SIGINT), Measurement and Signatures Intelligence (MASINT), Open Source Intelligence (OSINT), and Counterintelligence (CI) to produce all-source assessments. IC analysts must also consider GEOINT when performing all-source analysis. As such, many IC members are primarily users of GEOINT. The users drive the GEOINT process by developing and generating requirements for collection and production.

There are several key IC players in the production and development of GEOINT. Their roles are addressed in more detail below.

The Central Intelligence Agency (CIA) is an independent agency whose mission is to support the President, the National Security Council, and all officials who make and execute U.S. national security policy. GEOINT is used in finished intelligence for the President and senior policymakers.

The Defense Intelligence Agency (DIA) produces and manages foreign military intelligence. DIA provides military intelligence to warfighters, defense policymakers, and force planners. DIA produces and uses GEOINT products and services to support all-source analysis in many forms for its customers. In fact, DIA's all-source analytic support for military operations increasingly demands GEOINT for visualization. GEOINT is a principle component of all-source analysis and is a key contributor to order of battle analysis and facilities characterization. It also supports ongoing military operations and scientific and technical analysis of foreign military weapons programs. DIA also manages the Joint Reserve Intelligence Program (JRIP) which provides manpower and support to GEOINT operations.

The National Geospatial-Intelligence Agency (NGA) is the primary source for GEOINT analysis and products at the national level. Since NGA disseminates data and makes it available in repositories, GEOINT-trained personnel throughout much of the IC, including military intelligence personnel in the field, can access the data to develop their own GEOINT analysis and products. Additionally, NGA provides NGA Support Teams (NSTs) to many organizations, including IC agencies, the Services, and COCOMs. The Agency supports the warfighter by providing NSTs, including equipment and experienced personnel, down to the COCOM/JTF level. NSTs are co-located with each COCOM to provide reachback support from national resources. Each team is configured to optimally support the unique mission of each COCOM. NGA also deploys analysts and managers worldwide to provide direct GEOINT support to national policymakers, operational and departmental planners, and warfighters.

NGA works with commercial imagery vendors to procure diverse imagery to better support its customers and to facilitate its work with international coalition partners, other IC agencies, DoD organizations, and other civil and government organizations. NGA also provides GEOINT strategic workforce planning and specific training for general and specialized tradecraft skills through its National Geospatial-Intelligence College.

The National Reconnaissance Office (NRO) designs, builds, and, with the Air Force, operates the nation's reconnaissance satellites, which are the main collection assets for GEOINT source data. The satellites also provide significant geospatial data to support mapping requirements and targeting data for DoD. Once the GEOINT source data is collected, NRO, NGA the Services, COCOMS, and other commands work together to process the data. The NRO is a DoD agency staffed by DoD and CIA personnel.

The National Security Agency/Central Security Service (NSA/CSS) is America's signals intelligence organization. It serves as a critical component, working closely with other NSG members. Both NSA's information assurance and foreign signals intelligence information missions incorporate GEOINT in the agency's day-to-day operations worldwide to keep the information edge. The nature of the majority of SIGINT information lends itself to the analytic realm of geospatial analysis and thus becomes an important partner to GEOINT and the NSG. With the implementation of expanding technology and increasing IC collaboration and partnerships, NSA is able to gain a deeper understanding of SIGINT through geospatial associations and pattern analysis. The expanding collaborative partnership between NSA and NGA has helped to exemplify a paradigm within the greater construct of the NSG. NSA and NGA are also partnering on current and future geospatial requirements to support increasing multi-intelligence analytic efforts in reaction to the Global War on Terrorism.

The Joint Staff is responsible for establishing GEOINT policy and procedures. The Joint Staff is involved throughout the GEOINT Cycle from the development of the five-volume CJCSM 3122 series Joint Operation Planning and Execution System (JOPES) to interaction on feedback issues with Service and COCOM GI&S officers and imagery intelligence staffs. The Joint Staff articulates and refines GEOINT requirements to ensure NGA implements the most effective production strategy. The Joint Staff also partners with NGA and NRO in the design, development, and approval of GEOINT collection systems through the Joint Capabilities Integration and Development System (JCIDS)."

The Combatant Commands (COCOMs) promote and enhance security to achieve U.S. strategic objectives and plan and conduct military operations. The Unified Command Plan (UCP) establishes the missions, responsibilities, and force structure for commanders of combatant commands and establishes their general geographic areas of responsibility (AOR) and functions. The latest UCP outlined nine COCOMs, which are either regional or functional in focus. The COCOMs have a broad, comprehensive mission, and provide support across the entire spectrum of operations within their function or regional AOR. To support the breadth of this mission, the commands integrate national, theater, and Service capabilities to collect GEOINT information and to provide intelligence to the commander, assigned forces, and military planners. GEOINT is a critical component of this capability and directly impacts every facet of the commands' missions. The COCOMs submit GEOINT requirements to support operations plans, operations plans in concept format, functional plans, and campaign plans or operation orders. COCOMs submit requirements for GEOINT to support joint training exercises both inside and outside the United States. The GI&S officer and J2 imagery staff assigned to each COCOM are responsible for coordinating staff-related GEOINT activities, while ensuring that the supporting commands or component commands are executing theater and mission-specific GEOINT requirements, to include the planning provisions for war-reserve requirements.

United States Combatant Commands

The COCOM intelligence capabilities reside within the intelligence staffs (J2) and the joint intelligence organizations. These organizations analyze, produce, and disseminate accurate and timely all-source intelligence and GEOINT to support operations plans, contingency plans, and exercises for the subordinate / component commands and their operating forces. The commands have imagery exploitation capabilities and GI&S capabilities and responsibilities.

