Geospatial Intelligence: Emergent Profession

Dr. Darryl Murdock

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USGIF

- 501(c)(3) Educational non-profit Foundation
- Accredit Academic Geospatial Intelligence Programs
- Sponsor for Professional Universal GEOINT Program
- 250 Partner Organizations
- 1700 Individual Members
Topics

- Definition of Geospatial Intelligence (GEOINT)
- Explosion of GEOINT globally: We are all GEOINTers (Why GEOINT differs from GIS)
- Examples of GEOINT in action
- Credentialing & Standards: Building and maintaining a strong GEOINT workforce
- Barriers to Implementing an effective GEOINT Program (hint: it is all about people)
What is Geospatial Intelligence?

**Definition:**

Geospatial Intelligence, or GEOINT, is the *professional practice of integrating* and *interpreting* all forms of *geospatial data* to create historical and anticipatory intelligence products used for *planning* or that answer questions posed by *decision makers*.

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Darryl Murdock and Robert M. Clark
*The Five Disciplines of Intelligence Collection* (2015)
The term "geospatial intelligence" means the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the earth.

*de jure definition - applies to U.S. defense-intelligence enterprise
Why GEOINT?

“GEOINT brings a better understanding of an operational environment and the ability to evaluate efficiently a situation’s potential at all decision levels. By allowing users to access, share, and visualize geospatial data, GEOINT provides decision-makers with a decisive support and relevant situational awareness.”

Rousselin, Hernoust, Perl barg, Saporiti, Morisseau, Testé in upcoming 2018 State and Future of GEOINT
Why does GEOINT matter?

“The Geospatial Imagery Analytics Market is Projected to Grow from USD 3.41 Billion in 2017 to USD 13.21 Billion By 2022, at a CAGR (compound annual growth rate) of 31.1%”

Source: Geospatial Imagery Analytics Market by Type (Imagery Analytics, Video Analytics), Collection Medium (GIS, Satellites, UAVs), Vertical (Defense & Security, Insurance, Agriculture, Healthcare & Life Sciences), and Region - Global Forecast to 2022
The key components of Critical Thinking are:

- Asking the right questions.
- Identifying your assumptions.
- Reaching out to sources of information beyond those readily available.
- Evaluating data for accuracy, relevance, and completeness.
- Assessing the data and forming hypotheses.
- Evaluating the hypotheses, particularly looking for conflicting data.
- Drawing conclusions.
- Presenting your findings.

Geography

Human

GIScience

Physical

recreation
HISTORICAL
medical
political
planning
ECONOMIC
URBAN
SPATIAL STATS
transportation
location theory
GEOVISUALIZATION
CLIMATOLOGY
BIOGEOGRAPHY
ENVIRONMENTAL
agriculture
water
metadisciplinary
The World According to GEOINT Practioners

GEOINT Competencies

- Geospatial Data Management
- Remote Sensing
- GIS
- Visualization
- Synthesis
- Reporting
- Collaboration
Definition of Community Resilience

“Community resilience is the capability to anticipate risk, limit impact, and bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change.”

Source:

Community & Regional Resilience Institute

USGIF
GEOINT Ethics Component: The Madison Collaborative*

- **Fairness:** How can I act equitably and balance legitimate interests?
- **Outcomes:** What achieves the best short- and long-term outcomes for me and all others?
- **Responsibilities:** What duties and/or obligations apply?
- **Character:** What action best reflects who I am and the person I want to become?
- **Liberty:** How does respect for freedom, personal autonomy, or consent apply?
- **Empathy:** What would I do if I cared deeply about those involved?
- **Authority:** What do legitimate authorities (e.g. experts, law, my religion/god) expect of me?
- **Rights:** What rights (e.g. innate, legal, social) apply?

