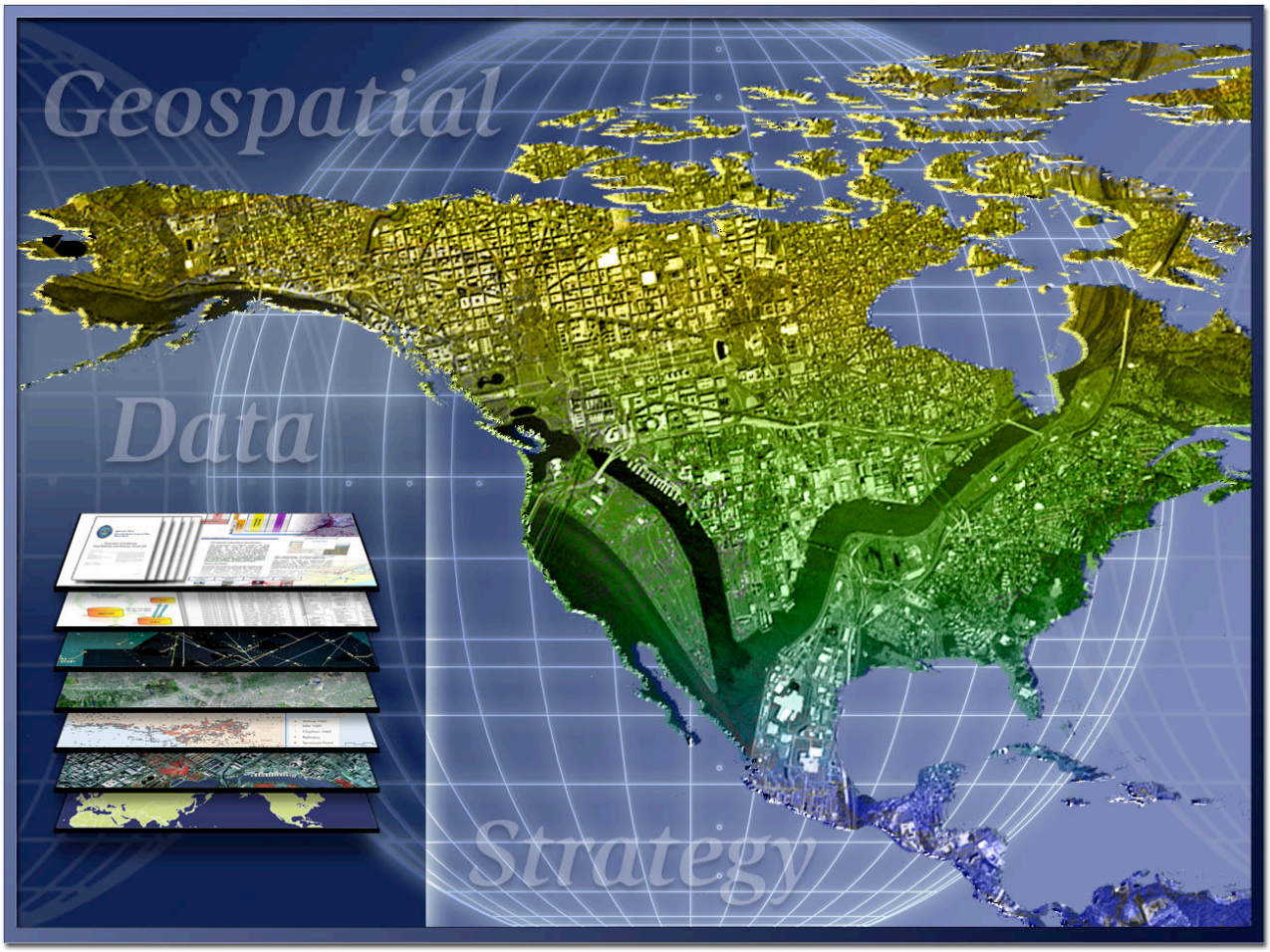
DEPARTMENT OF DEFENSE

Defense Critical Infrastructure Program (DCIP)

Geospatial Data Strategy



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FOREWORD

Within the broad military context, access to accurate and up-to-date geospatial information is absolutely critical. This is a need shared by military operators, planners, and high-level decision makers alike. At its simplest level, this might be information about the location of friendly and enemy forces, lines of communication, and key terrain for a military operation. Within the context of the Defense Critical Infrastructure Program (DCIP)—the Department of Defense (DoD) risk management program that seeks to ensure the availability of networked assets critical to DoD missions—the need is for authoritative geospatial data pinpointing the location of infrastructure assets in the explicit context of understanding specific infrastructure capabilities available at any given time in order to execute risk management strategies. Infrastructure capabilities can be compromised or degraded as a result of associated threats, both man-made and natural hazard. In addition, geospatial data implicitly supports military operations, during which infrastructure assets can be moved, expended, or extended to sustain military forces.

Geospatial information is at the heart of all we do, not only within the DoD, but also within the government and the private sector at large. It is estimated that approximately 80 percent of all information collected and used by government has a geospatial component, that is to say, a correlation to a specific location on the Earth. Due to the pervasive nature of geospatial, or location-referenced, information within our government and society, it is necessary to put into place processes and procedures by which authoritative geospatial information can be developed, maintained, and shared across a wide range of functions and mission areas.

Advances in technology now permit improved acquisition, distribution, and utilization of geospatial data, as well as supporting mapping and analysis technologies. Building upon these capabilities and the goals of the DoD Net-Centric Data Strategy, the DCIP Geospatial Data Strategy establishes a vision for creation and maintenance of a common and comprehensive foundation of geospatial infrastructure data that leverages the very best data sources and tools available for DCIP and DoD use. Implementation of this Strategy will reduce duplication of effort across agencies and organizations, improve the quality and accessibility of DCIP and foundation infrastructure geospatial information, and thereby increase its value and impact to the Department of Defense at all levels.

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1. EXECUTIVE SUMMARY

The Defense Critical Infrastructure Program (DCIP) Geospatial Data Strategy establishes a vision for the creation, use, and maintenance of a common and comprehensive foundation of geospatial infrastructure data. This strategy represents Defense Critical Infrastructure Sectors and their counterpart national-level Critical Infrastructure/ Key Resource (CI/KR) Sectors. This Strategy ensures that DCIP geospatial data and broader national-level critical infrastructure data are timely, accurate, visible, accessible, and understandable in a "many-to-many" construct within the DCIP, the Homeland Defense (HD) arena, and within the Homeland Security (HLS) Community. The goal of the Strategy is to enable authorized users to leverage the same up-to-date and authoritative infrastructure data at the same time within the DCIP Enterprise Architecture (EA). This document identifies the collaborative interagency relationships that are required to build a comprehensive DCIP geospatial data foundation that is nested within the overarching National Infrastructure Protection Plan (NIPP). This Strategy will be supported by implementation guidance.

DoD Directive (DoDD) 3020.40 (Subject: Defense Critical Infrastructure Program (DCIP), dated August 19, 2005), which defines the DCIP, states in section 4.1, "It is DoD policy that: Defense Critical Infrastructure, which includes DoD and non-DoD domestic and foreign infrastructures essential to planning, mobilizing, deploying, executing, and sustaining U.S. military operations on a global basis, shall be available when required. Coordination on remediation and/or mitigation shall be accomplished with other Federal Agencies, State and local governments, the private sector, and equivalent foreign entities, as appropriate." To address the complexities of the interagency environment, this Directive further states in 5.1.4, "The Assistant Secretary of Defense for Homeland Defense (ASD[HD]) shall: Serve as the principal DoD representative for DCIP-related matters with the Congress, the Executive Office of the President, other Federal Agencies, State and local entities, the public, host nations, and other foreign entities. "

Within this interagency construct, the Office of the Assistant Secretary of Defense for Homeland Defense (OASD[HD]) must ensure that appropriate mechanisms are in place and capabilities developed to facilitate the acquisition and maintenance of authoritative geospatial infrastructure data to ensure full spectrum Homeland Defense mission accomplishment. This includes data requirements and source identification, data acquisition, data interoperability, and data dissemination both within the DCIP and the wider Federal interagency Homeland Defense/Homeland Security (HD/HLS) Community. Without appropriate mechanisms in place to develop, acquire, and share accurate, up-to-date, and standardized infrastructure data, OASD(HD) will be unable to maintain efficient, near-real-time situational awareness of critical infrastructure assets and linked foundational infrastructure on a routine basis or during a crisis. This document lays the framework for this necessary DCIP geospatial data foundation as part of the underlying DCIP Enterprise Architecture.

The strategic goals which constitute the DCIP Geospatial Data Strategy include:

- Development and implementation of a DCIP Spatial Data Infrastructure using a National Spatial Data Infrastructure (NSDI)-like approach;
- Development of formalized DCIP geospatial data and visualization requirements processes leveraging existing data providers and capabilities;
- Development of a core geospatial dataset for each Defense Sector, Service, and Combatant Command (COCOM) that conforms to a uniform locational-accuracy standard for all assets;
- Development of a Web-based, service-orientated DCIP EA in which geospatially-referenced asset databases for each Defense Sector, Service, and COCOM are linked in a net-centric solution;
- Implementation of a Web services approach to link the DCIP EA to other geospatial tools and capabilities;
- Cultivation of effective partnerships within the broader HD/HLS Community that will facilitate DCIP access to authoritative CI/KR databases and the best tools available for geospatial data visualization and analysis; and
- Assurance of geospatial data security, information protection, and data access across the DCIP EA.

The DCIP Geospatial Data Strategy goals are supported by the following activities:

- Adaptation of the DCIP Defense Sectors to the geospatial data theme construct with assignment of corresponding data theme lead agency responsibilities;
- Adherence to the evolving standards-based environment promulgated by the Geospatial Intelligence Standards Working Group (GWG) and the Defense Information Systems Agency (DISA);
- Development of consistent, DCIP-wide standardized geospatial metadata conforming to the ISO19115/19139 and DoD Discovery Metadata Specifications;
- Development of an effective spatial data clearinghouse for DCIP geospatial data to facilitate data discovery and access; and
- Cultivation of effective partnerships within DoD and the broader HD/HLS Community that facilitate DCIP access to authoritative CI/KR databases, as well as the best available tools for geospatial data visualization and analysis.

These strategic goals and supporting activities represent a comprehensive approach for development and maintenance of DCIP geospatial data, as well as establishing access to common, authoritative infrastructure data sources as part of the of the DCIP Enterprise Architecture. These goals are buttressed by supporting objectives, which will facilitate development and maintenance of a common and comprehensive foundation of geospatial infrastructure data, leveraging the very best data sources and tools available for use by the DCIP and DoD.

2. FOUNDATION

2.1 NATIONAL SPATIAL DATA INFRASTRUCTURE (NSDI)

The preexisting National Spatial Data Infrastructure (NSDI) is mandated by Executive Order (EO) 12906 (Subject: Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure), dated April 13, 1994. The NSDI is defined as the technology, policies, criteria, standards, and people necessary to promote geospatial data sharing throughout all levels of government, the private and non-profit sectors, and academia. The NSDI was created to provide a consistent means to share geographic data among all users, which could produce significant cost savings for data collection and use and enhance decision making processes. The NSDI further provides a base or structure of practices and relationships among data producers and users that facilitates data sharing and use. The components of the NSDI are standards, metadata (data about data), a National Spatial Data Clearinghouse (to facilitate data discovery and access), geospatial data themes, and the organizational partnerships required to implement and maintain such a system. The NSDI applies to virtually all spatial data and geographic information systems activities financed directly or indirectly, in whole or in part, by Federal government funds. The DCIP Geospatial Data Strategy foundation is derived from the NSDI.

All unclassified geospatial data produced by the Federal government, including the vast majority of national-level infrastructure foundation data, is governed by EO 12906 and the Office of Management and Budget (OMB) Circular A-16 (revised), dated August 19, 2002. Examples of DoD geospatial data activity that fall under the provisions of this Federal direction include the U.S. Army Corps of Engineers (USACE) inland waterway charting program, port facilities mapping program, and the National Inventory of Dams (NID). OMB Circular A-16 incorporates EO 12906; provides direction for Federal agencies that produce, maintain, or use spatial data; and establishes a coordinated approach to electronically develop the NSDI. OMB Circular A-16 also establishes the Federal Geographic Data Committee (FGDC).

2.2 THE FEDERAL GEOGRAPHIC DATA COMMITTEE (FGDC)

The FGDC is the 19-member interagency committee responsible for implementing the NSDI, including promoting the coordinated use, sharing, and dissemination of geospatial data on a national basis. The FGDC is composed of representatives from the Executive Office of the President and Cabinet-level and independent agencies. The FGDC is developing the NSDI in cooperation with organizations from state, local and tribal governments, the academic community, and the private sector.

The FGDC is chaired by the Secretary of the Department of the Interior, with the Deputy Director for Management, OMB, serving as Vice-Chair. Federal departments or agencies responsible for spatial data themes are required to be members of the FGDC. Departments or agencies that are not members of the FGDC but use and/or have activities in geographic

information or spatial data collection may request membership in writing to the Chair of the FGDC.

Table 1. The Federal Geographic Data Committee (FGDC)[1]

Federal Members	Other Collaborating Partners
Department of Agriculture	American Congress on Surveying and Mapping
Department of Commerce	Geospatial Information & Technology Assn.
Department of Defense[2]	International City/County Management Assn.
Department of Energy	National Association of Counties
Department of Health and Human Services	National League of Cities
Department of Homeland Security	National States Geographic Information Council
Department of Housing and Urban Development	Open Geospatial Consortium
Department of the Interior	University Consortium for Geographic Information Science
Department of Justice	Urban and Regional Information Systems Assn.
Department of State	Western Governors' Association
Department of Transportation	
Environmental Protection Agency	
Federal Communications Commission	
General Services Administration	
Library of Congress	
National Archives and Records Administration	
National Aeronautics and Space Administration	
National Science Foundation	
Tennessee Valley Authority	

[1] As of May 2006
[2] Co-represented on the FGDC Steering Committee by the U.S. Army Corps of Engineers (USACE) and the National Geospatial-Intelligence Agency (NGA)

DoD is represented on the FGDC at a variety of levels, thereby ensuring that the Department's interests are adequately represented and that there are multiple conduits for information flow between key DoD entities and the FGDC regarding NSDI initiatives impacting the Defense Community. DoD is represented at the highest level of the FGDC, the FGDC Steering Committee, by the U.S. Army Corps of Engineers (USACE) and the National Geospatial-Intelligence Agency (NGA). In the FGDC Coordination Group, which is composed of the various subcommittee and working group chairpersons and other Federal agencies and FGDC-recognized stakeholder representatives, DoD is represented by the Office of the Deputy Under Secretary of Defense for Installations & Environment (DUSD[I&E]), NGA, and USACE. DoD also plays a significant role in the FGDC's Homeland Security Working Group (HSWG). The HSWG was established under the auspices of the FGDC to serve as the focal point for identification of geospatial metadata, information content, symbology, interface and other specifications, guidelines, and standards required to ensure that geospatial information technologies support the achievement of homeland security strategic goals.

The HSWG also serves as a bridge between the Homeland Security (HLS) and Homeland Defense (HD) geospatial domains. The HSWG serves this bridging function by providing DHS and DoD representatives, as well as other agencies, with a forum for collaboration on cross-domain geospatial requirements definition and complementary standards and policy development. HLS, for which the Department of Homeland Security (DHS) is the Federal lead, is defined as the unified national effort to secure America, prevent and deter terrorist attacks,

protect against and respond to threats and hazards to the Nation, ensure safe and secure borders, welcome lawful immigrants and visitors, and promote the free-flow of commerce. HD, for which DoD is the Federal lead, is juxtaposed to the HLS mission area and encompasses the protection of U.S. sovereignty, territory, domestic population, and critical defense infrastructure against external threats and aggression. The linkage between these two domains is critical, and both should leverage the same commonly identified authoritative data sources for homeland infrastructure visualization and analysis.

2.3 DEFENSE INSTALLATION SPATIAL DATA INFRASTRUCTURE (DISDI)

A partial DoD counterpart program to the NSDI exists within the Defense Installation Spatial Data Infrastructure (DISDI). The DISDI Office was created July 2004 to satisfy OMB Circular A-16 responsibilities for DoD installation geospatial data, to manage development and use of the DoD Installation Visualization Tool (IVT) for the Base Realignment and Closure (BRAC) process, and to serve as the focal point for development of a strategy for integrating geographic information and spatial data activities across the DoD Installations & Environment domain. This DISDI effort is subordinate to the DUSD(I&E) and consists of the business processes, people, and policies necessary to provide installation visualization and mapping capabilities.