The types of imagery products generated by the commands include text reports, database entries, target materials and support products, visualization products, and identification keys. The GI&S activity provides advice to the combatant commander on all geospatial information and geodetic sciences. While the commands rely heavily on basic maps, charts, target coordinates, geodetic surveys, and other standard geospatial information data provided by NGA, they also research, develop, and produce mission-specific, specialized geospatial products and services for the commander and the components. These products (e.g., aeronautical and hydrographic products, terrain graphics/data, charts, perspective views, image graphics, target materials) provide value-added improvements to NGA digital products. The COCOMs disseminate digital GEOINT products to several libraries and storage devices on multiple security domains. When limited bandwidth or timeliness is an issue, other types of media may be used to disseminate GEOINT (e.g. DVDs or external hard drives). The COCOM GEOINT staff works with appropriate foreign disclosure authorities and ensures GEOINT is properly marked before releasing or disclosing to allies or coalition partners.

The designated Joint Force Commander (JFC) of a Joint Task Force (JTF) or other joint force element translates operational objectives into tactical tasks and plays a pivotal role in the GEOINT cycle. The J2 may stand up a GEOINT cell that contains both the geospatial and imagery competencies required to oversee GEOINT support to the joint force. The GEOINT cell must be knowledgeable of air, land, sea, space and special operations capabilities and requirements for GEOINT to effectively execute the JFC's vision and concept of operations. In summary, the GEOINT cell ensures that geospatial and imagery requirements are identified and resourced for the timely development, planning, and execution of the mission.

The Military Departments (to include the Services) Each military Service possesses unique warfighting capabilities. The Services train, equip, and coordinate their capabilities to operate as a joint force. As a joint force, the Services must be able to respond rapidly to threats to U.S. interests in any region of the world. The Services support their departmental planning missions and the COCOMs with GEOINT products, service-specific content, format, and media. Capabilities exist primarily within the intelligence and civil engineering elements. The Services are responsible for ensuring forces train with the appropriate range of GEOINT and have the appropriate systems to implement GEOINT. Services also have the responsibility to keep COCOMs informed on Service GEOINT programs and capabilities. Designated Service GI&S or intelligence officers coordinate with NGA to establish policy regarding roles and responsibilities for co-production of value-added data and management of distributed geospatial databases and libraries.

U.S. Army. Army GEOINT supports all aspects of military planning and ground force operations. GEOINT provides the basic framework for battlespace visualization and the foundation for knowledge of the battlespace environment. The Army uses GEOINT by

analyzing aeronautical, topographic, hydrographic, littoral, cultural, imagery-based, and atmospheric data essential for successful combat operations.

GEOINT support is embedded in field commands. Army GEOINT consists of both GI&S and imagery/imagery intelligence. The GI&S aspect of GEOINT is derived largely from topographic engineering units that provide in-depth geospatial analysis and topographic support to the warfighter. Military Intelligence (MI) units use imagery and feature data from NGA, supplemented by commercial and field-derived information, to produce imagery intelligence and conduct all-source intelligence analysis. Army topographic and intelligence units have the latest technology and work closely with the commands at all levels to conduct IPB, produce specialized, tailored views and products, and then support mission execution.

The Army also has two service centers which support GEOINT. The National Ground Intelligence Center (NGIC) and the Topographic Engineer Center (TEC). NGIC has the mission to produce and disseminate all-source integrated intelligence on foreign ground forces and related military technologies to ensure that U.S. forces have a decisive edge in current and future military operations. A major component of the NGIC is the 3d Military Intelligence Center, the Army's only geospatial intelligence battalion. The 3d Military Intelligence Center produces and disseminates geospatial intelligence products, to include: national and commercial imagery and advanced geospatial intelligence to the U.S. Army, Joint and Combined Commands, and national-level agencies in support of tactical commanders in the field, operational requirements, contingency planning, and force protection operations. The NGIC and the 3d MI Center also provide comprehensive all source and GEOINT training for Army units prior to world wide deployments.

TEC has the mission to provide the warfighter with a superior knowledge of the battlefield, and support the Nation's civil and environmental initiatives through research, development, and the application of expertise in the topographic and related sciences. They produce and disseminate non-standard and value-added geospatial products and provide technical support and advice to field units.

U.S. Marine Corps. All Marine Corps GEOINT supports the Marine Air Ground Task Force (MAGTF) in performing its warfighting functions: Command and Control, Intelligence, Maneuver, Fire Support, Aviation, and Logistics. Marines use GEOINT to analyze key terrain, observation and fields of fire, cover and concealment, obstacles, and avenues of approach (KOCOA). This analysis includes intensification, and/or verification of current information through comparison with data from new sources.

GEOINT provides the commander with the initial framework for visualizing the battlespace. Marine Corps GEOINT consists of Geospatial Intelligence and Information (GI&I), as well as Imagery and IMINT. The GI&I aspect of GEOINT is provided by a Geospatial-Intelligence Support Team (GiST) assigned to the MAGTF Command Element (CE). An Imagery Detachment, also embedded in the MAGTF CE, uses tactical, commercial, and national imagery to produce IMINT in support of the commander's planning for, and execution of, Expeditionary Maneuver Warfare (EMW). To further this end, GEOINT provides the information Marines need to develop friendly Courses of Action (COA) and to conceptualize possible enemy COAs based on environmental and geophysical conditions within the Area of Interest (AOI).

U.S. Navy. The U.S. Navy applies GEOINT broadly because its forces operate globally in all environments—sea, land and air. The Navy relies on GEOINT in the everyday operations of its units and personnel assigned to the naval elements of the theater combatant commands, Special Operations Command, and functional global commands. Naval GEOINT also directly supports naval weapons systems design, development, operational test, exercise, and operational employment. Navy intelligence analysts, supported by NGA imagery and geospatial analysts, collect, exploit, process, and produce GEOINT as a segment of its all-source production from its locations at the Office of Naval Intelligence (ONI) and the Naval Oceanographic Office (NAVOCEANO).