*Learn more at www.jmu.edu/mc
GEOINT within the U.S. Government

- GEOINT is practiced by virtually all U.S. Federal, State and Local agencies
- At the Federal level, there are 17 members of the U.S. Intelligence Community (IC)
- National Geospatial-Intelligence Agency (NGA) is the GEOINT “functional manager (lead agency) for the IC
The National Geospatial-Intelligence Agency (NGA) is the nation's primary source of geospatial intelligence, or GEOINT for the Department of Defense and the U.S. Intelligence Community. As a DOD combat support agency and a member of the IC, NGA provides GEOINT, in support of U.S. national security and defense, as well as disaster relief.

NGA employs approximately 14,500 government civilians, military members and contractors, with approximately two-thirds of the workforce located at the NGA Headquarters at NGA Campus East, on Fort Belvoir North Area in Springfield, Va., and approximately one-third of the workforce located at NGA's two St. Louis facilities.

Source: https://www.nga.mil/About/Pages/Default.aspx
GEOINT in the U.S. Government: Military

• The U.S. Military Academy and U.S. Air Force Academy have strong GEOINT Certificate programs serving to bolster and constantly improve the knowledge, skills and abilities of their officer corps.

• Each arm of the U.S. Military also has designated GEOINT positions:
  • Army: 35G - Geospatial Intelligence Imagery Analyst
  • Marine Corp: 0241 - Imagery Analyst Specialist, 0261 - GEOINT
  • Air Force: 1N1X1X – Geospatial Intelligence
  • Navy: 3910 – Imagery Intelligence Analyst

Source: https://www.nga.mil/About/Pages/Default.aspx
GEOINT Common Operating Picture
Natural Hazards in North Carolina

North Carolina is subject to numerous natural hazards that pose risks to public health and safety, the environment, property, and the economy.

This site is under development and is still draft. Do not quote or cite data. Site is subject to disruptions for updates and revisions.
IRISK Viewer

904 E Church St
Tarboro, NC 27886

Building Value ($): 110,000
Stories: 1
Square Foot (sq): 1,500
Foundation: Pier
Occupancy Type: Single Family Dwelling

The river flooding hazard is rated Medium for this location.

This year you have a 1% chance of flooding.
Over the next 15 years you have a 19% chance.
Over the next 30 years you have a 34% chance.

<table>
<thead>
<tr>
<th>Annual Chance of Flood</th>
<th>Damage Severe Property (in Year)</th>
<th>Damage Moderate Property (in Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>10%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>15%</td>
<td>9%</td>
<td>6%</td>
</tr>
<tr>
<td>20%</td>
<td>12%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Am I financially prepared?
What are my county roles?
Where can I learn more about River Flooding?
Using GEOINT to Address Asymmetric Threats
Geospatial Profile

Nationality: Unknown
Time in Country: Unknown
Alias: Lynn Smith
Affiliation: Radical Extremist Front
Role: Explosives Expert

- According to a foreign intelligence report, Jane Doe (aka Lynn Smith) was a pediatric nurse prior to joining the REF. In her previous assignment she posed as a nurse at a hospital.

- Local law enforcement has discovered that she has a sister that lives in the vicinity of City Hall.

- A separate foreign intelligence agency has provided a tip she is leading a bombmaking cell that intends to target a “tourist office in Myanmar.”

- Geospatial and temporal analysis of call data records indicate that she may again be posing as a nurse at the Children’s Hospital; and the suspected bombmaking cell may be located in close proximity to the Mandalay Palace Tourist Offices.

*Cell ID information can be found at www.opencellid.org
Imagery Intelligence Report

Photo – Imagery Correlation

**Background**

Open source reporting indicates a new New Zealand born radical Islamic extremist is tweeting his location from Syria as he updates his followers on his time in the warzone. A series of tweets were saved by the Canadian-based social media jihad monitor Ibrabo.

