

GEOINT Job/Practice Analysis

USGIF, in consultation with psychometric consultants and the GEOINT community, executed a job/practice analysis to identify common competencies within the GEOINT profession. Qualified Subject Matter Experts (SMEs) from government, industry, and academia participated in each phase of the job/practice analysis to ensure accurate reflection of GEOINT practices. The results of the GEOINT job/practice analysis are described here in the GEOINT Essential Body of Knowledge (EBK). As GEOINT technology, tools, and practices change, so too will the GEOINT EBK.

USGIF Essential Body of Knowledge Competency Areas

The GEOINT Essential Body of Knowledge (EBK) describes geospatial intelligence competency and practice in terms of key job tasks and essential knowledge, skills, and abilities required for a professional to be successful. These are organized into four competency areas as described below.

Competency I: GIS & Analysis Tools describes the knowledge necessary to ensure the various elements and approaches of GIS and analysis are properly understood in order to successfully capture, store, manage, and visualize data that is linked directly to a location.

Competency II: Remote Sensing & Imagery Analysis describes the knowledge necessary to generate products and/or presentations of any natural or manmade feature or related object of activity through satellites, airborne platforms, unmanned aerial vehicles, terrestrially based sensors, or other similar means. This competency area contains the knowledge necessary to synthesize technical, geographic, and intelligence information derived through the interpretation or analysis of imagery and collateral materials as well as the processes, uses, interpretations, and manipulations of imagery for dissemination.

Competency III: Geospatial Data Management describes the knowledge required to acquire, manage, retrieve, and disseminate data to facilitate integration, analysis, and synthesis of geospatial information.

Competency IV: Data Visualization describes the use of cartographic and visualization principles to generate products that represent information about the physical environment that can be easily understood by decision-makers.

Universal GEOINT Competency Areas

Competency I: GIS & Analysis Tools

A subset of GEOINT that includes the requisite knowledge to ensure the various elements and approaches to GIS and analysis are properly understood in order to successfully capture, store, manage, and visualize data that is linked directly to a location. GIS & Analysis Tools consist of:

Fundamental GIS Principles

- Vector and Vectorization (e.g., digitization)
- Raster
- Types of Geospatial Information
- Fundamentals of Geodesic Science (e.g., geoid, ellipsoid, coordinate systems, heights, point positioning, datum)
- Spatial Topology
- Feature Attribution

Data Evaluation Principles

- Common Limitations of Geospatial Data (e.g., uncertainty, relative and absolute accuracy, precision)
- Data Validation
- Non-structured Data Evaluation

Spatial Analysis & Statistics

- Spatial Structures and Models
- Algorithms for Spatial Analysis
- Spatio-temporal Analysis (e.g., trend analysis, predictive/anticipatory analysis)
- Analysis of Surfaces (e.g., elevation data)
- Raster Analysis Techniques (e.g., raster mathematics)
- Geocoding (e.g., land partitioning systems)
- Vector Analysis (e.g., network analysis)
- Statistical Techniques and Concepts
- Non-structured Data Analytics
- Geostatistical Methods
- Conceptual Analytic Modeling
- Structured Analytic Techniques

Geospatial Data Fusion

- Metadata Requirements (e.g., metadata standards, geospatial standard organizations—Federal Geospatial Data Committee)
- Common Data Fusion Applications
- Fusion of Geospatial Data with Remotely Sensed Data (e.g., applications and location-based intelligence, activity-based intelligence)
- Fusion of Various Types of Remotely Sensed Data
- Common Errors and Limitations Resulting from Data Fusion

Open-Source Geospatial Data

- Sources and Types of Open-Source Geospatial Data (e.g., non-structured data)
- Geospatial Crowdsourcing (e.g., volunteered geographic information, “participatory sensing”)
- Common Capabilities and Limitations of Open-Source Geospatial Data (e.g., open-source versus proprietary data, data quality)
- Open-Source Geospatial Standards
- Sources of Open-Source Geospatial Error
- Open-Source “Spoofing”

Geography Concepts & Principles

- Human Geography: Interrelationships Between Humans and Their Environment (e.g., cultural, economic, health, historic, political, population)
- Physical Geography: Geomorphology, Environmental/Climate Geography
- Virtual Geography

Competency II: Remote Sensing & Imagery Analysis

Remote Sensing & Imagery Analysis generates products and/or presentations of any natural or man-made feature or related object or activity through satellites, airborne platforms, unmanned aerial vehicles, or other similar means. This competency area contains the knowledge necessary to synthesize technical, geographic, and intelligence information derived through the interpretation or analysis of imagery and collateral materials as well as the processes, uses, interpretations, and manipulations of imagery for disseminations. Remote Sensing & Imagery Analysis includes:

Remote Sensing Fundamentals

- Image Target Elements (e.g., tone, shape, size, pattern, texture, shadow, association)
- Types of Resolution (e.g., spatial, spectral, radiometric, temporal, extent)
- Analog and Digital Imagery Formats
- Imagery Sensors for Remotely Sensed Data (e.g., LiDAR, airborne, electro-optical, radar, infrared, full-motion video)
- Airborne vs. Satellite Imagery
- Active and Passive Sensor Considerations
- Relationship Between Sensors, Resolution, and Electromagnetic Spectrum
- Combinations of Sensors and/or Resolutions to Generate End Product
- Common Challenges Associated with Remotely Sensed Imagery Data (e.g., atmospheric/weather, ground effects/dust, camouflage)
- Image Evaluation (e.g., sources of systematic and unsystematic errors, accuracy, precision, National Imagery Interpretation Ratings Scales)
- Image Metadata
- Other Sensors (e.g., unattended ground sensors, supervisory control and data acquisition, relationship with materials identification and analysis)