ONI is the Navy's service Intelligence Center and represents the imagery and imagery intelligence focal point for Navy GEOINT. ONI is the home of maritime S&T tradecraft as well as host for the primary node of imagery dissemination to the Fleet via the Distributed Common Ground System - Navy (DCGS-N). ONI is the center of expertise for every major maritime issue, from the scientific and technical analysis of the design and construction of foreign surface ships, to the collection and analysis of acoustic information on foreign sensor systems, ocean surveillance systems, submarine platforms, and undersea weapons systems. ONI is also the principal source for maritime intelligence on global merchant affairs and a national leader in other non-traditional maritime issues such as counternarcotics, fishing issues, ocean dumping of radioactive waste, technology transfer, and counterproliferation.

NAVOCEANO is the GI&S center of gravity for Navy GEOINT. NAVOCEANO acquires and analyzes global ocean and littoral data to provide specialized, operationally significant products and services for warfighters and civilian, national and international customers. Utilizing airborne, surface and subsurface platforms deployed worldwide, remote-sensing satellites, and seaborne buoys, NAVOCEANO data is converted into products that are tailored to every warfighter's needs. These products and services support virtually every type of Fleet operation by providing mission essential information to the warfighter 24 hours a day, seven days a week.

U.S. Air Force. GEOINT is a key enabler across the spectrum of Air Force ISR operations. One of the Air Force's key responsibilities is to analyze data collected by airborne ISR sensors. This is accomplished through the Air Force Distributed Common Ground System (AF DCGS) ISR weapon system. AF DCGS is a powerful, network-centric, global enterprise tasked and managed to support COCOMs and forces—primarily at the Joint Task Force (JTF) level and below—with actionable, decision-quality information in accordance with established priorities as approved by the Secretary of Defense via the JCS deployment order (DEPORD) process. It operates with the full flexibility of the established intelligence process, as detailed in Joint Publication 2-01, Joint and National Intelligence Support to Military Operations, in order to make usable information immediately and simultaneously available to both engaged forces and intelligence analysts.

AF DCGS takes advantage of Air Force, sister-service, national, and coalition sensors in the air, on land, in space, and at sea, spanning multiple intelligence (multi-INT) sources (to include GEOINT) and provides tailored, correlated information to those who need it—in the formats, timelines, and channels they need it—at all levels across the globe in peace and in combat. It is scalable and comprised of

fixed and deployable components capable of forward-based activities and robust, full-scale reachback operations. AF DCGS is a component of the larger Department of Defense Distributed Common Ground/Surface System (DoD DCGS) enterprise.

In addition, the Air Force employs two Intelligence Centers -- the National Air and Space Intelligence Center (NASIC) and the 480th Intelligence Wing (480 IW) – that perform a host of GEOINT functions. NASIC's mission is to produce integrated, predictive air and space intelligence to enable military operations, force modernization, and policymaking. It also serves as the National and DoD center of excellence for foreign air & space intelligence and Scientific and Technical Intelligence (S&TI). The 480 IW is the lead Air Force wing for global distributed and reachback ISR, and serves as the Air Force center of excellence for GEOINT, target analysis, precision engagement, and MASINT. Finally, the Air National Guard (ANG) and Air Force Reserve (AFRES) augment the active duty forces and also provide critical GEOINT support to operations.

U.S. Coast Guard. The U.S. Coast Guard is addressed separately under the Department of Homeland Security, in the Partners section.

NSG PARTNERS

NSG community partners include organizations, agencies, and people who indirectly contribute to or influence GEOINT collection and production, but are not NSG members.

List of NSG Partners

Government Partners:

- U.S. Army Corps of Engineers
- U.S. Department of Agriculture
- U.S. Department of Commerce
- U.S. Department of Health and Human Services
- U.S. Department of Interior
- U.S. Department of Transportation
- U.S. Environmental Protection Agency
- Federal Emergency Management Agency
- National Aeronautics and Space Administration
- National Science Foundation
- Defense Information Services Agency
- Defense Logistics Agency

International Partners:

- Australia
- Canada
- United Kingdom of Great Britain and Northern Ireland

Industry

Academia

There are several entities that are particularly active GEOINT Partners. Their roles are addressed in more detail below.

US GOVERNMENT PARTNERS

Close partnerships are needed to coordinate activities among the national, defense and civil communities. In 1975, the Office of the President chartered the **Civil Applications Committee (CAC)** to provide Federal agencies the required access to classified data and facilitate appropriate civil uses of data and technology in support of their agency missions. The CAC is an example of a Civil Community forum that coordinates and oversees the Federal civil use of classified collections and sponsors numerous working groups that convene regularly or on an ad hoc basis, as needed.

In recent years, civil partner activities have expanded beyond standard mapping applications to a broad range of environmental and remote sensing applications, to include:

- Working closely with DoD, and the IC;
- Collections and management oversight; and
- National disaster response.

Advances in remote sensing and improved analytical tools have led to an increase in the use of classified remote sensing data for a broad range of environmental and scientific applications that support Federal civil agency missions. Critical applications include monitoring eruptions of volcanoes; detecting wildfires; responding to natural disasters, such as hurricanes, earthquakes, and floods; monitoring ecosystems; mapping wetlands; and studying global change.

Today, GEOINT products supplement and are integrated with remote sensing data from other sources such as ground surveys, aerial photography, and civil and commercial satellites. Civil uses of this data have moved beyond mapping and charting to include land and resource management activities such as wetland, crop, forest, and rangeland inventories; unique environmental and science studies aimed at monitoring, protecting, and preserving the environment; response to manmade events such as oil spills; and geospatial support for critical infrastructure protection and homeland security efforts.