**Analysis**

Analysis of a social media photo posted on the Twitter account of a known New Zealand-born ISIS member revealed the photo was taken in Al Tabaqah, Syria. Further analysis of commercial satellite imagery and background features contained in the photo revealed the precise location where the photo was taken. Temporal and geospatial analysis of the tweets associated with this Twitter account suggest the user lives in the immediate vicinity of the location in which the photo was taken.
Geospatial Debriefing

Describe:
- Receive a physical geographical description of a location of interest from your subject
- Subject describes as much detail as possible
  - Terrain
  - Features
  - Landmarks
  - Buildings
  - Sights, Smells, Sounds

Sketch:
- Subject sketches as much information about a location of interest as possible
- Subject sketches
  - Horizon line if mountainous
  - Roads, fences, railroad tracks
  - Buildings, vegetation, livestock
  - Landmarks, signs, directional information

Maptrack:
- Subject is guided to the location of interest via a geospatial application with accurate, recent imagery
- Additional information can be gathered about areas adjacent to the location of interest during the maptracking process
- Maptracking can be utilized for vetting of the subject, verification of description and sketch, and positive identification of the location of interest.
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  - Buildings
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Deep Learning over Earth: GeoVisual Search

search.descarteslabs.com
Automated Ship Detections using Sentinel-1 Synthetic Aperture Radar
Satellite Manufacturer Index (SMI) as an Economic Indicator

\[
\text{NDVI} = \frac{\text{NIR-VIS}}{\text{NIR+VIS}}
\]

SMI extends the NDVI methodology to industrial activity. Cement and steel on the ground uniquely reflect light of differing wavelengths, which, when adjusted for atmospheric and meteorological effects, allows us to calculate their respective surface coverage. SMI tracks satellite imagery over 6,000 sites and produces an index that informs investors when industrial activity is picking up or slowing down in China.
Damage Assessment in Mexico City, Mexico

This map illustrates satellite-detected, potentially damaged structures in some affected colonies located in Venustiano Carranza, Cuauhtémoc, Benito Juárez, Coyocán and Iztapalapa Municipalities, Federal District, Mexico. The analysis was performed by Faculty of Geography of the Autonomous University of the State of Mexico (UAEMex) using its post-event satellite imagery. WorldView-2 acquired on 20 and 26 September 2017 and Pléiades acquired as of 22 September 2017. UAEMex identified 201 potentially damaged structures within the limit of the analyzed colonies, surrounded by a blue line in the map. 24 are located in Magdalena Mixhuca colony, 22 in Acuña, 21 in Atenco Sala and 20 in El Anual. Please do not hesitate to send feedback to UNITAR - UNOSAT.

Legend
- Damage structure
- City/Town
- Analyzed area/colony
- Municipality boundary

Map Scale: 1:2,500,000

<table>
<thead>
<tr>
<th>Analyzed colonies</th>
<th>Damaged structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magdalena Mixhuca</td>
<td>24</td>
</tr>
<tr>
<td>Acuña</td>
<td>22</td>
</tr>
<tr>
<td>Atenco Sala</td>
<td>21</td>
</tr>
<tr>
<td>El Anual</td>
<td>20</td>
</tr>
<tr>
<td>Iztapalapa</td>
<td>17</td>
</tr>
<tr>
<td>Sevillla</td>
<td>13</td>
</tr>
<tr>
<td>Lerma Noriega</td>
<td>13</td>
</tr>
<tr>
<td>Azcapotzal</td>
<td>12</td>
</tr>
<tr>
<td>Tzompantitla</td>
<td>12</td>
</tr>
<tr>
<td>Atascate</td>
<td>11</td>
</tr>
<tr>
<td>San Mateo</td>
<td>10</td>
</tr>
<tr>
<td>Coyoacán</td>
<td>10</td>
</tr>
<tr>
<td>Ciudad De Los Deportes</td>
<td>10</td>
</tr>
<tr>
<td>Mezquital</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>201</strong></td>
</tr>
</tbody>
</table>

UNITAR - UNOSAT - Palais des Nations CH-1211 Geneva 10, Switzerland - T: +41 22 767 4020 (UNOSAT Operations) - Hotline 24/7: +41 76 411 4908 - unosat@unitar.org - www.unitar.org/unosat

https://disasterscharter.org
UAS/UAV (Drones)
Altavian R8700 Launch
Building a Strong & Resilient GEOINT Workforce

- Organizations must have commitment to excellence, including ongoing GEOINT professional development program.