DISDI does not focus on Information Technology (IT) development and acquisition. Rather, DISDI is a mechanism by which geospatial data, stewarded at the installation level and by the geospatial programs of the individual Services, can be shared with validated stakeholders to meet their specific installation visualization requirements. These Service-level programs for installation geospatial data, which feed the overarching DISDI initiative, include Air Force GeoBase, U.S. Navy GeoReadiness, the Marine Corps' GEOFidelis, and the Army's Installation Geographic Information and Services (IGI&S) Program and Geographic Information System (GIS) Repository (GISR). The partnership between these Service geospatial programs and DISDI is essential to the process of identifying and incorporating authoritative Service-specific installation geospatial data and technologies into the DoD Net-Centric EA.

Given the fact that a significant number of Defense CI/KR assets are located on DoD facilities, the DCIP is a valid consumer of the authoritative installation data originally produced by GeoBase, GeoReadiness, GEOFidelis, and GISR; certified by individual installation commanders; and, ultimately, incorporated within DISDI. As a result, the DCIP is also a stakeholder in the evolving process by which installation geospatial data are assembled, maintained, and disseminated to support the DISDI customer base. This and other DoD and Federal interagency geospatial data partnerships are key to effective implementation of the DCIP Geospatial Data Strategy.

3. STRATEGIC GOALS AND KEY OBJECTIVES

3.1 GOAL: DEVELOP AND IMPLEMENT A DCIP SPATIAL DATA INFRASTRUCTURE USING AN NSDI-LIKE APPROACH

An NSDI-like construct offers the DCIP a diverse, distributed community environment that will facilitate more efficient and effective ways of accessing, sharing, and using geographic data and will enable more comprehensive analysis of data to aid decision makers and operational entities alike.

NSDI and its supporting components of standards, metadata, a spatial data clearinghouse, and data themes have great applicability to the DCIP Geospatial Data Strategy, even though a significant portion of DCIP data fall into the classified domain and are thereby exempt from strict compliance with EO 12906. While unclassified DoD geospatial data fall within the framework of the NSDI, the following spatial data activities are exempt from EO 12906:

- National security-related (classified) activities of the Department of Defense, as determined by the Secretary of Defense;
- National defense-related activities of the Department of Energy, as determined by the Secretary of Energy;
- Intelligence activities, as determined by the Director of Central Intelligence; and
- The national security-related activities of the Department of Homeland Security, as determined by the Secretary of Homeland Security.

This broad exemption for classified geospatial data activity from the NSDI is based on the intent that spatial data collected by Federal agencies or their agents be made available in the public domain via the National Spatial Data Clearinghouse. Exclusion of classified data is the one component of the NSDI that does not coincide with the DCIP Geospatial Data Strategy.

Although the NSDI was originally envisioned in a pre-2001 environment to support public and private sector applications of geospatial data in areas such as transportation, community development, agriculture, emergency response, environmental management, and information technology, its concepts equally apply to the CIP mission area. Therefore, it is in the best interest of the DCIP Community to apply the principles of the NSDI to its own geospatial activities, provided they do not impose an undue burden on the collective and its members or compromise the sensitive or classified nature of DCIP geospatial data.

Conforming to this model benefits the DCIP Community because the model facilitates more efficient and effective ways of accessing, sharing, and using geographic data. This enables more comprehensive analysis of data to help decision makers choose the best courses of action in a variety of situations. The DCIP Geospatial Data Strategy will accomplish these goals through the following activities: (1) adaptation of the DCIP Defense Sectors to the geospatial data theme construct with assignment of corresponding data theme lead agency responsibilities; (2) adherence to the evolving standards-based environment promulgated by the Geospatial

Intelligence Standards Working Group (GWG) and the Defense Information Systems Agency (DISA); (3) development of consistent, DCIP-wide standardized geospatial metadata conforming to the ISO19115/19139 and DoD Discovery Metadata Specifications; (4) development of an effective spatial data clearinghouse for DCIP geospatial data to facilitate data discovery and access; and (5) cultivation of effective partnerships within DoD and the broader HD/HLS Community that will facilitate DCIP access to authoritative CI/KR databases, as well as the best available tools for geospatial data visualization and analysis.

3.1.1 Objective: Adapt the DCIP Defense Sectors to the Geospatial Data Theme Construct with Assignment of Corresponding Data Theme Lead Agency Responsibilities

3.1.1.1 NSDI Data Themes

An important component of the NSDI is data themes. Data themes are electronic records and coordinates for a topic or subject, such as elevation (terrain) or transportation. OMB Circular A-16 requires the development, maintenance, and dissemination of a standard core set of digital spatial information for the NSDI that serves as a "foundation map" for users of geographic information. This set of data consists of themes of national significance. Themes providing the most commonly used set of base data within the NSDI are known as "framework data." These framework data include: geodetic control (coordinate system), ortho-imagery (geo-referenced images), elevation, bathymetry (water depth), transportation, hydrography (water bodies), cadastral (land ownership), governmental units (government administrative boundaries), and other themes of national significance. There are currently 34 unique data themes that constitute the standard core set of digital spatial information for the NSDI (see Appendix C). These NSDI data themes, developed with FGDC-compliant metadata and served through the National Spatial Data Clearinghouse, facilitate interoperability and information exchange across organizations and administrative boundaries.

3.1.1.2 NSDI Data Theme Lead Agencies & Responsibilities

Per OMB Circular A-16, certain Federal agencies have lead responsibilities for coordinating the national coverage and stewardship of specific spatial data themes. Key responsibilities of a data theme lead agency include the following: (1) development and implementation of "theme-specific" data content standards; (2) development and implementation of a plan for building nationwide coverage for the theme; (3) collection and analysis of "theme-specific" data requirements from users; (4) designation of a point of contact within the lead agency who is responsible for developments, maintenance, coordination, and dissemination of data using the National Spatial Data Clearinghouse; and (5) publication of maps or comparable graphics online, which show the current extent and status of the data theme(s) for which they have lead responsibility. These NSDI data theme lead agencies represent authoritative sources for domestic geospatial data produced by the Federal government.

Table 2. NSDI Framework Data Themes & Lead Agencies

"Framework" Data Theme	Corresponding NSDI Data Theme Lead Agency
Cadastral	Dept. of Interior / Bureau of Land Management (DOI/BLM)
Digital Ortho-Imagery	Dept. of Interior / U.S. Geological Survey (DOI/USGS)
Elevation (Terrestrial)	DOI/USGS
Elevation (Bathymetric) - U.S. Waters Outside Channels - Inland Waterways	 - Dept. of Commerce / National Oceanic & Atmospheric Admin. (DOC/NOAA) - U.S. Army Corps of Engineers (USACE)
Geodetic Control	DOC/NOAA
Governmental Units	Dept. of Commerce / U.S. Census Bureau
Hydrography	DOI/USGS
Transportation (Marine)	USACE
Transportation (All other modes)	Dept. of Transportation / Bureau of Transportation Statistics

3.1.1.3 NSDI Data Theme Gaps

Homeland Security Presidential Directive (HSPD)-7 establishes a national policy for Federal departments and agencies to identify, prioritize, and protect U.S. CI/KR assets and builds a foundation for the current set of 17 CI/KR Sectors and their corresponding lead Sector-Specific Agencies (SSAs). An SSA is a Federal department or agency responsible for infrastructure protection activities in a designated CI/KR category, as identified by HSPD-7.

While the current list of NSDI data themes and associated lead agencies provide a solid foundation for a large number of geospatial activities undertaken by the Federal government, it is incomplete from a Critical Infrastructure Protection (CIP) mission perspective. Analysis relating HSPD-7 lead SSAs to NSDI data theme lead agencies identifies a number of critical gaps in current NSDI data theme coverage. NSDI data themes and corresponding data theme lead agencies have not been identified for approximately three-quarters of the CI/KR Sectors. Therefore, no Federal government department or agency has been given official responsibility for coordinating the national coverage and stewardship of these specific data themes. Lacking established NSDI data themes and lead agencies for 13 of 17 CI/KR Sectors, identification of authoritative data sources in these areas is problematic for the DCIP and for the DoD Net-Centric Enterprise, which specifies the use of authoritative data sources. Logical data theme lead agencies for these currently unaddressed Sectors are suggested in Table 3. The DCIP Community will work with DHS through FGDC bodies, such as the Homeland Security Working Group (HSWG), to nominate new data themes and corresponding lead agencies for inclusion within the NSDI. Per OMB Circular A-16, lead agency responsibilities and new data themes may be added or altered with the recommendation of the FGDC and concurrence by the OMB.

Table 3. NDSI Data Theme Gaps

	Critical Infrastructure / Key Resource (CI/KR) Sector	Lead Sector-Specific Agency (SSA)	NSDI Data Theme Lead Agency (none designated; logical lead)
Critical Infrastructure	Agriculture & Food[1]	Dept. of Agriculture (USDA)	USDA
	Banking & Finance	Dept. of Treasury (DOT)	Dept. of Treasury (with FDIC)
	Chemical	Dept. of Homeland Security (DHS) Office of Infrastructure Protection (OIP)	EPA
	Defense Industrial Base (DIB)	Dept. of Defense (DoD)	DoD (Defense Contract Management Agency)
	Emergency Services	DHS/OIP	DHS/ Federal Emergency Management Agency (FEMA)
	Energy (except nuclear)[2]	Dept. of Energy (DOE)	DOE
	Healthcare & Public Health[3]	Dept. of Health & Human Services (HHS)	HHS
	Information Technology	DHS/Cyber & Telecommunications	DHS/Cyber & Telecommunications (NCS)
	Postal & Shipping	DHS/Transportation Security Admin. (TSA)	DHS/TSA (with U.S. Postal Service)
	Telecommunications	DHS/Cyber & Telecommunications	DHS/Cyber & Telecommunications (NCS)
	Transportation	DHS/TSA and U.S. Coast Guard (USCG)	U.S. Army Corps of Engineers (USACE) [6] Dept. of Transportation (DOT)[7]
	Water[4]	Environmental Protection Agency (EPA)	EPA
Key Resources	National Monuments & Icons	Dept. of Interior (DOI)	DOI/National Park Service (NPS)
	Commercial Facilities	DHS/OIP	DHS/OIP
	Government Facilities	DHS/Federal Protective Service (FPS)	General Services Admin. (GSA)
	Dams	DHS/OIP	USACE
	Nuclear Facilities[5]	DHS/OIP	Nuclear Regulatory Commission (NRC)

[1] Food responsibility includes meat, poultry, and egg products only.
[2] Includes production, refining, storage, and distribution of oil and gas, and electric power, except for commercial nuclear power facilities.
[3] Includes responsibility for food other than meat, poultry, and egg products.
[4] Drinking water and water treatment systems.
[5] Commercial nuclear reactors, materials, and waste.
[6] Responsible for inland and intracoastal waterways.
[7] Responsible for all other modes of transportation.

Another shortfall of the NSDI data theme approach from the DCIP perspective is its exclusive focus on the United States, its territories, and possessions. With a significant number of Defense Critical Infrastructure assets located outside of this U.S. "homeland" geographic area, the DCIP must have authoritative sources of geospatial data on overseas assets that it can readily access as part of the DCIP Geospatial Data Strategy. This Strategy recognizes this requirement and the important roles played outside of the NSDI by the Services, COCOMs, Defense Sector Lead Agencies, and NGA in acquiring and maintaining this internationally-focused geospatial data. This is a necessary extension of the NSDI framework required to meet the unique geospatial data needs of the DCIP Community.

Another issue with the NSDI, as it relates to HSPD-7, is the alignment of responsibilities. HSPD-7 SSAs do not necessarily correspond to NSDI data theme lead agencies in those instances where data themes have been established and lead agencies designated. This is the case for the CI/KR Sectors of Transportation and Government Facilities. NSDI data theme leadership for Transportation is split between the U.S. Army Corps of Engineers (USACE) for Marine Transportation and the Dept. of Transportation/Bureau of Transportation Statistics

(DOT/BTS) for all other forms of transportation. This is different from the HSPD-7 SSA responsibility for the Transportation Sector, which lies with DHS/Transportation Security Administration (TSA) and the U.S. Coast Guard. A similar situation exists with the Key Resource (KR) Sector of Dams. Although the Dept. of the Interior (DOI) is the HSPD-7 SSA for Dams, the USACE has the Congressional mandate to maintain the National Inventory of Dams (NID). The result of these situations could be a misalignment of sector-specific responsibilities and resources for identifying, locating, and protecting sector assets. Ideally, there should be complete agreement between each HSPD-7 SSA and the corresponding NSDI data theme lead agency.

For a CI/KR Sector such as Government Facilities, where there are split spatial data responsibilities (e.g. General Services Administration [GSA] for civilian government facilities and DoD/DISDI for defense installations), there should be dual NSDI data theme leadership. For Government Facilities, this currently is not the case; GSA is the sole NSDI data theme lead. Where alignment of NSDI data theme leadership with HSPD-7 SSA responsibility is not possible or practical, a joint coordinating body should be established between the NSDI data theme lead(s) and the HSPD-7 SSA to ensure an effective joint strategy for accomplishing both NSDI and infrastructure protection responsibilities.

3.1.1.4 Defense Sector Data Theme Lead Agents and Roles

The DCIP Geospatial Data Strategy envisions creation of a DCIP Spatial Data Infrastructure construct similar to the NSDI, but expanded to account for the exception of the NSDI's public information mandate and its exclusive focus on homeland data sources. Because there is no established NSDI data theme for Defense Critical Infrastructure, OASD(HD), as the designated lead for the DCIP Community, asserts its right to assign geospatial lead agency responsibilities for the various Defense Critical Infrastructure Sectors.

Defense Sector geospatial data themes must be established and lead agent responsibilities for DCIP geospatial data must be assigned for a DCIP-focused spatial data infrastructure to function effectively. Unlike the HSPD-7 Sectors and their associated NSDI data theme lead agencies, the Defense Sectors and associated geospatial data theme lead agents for Defense Critical Infrastructure will show a one-to-one correspondence. Defense Sector geospatial data theme lead agents should also correspond to the overall Defense Sector Lead Agents as identified in DoDD 3020.40 and shown in Table 4.

DCIP Lead Agent responsibilities for geospatial data must be assigned to build a spatial data infrastructure that can be leveraged to its maximum potential by all DCIP stakeholders and to allocate resources efficiently. These responsibilities should include the following:

- Development, implementation, and maintenance of procedures for advancing geographic information and related spatial data activities appropriate to their mission in support of the DCIP;

- Collection, maintenance, and dissemination of spatial information such that the resulting data, information, or products can be readily shared with other DCIP Community members, as well as other HD/HLS partners;
- Use of GWG-approved and other appropriate standards, documenting spatial data with the relevant metadata, and making metadata available online via the DoD Metadata Registry and DCIP/DoD clearinghouse activity in accordance with the DoD Discovery Metadata Standard (DDMS); and
- Appointment of an executive agent to coordinate with other lead agencies for collection, acquisition, maintenance, or dissemination of the spatial data used by their Sector in support of the DCIP.

Table 4. Defense Sector Geospatial Data Themes and Corresponding Lead Agents

DEFENSE SECTOR	LEAD AGENCY
Defense Industrial Base (DIB)	Defense Contract Management Agency (DCMA)
Financial Services	Defense Finance & Accounting Service (DFAS)
Global Information Grid (GIG)	Defense Information Systems Agency (DISA)
Health Affairs	Office of the Assistant Secretary of Defense for Health Affairs—OASD(HA)
Intelligence, Surveillance, and Reconnaissance (ISR)	Defense Intelligence Agency (DIA)
Logistics	Defense Logistics Agency (DLA)
Personnel	Defense Human Resources Activity (DHRA)
Public Works	U.S. Army Corps of Engineers (USACE)
Space	U.S. Strategic Command (USSTRATCOM)
Transportation	U.S. Transportation Command (USTRANSCOM)

An important clarification of these proposed Defense Sector geospatial data theme lead agent responsibilities relates to the DISDI Community of Interest (CoI). DISDI retains responsibility for the collection, maintenance, and dissemination of Installation and Environment (I&E) geospatial data (e.g. installation maps). However, USACE, as the lead agency for the Public Works Defense Sector, will have the responsibilities outlined in this section but pertaining specifically to this Sector's identified Defense Critical Infrastructure. There will need to be close, ongoing coordination between USACE and DISDI to ensure that USACE is leveraging the authoritative I&E data already collected by DISDI as part of the geospatial foundation for this Sector. This type and level of coordination applies to the other Defense Sectors as well in that a significant number of Defense Critical Infrastructure assets are located on military facilities and, therefore, within the DISDI domain.