Through the National Civil Applications Program (NCAP), the USGS Eastern Region Geography (ERG) staff in the Advanced Systems Center (ASC) processes requests from civil agencies for the acquisition of geospatial data. The team provides expertise for acquiring, receiving, archiving, and disseminating data in support of a wide variety of scientific investigations and mapping projects with unique requirements. Government and contractor personnel work together with customers to analyze these requirements, plan and coordinate support for submitting data requests, and acquire approval from appropriate authorities.

Examples of close US government partnerships

While U.S. DoD and IC agencies are key GEOINT producers, civil agencies are playing an increasing role supporting operations, whether they are military or humanitarian in nature. For example, the Department of Interior's United States Geological Survey (USGS) and elements of the Department of Homeland Security participate with the NSG in providing support to defense and civil operations through the acquisition and analysis of commercial imagery and topographic products.

Partnership in Action

Shortly after the terrorist attacks of 2001, NGA began a collaborative project with the USGS, forming a team to identify the geospatial and other critical infrastructure information that would be necessary to address the anticipated requirements of defense and homeland security organizations. Using The National Map coverage as a foundation, the team identified the required data for both national and urban levels and established an approach called the Homeland Security Infrastructure Program (HSIP). HSIP national coverage data layers range from transportation and utilities infrastructure to public health and financial assets. Urban layers include airports, government installations, place names, landmarks, high-resolution imagery and elevation data, and much more (see Figures 1A-1C).

Working with USGS to obtain and integrate data from state and local governments, the private sector to acquire commercial datasets, and the Federal Geographic Data Committee (FGDC) to develop homeland geospatial standards and other support, NGA began to consolidate HSIP data such that it could be shared with relevant agencies during security events. As the datasets grew, the agency also developed Palanterra, a secure, Web-enabled COP (common operational picture) data viewer, or portal.

Accessing Palanterra's national-level site provides critical infrastructure and asset data for the entire United States. Zooming to an urban site gives controlled access to high-resolution datasets of major cities. HSIP data are vector- and raster-based and include satellite and airborne imagery and light detection and ranging (LIDAR) data. Such products are employed to create virtual analytic environments for 3D analysis in support of national security events. (Source: GeoIntelligence Magazine, Jul/Aug 2004)

U.S. Geological Survey (USGS)

The U.S. Geological Survey (USGS), under the U.S. Department of Interior, provides reliable scientific information to: describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect quality of life. As the Nation's largest water, earth, and biological science and civilian mapping agency, the USGS collects, monitors, analyzes, and provides scientific understanding about natural resource conditions, issues, and problems. The USGS forms cooperative partnerships with organizations from all levels of government and industry. An example of the partnership that the USGS has with the NGA and NSG follows.

CLOSE PARTNERSHIP WITH ELEMENTS OF DEPARTMENT OF HOMELAND SECURITY (DHS)

In the aftermath of the September 11th terrorist attacks, 22 government organizations were brought together under the auspices of the Department of Homeland Security (DHS) to prevent future terrorist attacks within the U.S., reduce America's vulnerability

to terrorism, and minimize the damage from potential attacks and natural disasters. The ability to organize and coordinate the collective efforts of overlapping federal, state, and local governments is crucial to the achievement of DHS goals of awareness, prevention, protection, response, recovery, service, and organizational excellence.

The DHS mission requires accurate and timely GEOINT focused across the United States. Much of the GEOINT data needed for DHS activities comes from local and state sources. Under certain conditions, however, DHS requests and receives GEOINT support from the IC, principally NGA and through its relationship with U.S. Northern Command. Within DHS, the Federal Emergency Management Agency (FEMA) and the U.S. Coast Guard (USCG) represent important NSG partners.

The Federal Emergency Management Agency (FEMA) leads the effort to prepare the nation for all hazards and effectively manage federal response and recovery efforts following any national incident. FEMA's missions include: assisting law-enforcement agencies with security; transporting and distributing food and water; conducting search and rescue operations; providing counseling services; hiring and assigning critical personnel; planning for continuity of DoD operations; and coordinating relief efforts. FEMA also initiates proactive mitigation activities, trains first responders, and manages the National Flood Insurance Program and the U.S. Fire Administration.

The **U.S. Coast Guard (USCG)**, a member the IC as well as a DHS component, has multiple missions, is a maritime service, and is also one of the nation's five Armed Services. Its mission is to protect the public, the environment, and U.S. economic interests in the nation's ports and waterways, along the coast, on international waters, or in any maritime region to support national security.

As a member of the IC, the USCG uses GEOINT data and products in support of its multiple missions. These missions include surveillance functions in: maritime and port security; fisheries enforcement; migrant interdiction; maritime drug interdiction; intelligence production; and search and rescue. The USCG is a provider of intelligence information to members of the IC and law enforcement. The Intelligence Coordination Center (ICC), a USCG tenant command at the National Maritime Intelligence Center, provides strategic intelligence support to Coast Guard law enforcement, military readiness, port security, marine safety, and environmental protection missions. The ICC relies upon GEOINT to support its analytic and warning mission.

DEFENSE GEOINT USERS AND SERVICE PROVIDERS

There are a number of U.S. organizations involved in GEOINT as NSG partners. These partner organizations include civil and defense agency GEOINT users and service providers:

- Examples of defense GEOINT service providers include the **Defense Logistics Agency (DLA)** and the **Defense Information Services Agency (DISA)**. DLA is DoD's largest combat support agency and provides support to military operations as well as civil disasters in support of FEMA. DLA also supports NSG production, publishing and dissemination. DISA is a combat support agency responsible for planning, engineering, acquiring, fielding, and supporting global net-centric solutions that support national security. DISA supports information dominance by ensuring interoperable systems, assured security, survivability, availability, and superior quality.