Imagery Preprocessing

- Geometric Correction
- Radiometric Corrections
- Mosaicking
- Geometric Registration

Imagery Enhancement

- 1st and 2nd Generation Orthorectification
- Georeferencing
- Dynamic Range Adjustments
- Spatial Filtering
- Image Histogram
- Stereoscopic Visualization
- Imagery Mensuration Techniques

Imagery Transformation

- Principal Components Analysis
- Spectral Ratioing
- Multi-Resolution Integration

Imagery Classification

- Supervised Image Classification
- Unsupervised Image Classification
- Classification Accuracy Assessment and Error Analysis
- Information Classes and Spectral Classes
- Automated Feature Extraction

Imagery Analysis

- Radar Imagery Analysis
- LiDAR Imagery Analysis
- Multispectral Imagery Analysis
- Hyperspectral Imagery Analysis
- Pan Sharpening
- Change Detection Techniques
- Geographic Object-Based Imagery Analysis
- Time Series Imagery Exploitation
- Analysis of Polarized Imagery

Competency III: Geospatial Data Management

A subset of GEOINT that includes the knowledge required to acquire, manage, retrieve, and disseminate data to facilitate integration, analysis, and synthesis of geospatial information. Geospatial Data Management consists of:

Data Types & Considerations

- Structured Data Considerations (e.g., analysis, manipulation, creation, integration)
- Unstructured Data Considerations (e.g., analysis, manipulation, creation, integration)
- Geospatial File Types
- Data Dissemination Considerations
- Metadata Considerations
- Attribution
- Map Services/Web Mapping Services
- Data Creation

Database Design

- Characteristics of Geospatial Databases (e.g., minimizes “redundancy”)
- Data Normalization (e.g., first normal form, second normal form, third normal form)
- Conceptual Database Models (e.g., requirements definition, database planning, Entity-Relationship diagram)
- Logical Database Models (e.g., cardinality, incidental and structural relationships, storage requirements)
- Physical Database Models (e.g., software capabilities and limitations)
- Types of Databases (e.g., schema types)
- Geospatial Data Considerations • SQL Fundamentals
- Distributed Databases (e.g., cloud databases)
- Common Geospatial Database Tools

Database Management

- Data Searching (e.g., query operations, query languages)
- Big Data Management
- Storage and Retrieval Principles

Data Security

- Data Privacy and Confidentiality Considerations
- Data Encryption

Programming & Development

- Common Programming Languages (e.g., Python)
- Software and Application Development Processes
- Web Application Program Interfaces (e.g., iOS, Android)

Competency IV: Data Visualization

Data Visualization is a subset of GEOINT that uses cartographic and visualization principles to generate products that represent information about the physical environment and can be easily understood by decision-makers. Data Visualization consists of:

Visualization Principles

- Integrity Principles
- Design Principles
- Subjective Considerations
- Data Types
- Visual Variables

Types of Visualizations

- Area
- Bar
- Circle
- Diagram
- Distribution
- Tree & Network
- Grid/Matrix
- Line
- Point
- Table
- Text-based
- Properties

Maps of Visualizations

- Color Theory
- Symbolizations
- Uncertainty (e.g., thematic or positional)
- Typography (e.g., data and text annotation)
- Attribute Display
- Map Projections
- Map Scale
- Metadata Annotation (e.g., marginalia)
- Hardcopy/Softcopy Maps
- Topographic Maps (e.g., hydrographic, aeronautical)
- Thematic Maps
- 3-Dimensional Maps
- Flow Maps
- Choropleth Maps
- Contour Maps
- Distorted Maps (e.g., cartogram)
- Statistical Plot Maps
- Time-Varying Maps
- Map Mashups

Essential Body of Knowledge Cross-Functional Knowledge and Skills

Cross-functional knowledge areas are necessary when there are widely accepted knowledge, skills, and abilities that transcend specific core competencies or where competencies are found across the full scope of practice. Cross-functional GEOINT knowledge, skills, and abilities generally reflect:

- Qualitative “soft skills” used by most GEOINTers
- Unique aspects of the Universal GEOINT tradecraft applicable to the majority of practitioners
- Common GEOINT knowledge and practices that, if followed, will improve the performance of a practitioner

COMPETENCY: Synthesis

Identifies, locates, and obtains essential information efficiently and effectively. Identifies, defines, and decomposes problems into component parts to facilitate a search for a solution. Generates ideas about a given topic and applies old ideas to new situations or in new combinations. Synthesizes and integrates information into meaningful concepts and ideas. Draws conclusions from a set of facts, recognizes patterns or trends, and determines the consequences of an action.

COMPETENCY: Reporting

Expresses ideas, information, and facts clearly and appropriately. Tailors verbal, written, and other forms of communication to intended purpose and audience. Uses language conventions of spelling, punctuation, and grammar properly. Uses appropriate sentence and paragraph structure. Generates products according to organization, industry, and/or professional standards. Solicits constructive feedback from peers in an iterative manner; synthesizes recommendations to generate improved products, services, and processes.

COMPETENCY: Collaboration

Interacts with others in a friendly, courteous, and tactful manner that demonstrates respect for individual and cultural differences and for the attitudes and feelings of others. Works cooperatively and collaboratively with others to achieve goals through sharing or integrating ideas, knowledge, skills, information, support, resources, responsibility, and recognition. Facilitates agreements that involve sharing or exchanging resources to promote mutual goals and interest; persuades others to change their points of view or behavior without losing support; and resolves conflicts and disagreements. Develops and leverages professional networks to facilitate cooperative partnerships that help attain goals.