3.1.2 Objective: Adhere to the Evolving Standards-Based Environment Promulgated by the GWG and DISA

3.1.2.1 Standards

Development and implementation of an effective body of geospatial data standards is central to the creation of an effective NSDI-like construct for the DCIP. Standards are common and repeated rules, conditions, guidelines or characteristics for data, and related processes, technology, and organization. The DCIP must adhere to the same standards-based model developed and adopted by the FGDC for use within the NSDI. This allows the DCIP to have its own authoritative geospatial data effectively interoperate with infrastructure and threat data developed and maintained by its Federal interagency partners. The NSDI and any counterpart DoD or DCIP "spatial data infrastructure" exchange is made possible only by their use of common standards and protocols for data development, documentation, exchange, and geospatial services.

NSDI standards are developed and promulgated by the FGDC in accordance with OMB Circular A-119 using an FGDC-established process with input from a broad range of data users and providers. As a rule, the FGDC adopts national and international geospatial data standards in lieu of "Federal-only," national, or agency-specific standards whenever possible. This is to the benefit of DoD, as DoD routinely accesses and uses international partner geospatial data to support a variety of mission areas. FGDC adoption of internationally-recognized geospatial data standards for Federal government use helps create an environment in which data interoperability issues are reduced, particularly in situations where DoD must work with alliances or other foreign military partners. Adoption of these international geospatial standards also facilitates integration of homeland and international DCIP geospatial data for seamless visualization and analysis.

3.1.2.2 DoD Standards Environment

As an active member of the FGDC Standards Working Group, NGA has been instrumental in DoD's adoption of common standards. The standards approved and established by the FGDC lay the foundation for Geospatial Intelligence (GEOINT) standards within DoD and the Intelligence Community (IC). NGA engages these communities through its National Center for Geospatial Intelligence Standards (NCGIS), through its GEOINT Standards Program, and, most directly through the GWG. The GWG is separate from, but linked to, the FGDC Standards Working Group.

NGA established the NCGIS in October 2003. The NCGIS manages the GEOINT Standards Program, which supports the requirements of the National System for Geospatial Intelligence (NSG) Community and the NSG enterprise-wide system architecture. The NSG is defined as the integration of technology, policies, capabilities, and doctrine necessary to conduct geospatial intelligence in a multi-intelligence environment. The NCGIS ensures a standards-based approach to interoperability by setting, implementing, and advocating GEOINT standards and

standards management processes and policies that promote interoperability and operational efficiency across the NSG Community. The NCGIS also coordinates the efforts of the GWG, which draws its members from throughout the NSG Community.

The primary responsibility of the GWG is to build consensus for and approval of geospatial standards for the NSG Community. The GWG has adopted a wide variety of geospatial mapping standards, including ones covering metadata, feature and attribute cataloguing, spatial and temporal schema, imagery formatting, Web services, and symbology, among others (see Appendix B). These standards have been inserted into the DoD Information Technology Standards Registry (DISR), which is maintained by the Defense Information Systems Agency (DISA). The DISR is mandated for the management, development, and acquisition of new or improved information technology (IT) systems throughout DoD. Therefore, GWG-approved standards have broad impact and serve as direction for DoD geospatial activities at large.

Although DISA is charged with responsibility for data services and other data-related infrastructures that promote interoperability within the DoD's Net-Centric environment, DISA defers to the NCGIS and the GWG on interoperability and standards issues related to geospatial information. These DoD-approved, often internationally-based standards form a robust foundation for DoD's geospatial data activities, which is consistent with the standards-based approach of the NSDI. It is the intent of the DCIP to follow the standards developed by the GWG and, when appropriate, recommend geospatial standards changes or new standards to that body.

3.1.3 Objective: Develop Consistent, DCIP-Wide Standardized Geospatial Metadata Conforming to the ISO19115/19139 and DoD Discovery Metadata Specifications

Metadata, in the geospatial context, are information about data and/or geospatial services, such as content, source, vintage, spatial scale, accuracy, projection, responsible party, contact phone number, method of collection, and other descriptions. Metadata are critical to document, as they preserve and protect agencies' and communities' spatial data assets. Reliable metadata, structured in a standardized manner, are essential to ensuring that geospatial data are used appropriately and that any resulting analysis is credible. Metadata also can be used to facilitate the search and access of datasets or geospatial services within a "clearinghouse" or data library structure. The FGDC's Content Standard for Digital Geospatial Metadata (CSDGM) was developed in 1998 for this purpose. Subsequently, the internationally-accepted ISO19115/19139 geospatial metadata standards have been approved by the DoD Geospatial Intelligence Standards Working Group and inserted into the DISR. These companion metadata standards establish the framework for production of standardized DoD geospatial metadata to preserve the value and meaning of geospatial datasets, allow search and retrieval of metadata (data discovery), and aid in data transfer.

3.2 GOAL: DEVELOP FORMALIZED DCIP GEOSPATIAL DATA AND VISUALIZATION REQUIREMENTS PROCESSES LEVERAGING EXISTING DATA PROVIDERS AND CAPABILITIES

The DCIP must establish a formalized geospatial data requirements process that involves all of the DCIP Community stakeholders to ensure ready access to the wide variety of geospatial data that are required to perform risk management functions in support of the National Military Strategy. This data requirements process will include the DCIP Defense Sector Lead Agencies, Services, COCOMs, as well as the DCIP analytical support community. This is a necessary step in building a comprehensive, integrated capability to identify, visualize, analyze, and maintain situational awareness of all Defense Critical Infrastructure, as well as supporting foundation infrastructure.

The baseline analysis of DCIP information requirements dictates what geospatial data must be collected or developed to answer the critical infrastructure-related questions of DCIP decision makers and operational entities. This requirements analysis includes determination of attributes and specific data field requirements for individual datasets. Because this requirements definition process involves all DCIP Community stakeholders, OASD(HD)CIP will lead this effort via the emerging DCIP Geospatial Community of Interest (CoI). Requirements for geospatial data from DCIP Community members will be levied by OASD(HD) in coordination with the Joint Staff.

3.2.1 Objective: Identify DCIP-specific Data Requirements and Process

Baseline requirements identification is essential to building an effective DCIP geospatial data requirements process. At its highest level, it will take into account ASD(HD), Defense Sector Lead Agents', the Services', and COCOM commanders' critical information requirements, as they relate to Defense Critical Infrastructure, for contingency planning and operations and for maintaining routine situational awareness of Defense Critical Infrastructure. Once these information requirements are identified, the Defense Sector Lead Agencies, Services, COCOMs, and the DCIP analytical support community can determine what types of existing and new geospatial data are required to satisfy the information needs of both the DCIP leadership and operational counterparts.

Because the information needs of the DCIP Community will evolve, and access to types of geospatial data and emerging technologies will change over time, the DCIP geospatial data requirements process must be cyclic and updatable. This function will be facilitated through the establishment of a DCIP-specific Geospatial CoI comprised of geospatial data leads from each of the DCIP stakeholder and supporting organizations. This CoI should include the Defense Sector Lead Agencies, COCOMs, DISDI, the Services, and representatives from the DCIP analytical support community. Although this geospatial data requirements update process could be done on an annual cycle, there must be provision for ad hoc and time-sensitive requirements identification that might fall outside of the annual update process.

Related to the DCIP data requirements process is the question of which governmental entities have the authority to define and certify data as "authoritative" or as the best or most accurate source for Federal use. This is a currently unresolved issue in the Federal geospatial community. Existing policy guidance governing the NSDI, specifically OMB Circular A-16, does not directly assign this role, though it implies that the NSDI data theme lead agencies are to play this role. Due to the facts that NSDI data theme leadership has not been established for a large number of infrastructure sectors and that currently there is no NSDI data theme for Defense Critical Infrastructure, OASD(HD) asserts that this function for DCIP-specific geospatial data layers should be performed by the emerging DCIP Geospatial Community of Interest.

3.2.2 Objective: Identify Data Visualization and Analysis Requirements

A formalized effort is necessary to capture current and long-term DCIP Community geospatial visualization and analysis requirements. To meet the needs of all DCIP stakeholders, baseline geospatial visualization and analysis requirements must be solicited from this Community. Part of this dialogue must consider the different customer base groups that will use the capability and the functionality that each requires. An important consideration is the primary customer base and what purpose the tools should serve. Is it high-level decision making or is it detailed infrastructure analysis? If the purpose is dual, then substantial customization of the capability may be required for each audience. If the functionality required by different user groups is too diverse, then different capabilities may need to be developed for the two divergent user groups.

3.2.3 Objective: Integrate DCIP Geospatial Data Requirements into the Body of Accepted Federal Interagency Geospatial Data Requirements via Mechanisms such as the HSIP MEDS and the FGDC Homeland Security Geospatial Data Content Guidelines

In many cases, satisfaction of specific DCIP geospatial data requirements will involve Federal interagency data providers and sources. The DCIP geospatial data requirements process must be closely linked to the Federal interagency data requirements process to ensure fulfillment of DCIP-specific requirements and to leverage existing interagency requirements and authoritative data sources. Currently, the two most influential Federal interagency geospatial data requirements efforts are the NGA-lead Homeland Security Infrastructure Program (HSIP) and the separate but linked FGDC Homeland Security Working Group (HSWG) Data Content Subgroup initiative.

In the summer of 2002 NGA and USGS initiated a collaborative Tiger Team project under the HSIP. The goals of HSIP were three-fold: (1) identify and prioritize the largest and most important urbanized areas in the U.S. according to a methodology designed to show their relative importance as potential terrorist targets, (2) define the geographic extent of each of these high-profile urbanized areas, and (3) identify the geospatial Minimum Essential Data Sets (MEDS) requirements for the homeland that would meet the geospatial needs of the evolving HD/HLS Community. Using the USGS' "framework data" coverage for The National Map as a

foundation, the Tiger Team made an assessment of datasets required for national-wide and urban-level detail. The end result was a list of 103 MEDS that NGA and USGS continue to use today as their baseline geospatial requirements list for the HD and HLS mission areas. It remains the best-known Federal interagency geospatial requirements list; however, it is recognized that the HSIP MEDS is only a partial requirements list because the original development process did not involve the input of interagency sector-specific subject matter experts (SMEs). Nonetheless, HSIP provides a much-needed, common geospatial frame of reference for situational awareness, critical infrastructure analysis, and a host of other HD/HLS requirements.

The second prominent Federal data requirements effort—the FGDC HSWG Data Content Subgroup initiative—emerged from the interim goal of updating the content of the HSIP MEDS. The Subgroup, which included membership from USGS, NGA, DHS, and the DCIP, also intended to provide guidance to state and local governments on the type of geospatial data content they should collect as part of any Federal Homeland Security Grant Program (HLSGP)-funded projects that involve geospatial technology and geospatial data collection. The goal of the FGDC HSWG Data Content Subgroup initiative was to develop a single authoritative source for geospatial data content requirements supporting Homeland Security and Homeland Defense applications. The resulting Homeland Security Geospatial Data Content Guidelines were produced in November 2005. The Data Content Subgroup retains maintenance responsibility for this document and the subsequent Geospatial Data Model (GDM) currently used by DHS.

These two interagency geospatial requirements efforts are the best mechanisms for DCIP to forward its own baseline and evolving geospatial data requirements into the Federal interagency arena. Using this approach, broad consensus will be built around requirements common to both the HD and HLS domains. This type of cross-domain consensus within the Federal interagency allows more effective application of limited resources for geospatial data acquisition or development required to support both domains. This approach is consistent with the DoD Net-Centric Data Strategy goal of increasing enterprise and community data over private user and system data.

Although HSIP and the FGDC HSWG Data Content GDM represent a solid baseline into which the DCIP's homeland-specific geospatial data requirements can be incorporated, this DCIP Geospatial Strategy recognizes the need for a separate mechanism to integrate DCIP requirements for international geospatial data focused on overseas Defense Critical Infrastructure. NGA, the COCOMs, Services, and Defense Sector Lead Agencies will play an important role in defining this process for international DCIP geospatial data going forward.

3.3 GOAL: DEVELOP A CORE GEOSPATIAL DATASET FOR EACH DEFENSE SECTOR THAT CONFORMS TO A UNIFORM LOCATIONAL ACCURACY STANDARD FOR ALL ASSETS

3.3.1 Objective: Develop a Uniform Locational Accuracy Standard for All Assets

Per DoD Directive 3020.40, the responsibilities for mission area analysis and sector characterization are distributed throughout the DCIP stakeholders, who will leverage or enhance existing operational data stores within their individual business domains to perform DCIP activities. In many cases, lead component agencies, Services, and COCOMs have developed DCIP-specific database solutions. However, currently there is no standard within the DCIP that requires the location of individual Defense Critical Infrastructure assets be captured in these sector-specific databases with a particular degree of geospatial (or positional) accuracy. In some cases, the locations of these DCIP assets are only recorded by street address, which, in most cases, does not provide a sufficient level of positional accuracy. In other cases, the locations of assets are represented by ZIP Code or military base center points (centroids) an even less accurate way of recording locational position.

Table 5 shows that even when using latitude and longitude measurements to record the position of an asset, locational accuracy is dependent on the precision standard that is required. DCIP asset database owners must develop and maintain their data to a set standard of geospatial accuracy to afford decision makers and operators alike the knowledge that any geospatial data accessed through the DCIP EA is sufficiently accurate to allow location-related decisions to be made with confidence. In most cases, a precision of four decimal places for latitude-longitude coordinates will provide this level of confidence (within 8 meters). This is the recommended minimal standard for locational accuracy of this DCIP Geospatial Data Strategy.

Table 5. Positional Accuracy: Decimal Places and Derived Latitude-Longitude Positional Accuracy

Number of Decimals	Example	Positional Accuracy (in meters)
1	49.1	+/- 8,000
2	52.12	+/- 800
3	48.352	+/- 80
4	45.8972	+/- 8
5	51.22135	+/- 0.8
6	50.895132	+/- 0.08

3.3.2 Objective: Develop a Strong Awareness of the Types of Geospatial Data Available to DCIP Stakeholders

The DCIP and larger Homeland Defense Community use a wide array of geospatial data types to facilitate mission accomplishment. These data types include vector data, raster data (imagery and maps), and "specialty" data, such as hazard model data. Each of these data types plays an important role in building and maintaining situational awareness of critical infrastructure and

potential threats to these assets. All DCIP stakeholders must have a strong awareness of the different types of data available and how each can benefit their DCIP activities in order to build a successful geospatial data requirements process. This objective can be accomplished in part by ensuring CIP officers' awareness of and access to a variety of geospatial training opportunities, including computer-based training (CBT) modules, as well as mobile training team (MTT) and other group training opportunities offered by NGA and the COCOMs. COCOMs also offer resident and mobile geospatial training courses via their Regional Joint Intelligence Training Facilities (RJITF). In addition to the training resources available through NGA and the COCOMs, the Information Resources Management College (IRMC) of National Defense University (NDU) offers graduate-level education and professional development courses in homeland security concepts and technologies, critical infrastructure protection, enterprise architecture, and net-centric operations.

3.3.2.1 Vector Data

The most common and widely used type of geospatial data are vector data. Vector data can be divided into three basic types: point data, line (or arc) data, and polygon data. Point data are the most common of the three types and are typically used to represent nonadjacent features. Examples include a bridge, building, or other non-linear points of interest. Point data can also be used to represent abstract points or activity locations. For instance, point data can represent city locations or place names. Line (or arc) data are used to represent linear features. Common examples are road centerlines and pipelines. Polygon data are used to represent areas. Examples include building footprints, ZIP Code areas, and areas of interest.

Vector format data provide a smart database with associated data attributes that support intelligent manipulation of the data and is the best-suited data format for the GIS environment. Vector data also require less disk storage space and allow hyper-linkage to other data types such as publication data. Another benefit of vector data, when used correctly, is simplification of the GIS display. This is a result of the basic geometries (e.g. point, line, and polygon) represented by vector data.

3.3.2.2 Raster Data

Raster data are cell-based spatial datasets, in contrast to the points, lines, and polygons of vector datasets. NGA is the main provider of raster data to the DCIP and broader Homeland Defense Community. Although NGA is not the producer of all raster data useful from a DCIP or Homeland Defense perspective, NGA will be the DCIP conduit for most of this data. Examples of raster data include imagery and maps.