INTERNATIONAL ENTITIES

The NSG brokers production arrangements and agreements with other countries around the world. These relationships foster cooperative production, promote interoperability, and extend burdensharing. This allows the NSG to better support national requirements, the U.S. warfighter, the IC, and our allies' requirements during peacetime, contingency operations, and war. The NSG has many levels of relationships that foster a sharing of information and resources to enhance GEOINT activities and products. These relationships differ depending on the countries involved, the NSG member's mission and activity, and the product or information that is exchanged.

Within the NSG, NGA leverages international agreements, co-production agreements, and less formal arrangements to meet the GEOINT needs of the U.S. warfighter and the IC. International agreements provide for the exchange of GEOINT products and include the exchange of critical aeronautical, hydrographic, topographic, and geodetic products, as well as other geospatial data, and technical documentation. At present, NGA has over 100 formal active agreements with allied nations. These documents undergo routine review and are amended as required.

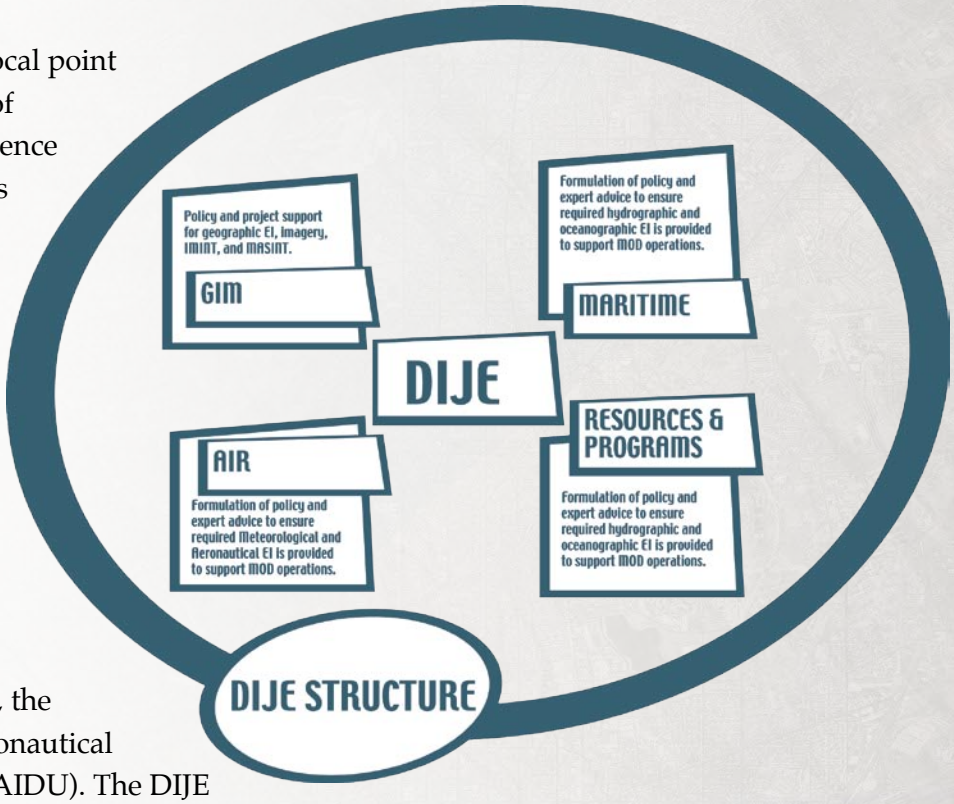
Co-production agreements are intended to guide and foster cooperative production capabilities with nations that would not otherwise have the resources or technology to succeed in this field, while at the same time building positive international relationships and providing access to foreign-produced information. Recently, NGA extended invitations to all bilateral agreement partners to participate in a collaborative multi-national production program. This program, the Multi-National Geospatial Co-production Program (MGCP), includes over 20 nations and is focused on the coordinated production of high-resolution vector data (1:50,000) over areas where no high-resolution data currently exists. The MGCP is predicated on the successful multinational VMap Co-production Working Group (VaCWG) that created global medium resolution vector data used for strategic planning by the United States and allies. The MGCP will produce a pool of high-resolution vector data, maintained in an International Geospatial Warehouse (IGW) that can be accessed by participants based on their production contributions.

Less formal arrangements are used to acquire critical data (e.g., aeronautical and hydrographical) where a more formal agreement is not possible or not required to meet the needs of the NSG. This data is used to support safety of navigation missions which include Flight Information Publications (FLIP) and Notice to Mariners (NTM). NGA has over 100 of these arrangements involving vast amounts of data support mission requirements.

Unified GEOINT Operations and the Quadripartite Partners

The United States shares a special relationship with its three primary Commonwealth partners - Australia, Canada and the Great Britain. The four nations work together to quickly respond to their customers' GEOINT needs with the best technology and information available. The quadripartite partners, through a shared vision, will enhance their worldwide capability to effectively address GEOINT requirements, focus research and development efforts, pursue economies in acquisition, and develop policies to improve information sharing. The participation of these Commonwealth partners with the NSG is critical to the success of unified operations.