- Individuals entering workforce must have appropriate GEOINT education and training:
  - Appropriate credentials should be held by individuals at all organizational levels.
  - Credentials (such as offered by NOVA IMS) should include a combination of Degrees, Certifications and Diplomas.
  - Microcredentials are a growing trend and, if offered by a qualified organization, should also be given consideration.

- Regular and ongoing participation in the global GEOINT community, in working groups, for example, is essential.
Benefits of Credentialing

For Employers
- Quality Assurance for GEOINT workforce
- Workforce prepared to Universal GEOINT EBK standards
- Continuing education for GEOINT workforce

For Students
- Academic Certificate in Geospatial Intelligence
- Focused preparation for Topical Professional Certification exams with the goal of achieving Universal GEOINT Certification (all three topical Certifications)
- Universal GEOINT credentials provide competitive advantage

For Colleges and Universities
- Accreditation review maintains program currency and relevance
- GEOINT community connections for program development
- GEOINT community resources for student development
“...provides a basic reference for anyone interested in or practicing the profession of GEOINT. This includes, but is not limited to:....”
GEOINT Essential Body of Knowledge (EBK)
Seven Core Competencies

- GIS and Analysis Tools
- Remote Sensing and Imagery Analysis
- Geospatial Data Management
- Visualization (includes cartographic principles)*
- Synthesis
- Reporting
- Collaboration

*Current focus area
Active USGIF Working Groups

- Analytic Modernization Working Group
- Geospatial and Remote Sensing Law Working Group
- *Machine Learning & Artificial Intelligence Working Group*
- NGA Advisory Working Group
- NRO ASP Industry Advisory Working Group
- Small Business Advisory Working Group
- *Small Satellite Working Group*
- St. Louis Area Working Group
- *Young Professionals Working Group*
Additional Professional Development Activities

- Universal GEOINT Certification Program (certification)
  - Administration of professional certifications
  - Support for continued updating of GEOINT Essential Body of Knowledge (EBK)
- Training and Educational offerings via Workshops and Events (this session, GEOINT Symposium, etc.) (training, education)
- Publications (State and Future of GEOINT, Trajectory) (professional development)
USGIF Accreditation Expansion

First non-U.S. Academic Program:

NOVA Information Management School
Universidade Nova de Lisboa
(Lisbon, Portugal)
Known Barriers to Using GEOINT for Resiliency

**Cost:**
- What is the value proposition given limited budgets (new bullet proof vest for an officer or software licenses?)
- Government costs are not always tied to obvious, quantifiable ROI

**Expertise:**
- Who is qualified to go beyond creating a street map?
- What training is available to begin developing GEOINT skills?
- What education is available to develop GEOINT knowledge?

**Standardization:**
- What are commonly accepted practices?
- What are the training & education standards?
GEOINT: Summary

- GEOINT is a well-characterized, scientific-method-based discipline that allows analysts to ask questions applicable to all phases of human security, defense operations, emergency management and community resilience.

- The greatest benefits of GEOINT are found in capacity and resilience building (planning and risk reduction) phases, although GEOINT is also used extensively in response phase.

- Barriers to GEOINT implementation exist at all levels and are primarily people-related.
What can YOU do?

- Get involved - Join the global GEOINT community!
- Read Trajectory (it’s free)
- Read State and Future of GEOINT (it’s also free)
  [http://usgif.org/education/StateofGEOINT](http://usgif.org/education/StateofGEOINT)