3.3.2.3 "Specialty" Data

There are a number of different types of "specialty" data the DCIP must be able access in near-real-time in order to maintain effective situational awareness of the likely impact of potential

hazards or threats on its assets or supporting infrastructure. Integration of this data is also required from a training and exercises perspective, including modeling and simulation. These types of specialty data include both natural and man-made hazard model data and weather data.

3.3.3 Objective: Develop a Core Geospatial Dataset for Each Defense Sector through the Identification and Acquisition of Authoritative Infrastructure Data

3.3.3.1 Federal Interagency Data Sources

Federal interagency partners provide a substantial number of homeland infrastructure vector datasets currently used to support DCIP visualization and analysis. These partners include the Environmental Protection Agency (EPA), Department of Energy (DOE), Federal Emergency Management Agency (FEMA), U.S. Coast Guard (USCG), and the Department of Transportation (DOT), among others. Most of this data is unclassified and is currently not directly available from the data originator via an EA. This puts a significant burden on the DCIP EA to develop appropriate mechanisms and procedures to acquire routine updates to ensure accessibility of the most up-to-date data via the DCIP EA.

3.3.3.2 Unified Vector Dataset—HSIP Gold

NGA is the main source of vector data supporting the DCIP and broader Homeland Defense Community. NGA is a national intelligence and Combat Support Agency, whose mission in part is to provide timely, relevant, and accurate geospatial intelligence in support of national security. This has enabled NGA to pursue acquisition of a wide variety of different types of geospatial data for HD/HLS and Outside the Continental United States (OCONUS) purposes and for their own enterprise solution.

NGA is actively involved in fulfilling these homeland data requirements through identification and acquisition of authoritative Federal government data sources and through negotiation of a variety of Federal omnibus data licenses with commercial data providers. The result of this effort has been creation of a "unified vector data set" called "HSIP Gold," that exceeds the HSIP MEDS in content; is updated at least annually; is consistently improving in content, accuracy, and quality; and is deliverable to the Federal interagency HD/HLS Community.

NGA's Office of Americas/North America & Homeland Security Division (PMH) first produced HSIP Gold in 2005 as the Agency's initial compilation of vector data across all national infrastructure sectors for distribution to the Federal HD/HLS customer base. HSIP Gold includes approximately 200 domestic infrastructure layers, which represent the best available infrastructure-specific vector data that PMH has in terms of accuracy, inclusiveness, and attribution.

Although currently a non-enterprise solution, HSIP Gold has become the de facto homeland infrastructure geospatial foundation for the Federal interagency community. While HSIP Gold

has only been in distribution since August 2005, numerous DoD and non-DoD agencies and organizations are using the data collaboratively, as demonstrated in Table 6. Given the pervasive use of HSIP Gold across the Federal interagency community, the DCIP will use HSIP Gold as a standard data source to enhance analysis of the Defense Sectors, as well as their supporting foundational infrastructures. HSIP Gold enhances Defense Sector analysis by providing a comprehensive source of free infrastructure data that can be used for visualization and interdependency analysis. HSIP Gold will only grow in value to the DCIP as its content is improved over time through recurring, formal HSIP Gold feedback sessions, which solicit user input on more authoritative data sources and valuable additional datasets for potential inclusion in the HSIP Gold inventory. Through this process, the DCIP can be assured access to a continually improving, comprehensive, and free data inventory that is common to both the DoD and the Federal interagency.

3.3.3.3 OCONUS Vector Data

To satisfy the additional need for authoritative infrastructure data supporting international DCIP assets, the DCIP Community will continue to rely on NGA, the regional COCOMs, and Services as primary sources of OCONUS infrastructure data. The roles that these entities play include those of geospatial data producer and data broker as they interface with host nation governments in the DCIP arena. The U.S. Department of State also is positioned to play an influential role as data broker in acquiring geospatial data that can add value to the DCIP mission area.

Table 6. HSIP Gold User Community[1]

DoD Users	Interagency Users
Armed Forces Institute of Pathology	Census Bureau
Defense Contract Management Agency (DCMA)	Department of Agriculture (USDA)
Defense Intelligence Agency (DIA)	Department of Energy (DOE)
Defense Logistics Agency (DLA)	Department of Health & Human Services (HHS)
Defense Threat Reduction Agency (DTRA)	Department of Homeland Security (DHS)
Fifth US Army	DHS Geospatial Management Office (GMO)
First US Army	DHS Federal Emergency Management Agency (FEMA)
Fleet Numerical METOC Center	DHS Office of Infrastructure Protection
The Joint Staff	DHS / Transporation Security Administration (TSA)
Mission Assurance Division, NSWCDD	DHS / US Border Patrol
MIssile Defense Agency (MDA)	DHS / US Coast Guard (USCG)
National Geospatial-Intelligence Agency (NGA)	Department of Transportation
National Guard Bureau (NGB)	Department of Treasury
Naval Criminal Investigative Service (NCIS)	Drug Enforcement Administration (DEA)
Office of the Assistant Secretary of Defense for Homeland Defense (OASD (HD))	Environmental Protection Agency (EPA)
US Air Force	Federal Bureau of Investigation (FBI)
US Army Center for Health Promotion & Preventive Medicine (USACHPPM)	Federal Communication Commission (FCC)
US Army Corps of Engineers (USACE)	Los Alamos National Laboratory
US Joint Forces Command (USJFCOM)	National Counterterrorism Center (NCTC)
US Marine Corpse Chemical Biological Incident Response Force (CBIRF)	National Park Service (NPS)
US Northern Command (USNORTHCOM)	National Oceanic & Atmospheric Administration (NOAA)
US Pacific Command (USPACOM)	Oak Ridge National Laboratory
US Special Operations Command (USSOCOM)	Sandia National Laboratories
US Strategic Command (USSTRATCOM)	US Geological Survey (USGS)
US Transportation Command (USTRANSCOM)	US Postal Service (USPS)

[1] As of July 2006. Not all inclusive.

3.3.3.4 Other Commercial Proprietary Data Sources

Commercial data to support the DCIP is acquired through a variety of means, primarily through Federal sources, such as HSIP Gold. However, DCIP infrastructure analysts establish contracts for some data sources for the purpose of producing a more comprehensive dataset than those available through the HSIP Gold or other omnibus data licenses. Although these data are not common to the HD/HLS Community in the way that the HSIP Gold data represents a common geospatial data foundation, access to these more specialized commercial proprietary datasets must be maintained and managed by the DCIP to meet the more specialized analytical needs of the Defense Critical Infrastructure Community. These needs will be addressed on a recurring basis by the formalized DCIP geospatial data requirements process, previously discussed in Section 3.2.

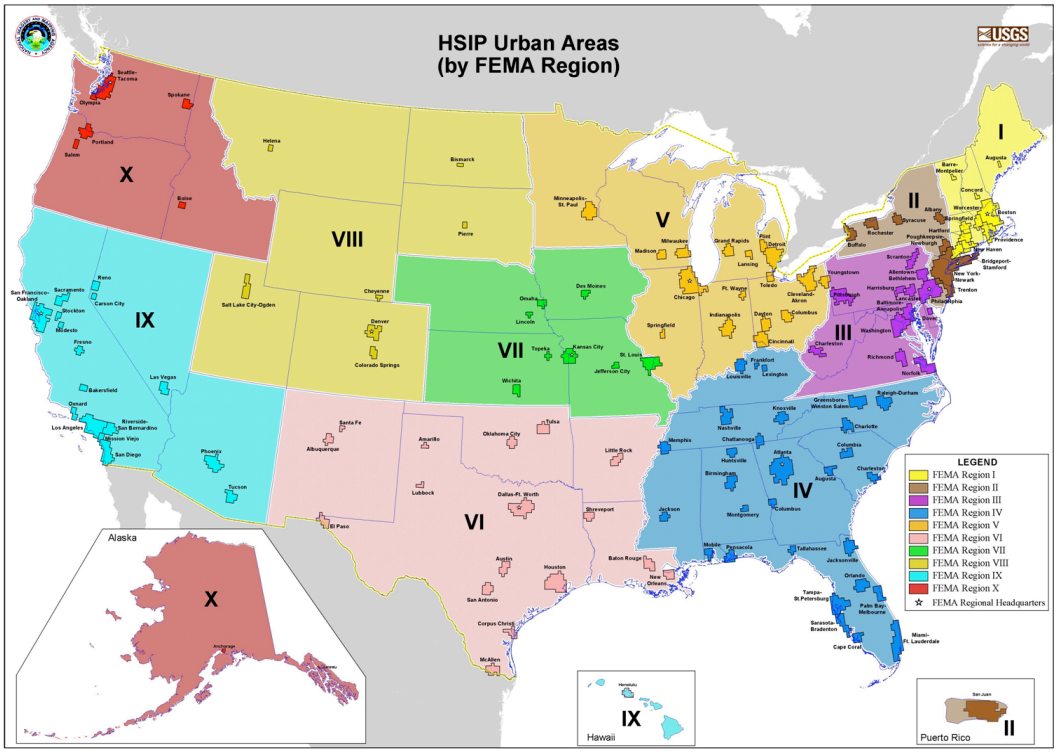
3.3.3.5 Imagery and Aerial Photography

Although vector data plays a key role in developing situational awareness of critical infrastructure, vector data in many cases will not give a sufficiently detailed picture of an area upon which operational decisions can be made. In these cases, geo-referenced imagery or aerial photography will oftentimes provide the required level of detail, such as in a heavily urbanized area where vector data alone cannot provide important context for the environment.

Perhaps the leading source of this domestic imagery data today is the data which has been collected as part of the HSIP 133 Urban Areas effort (see Figure 1). As an extension of their original HSIP Tiger Team effort, USGS and NGA agreed that USGS would use its existing relationships with local governments and aerial photo contractors to acquire the necessary data. Once USGS collects the data, NGA processes it for HD/HLS Community access. USGS also maintains access to the data for The National Map. Given its limited resources, NGA has embarked on a campaign with USGS to acquire ortho-rectified, 1-foot resolution, color aerial photography for a limited number of the 133 U.S. Urban Areas, with a vision to recollect more up-to-date coverage at two-year intervals for high-priority urban areas. Although this data is very useful to the DCIP, a number of issues related to its collection and use remain unresolved. These include the large amounts of disk space required for on-site storage of the data, the impact of bandwidth constraints on sharing this data over a Secret Internet Protocol Router Network (SIPRNET)-based EA, and the cost and frequency of recollection required to maintain sufficiently up-to-date imagery coverage for situational awareness and analysis.

For OCONUS imagery support requirements, NGA and the Services remain the primary data sources. These data sources run the gamut from classified National Technical Means (NTM) and unclassified commercial satellite imagery to Service-specific collection platforms.

Figure 1. HSIP Urban Areas



3.3.3.6 Elevation Data

There are several sources for elevation data to support the DCIP. These data are in the form of Digital Elevation Models (DEM). A DEM is a digital file consisting of terrain elevations for ground positions at regularly spaced horizontal intervals. The USGS, as the NSDI data theme lead agency for elevation data, produces five different digital elevation products. Although all are identical in data structure, each varies in sampling interval, geographic reference system, areas of coverage, and accuracy, with the primary difference being the spacing, or sampling interval, of the data. The highest resolution USGS DEM is the 7.5-minute DEM, which typically equates to a 30- x 30-meter grid spacing. The 7.5-minute DEMs correspond to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps, and are available for all of the U.S. and its territories. This particular DEM is also referred to as the National Elevation Dataset (NED).

NGA also produces or sponsors development of other CONUS and OCONUS DEM products that are readily available for DCIP use. These include Digital Terrain Elevation Data (DTED) and Light Detection And Ranging (LiDAR) products. DTED is a simple, regularly-spaced grid of elevation points similar to USGS DEM files but originally designed by NGA for military applications based on latitude and longitude. DTED is produced at a variety of resolutions, or

post spacing intervals. DTED Level 2, which is commonly available for the entire U.S. and most OCONUS areas, has a 30-meter post spacing, comparable to that of the USGS NED.

NGA is producing far more accurate DEMs for select U.S. urban areas using LiDAR technology. LiDAR is an active, typically airborne sensor that can quickly produce an extremely accurate DEM with 1-meter post spacing elevation data. This data is used to produce very accurate three-dimensional representations of complex urban environments. It can also be used for urban windfield modeling as well as to produce building footprint extractions for large urban areas, both of which are very useful from a Homeland Defense perspective.

3.3.3.7 Raster Map Data

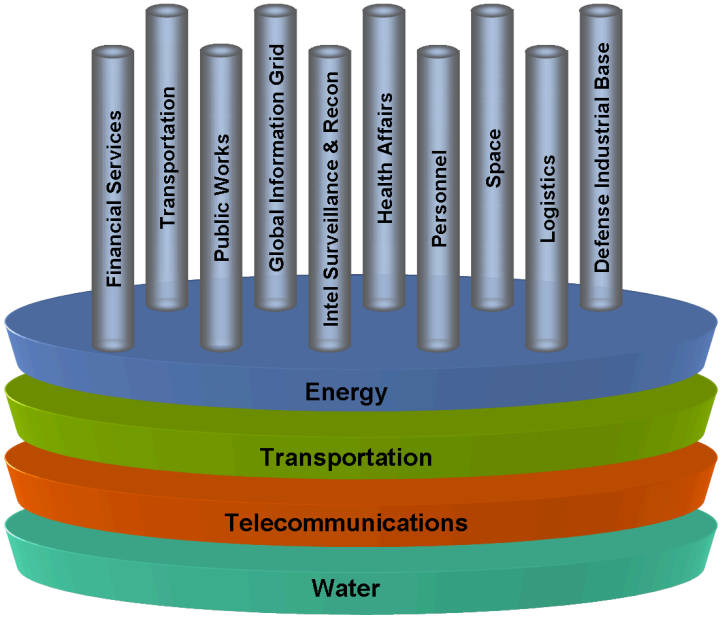
Compressed ARC Digitized Raster Graphics (CADRG), also produced by NGA, is the form of raster map data most applicable to the DCIP domain. CADRG is a military data format for storing digital map and chart images. CADRG are digital raster representations of paper graphic products, essentially an electronic version of a map. CADRG has been produced in the following scales: 1:1,000,000 Operational Navigational Chart (ONC), 1: 500,000 Tactical Pilotage Chart (TPC), 1:250,000 Joint Operations Graphic (JOG), 1:100,000 Topographic Line Map (TLM), 1:50,000 TLM, and City Graphics.

3.3.3.8 Hazard Model Data

All disasters, whether natural or man-made events, have a significant impact on the geography that they affect, both in terms of population and supporting infrastructure. From a DCIP perspective, the primary concern is the effect an event has on Defense Critical Infrastructure; supporting foundation infrastructure (see Figure 2); the local population operating or maintaining this infrastructure; and, ultimately, the impact of the hazard or event on DoD's ability to plan, mobilize, deploy, execute, and sustain U.S. military operations. The ability to determine the scale and potential impact of these events is an invaluable capability for military decision makers who must prioritize when, where, and how to allocate resources.

There are a number of different, very capable DoD and Federal interagency tools commonly used to model the potential effects of both man-made and natural hazard events. The Defense Threat Reduction Agency (DTRA) Hazard Prediction and Assessment Capability (HPAC) and Consequences Assessment Tool Set (CATS) are most commonly used by the DoD modeling community, including the National Guard Weapons of Mass Destruction Civil Support Teams (WMD-CSTs). Lawrence Livermore National Laboratory's Atmospheric Release Advisory Capability (ARAC) is the modeling tool of choice for DHS; whereas, the EPA and NOAA-co-sponsored Areal Locations of Hazardous Atmospheres (ALOHA), a much simpler atmospheric dispersion model used for evaluating releases of hazardous chemical vapors, is most commonly used by the state and local first responder communities.

Figure 2. Defense Sectors and Supporting Foundational Infrastructure



3.3.3.9 Interagency Modeling and Atmospheric Assessment Center (IMAAC)

Until recently, due to the sheer number of interagency modeling tools available, it was difficult to determine the authoritative data source for each of the different types of hazard models. The Interagency Modeling and Atmospheric Analysis Center (IMAAC) was created to remedy this problem. IMAAC is a DHS-led entity that provides a single Federal hazards prediction capability for airborne release of hazardous material constituting a domestic incident of "national significance." The IMAAC, which is subordinate to the DHS Science and Technology (S&T) Directorate, coordinates Federal atmospheric modeling and provides hazards predictions and consequence assessment support to Federal, state, and local responders for such incidents. This represents the authoritative data source for the geospatial representation of Chemical, Biological (non-contagious), Radiological, Nuclear, and high-yield Explosive (CBRNE) hazards, whether created by man-made or natural hazard events. This was demonstrated during the 2005 hurricane season, when the IMAAC provided airborne hazard predictions for potential fires and toxic chemical releases in the areas affected by Hurricane Katrina.