The United Kingdom (U.K.). The focal point for GEOINT in the U.K. is the Ministry of Defence (MoD) branch: Defence Intelligence Joint Environment (DIJE). DIJE provides strategic direction, policy, and guidance on 4D Environmental Information (EI) and imagery management, requirements and capabilities to the Ministry of Defence (MOD) central staffs, commands, national agencies, and related organizations. DIJE integrates output from the four existing principal U.K. Defence EI providers: the Defence Geographic and Imagery Intelligence (DGI) Agency, the United Kingdom Hydrographic Office (UKHO), the Meteorological Office, and the No 1 Aeronautical Information and Documents Unit (No1 AIDU). The DIJE acts as a single joint directorate to provide vision and formulate policy for EI and imagery management across U.K. defence. Roles include:



- Provide stakeholders with expert advice;
- Strategically manage EI policy and requirements from all sources;
- Coordinate, acquire, and prioritize MOD requirements from the key environmental agencies;
- Leverage joint expertise to capitalize fully on bilateral and multinational initiatives;
- Be a center of excellence and conduit for corporate knowledge;
- Act as lead MOD agency for international collaboration for EI in defense; and
- Oversight of MoD responsibilities for Safety of Navigation, (delivered by UKHO and No1 AIDU).

DIJE acts as defense customer of, and strategic partner to, suppliers of defense EI. It also develops, coordinates, and champions the Future Defence Environmental Fusion Capability (EFC). This includes development of the Recognised Environmental Picture (REP) concept in support of the Joint Operational Picture (JOP) and Network Enabled Capability (NEC) concepts. The DIJE also coordinates MOD relationships with other government departments and other organizations arising from bilateral and international agreements relating to the production and sharing of EI, IMINT, and MASINT.

Australia. Australia's lead GEOINT agency is the Defence Imagery and Geospatial Organisation (DIGO). DIGO collaborates with the Australian Hydrographic Service and the Royal Australian Air Force Aeronautical Information Service for the provision of maritime and aeronautical geospatial information.

DIGO provides GEOINT support to Australia's defense interests and other national objectives. DIGO efforts focus primarily on providing GEOINT in support of:

- National intelligence requirements;
- National emergencies;
- Australian Defence Force (ADF) operations and activities; and
- International collaboration.

DIGO is responsible for the collection, processing, analysis, and dissemination of imagery and geospatial products, and for determining the standards for imagery and geospatial information within the Australian Defence Organization (ADO). DIGO is accountable through the Defence Deputy Secretary Intelligence and Security (DEPSEC I&S) to the Secretary of the Department of Defence and the Chief of the Defence Force (CDF).

Canada. The responsibility for geospatial, imagery, meteorology and oceanography support to the Canadian Forces and the Department of National Defence (DND) rests with Directorate of Geospatial Intelligence (D Geo Int). D Geo Int provides geospatial, imagery, meteorology, and oceanography (MetOc) support to the Department of National Defence (DND), with a focus on the operational and training requirements of the Canadian Forces (CF)—navy, army and air force—worldwide. Canada recently merged the geospatial, imagery, meteorology and oceanography support functions into a GEOINT capability.

The D Geo Int organization is located at the National Defence Headquarters within the Chief of Defence Intelligence Branch under the Director General Intelligence Collection Division. D Geo Int consists of a small operations staff – Directorate of Geospatial Intelligence (D Geo Int – Ops); a small imagery and policy staff – Directorate of Geospatial Intelligence –Imagery, Plans and Policies (D Geo Int –Img P&P), which includes responsibility for MASINT; a small Met Oc planning and policy staff (D Met Oc); a Geomatics support and map production unit - Mapping and Charting Establishment (MCE); an Imagery exploitation unit - CF Joint Imagery Centre (CFJIC); and Geomatics/Imagery personnel posted or deployed with various CF formations and missions.

INDUSTRY

The NSG has forged partnerships with its private sector partners to enhance NSG operations now and in the future. Industry represents one of the NSG's most important and productive member sets. Industry assists the NSG and its partners at all levels and at all points along the GEOINT operations cycle. NGA looks to industry for data standards, information management models, commercial off-the-shelf applications, and business practices.

The private sector, like the NSG, is experiencing a convergence of GEOINT disciplines. The U.S. Geospatial-Intelligence Foundation (USGIF) provides members the opportunity to work together—outside their own organizational and corporate interests—toward a mutual goal of improving national and homeland security. The purpose of the USGIF is to promote the GEOINT tradecraft and to develop a stronger community of interest (COI). The COI includes government, industry, academic, professional organizations, and individuals who share a mission focus around the development and application of GEOINT data and geo-processing resources to address national security objectives.

ACADEMIA

The NSG hires and retains highly trained experts in specialized fields. The NSG has several program initiatives and works with U.S. universities that have academic programs with fields of study that relate to geospatial studies. For example, two programs that NGA sponsors are the NGA Academic Research Program (NARP) and the Vector Training Program.

The NARP is designed to be a multi-disciplinary program of basic research in GEOINT topics through grants and fellowships to the leading investigators, research universities, and colleges of the nation. This research provides the fundamental science support to applied and advanced research programs. Topics include such things as geospatial sciences, geodesy and geophysics, sensors and image science, and information technology.

The Vector Study Program allows GEOINT professionals the opportunity to develop mission-critical skills through continuing education on a full or part time basis while receiving full salary and benefits. The program funds undergraduate, graduate, and postgraduate tuition, fees, books, travel and per diem entitlements, as applicable. Participants are approved for one year of study at the undergraduate and graduate levels and two years of study at the postgraduate level.

GLOSSARY, ABBREVIATIONS AND ACRONYMS

Advanced Geospatial Intelligence (AGI) - Technical, geospatial, and intelligence information derived through interpretation or analysis using advanced processing of all data collected by imagery or imagery-related collection systems. Amplification: This definition of AGI, also known as Imagery-Derived MASINT, includes all types of information technically derived from the processing, exploitation, and non-literal analysis (to include integration or fusion) of spectral, spatial, temporal, radiometric, phase history, and polarimetric data. These types of data can be collected on stationary and moving targets by electro-optical, infrared, radar, and related sensor programs (both active and passive). AGI also includes both ancillary data needed for data processing/ exploitation and signature information (to include development, validation, simulation, data archival, and dissemination). (Joint Pub 2-03 Draft Feb 2006)

Common Operational 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. (DoD Dictionary)

Communications intelligence (COMINT) - Technical information and intelligence derived from foreign communications by other than the intended recipients. (Joint Pub 2-01)

Counterintelligence (CI) - Information gathered and activities conducted to protect against espionage, other intelligence activities, sabotage, or assassinations conducted by or on behalf of foreign governments or elements thereof, foreign organizations, or foreign persons, or international terrorist activities.

DNI - Director of National Intelligence.

Electronic intelligence (ELINT) - Technical and geolocation intelligence derived from foreign non-communications electromagnetic radiations emanating from other than nuclear detonations or radioactive sources. (Joint Pub 2-01)

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.

Geographic Information System (GIS) - The 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 Analysis - The science 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. (NGA Tradecraft Office)

Geospatial data - Any level or type of data that is derived from remote sensing, mapping and/or surveying technologies and references a geographic location.

Geospatial information - Information that 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. (Title 10 U.S. Code, §467)

Geospatial Information and Services (GI&S) - The concept for collection, information extraction, storage, dissemination, and exploitation of geodetic, geomagnetic, imagery (both commercial and national source), gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, and toponymic data accurately referenced to a precise location on the earth's surface. These data are used for military planning, training, and operations including navigation, mission planning, mission rehearsal, modeling, simulation, and precise targeting. Geospatial information provides the basic framework for battlespace visualization. It is information produced by multiple sources to common interoperable data standards. It may be presented in the form of printed maps, charts, and publications; in digital simulation and modeling databases; in photographic form; or in the form of digitized maps and charts or attributed centerline data. Geospatial services include tools that enable users to access a manipulate data, and also includes instruction, training, laboratory support, and guidance for the use of geospatial data. (Joint Pub 1-02)

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 consists of imagery, imagery intelligence, and geospatial information."(U.S. Code, Title 10, §467).

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)

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

Functional Manager - A functional manager provides strategic thinking and guidance, articulates overall direction for the organization and review of and coordination on investment activities related to GEOINT. GEOINT related activities include Research, Development, Test and Evaluation, and procurement activities within the National Intelligence Program, Joint Military Intelligence Program, and Tactical Intelligence and Related Activities aggregate. Review includes GEOINT-related fiscal and personnel resources, Program Objective Memoranda and budget submissions to affect resource allocation decisions and ensure compliance with architecture, equipment, and data and related standards and policy. (NSGD 1100 draft)

Geospatial Intelligence Preparation of the Environment (GPE) - Systematic, 4-component, analytic methodology used to develop predictive GEOINT. Based upon and used to support the military's Joint Intelligence Preparation of the Battlefield (JIPB) process.

Human Intelligence (HUMINT) - A category of intelligence derived from information collected and provided by human sources. (JP 1-02)

Hyper-spectral 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)

Intelligence Community (IC) - Intelligence Community; includes ODNI CIA, NSA, DIA, NRO, NGA, Dept. of Homeland Security/Directorate of Information and Analysis, intelligence elements of the Army, Navy, Air Force, Marine Corps, and Coast Guard, Dept. of State/Bureau of Intelligence and Research (INR), Federal Bureau of Investigation/Office of Intelligence, Dept. of the Treasury/Office of Intelligence Support, Dept. of Energy/Office of Intelligence, Drug Enforcement Agency/Office of National Security Intelligence, other offices of the DoD for collection of intelligence through specialized reconnaissance programs, other elements of any other department or agency as may be designated by the President, or designated jointly by the DNI and the head of the department or agency concerned as an element of the IC.

Imagery - A likeness or presentation of any natural or man-made feature or related object or activity and the positional data acquired at the same time the likeness or representation was acquired, including products produced by space-based national intelligence reconnaissance systems, and likenesses or presentations produced by satellites, airborne platforms, unmanned aerial vehicles, or other similar means (except that such term does not include handheld or clandestine photography taken by or on behalf of human intelligence collection organizations). (Title 10 U.S. Code §467)

Imagery Analysis - The science of converting information, extracted from imagery, into intelligence about activities, issues, objects, installations, and/or areas of interest. (NGA Tradecraft Office)

Imagery Intelligence (IMINT) - The technical, geographic, and intelligence information derived through the interpretation or analysis of imagery and collateral materials. (Title 10 U.S. Code §467)

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.

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)

Joint Intelligence Preparation of the Battlespace (JIPB) - The analytic process used by joint intelligence organizations to produce intelligence assessments, estimates, and other intelligence products in support of the joint force commander's decision-making process. It is a continuous process that includes defining the total battlespace environment; describing the battlespace's effects; evaluating the adversary; and determining and describing adversary potential courses of actions. The process is used to analyze the air, land, sea, space, electromagnetic, cyberspace, and human dimensions of the environment and to determine an opponent's capabilities to operate in each. Joint intelligence preparation of the battlespace products are used by the joint force and component command staffs in preparing their estimates and are also applied during the analysis and selection of friendly courses of action. (JP 1-02)

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)

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.

MTI (Definition #1) - Multispectral Thermal Imager; DOE research imaging satellite with 5m and 20m GSD MSI sensors launched March 2000; has 15 bands.

MTI (Definition #2) - Moving target indicator; category of data derived from pulsed-Doppler radar sent from sensor to user by Joint STARS, bypassing a processor as intermediary; a graphic display of moving target vectors highlighting the direction and velocity of the targets.

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

Multi-INT - The activities used to produce information of required accuracy, confidence level, timeliness and clarity not available through the use of single-INT methods.

National System for Geospatial Intelligence (NSG) - The combination of technology, policies, capabilities, doctrine, activities, people, data and communities necessary to conduct Geospatial Intelligence in a multi-intelligence, multi-domain environment.