There are seven departments and agencies currently participating in the IMAAC: DHS S&T, the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), the Environmental Protection Agency (EPA), the National Oceanic & Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), and DoD. The IMAAC is connected to the DHS Homeland Security Operations Center (HSOC) and the DHS FEMA National Emergency Operations Center (NEOC). IMAAC products are distributed through a variety of network capabilities (both classified and unclassified). Because IMAAC is responsible for producing the single Federal hazards prediction, its products must be accessible to the DCIP EA via both the Non-secure Internet Protocol Router Network (NIPRNET) and SIPRNET.

Table 7. Select Geospatial Data Sources of Value to DCIP[1]

DATA	SOURCE
VECTOR DATA	
Defense Installation Data	DISDI, Services
Defense Critical Infrastructure	DCIP Sector Leads, Services, COCOMs
HSIP Gold	NGA[2]
State and Local Partnership Agreement Data	USGS[3]
FEMA Master Database	DHS/FEMA[2]
National Transportation Atlas Database (NTAD)	DOT/BTS[4]
Electronic Navigational Charts (ENC®)—coastal waterways	NOAA
Inland Electronic Navigation Charts (IENC)	USACE
EPA Risk Management Program (RMP)	EPA
LiDAR Feature Extraction Data	NGA
Vector Smart Map (VMap)	NGA
SPECIALTY DATA (Primarily Vector)	
Hazard Model Data	
Natural Hazards	
HAZUS-MH (earthquake, hurricane, flood)	DHS/FEMA
CATS (hurricane, storm surge, earthquake)	DTRA
SLOSH (storm surge, winds)	NOAA
Man-made Hazards	
ARAC (CBRNE[5])	L. Livermore National Lab
HPAC (CBRNE[5])	DTRA
CATS (CBRNE[5])	DTRA
HYSPLIT (nuclear reactor accident, volcanic ash)	NOAA
ALOHA (hazardous chemicals)	EPA, NOAA
Weather Data	
Wind speed, direction, cloud cover, temperature, etc.	AFWA, NAVLANTMETOCCEN
Hurricane tracks and wind-field bands	NOAA, NAVLANTMETOCCEN
Infrared, visible, and water vapor imagery (raster data)	NOAA, AFWA
RASTER DATA	
Maps	
Compressed ARC Digitized Raster Graphics (CADRG)[6]	NGA
Imagery	
133-Cities Urban Area Imagery—up to 1-foot resolution	NGA/USGS
Digital Orthophoto Quarter Quadrangle (DOQQ)—1m res.	USGS
National Technical Means (NTM) Imagery (classified)	NGA
Digital Elevation Model (DEM) Data[7]	
Digital Terrain Elevation Data® (DTED®) Level 2 (30m)	NGA
National Elevation Dataset (NED)—(10-30m)	USGS
Light Detection and Ranging (LiDAR) Data (1m)	NGA/USACE

[1] Data sample; not all inclusive.
[2] Various government and commercial sources.
[3] Original source is state and local government entities.
[4] Dept. of Transportation/Bureau of Transportation Statistics; various government sources.
[5] Does not include bio-contagious modeling capability.
[6] Various map scales.
[7] Post spacing values in parentheses

3.3.3.10 Weather Data

Weather phenomena have far-ranging impacts on both military and civilian activities; and therefore, weather specialty data must be available to the DCIP. While many of these activities can be mapped and planned using GIS, GIS-formatted weather information is scarce. However, the Air Force Weather Agency (AFWA), the Naval Atlantic Meteorology and Oceanography Center (NAVLANTMETOCCEN), and NOAA have recently made significant strides in developing and serving GIS-format weather data to their customer base.

In November 2004, AFWA began to explore the possibility of making weather observation and forecast data available to GIS users and has recently hosted a variety of GIS weather data on a pilot, Web-based GIS portal. Similarly, NAVLANTMETOCCEN continues to make progress in this area and routinely makes GIS weather files available for download via its website. This geospatial weather data includes: wind speed, wind direction, barometric pressure, temperature, dew point readings, visibility, and cloud ceiling. Air Force and Navy METOC development efforts continue to progress toward making near-real-time, geo-referenced weather observation and forecast data available to improve both military and civilian planning efforts, including those of the DCIP Community.

3.4 GOAL: DEVELOP A WEB-BASED, SERVICE-ORIENTATED DCIP ENTERPRISE ARCHITECTURE IN WHICH GEOSPATIALLY-REFERENCED ASSET DATABASES FOR EACH DEFENSE SECTOR, SERVICE, AND COCOM ARE LINKED IN A NET-CENTRIC SOLUTION

Within the Enterprise Architecture construct, the DCIP data originators—the Defense Sector Lead Agencies, Services, and COCOMs—are the managers and stewards of the most current instance of their own databases. In the current non-enterprise environment, snapshots of these databases can be captured for integration into a GIS for visualization and analysis. However, a near-term goal of the DCIP EA and Geospatial Data Strategy is to have a Web-based, service-oriented architecture in which geospatially-referenced databases for each of the Defense Sectors, Services, and COCOMs are linked in a net-centric solution that is accessible to the DCIP Community via a variety of common and entity-unique visualization and analysis applications.

3.4.0.1 Data Collection

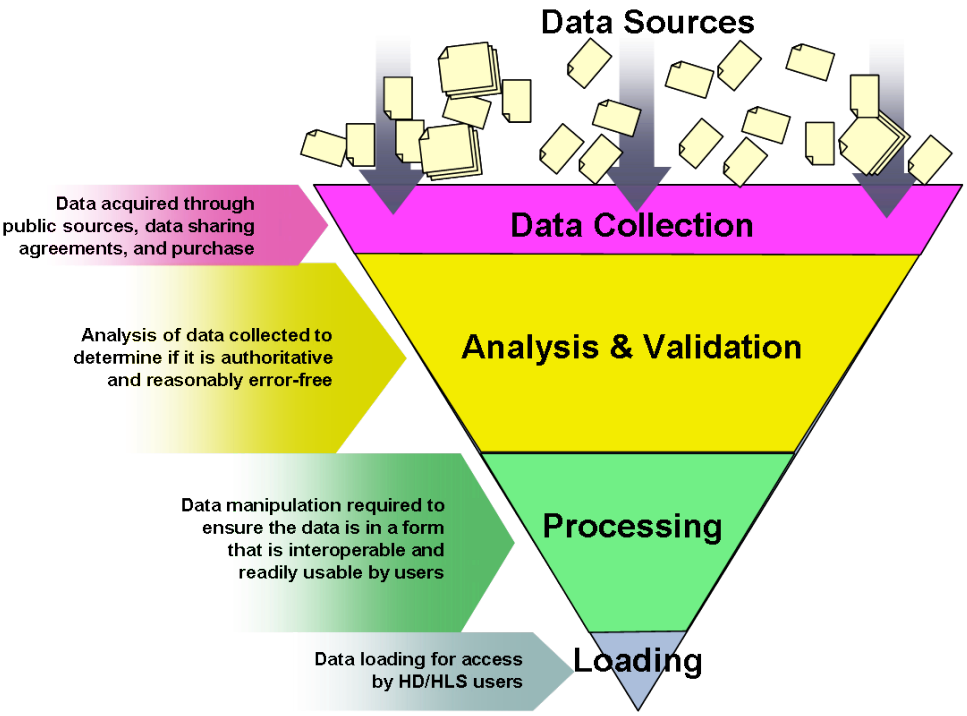
There are over 60 separate organizational data sources currently providing a portion of the DCIP geospatial situational awareness and analysis capability. These include NGA, USGS, the Central Intelligence Agency (CIA), DISDI, the Surface Deployment and Distribution Command (SDDC), National Oceanic & Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), Department of Justice (DOJ), Department of Transportation (DOT), the COCOMs, Services, and commercial data providers. These data are collected via a variety of means, including data download, CD, DVD, and Firewire drive and require constant update and maintenance due to the lack of a comprehensive Geospatial Enterprise Architecture (GEA)

encompassing these DoD and Federal interagency partners. Even after authoritative data sources are identified and collected, data sources require continual revisit to ensure that the most up-to-date versions of these data are available to the DCIP for situational awareness.

3.4.0.2 Data Analysis, Validation & Processing

Since most of this data is produced by other agencies, it is usually not designed for the purposes of the DCIP and, therefore, must be transformed into information that can be readily consumed by DCIP decision makers, operators, and analysts. This information processing cycle is a labor intensive but necessary process that enables analysts to produce a quality DCIP product. After an authoritative source is identified and the data is collected, the data must then be verified to ensure it is consistent, logical, of the right type, within reasonable limits, formatted properly, and complete. During the next and perhaps most labor intensive phase, the data must be manipulated into a standardized format. This includes converting relational data into a spatial format, such as a geodatabase or shapefile; indexing imagery so that it can be discovered by the user based on area of interest; reformatting imagery to be used for a particular application; and taking data from two or more disparate datasets and combining them to create useful information. This is the final stage before the processed data can be stored, ultimately, for retrieval by the user (see Figure 3).

Figure 3. Non-Enterprise Data Processing



This laborious effort to process new and updated data from a variety of disparate sources illustrates the value of a GEA. In a GEA, datasets are only added to an operational or analytical

picture after they have been identified as an authoritative data source. Once these nodes on the GEA are linked, a continuous conduit of updated and trusted data content is available to the user. The more data sources that are accessible via the GEA, the less resources must be expended in the data processing phase, which can slow access to incoming non-enterprise data to the point that the information can become unusable.

3.4.0.3 Data Maintenance & Synchronization

The issue of DCIP data maintenance and synchronization becomes most important in a crisis situation, in which the status of assets needs to be updated frequently. In these situations, a relatively static dataset that is seldom updated within the Enterprise will not suffice. Defense Sector Lead Agents, the Services, and COCOMs must ensure that the information populating their respective databases is updated with sufficient frequency that the status of assets available to the GIS is accurate enough to drive operational decision making with confidence. How often the status of assets and other attributes need to be updated in the system constitutes part of the baseline data requirements process.

Data synchronization is also a key issue in a multiple classification domain environment. This is especially true when trusted data sources outside of the Enterprise do not update their data on an anticipated, routine basis. For non-enterprise data synchronization to be conducted efficiently, the potential user must be immediately aware of data updates so that the new, more accurate instance of the data can be uploaded to the Enterprise. This is a crucial part of the partnership between data provider and data consumer.

3.4.1 Objective: Develop an Effective Spatial Data Clearinghouse for DCIP Geospatial Data to Facilitate Data Discovery and Access

3.4.1.1 National Spatial Data Clearinghouse

An important foundation block of the NSDI is the implementation of a spatial data clearinghouse. The Clearinghouse Activity, sponsored by the FGDC, is a decentralized system of servers located on the Internet that contain metadata of available digital spatial data. Because these metadata are collected in a standard format, they facilitate query and consistent presentation across multiple participating sites. The NSDI Clearinghouse functions as a detailed catalog service with support for links to spatial data and to browse graphics. Clearinghouse sites are encouraged to provide hypertext linkages within their metadata entries that enable users to directly download the digital dataset in one or more formats.

While mandated by EO 12906, the development of an NSDI Clearinghouse among Federal agencies was motivated by a desire to minimize duplication of effort in the collection and development of expensive digital spatial data and to foster cooperative digital data collection activities. By promoting the availability, quality, and requirements for digital data through a

searchable on-line system, the Clearinghouse greatly assists in coordination of data collection and analysis, and provides a mechanism to disseminate authoritative geospatial datasets.

3.4.1.2 DCIP Spatial Data Clearinghouse

Data can be made visible and accessible through a geospatial data clearinghouse activity. A DCIP or larger DoD data clearinghouse would be a decentralized system of servers located on the SIPRNET containing field-level descriptions of available spatial data. The fundamental goal of the clearinghouse is to provide access to digital spatial data through metadata. The clearinghouse functions as a detailed catalog service with support for links to spatial data. Just as for the NSDI, DCIP clearinghouse sites are encouraged to provide hypertext linkages within their metadata entries that enable users to directly download the digital dataset in one or more formats. This clearinghouse function can be built as an extension of the Enterprise Architecture for the community it serves. This allows data to be searched for, discovered, and then, with relative ease, be added to their geospatial view for visualization and/or analytical purposes.

The geospatial “dataset" will be the target unit of description defined within the protected DCIP or HD/HLS clearinghouse activity. The definition of a dataset generally corresponds to the smallest identifiable data product (e.g. file) for which metadata are collected. This may equate to a specific satellite image or vector dataset that is managed by a data producer. A variety of metadata may exist and be maintained by an organization, but the target level for data discovery within a geospatial clearinghouse should be at the dataset level. Because so much of the geospatial data available within DCIP or HD Community is sensitive or classified, the clearinghouse activity should be located within the classified domain. Finally, any comprehensive clearinghouse activity should be undertaken in partnership with NGA to ensure visibility of the widest array of available data because so much of the geospatial data of interest to the DCIP is actually brokered and maintained by this Agency.

3.5 GOAL: IMPLEMENT A WEB SERVICES APPROACH TO LINK THE DCIP EA TO OTHER GEOSPATIAL TOOLS AND CAPABILITIES

For the geospatial component of the DCIP EA to have long-term success, it must take advantage of a service-oriented, Web services architecture that allows for access to accurate and up-to-date data not only from within the DCIP Community but also from compatible Federal interagency nodes. A major focus of Web services is to make functional building blocks accessible over standard Internet protocols that are independent from platforms and programming languages, thereby making them inherently interoperable. These services can be new applications or wrapped around existing legacy systems to make them network-enabled. Another benefit of Web services is that they are inherently open and standards-based.

By providing a framework for loosely coupled distributed spatial services, Web services make it easier to share spatial data and tools among and within organizations as well as integrate GIS

within existing computing infrastructure. Other benefits of a Web services approach include access to up-to-date, continuously available services; reduction in data purchase and maintenance costs; reduction in functionality development and maintenance costs; reduction in hardware and software costs; and the ability to integrate services from multiple providers to produce tailored applications. This can be accomplished using a backbone that is the hallmark of the majority of Web-based, geospatial visualization and analysis capabilities within DoD and the interagency community. As more authoritative data-producing organizations adopt compatible technology, the more data sources the DCIP EA will be able to access and integrate to provide a more complete and accurate picture of infrastructure and its environs to DCIP stakeholders.

3.5.1 Objective: Link the DCIP EA to other DoD Tools/Capabilities To Provide a Seamless Linkage to the Best Available Geospatial Capabilities

The DCIP EA must provide seamless linkage to a variety of "best of breed," Web-based, geospatial capabilities. These include NGA's Palanterra, the Mission Assurance Division's Homeland Defense Mission Assurance Portal (HD-MAP), the SDDC's Intelligent Road/Rail Information System (IRRIS), the DISDI Portal, U.S. Army Corps of Engineers (USACE) CorpsMap, and participating Service and COCOM operational pictures. Only as part of this type of federated Geospatial Enterprise Architecture can the DCIP be assured of having the most up-to-date, authoritative geospatial information for DCIP decision makers and operational entities.

3.5.1.1 Palanterra

The most prominent of these Web-based technologies is NGA's Palanterra portal. Palanterra is a Web-enabled capability that provides the Intelligence, Defense, and Homeland Security Communities the architecture for integrated geographic information and Web-based dissemination, visualization, and analysis. Palanterra incorporates over 300 data layers, comprised of the best available data acquired by NGA from Federal, state and local agencies, as well as commercial data providers. This data is stored in a GEOINT-centric object-relational (Oracle) database. Palanterra is currently available on the NIPRNET, SIPRNET, and Joint Worldwide Intelligence Communications System (JWICS) domains.

NGA is currently using Palanterra to support a number of DoD and Federal interagency entities, including the White House Situation Room, U.S. Northern Command (USNORTHCOM), other regional COCOMs, U.S. Joint Forces Command (USJFCOM), DHS, the Coast Guard, and the Federal Bureau of Investigation (FBI). Users can access Palanterra via commercially-available Web browsers. Palanterra is available in thin, medium, and thick client versions and is interoperable through common enterprise architecture features with the Mission Assurance Division's HD-MAP and the SDDC's IRRIS applications. DHS has customized NGA's Palanterra to provide a unified geospatial platform in the DHS environment to provide a mission-specific operational picture called the Infrastructure Critical Asset Viewer (iCAV)/Geospatial Information Infrastructure (GII).

3.5.1.2 Homeland Defense Mission Assurance Portal (HD-MAP)

HD-MAP, a primarily SIPRNET-accessible, Web-based portal, is designed to be a comprehensive geospatial visualization and analysis portal for the DCIP Community, to include the Defense Sectors, COCOMs, and Services. The capability is based on a thin-client architecture that can be readily accessed using Internet Explorer. Current HD-MAP capabilities include custom baseline maps, analytical reports, remote data integration, SIPRNET chat within each information portal, shared data views, geocoding, and a file exchange feature for pushing/pulling large files. Although HD-MAP is primarily SIPRNET-based, an Unclassified-FOUO instance was developed and hosted in the aftermath of Hurricane Katrina. HD-MAP is capable of integrating enterprise data, including tracking data, from Palanterra and IRRIS.

3.5.1.3 Intelligent Road/Rail Information System (IRRIS)

IRRIS is the Web-based GIS tool used by Surface Deployment and Distribution Command Transportation Engineering Agency (SDDC TEA)—the arm of the U.S. Transportation Command (USTRANSCOM) that is responsible for all U.S. military surface cargo movement. IRRIS is used for providing transportation-related situational awareness as well as routing and tracking sensitive DoD road and rail shipments. The primary IRRIS portal is accessible via the NIPRNET. A SIPRNET-based version is also available, but this version lacks the real-time data feeds available via the NIPRNET version. Access within IRRIS is role-based and determined by the particular user's mission.

IRRIS' numerous live geospatial data feeds, including weather data updated every five minutes, traffic flow data, and traffic-cam feeds, give the user a high level of transportation-related situational awareness. SDDCC TEA has partnered with the DTRA to integrate hazard models within IRRIS and to build quick turn-around scenarios. IRRIS tracks military cargo movements at sea with updates every six hours. IRRIS also allows tracking of Arms, Ammunition and Explosives (AA&E) vehicle movements via GPS and rail via Radio Frequency ID (RFID) tags every 15 minutes. There are currently 180 geospatial data layers accessible within IRRIS, including select HSIP Gold data.

3.5.1.4 DISDI Portal

The DISDI Portal is a capability first available in 2006 through a partnership arrangement between DISDI and the USACE CorpsMap Project. The DISDI Portal is designed to support DoD through: (1) visualization of defense installations worldwide, (2) discovery of available installation geospatial data via a metadata search and query capability, and (3) streamlined access to Service-specific installation data holdings, such as those of GeoBase, GeoReadiness, GEOFidelis, and GISR. The DISDI Portal is available to all .mil domain users via the NIPRNET and requires CAC/PKI authentication for access. The DISDI Portal will also re-host Web services for use by other DoD geospatial applications, such as Palanterra and HD-MAP. The

DISDI Portal is hosted by the USACE as part of their CorpsMap capability. The DISDI Portal will also be the platform by which DoD will publish non-sensitive DoD installation geospatial metadata to the NSDI Clearinghouse.

3.5.1.5 USACE CorpsMap

CorpsMap is the Corps of Engineers' national-level, Web-based GIS designed to provide a single geospatial interface for all nation-level databases, thus allowing any Federal agency to incorporate Corps data easily. The public CorpsMap site is accessible via the Internet and serves as the Corps' interface with the NSDI Clearinghouse. The NIPRNET version of CorpsMap will host more sensitive USACE data for Corps' use as well as other military customers.

The CorpsMap geospatial database contains more than 200 nationwide map themes from simple, useful datasets, such as the location of all USACE district and division offices, to large datasets, such as Inland Electronic Navigation Charts (IENC). Other available datasets include the complete National Inventory of Dams (NID), USACE flood control projects, Formerly Used Defense Sites (FUDS) database, and the USACE Port Facilities and Infrastructure Database. Base map data within CorpsMap include complete road networks for the U.S., flood plains data from FEMA, and a complete set of nationwide aerial photos. As with each of these Web-based tools, anyone operating in the proper domain with a Web browser, GIS software, or database application can access and use these tools with confidence that originator-hosted data will be consistent, complete, and current.

3.5.2 Objective: Link the DCIP EA to Other Federal Interagency Tools and Capabilities

The DCIP EA must bridge the gap between the HD and HLS domains. The requirement for this interagency geospatial collaboration is clearly stated in HSPD-7. HSPD-7 directs that "the Secretary (of Homeland Security) will collaborate with other appropriate Federal departments and agencies to develop a program, consistent with applicable law, to geospatially map, image, analyze, and sort critical infrastructure and key resources by utilizing commercial satellite and airborne systems, and existing capabilities within other agencies." This Directive further states that "the Secretary, with advice from the Director of Central Intelligence, the Secretaries of Defense and the Interior, and the heads of other appropriate Federal departments and agencies, shall develop mechanisms for accomplishing this initiative." More recently, the 2006 NIPP Base Plan echoed the importance of interagency collaboration to accomplish this database and geospatial mapping goal for the Nation's CI/KR Sectors.

The cornerstone of the DHS-led effort to database and map our Nation's CI/KR Sectors in accordance with HSPD-7 is the National Asset Database (NADB). The NADB is an inventory of the national infrastructures and resources collected from Federal agencies, state and local entities, and commercial and private-sector databases. As such, the NADB includes CI/KR

Sector databases as a subset and is an all-encompassing inventory and situational awareness tool that provides the foundation for DHS risk analysis.

It is envisioned that the NADB will be linked to SSA databases, geospatial displays, modeling/simulation tools, the DHS Office of Infrastructure Protection's Vulnerability and Protective Measures databases, and the DHS Office of Information Analysis (OIA) National Threat Incident Database (NITD), as well as to the DHS GEA. The DHS integration of these capabilities provides an excellent opportunity for the DCIP to extend its own EA and create an important bridge between the DCIP and the DHS Infrastructure Protection domains. An important first step in building this bridge is for the DCIP to adopt the same global unique identification (GUID) convention for domestic DCIP assets and supporting infrastructure as developed for the NADB. This common convention for identification of assets will not only enhance cooperation during routine operations but will also greatly facilitate the sharing of information during emergency situations. Furthermore, the linkage of authoritative geospatial data sources and capabilities will benefit the Defense Critical Infrastructure Program and the Nation as a whole.

3.6 GOAL: CULTIVATE EFFECTIVE PARTNERSHIPS WITHIN THE BROADER HD/HLS COMMUNITY THAT WILL FACILITATE DCIP ACCESS TO AUTHORITATIVE CI/KR DATABASES AND THE BEST TOOLS AVAILABLE FOR GEOSPATIAL DATA VISUALIZATION AND ANALYSIS

3.6.1 Objective: Develop DoD-DHS Geospatial Requirements Partnership and Collaboration

The relationship between the national-level CI/KR Sectors and the DCIP Community provides an opportunity for increased collaboration and partnership in the geospatial data requirements arena. Table 8 shows the natural linkage between these two Communities, both focused on critical infrastructure protection. Although there is not a one-to-one correlation between the 17 national-level CI/KR Categories and the 10 Defense Sectors, there are corresponding entities of responsibility for all but four of the CI/KR Categories. In these four cases, there is no corresponding Defense Sector. Conversely, there are no national-level CI/KR Categories directly corresponding to three of the Defense Sectors. These Defense Sectors include Intelligence, Surveillance, and Reconnaissance (ISR); Personnel; and Space. Nonetheless, each of these Sectors has a strong correlation with a portion of the national-level Government Facilities Sector.

Table 8. Common Requirements: CI/KR – DCIP Sector Linkage

	Critical Infrastructure / Key Resource (CI/KR) Sector	Lead Sector-Specific Agency (SSA)	Corresponding Defense Critical Infrastructure Program (DCIP) Sector	Defense Sector Lead Agency
Critical Infrastructure	Agriculture & Food	Dept. of Agriculture (USDA)	No Corresponding Defense Sector	
	Banking & Finance	Dept. of Treasury (DOT)	Financial Services	Defense Finance & Accounting Service (DFAS)
	Chemical	Dept. of Homeland Security (DHS) Office of Infrastructure Protection (OIP)	No Corresponding Defense Sector	
	Defense Industrial Base	Dept. of Defense (DoD)	Defense Industrial Base (DIB)	Defense Contract Management Agency (DCMA)
	Emergency Services	DHS/OIP	Public Works	US Army Corps of Engineers (USACE)
	Energy (except nuclear)	Dept. of Energy (DOE)	Public Works	USACE
	Healthcare & Public Health	Dept. of Health & Human Services (HHS)	Health Affairs	Assistant Secretary of Defense for Health Affairs—OASD(HA)
	Information Technology	DHS/Cyber & Telecommunications	Global Information Grid (GIG)	Defense Information Systems Agency (DISA)
	Postal & Shipping	DHS/Transportation Security Admin. (TSA)	Logistics	Defense Logistics Agency (DLA)
	Telecommunications	DHS/Cyber & Telecommunications	GIG	DISA
	Transportation	DHS/TSA and U.S. Coast Guard (USCG)	Transportation	US Transportation Command (USTRANSCOM)
	Water	Environmental Protection Agency (EPA)	Public Works	USACE
Key Resources	Nat'l Monuments & Icons	Dept. of Interior (DOI)	No Corresponding Defense Sector	
	Commercial Facilities	DHS/OIP	No Corresponding Defense Sector	
	Government Facilities	DHS/Federal Protective Service (FPS)	Public Works[1]	USACE
	Dams	DHS/OIP	Public Works	USACE
	Nuclear Facilities	DHS/OIP	Public Works	USACE

[1]Each of the ten Defense Sectors has responsibility for a component of the national-level Government Facilities Sector. Public Works, however, has the most direct correlation with this Sector.

For each of the Defense Sectors, with the exception of the Defense Industrial Base (DIB), where DoD already serves as the Lead SSA, there will be close coordination and collaboration on identification of common geospatial data requirements to support each Sector. By doing so, the DCIP and National Infrastructure Protection Program can increase the priority of effort dedicated to their joint requirements by geospatial data broker organizations, such as NGA and the DHS Geospatial Management Office (GMO). This type of joint approach to the requirements process will also ensure the procurement and development of common geospatial data for ultimate use in a GEA that serves the needs of both the HD and HLS Communities.

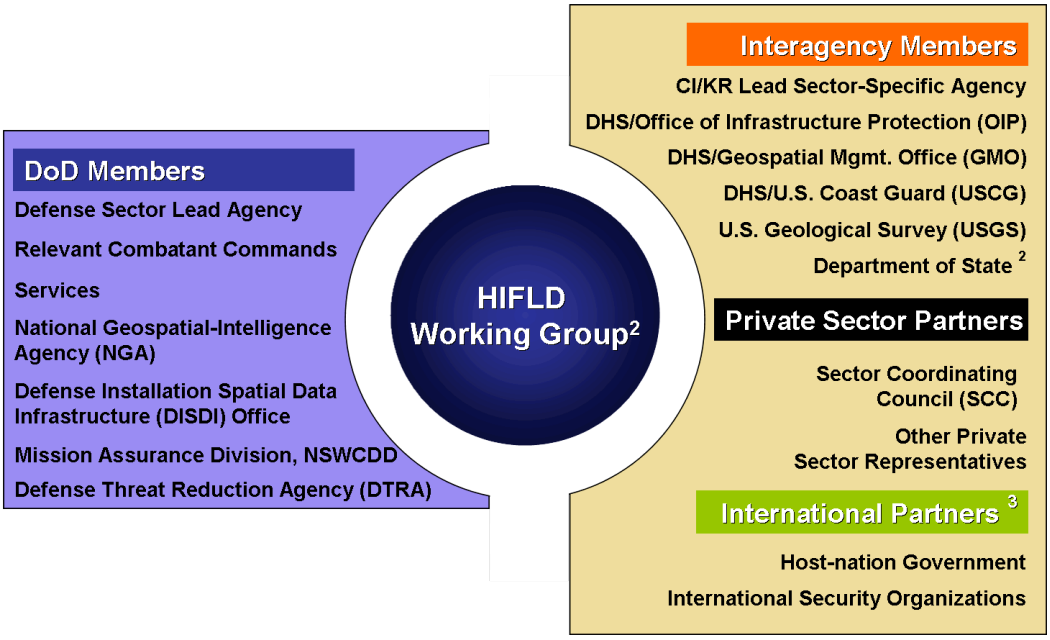
3.6.2 Objective: Continue Support for the Homeland Infrastructure Foundation-Level Database (HIFLD) Working Group and its Federal Interagency-wide Efforts

The task of DCIP geospatial data requirements and data source identification is fulfilled partially by entities such as the Homeland Infrastructure Foundation-Level Database (HIFLD) Working Group. HIFLD is an OASD(HD)-sponsored coalition of Federal, state, and local government organizations, Federally-funded Research and Development Centers (FFRDC), and supporting private industry partners who are involved with geospatial or "location awareness" issues related to Homeland Security, Homeland Defense, Civil Support, and Emergency Preparedness and Response. The primary goal of HIFLD is the identification of requirements and authoritative geospatial data sources in support of these mission areas. While HIFLD has played an important role in the current informal DCIP geospatial data requirements process, a more formalized mechanism focused specifically on the DCIP is required. This mechanism must survey and respond to the evolving information needs of the broad DCIP Community, including the Services and COCOMs.

3.6.3 Objective: Coordinate with DHS, Lead SSAs, and Logical CI/KR Geospatial Data Theme Lead Agencies through Development of CI/KR—DCIP Geospatial Data Communities of Interest (CoI) for the Defense Sectors and their Companion CI/KR Categories

An important facet of an effective DCIP Spatial Data Infrastructure is a collaborative partnership linking the DCIP geospatial community, on a sector-by-sector basis, with its counterpart geospatial leads from DHS, the CI/KR Sectors, and partner agencies. This type of collaborative partnership could be facilitated through creation of sector-specific CI/KR—DCIP geospatial CoIs. A CoI is a collaborative group of users that must exchange information in pursuit of its shared goals, interests, missions, or business processes and, therefore, must have shared vocabulary for the information it exchanges. In the geospatial context, this type of CoI could be an effective nexus to promote shared geospatial requirements and authoritative data source identification, cost-effective data collection and sharing, development of geospatial best practices, and leveraging of Federal and other resources. Such a CoI might be depicted as shown in Figure 4.

Figure 4. CI/KR-DCIP Geospatial CoI Model[1]



[1] CoI membership will be sector-dependent.
[2] Or other bridging entity.
[3] For overseas DCIP—CI/KR Community of Interest.

CoI membership would be sector-dependent with voluntary participation. This geospatial CoI would also require a bridging entity, such as the HIFLD Working Group, to serve a linking function between DoD and Federal interagency geospatial leads within each of the Sectors. In an OCONUS COCOM realm, the composition of the DCIP geospatial CoI would be modified substantially. In such an environment, the non-DoD interagency would play far less of a role while a new, more prominent role will be played by those entities representing international infrastructure data sources. These would include host-nation civilian governments, their military establishments, commercial asset owners, and international security organizations.

3.7 GOAL: ENSURE GEOSPATIAL DATA SECURITY, INFORMATION PROTECTION, AND DATA ACCESS ACROSS THE DCIP ENTERPRISE ARCHITECTURE

A very important issue related to DCIP development and use of geospatial data is data classification. As mandated by the Federal Information Security Management Act of 2002, DoD and other Federal agencies must identify and provide information security protections commensurate with the risk and magnitude of the harm resulting from the unauthorized access, use, disclosure, disruption, modification, or destruction of information. This is particularly important in the DCIP arena where unauthorized access to sensitive or classified Defense Critical Infrastructure data could harm national security. Perhaps the most important safeguard to ensure

adequate protection of this information is data classification. However, there are significant classification issues related to geospatial data that are not adequately addressed by current DoD classification policy. These include the aggregation of unclassified infrastructure data, the protection and safe handling of information not within Federal control but which is nonetheless sensitive, and DoD policy as it relates to the numerous sensitive but unclassified control caveats used across the Federal geospatial community. Needed changes in classification policy, guidance, and procedures that flow from them, must be addressed in parallel with implementation of the DCIP Geospatial Data Strategy in order to provide an unambiguous path to reach the goals and objectives of this Strategy. The DCIP Geospatial CoI will examine and make recommendations regarding these and other related issues required for full and effective implementation of this Strategy.