ODNI - Office of the Director of National Intelligence.

Open-Source Intelligence (OSINT) - Relevant information derived from overt and non-intrusive systemic collection, processing and analysis of publicly available information. Army draft FM 2-22-9

Persistent Surveillance - A collection strategy that emphasizes the ability of some collection systems to linger on demand in an area to detect, locate, characterize, identify, track, target and possibly provide battle damage assessment and re-targeting in near or real-time. Persistent Surveillance facilitates the formulation and execution of preemptive activities to deter or forestall anticipated adversary courses of action. (Joint Pub 2-01)

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.

Synthetic Aperture RADAR (formerly synthetic antenna RADAR) - makes range, azimuth, frequency, and phase measurements of radar reflectance; supports elevation extraction through stereo correlation, interferometry (IFSAR), or monoscopic autofocus techniques.

Signals Intelligence (SIGINT) - 1. A category or intelligence comprising either individually or in combination all communications intelligence, electronic intelligence, and foreign instrumentation signals intelligence, however transmitted. 2. Intelligence derived from communications, electronic, and foreign instrument signals. (Joint Pub 2-01)

Spatial data - Synonymous with geospatial data.

Thermal IR - Generally, the infrared (IR) region from 3 to 1000m; specifically connotes the two intervals employed in remote sensing (3-5 and 8-14 m); this spectral region spans the radiant power peak of the earth.

Ultraspectral - Sensor or imagery with very narrow bandwidth and thousands of bands in the emissive range; allows detection and identification of solids, liquids, and gases; compare/contrast with monochromatic, multispectral, and hyperspectral .

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APPENDIX

ADMINISTRATIVE INSTRUCTIONS

1. User Comments

Users are highly encouraged to submit comments or feedback on this publication to the NGA Doctrine Office (NGA/OGMC) at www.nga.mil.

2. Authorship

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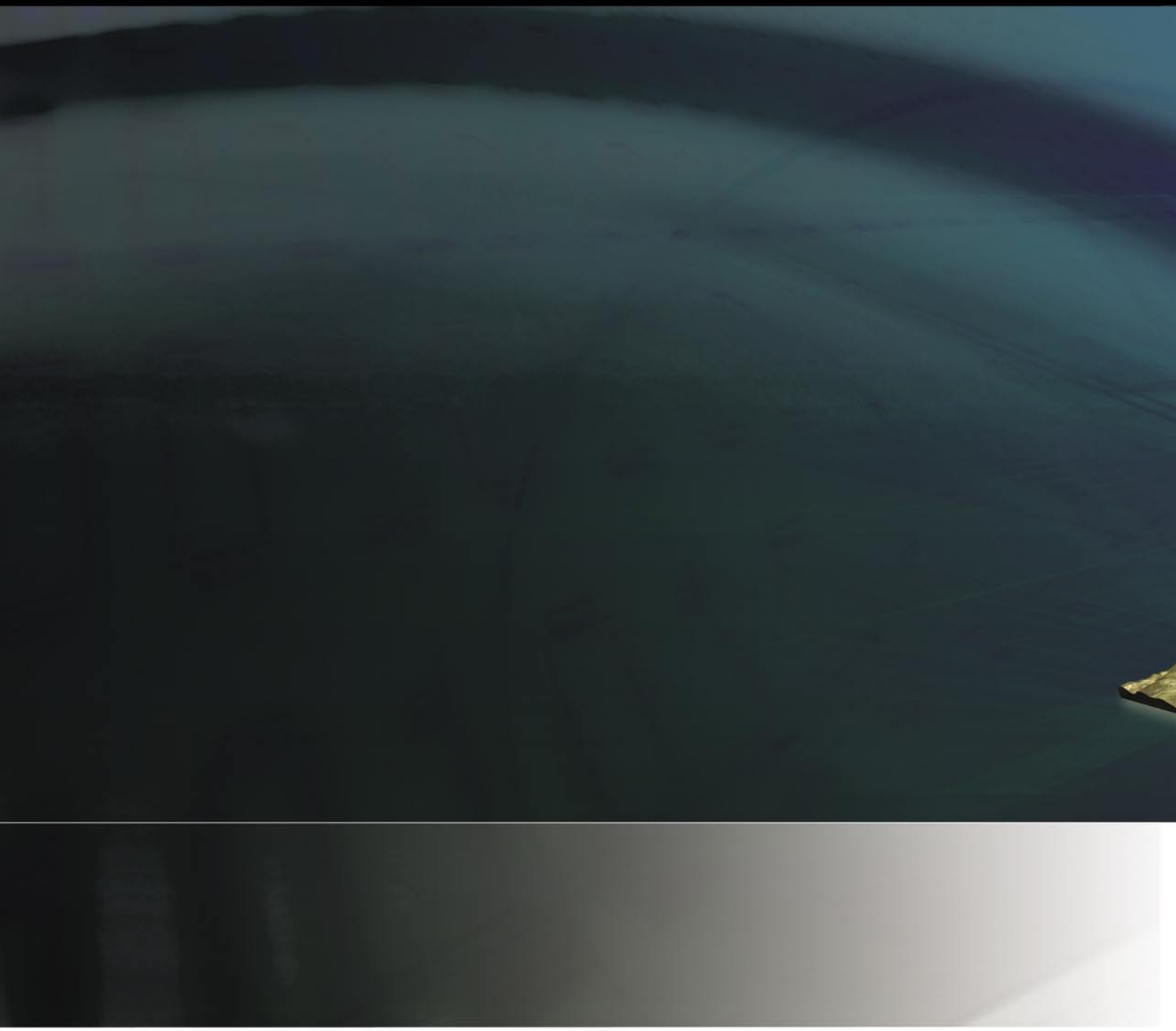

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