3.7.1 Objective: Leverage Existing Work by NGA to Develop Effective One-Way Guard Technology that Can Be Used by the DCIP EA

A level of protection will be afforded to geospatial data within the DCIP EA by virtue of the fact that the primary classification domain for DCIP data is the SIPRNET. Nonetheless, most foundational infrastructure datasets, such as HSIP Gold, VMAP, or military installation data stewarded by DISDI and Service geospatial programs, are unclassified and will remain so even when used in the SIPRNET environment, unless they are modified in such a way as to require their classification. In order for the DCIP EA to seamlessly integrate the wide body of Federal interagency, international, and state and local government-produced geospatial data available only on the Internet or NIPRNET, and to do so without significant manual processing, there must be developed a reliable and secure means to automatically ingest unclassified enterprise data and replicate it for visualization and analysis purposes on the SIPRNET. Currently, if there is a need to access this valuable but unclassified information on the SIPRNET, it must be manually copied to some form of secure media and then loaded in the SIPRNET environment. Depending on the volume of data and the frequency of its update on the unclassified domain, this is an incredibly labor-intensive task that is never complete. Also, without an automated geospatial data bridge between these two classification domains, the user of the data on the SIPRNET can never be assured that he possesses the most up-to-date data.

A solution to this multiple domain problem is currently being pursued by NGA as a part of their Project Homeland partnership with USGS. Although the problem has not yet been completely solved, its resolution within the context of one-way data transfer from the unclassified to the SIPRNET domain is within sight. Because this issue is of such importance to the developing DCIP EA, the DCIP will remain engaged with NGA and its Project Homeland effort to ensure that the one-way guard solution developed for Project Homeland has direct benefit for the DCIP EA.

3.7.2 Objective: Partner with the DHS Geospatial Management Office and NGA to Extend Current Commercial Omnibus Data Licenses to Include Dissemination to Title 32 National Guard Elements

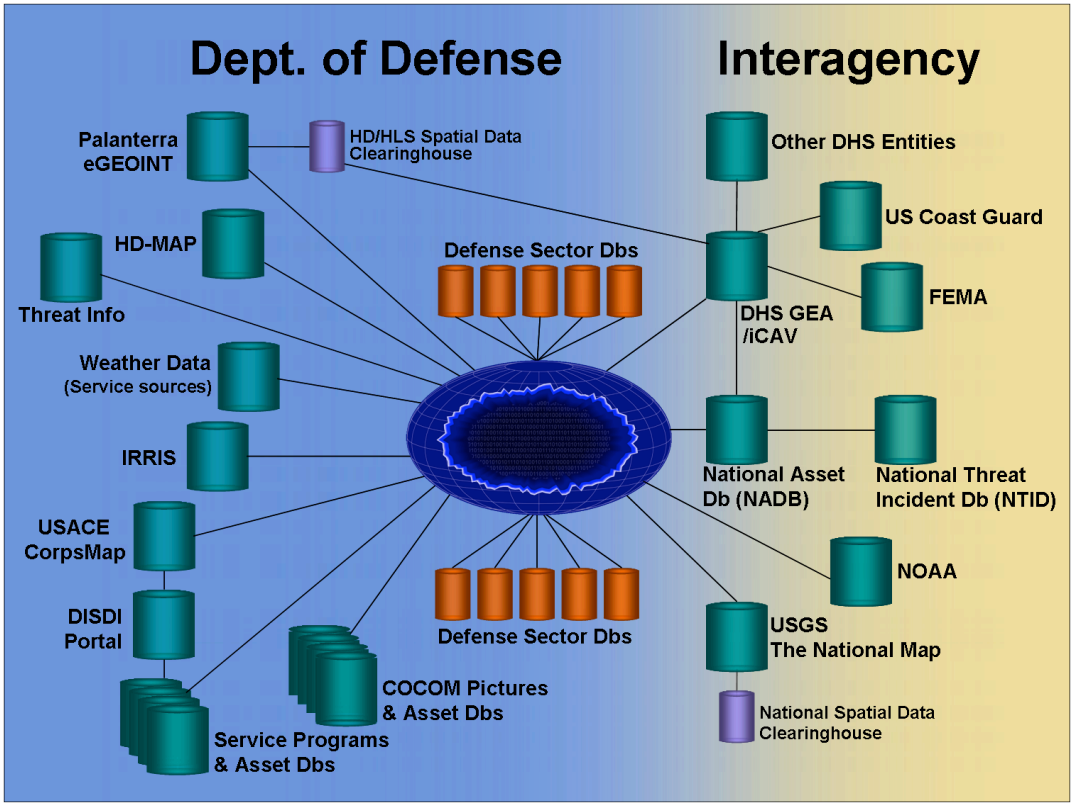
Beyond the realm of the various classified data domains, other data restrictions are currently in place that impact the DCIP EA. These include licensing restrictions that are in force for the commercial proprietary data acquired by NGA for distribution as part of the HSIP Gold inventory. Under existing licenses, HSIP Gold data "dissemination" outside of the Federal government is prohibited. This applies to an array of commercial proprietary data covering the following CI/KR Sectors: Agriculture & Food, Banking & Finance, Emergency Services, Energy, Healthcare & Public Health, Postal & Shipping, Transportation, and Commercial Facilities. The exception to this policy is the recently authorized disclosure (not dissemination) of the commercial proprietary data within HSIP Gold to state and local government officials for "homeland security" purposes.

While access to this common homeland infrastructure data certainly benefits state and local governments in the aftermath of a Federal disaster declaration, there are numerous purposes and potential scenarios for which state governments, and particularly their Title 32 National Guard elements, would benefit substantially from direct access to the same common infrastructure data that the Federal government holds. Recognizing this need and the potentially important role that Title 32 National Guard elements can play in domestic CIP activities in emergency situations, the DCIP will examine potential HD-related data use scenarios that necessitate state government and National Guard access to common, Federally-controlled, unclassified geospatial data. DCIP analysis of potential data sharing requirements will be communicated to DHS and NGA for consideration in future HSIP Gold license extension initiatives.

4. CONCLUSION

The DCIP and partner organizations within the HD/HLS Community are dependent on access to timely and accurate data, of which a key component is geospatial data. These data must be accurate from both a locational standpoint as well as from a data content standpoint. The geospatial infrastructure foundation must be common across the Federal interagency if our government is to meet the challenges of critical infrastructure protection in the current threat environment. Without a common, authoritative, up-to-date, and secure picture of our Nation's Defense Critical Infrastructure assets, supporting foundational infrastructure, and associated threats, the DCIP will be faced with a situation in which it must rely, at best, on an incomplete picture populated with dated information. Under these circumstances, the DCIP will be faced with a situation in which it may have to rely on inaccurate data that result in faulty decisions. Neither of these options is acceptable.

Figure 5. DCIP-Centric, Cross-Domain Geospatial EA Vision



A robust and interconnected DCIP Spatial Data Infrastructure which assures authoritative and up-to-date data for the DCIP and other HD mission areas creates a more secure homeland. However, this is not possible without broad interagency linkages of geospatial data and capabilities, as shown in Figure 5. The cross-domain HD/HLS Geospatial Enterprise Architecture vision represented by this graphic is a long-term goal of the DCIP EA. This linkage of authoritative interagency geospatial data sources and capabilities is possible within the framework of goals and objectives represented by this Strategy, which is contingent on the development and maintenance of collaborative interagency relationships that are required within the overarching National Infrastructure Protection Plan.

4.1 Next Steps

To achieve the goals of the DCIP Geospatial Data Strategy, OASD(HD) Critical Infrastructure Protection will undertake a variety of steps in coordination with the Defense Sectors, Services, COCOMs, DISDI, and interagency partners. The Instruction supporting DoD Directive (DoDD) 3020.40, will incorporate specific verbiage addressing the implementation of this Strategy. This will include guidance on associated resourcing issues. OASD(HD)CIP acknowledges that some DCIP-specific requirements for data from source providers may require additional resources. The DoD Instruction (DoDI) for DCIP will address these situations, where OASD(HD)CIP or

the DCIP CoI is the sole originator of new data requirements. As much as possible, the DCIP CoI will seek to identify and use geospatial datasets already developed by authoritative data producers. The DCIP CoI will also work with its interagency partners to develop effective cost sharing arrangements to maximize access to required geospatial data benefiting the DCIP and HD/HLS Community at large.

APPENDIX A. KEY TERMS AND DEFINITIONS

Terms used in this Strategy are further explained for reference.

- *Authoritative Source.* A source of data or information that is recognized by members of a COI to be valid or trusted because it is considered to be highly reliable or accurate or is from an official publication or reference (e.g., the United States (U.S.) Postal Service is the official source of U.S. mailing ZIP codes).

- *Bathymetry.* The measurement of water depth at various places in a body of water; also : the information derived from such measurements.

- *Clearinghouse.* A distributed network of data producers, managers, and users linked electronically, such as over the Internet. Through the Clearinghouse, users can use a single interface to search and access metadata and/or data for the themes they seek. The Clearinghouse includes the sites across the country where the metadata and data are stored, usually at the site of the producer or intermediary.

- *Community of Interest (CoI).* A collaborative group of users that must exchange information in pursuit of its shared goals, interests, missions, or business processes and, therefore, must have shared vocabulary for the information it exchanges.

- *Critical Infrastructure.* Systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters. (Source: Section 1016(e) of the USA PATRIOT Act of 2001 (42 U.S.C. 5195c(e)))

- *Dataset.* A collection of related data.

- *Data Theme.* Electronic records and coordinates for a topic or subject, such as elevation, transportation, or hydrography. In this Strategy, data theme refers to a Geographic Information System (GIS)- or location-based data theme.

- *Data Theme Lead Agency.* A federal agency or organization that has lead responsibility for coordinating the national coverage and stewardship, including maintenance and update, of a specific spatial data theme.

- *Defense Critical Infrastructure.* DoD and non-DoD networked assets essential to project, support, and sustain military forces and operations worldwide.

- *Defense Critical Infrastructure Program (DCIP).* A DoD risk management program that seeks to ensure the availability of networked assets critical to DoD missions. Activities include the identification, assessment, and security enhancement of assets essential for executing the National Military Strategy.

- *Defense Sector.* A virtual association within the DCIP that traverses normal organizational boundaries, encompasses defense networks, assets, and associated dependencies, that perform similar functions within the DoD and are essential to the execution of the National Military Strategy.

- *Geographic Information*. Coordinate and attribute data for location-based features, usually in the categories of point (e.g., a well), line (e.g., a road), polygon (e.g., a forest), cell (e.g., a raster-based "rectangle"), or coordinates (e.g., the latitude-longitude of a point on the ground).

- *Geographic Information System (GIS)*. A computer system for the input, editing, storage, retrieval, analysis, synthesis, and output of location-based information. GIS may refer to hardware and software, or include data.

- *Geospatial Information*. Information that identifies the geographic location and characteristics of natural or constructed features and boundaries on the Earth and includes: (a) statistical data and information derived from, among other things, remote sensing, mapping, and surveying technologies; and (b) mapping, charting, and geodetic data, and related products. (Source: 10 U.S.C. 467)

- *Geospatial Intelligence*. 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.

- *Interagency Modeling and Atmospheric Assessment Center (IMAAC).* The interagency center responsible for production, coordination, and dissemination of consequence predictions for an airborne hazardous material release. The IMAAC generates the single Federal prediction of atmospheric dispersions and their consequences utilizing the best available resources from the Federal government.

- *Key Resources.* Publicly or privately-controlled resources essential to the minimal operations of the economy and government. (Source: Section 2(9) of the Homeland Security Act of 2002 (6 U.S.C. 101(9)))

- *Metadata (Geospatial)*. Descriptive information about data, such as content, source, vintage, accuracy, condition, projection, responsible party, contact phone number, method of collection, and other characteristics.

- *Metadata Registry.* Repository of all metadata related to data structures, models, dictionaries, taxonomies, schema, and other engineering artifacts that are used to support interoperability and understanding through semantic and structural information about the data. A federated metadata registry is one in which multiple registries are joined

electronically through a common interface and exchange structure, thereby affecting a common registry.

- *Spatial Data Clearinghouse.* An electronic service providing access to documented spatial data and metadata from distributed data sources. These sources include a network of data producers, managers, and users, linked through the Internet and other communications means, and accessible through a common interface. All spatial data collected by federal agencies or their agents, as described in OMB Circular A-16, will be made available to spatial data users through the National Spatial Data Clearinghouse.

- *National Spatial Data Infrastructure (NSDI)*. The technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data (e.g., information and process discovery, publishing data, publishing symbol libraries, query filtering, data fusing, Earth imaging, photogrammetry, location processing, and spatial analysis).

- *Net-Centric.* Relating to or representing the attributes of net-centricity. Net-centricity is a robust, globally interconnected network environment (including infrastructure, systems, processes, and people) in which data is shared timely and seamlessly among users, applications, and platforms. Net-centricity enables substantially improved military situational awareness and significantly shortened decision making cycles.

- *Sector-Specific Agency.* A Federal department or agency responsible for infrastructure protection activities in a designated critical infrastructure sector or key resources (CI/KR) category, as identified by Homeland Security Presidential Directive (HSPD)-7.

- *Situational Awareness.* Maintaining knowledge of infrastructure viability through alertness in observation

- *Standards*. 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 their purposes.

- *Web Services.* A standardized way of integrating Web-based applications using open standards over an Internet Protocol backbone. Web services allow applications developed in various programming languages and running on various platforms to exchange data without intimate knowledge of each application's underlying IT systems.

APPENDIX B. GEOSPATIAL STANDARDS IDENTIFIED IN THE DOD INFORMATION TECHNOLOGY STANDARDS REGISTRY (DISR)

STANDARD ID	STANDARD TITLE	STATUS	PRIMARY OWNER
DGIWG FDD (DFDD)	DGIWG Feature Data Dictionary (DFDD)	Mandated	Geospatial Intel TWG (GWG)
GML 2.1.1	OpenGIS Geography Markup Language Encoding Specification	Mandated	GWG
ISO 19107:2003	Geographic information - Spatial schema	Mandated	GWG
ISO 19108:2002	Geographic information - Temporal Schema	Mandated	GWG
ISO 19109:2005	Geographic information - Rules for application schema	Mandated	GWG
ISO 19110	Geographic information Methodology for feature cataloguing	Mandated	GWG
ISO 19115:2003	Geographic information - Metadata	Mandated	GWG
ISO 19119:2005	Geographic information - Services	Mandated	GWG
ISO 19123:2005	Geographic information - Schema for coverage geometry and functions	Mandated	GWG
ISO 19135:2005	Geographic information - Procedures for item registration	Mandated	GWG
ISO/IEC 15444-1:2004 | ITU-T Rec.	Information Technology -- JPEG 2000 image coding system: Core coding system	Mandated	GWG
MIL-STD-2401	DoD World Geodetic System 84 (WGS84)	Mandated	GWG
MIL-STD-2407(1)	Interface Standard for Vector Product Format (VPF)	Mandated	GWG
MIL-STD-2411(2)	Raster Product Format	Mandated	GWG
MIL-STD-2500B(2)	National Imagery Transmission Format (Version 2.1)	Mandated	GWG
SLD 1.0	OpenGIS® Styled Layer Descriptor (SLD) Implementation Specification	Mandated	GWG
WMC	OpenGIS® Web Map Context (WMC) Implementation Specification	Mandated	GWG
WMS 1.1.1	OpenGIS® Web Map Service (WMS) Implementation Specification	Mandated	GWG
DGIWG FACC	DGIWG Feature and Attribute Coding Catalogue	Mandated	GWG
CAT 2.0	OpenGIS® Catalogue Service (CAT) Implementation Specification	Emerging	GWG
GML 3.1.1	OpenGIS Geography Markup Language Encoding Specification	Emerging	GWG
ISO 19139	Geographic information - Metadata - Implementation specification	Emerging	GWG
NFDD	National System for Geospatial-Intelligence (NSG) Feature Data Dictionary (NFDD), Version 1.5	Emerging	GWG
NSG FC	National System for Geospatial-Intelligence (NSG) Feature Catalog (NSG FC), Version 1.5	Emerging	GWG
WCS 1.0	OpenGIS® Web Coverage Service (WCS) Implementation Specification	Emerging	GWG
WFS 1.1	OpenGIS® Web Feature Service (WFS) Implementation Specification	Emerging	GWG
WMS 1.3	OpenGIS® Web Map Service (WMS) Implementation Specification	Emerging	GWG
DDMS	DoD Discovery Metadata Specification (DDMS) Version 1.3	Mandated	DoD Intel TWG

APPENDIX C. NSDI DATA THEMES, DEFINITIONS, AND LEAD AGENCIES*

The lead federal agencies with responsibilities for NSDI spatial data themes are as follows:

Baseline (Maritime): Co-leaders: Department of Commerce, National Oceanic & Atmospheric Administration (DOC/NOAA) and Department of the Interior, Minerals Management Service (DOI/MMS)

Baseline represents the line from which maritime zones and limits are measured. Examples of these limits include the territorial sea, contiguous zone, and exclusive economic zone. The spatial extent of the baseline is defined as "ordinary low water," interpreted as mean lower low water, as depicted on National Ocean Service nautical charts and/or appropriate supplemental information.

Biological Resources: DOI, U.S. Geological Survey (USGS)

This dataset includes data pertaining to or descriptive of (nonhuman) biological resources and their distributions and habitats, including data at the suborganismal (genetics, physiology, anatomy, etc.), organismal (subspecies, species, systematics), and ecological (populations, communities, ecosystems, biomes, etc.) levels.

Cadastral: DOI, Bureau of Land Management (BLM)

Cadastral data describe the geographic extent of past, current, and future right, title, and interest in real property, and the framework to support the description of that geographic extent. The geographic extent includes survey and description frameworks such as the Public Land Survey System, as well as parcel-by-parcel surveys and descriptions.

Cadastral (Offshore): DOI/MMS

Offshore Cadastre is the land management system used on the Outer Continental Shelf. It extends from the baseline to the extent of United States jurisdiction. Existing coverage is currently limited to the conterminous United States and portions of Alaska. Maximum extent of United States jurisdiction is not yet mathematically calculated.

Climate: Co-leaders, Department of Agriculture, Natural Resources Conservation Service (USDA/NRCS) and DOC/NOAA

Climate data describe the spatial and temporal characteristics of the Earth's atmosphere/hydrosphere/land surface system. These data represent both model-generated and observed (either in situ or remotely sensed) environmental information, which can be summarized to describe surface, near surface and atmospheric conditions over a range of scales.

Cultural and Demographic Statistics: DOC, U.S. Census Bureau (USCB)

These geospatially referenced data describe the characteristics of people, the nature of the structures in which they live and work, the economic and other activities they pursue, the facilities they use to support their health, recreational and other needs, the environmental consequences of their presence, and the boundaries, names and numeric codes of geographic entities used to report the information collected.

Cultural Resources: DOI, National Park Service (NPS)

The cultural resources theme includes historic places such as districts, sites, buildings, and structures of significance in history, architecture, engineering, or culture. Cultural resources also encompass prehistoric features as well as historic landscapes.

Digital Ortho Imagery: DOI/USGS

This dataset contains geo-referenced images of the Earth's surface, collected by a sensor in which image object displacement has been removed for sensor distortions and orientation, and terrain relief. For very large surface areas, an Earth curvature correction may be applied. Digital ortho-images encode the optical electromagnetic spectrum as discrete values modeled in an array of geo-referenced pixels. Digital ortho-images have the geometric characteristics of a map, and image qualities of a photograph.

Earth Cover: DOI/USGS

The Earth Cover theme uses a hierarchical classification system based on observable form and structure, as opposed to function or use. This system transitions from generalized to more specific and detailed class divisions, and provides a framework within which multiple land cover and land use classification systems can be cross-referenced. This system is applicable everywhere on the surface of the Earth. This theme differs from the Vegetation and Wetlands themes, which provide additional detail.

Elevation Bathymetric: Co-leaders: DOC/NOAA (U.S. waters outside channels) and US Army Corps of Engineers (USACE) (inland waterways)

The bathymetric data for inland and intracoastal waterways is highly accurate bathymetric sounding information collected to ensure that federal navigation channels are maintained to their authorized depths. Bathymetric survey activities support the Nation's critical nautical charting program. This data is also used to create Electronic Navigational Charts. The bathymetric sounding data supports the elevation layer of the geospatial data framework.

Elevation Terrestrial: DOI/USGS

This data contains geo-referenced digital representations of terrestrial surfaces, natural or man-made, which describe vertical position above or below a datum surface. Data may be

encapsulated in an evenly spaced grid (raster form) or randomly spaced (triangular irregular network, hypsography, single points). The elevation points can have varying horizontal and vertical resolution and accuracy.

Buildings and Facilities: General Services Administration (GSA)

The facility theme includes federal sites or entities with a geospatial location deliberately established for designated activities; a facility database might describe a factory, military base, college, hospital, power plant, fishery, national park, office building, space command center, or prison. Facility data is submitted from several agencies, since there is no one party responsible for all the facilities in the Nation, and facilities encompass a broad spectrum of activities. The FGDC promotes standardizing on database structures and schemas to the extent practical.

Federal Land Ownership Status: DOI/BLM

Federal land ownership status includes the establishment and maintenance of a system for the storage and dissemination of information describing all title, estate or interest of the federal government in a parcel of real and mineral property. The ownership status system is the portrayal of title for all such federal estates or interests in land.

Flood Hazards: Department of Homeland Security, Federal Emergency Management Agency (DHS/FEMA)

National Flood Insurance Program has prepared flood hazard data for approximately 18,000 communities. The primary information prepared for these communities is for the 1 percent annual chance (100-year) flood, and includes documentation of the boundaries and elevations of that flood.

Geodetic Control: DOC/NOAA

Geodetic control provides a common reference system for establishing coordinates for all geographic data. All NSDI framework data and users' applications data require geodetic control to accurately register spatial data. The National Spatial Reference System is the fundamental geodetic control for the United States.

Geographic Names: DOI/USGS

This dataset contains data or information on geographic place names deemed official for federal use by the U.S. Board on Geographic Names as pursuant to Public Law 80-242. Geographic Names information includes both the official place name (current, historical, and aliases) and locative direct (i.e., geographic coordinates) and indirect (i.e., State and County where place is located) geospatial identifiers and categorized as populated places, schools, reservoirs, parks, streams, valleys, and ridges.

Geologic: DOI/USGS

The geologic spatial data theme includes all geologic mapping information and related geoscience spatial data (including associated geophysical, geochemical, geochronologic, and paleontologic data) that can contribute to the National Geologic Map Database as pursuant to Public Law 106-148.

Governmental Units: DOC/USCB

These data describe, by a consistent set of rules and semantic definitions, the official boundary of federal, state, local, and tribal governments as reported/certified to the U.S. Census Bureau by responsible officials of each government for purposes of reporting the Nation's official statistics.

Housing: Department of Housing and Urban Development (HUD)

HUD's database maintains geographic data on homeownership rates, including many attributes such as HUD revitalization zones, location of various forms of housing assistance, first-time homebuyers, underserved areas, and race. Data standards have not yet been formalized.

Hydrography: DOI/USGS

This data theme includes surface water features such as lakes, ponds, streams and rivers, canals, oceans, and coastlines. Each hydrography feature is assigned a permanent feature identification code (Environmental Protection Agency Reach Code) and may also be identified by a feature name. Spatial positions of features are encoded as centerlines and polygons. Also encoded is network connectivity and direction of flow.

International Boundaries: Department of State

International boundary data include both textual information to describe, and GIS digital cartographic data to depict, both land and maritime international boundaries, other lines of separation, limits, zones, enclaves/exclaves and special areas between States and dependencies.

Law Enforcement Statistics: Department of Justice

Law enforcement statistics describe the occurrence of events (including incidences, offenses and arrests) geospatially located, related to ordinance and statutory violations and the individuals involved in those occurrences. Also included are data related to deployment of law enforcement resources and performance measures.

Marine Boundaries: Co-leaders: DOC/NOAA and DOI/MMS

Marine boundaries depict offshore waters and seabeds over which the United States has sovereignty and jurisdiction.

Offshore Minerals: DOI/MMS

Offshore minerals include minerals occurring in submerged lands. Examples of marine minerals include oil, gas, sulfur, gold, sand and gravel, and manganese.

Outer Continental Shelf Submerged Lands: DOI/MMS

This data includes lands covered by water at any stage of the tide, as distinguished from tidelands, which are attached to the mainland or an island and cover and uncover with the tide. Tidelands presuppose a high-water line as the upper boundary; whereas submerged lands do not.

Public Health: Department of Health and Human Services (HHS)

Public health themes relate to the protection, improvement and promotion of the health and safety of all people. For example, public health databases include spatial data on mortality and natality events, infectious and notifiable diseases, incident cancer cases, behavioral risk factor and tuberculosis surveillance, hazardous substance releases and health effects, hospital statistics and other similar data.

Public Land Conveyance (patent) Records: DOI/BLM

Public land conveyance data are the records that describe all past, current, and future, right, title, and interest in real property. This is a system of storage, retrieval and dissemination of documents describing the right, title, and interest of a parcel.

Shoreline: DOC/NOAA

Shorelines represent the intersection of the land with the water surface. The shoreline shown on NOAA Charts represents the line of contact between the land and a selected water elevation. In areas affected by tidal fluctuations, this line of contact is the mean high water line.

Soils: USDA/NRCS

Soil data consist of georeferenced digital map data and associated tabular attribute data. The map data describe the spatial distribution of the various soils that cover the Earth's surface. The attribute data describe the proportionate extent of the various soils as well as the physical and chemical characteristics of those soils. The physical and chemical properties are based on observed and measured values, as well as model-generated values. Also included are model-generated assessments of the suitability or limitations of the soils to various land uses.

Transportation: Department of Transportation, Bureau of Transportation Statistics (BTS)

Transportation data are used to model the geographic locations, interconnectedness, and characteristics of the transportation system within the United States. The transportation system

includes both physical and non-physical components representing all modes of travel that allow the movement of goods and people between locations.

Transportation (Marine): USACE

The Navigation Channel Framework consists of highly accurate dimensions (geographic coordinates for channel sides, centerlines, wideners, turning basins, and River Mile Markers) for every federal navigation channel maintained by USACE. The Navigation Framework will provide the basis for the marine transportation theme of the geospatial data framework.

Vegetation: USDA/U.S. Forest Service

Vegetation data describe a collection of plants or plant communities with distinguishable characteristics that occupy an area of interest. Existing vegetation covers or is visible at or above the land or water surface and does not include abiotic factors that tend to describe potential vegetation.

Watershed Boundaries: Co-leaders: DOI/USGS and USDA/NRCS

This data theme encodes hydrologic, watershed boundaries into topographically defined sets of drainage areas, organized in a nested hierarchy by size, and based on a standard hydrologic unit coding system.

Wetlands: DOI/Fish and Wildlife Service

The wetlands data layer provides the classification, location, and extent of wetlands and deepwater habitats. There is no attempt to define the proprietary limits or jurisdictional wetland boundaries of any federal, state, or local agencies.

Lead Agency responsibilities and new data themes may be added or altered by recommendation of the FGDC and concurrence by the OMB.

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* From Office of Management & Budget (OMB) Circular No. A-16, Revised; Subject: Coordination of Geographic Information and Related Spatial Data Activities, August 19, 2002

APPENDIX D. ACRONYMS AND ABBREVIATIONS

ALOHA	Areal Locations of Hazardous Atmospheres
AFWA	Air Force Weather Agency
ANSI	American National Standards Institute
ARAC	Atmospheric Release Advisory Capability
BLM	Bureau of Land Management
BTS	Bureau of Transportation Statistics
CAMEO	Computer-Aided Management of Emergency Operations
CATS	Consequences Assessment Tool Set
CDC	Centers for Disease Control and Prevention
CIA	Central Intelligence Agency
CI/KR	Critical Infrastructure/Key Resource
CIP	Critical Infrastructure Protection
COCOM	Combatant Command
CONUS	Continental United States
DCIP	Defense Critical Infrastructure Program
DCMA	Defense Contract Management Agency
DDMS	DoD Discovery Metadata Standard
DEM	Digital Elevation Models
DFAS	Defense Finance & Accounting Service
DGIWG	Digital Geographic Information Working Group
DHRA	Defense Human Resource Activity
DHS	Department of Homeland Security
DIA	Defense Intelligence Agency
DIB	Defense Industrial Base
DISA	Defense Information Systems Agency
DISDI	Defense Installation Spatial Data Infrastructure
DLA	Defense Logistics Agency
DOC	Department of Commerce
DoD	Department of Defense
DoDD	DoD Directive
DoDI	DoD Instruction
DOE	Department of Energy
DOI	Department of Interior
DOJ	Department of Justice
DOQQ	Digital Orthophoto Quarter-Quadrangle
DOS	Department of State
DOT	Department of Transportation
DTED	Digital Terrain Elevation Data
DTRA	Defense Threat Reduction Agency
DUSD (I&E)	Deputy Under Secretary of Defense for Installations & Environment
EA	Enterprise Architecture
ENC	Electronic Navigational Charts
EO	Executive Order

EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FDIC	Federal Deposit Insurance Corporation
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
GCC	Government Coordinating Council
GEA	Geospatial Enterprise Architecture
GEOINT	Geospatial Intelligence
GIG	Global Information Grid
GII	Geospatial Information Infrastructure
GIS	Geographic Information System
GISR	GIS Repository
GNIS	Geographic Names Information System
GSA	General Services Administration
GWG	Geospatial Intelligence Standards Working Group
HAZUS-MH	Hazards U.S.—Multi-Hazard
HD	Homeland Defense
HD-MAP	Homeland Defense Mission Assurance Portal
HHS	Health and Human Services
HIFLD	Homeland Infrastructure Foundation-Level Database
HITRAC	Homeland Infrastructure Threat and Risk Analysis Center
HLS	Homeland Security
HPAC	Hazard Prediction and Assessment Capability
HSIP	Homeland Security Infrastructure Program
HSPD	Homeland Security Presidential Directive
HSWG	Homeland Security Working Group (of the FGDC)
HYSPLIT	HYbrid Single-Particle Lagrangian Integrated Trajectory
IAIP	Information Analysis and Infrastructure Protection
IC	Intelligence Community
iCAV	Infrastructure Critical Asset Viewer
IGI&S	Installation Geographic Information and Services
IMAAC	Interagency Modeling and Atmospheric Assessment Center
IMINT	Imagery Intelligence
ISO	International Organization for Standardization
ISR	Intelligence, Surveillance, and Reconnaissance
IT	Information Technology
IVT	Installation Visualization Tool
JWICS	Joint Worldwide Intelligence Communications System
JPEG	Joint Photographic Experts Group
KR	Key Resource
LiDAR	Light Detection and Ranging
MIL-STD	Military Standard
NADB	National Asset Database
NARAC	National Atmospheric Release Advisory Center

NASA	National Aeronautics and Space Administration
NCGIS	National Center for Geospatial Intelligence Standards
NED	National Elevation Dataset
NGA	National Geospatial-Intelligence Agency
NICC	National Infrastructure Coordinating Center
NID	National Inventory of Dams
NIFC	National Interagency Fire Center
NIMA	National Imagery & Mapping Agency
NIPRNET	Non-secure Internet Protocol Router Network
NIPP	National Infrastructure Protection Plan
NITFS	National Imagery Transmission Format Standard
NLCD	National Land Cover Characterization
NOAA	National Oceanic and Atmospheric Administration
NORAD	North American Aerospace Defense Command
NORTHCOM	Northern Command
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NSG	National System for Geospatial Intelligence
NSDI	National Spatial Data Infrastructure
NSSE	National Security Special Event
NTAD	National Transportation Atlas Database
NTID	National Threat Incident Database
NTM	National Technical Means
NWS	National Weather Service
OASD (HA)	Office of the Assistant Secretary of Defense for Health Affairs
OASD (HD)	Office of the Assistant Secretary of Defense for Homeland Defense
OCONUS	Outside CONUS
OGC	Open Geospatial Consortium
OIP	Office of Infrastructure Protection
OMB	Office of Management and Budget
RMP	Risk Management Program
SCC	Sector Coordinating Council
SDDC	Surface Deployment and Distribution Command
SDDCTEA	Surface Deployment and Distribution Command Transportation Engineering Agency
SLOSH	Sea, Lake, and Overland Surges from Hurricanes
SIPRNET	SECRET Internet Protocol Router Network
SOA	Service-Oriented Architecture
SSAs	Sector-Specific Agencies
STRATCOM	Strategic Command
TRANSCOM	Transportation Command
TSA	Transportation Security Administration
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDA	United States Department of Agriculture

USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USJFCOM	United States Joint Forces Command
USNORTHCOM	United States Northern Command
USPS	United States Postal Service