

V International Seminar: Asymmetric Threats and Strategic Planning

Geospatial Intelligence: Emergent Profession

Dr. Darryl Murdock

December 12th, 2017

USGIF

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

USGIF Strategic Partners



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?

Elements

- Location
- Sensors
- Platforms
- Imagery
- Processing
- Features
- Attributes
- Data Science
- Analytics
- Visualization
- Tradecraft

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***.

Darryl Murdock and Robert M. Clark
The Five Disciplines of Intelligence Collection
(2015)

U.S. Code Title 10, §467 definition*:

The term "geospatial intelligence" means the exploitation and analysis of **imagery** and **geospatial information** to **describe**, **assess**, and **visually depict** physical features and geographically referenced activities on the earth.

*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, Perlberg, 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

“GEOINT IS Critical Thinking”

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

*Cited in Pherson, Katherine Hibbs and Randolph Pherson. *Critical Thinking for Strategic Intelligence* (2nd ed.), (Washington, DC: CQ Press/Sage Publications, 2016), p. xxvi.

Geography

recreation
HISTORICAL
political medical

gender SOCIAL ECONOMIC
CULTURAL **Human** planning

regional population URBAN

land use CARTOGRAPHY SPATIAL STATS transportation

qualitative methods **GIScience** location theory

energy REMOTE SENSING GEOVISUALIZATION

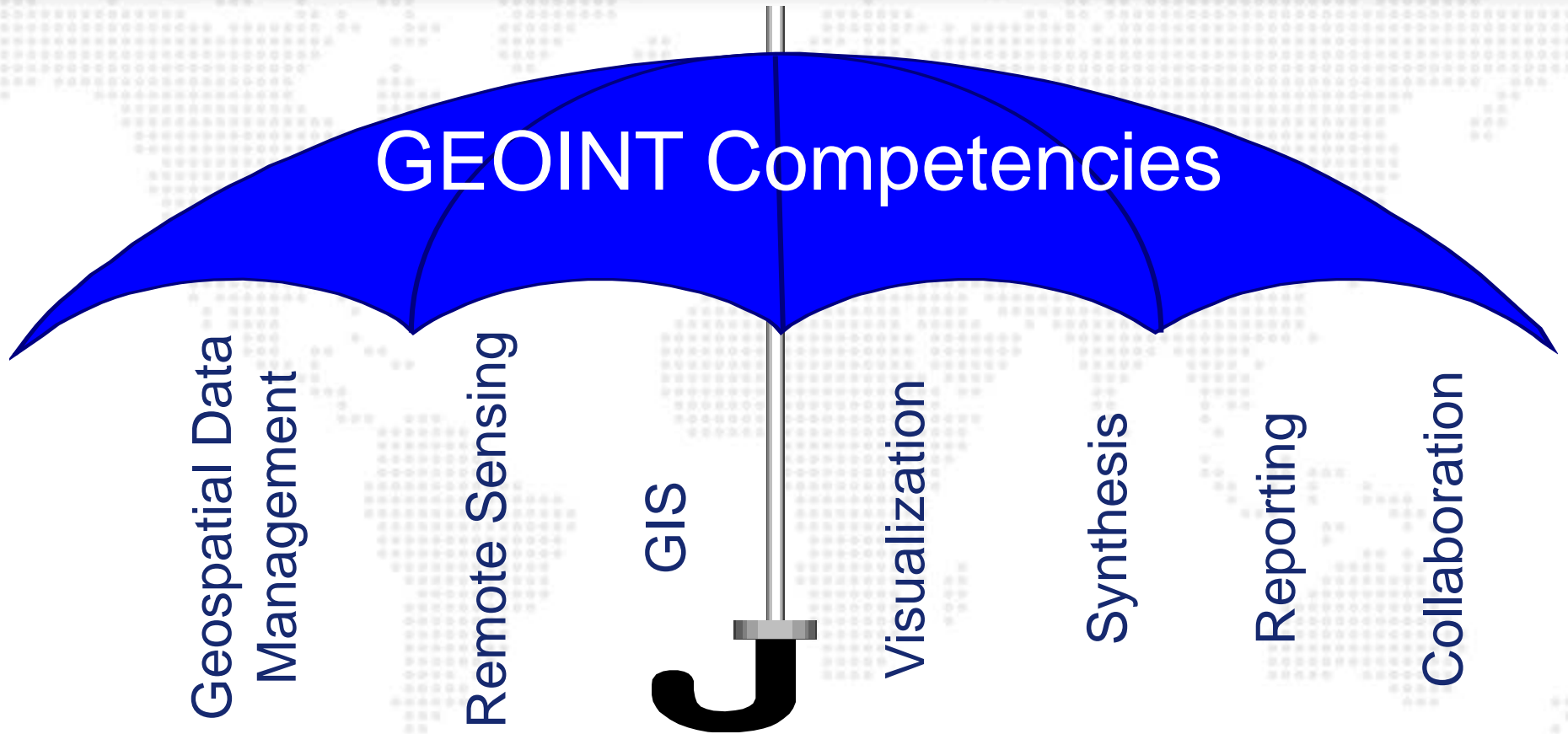
GEOMORPHOLOGY coastal CLIMATOLOGY

hazards **Physical** BIOGEOGRAPHY

ENVIRONMENTAL agriculture

water *metadisciplinary*

The World According to GEOINT Practitioners



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:



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

U.S. Intelligence Community



GEOINT in the U.S. Government: NGA

- 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>

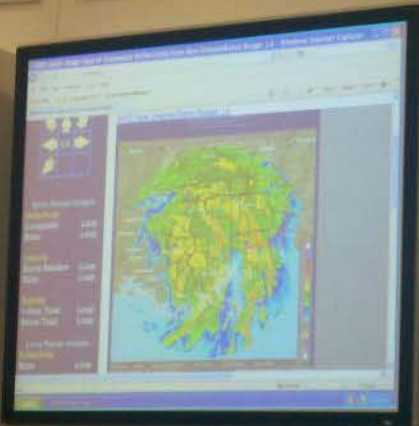
GEOINT in the U.S. Government: Military


- 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>

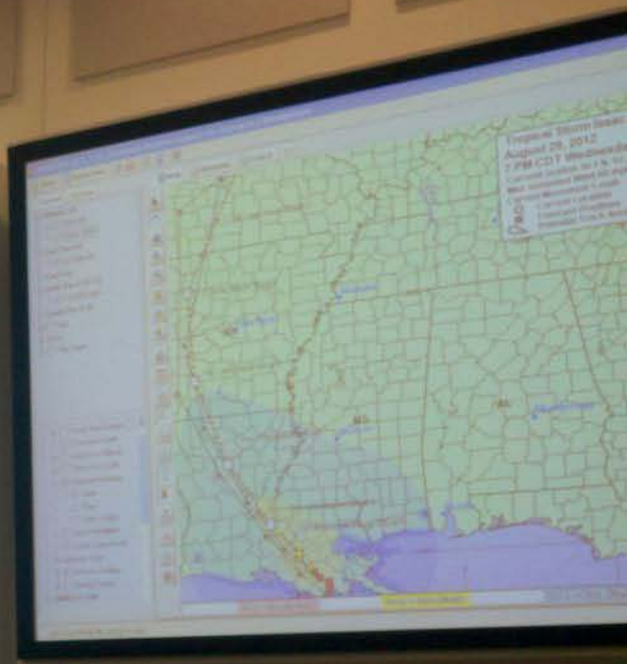
GEOINT Common Operating Picture






SIT REP and IAP
input due today by 04:00 CDT

Next Operational Briefing
08/29/2012 @06:45 CDT



Risk Management

iRISK

Am I at Risk?

Getting Started

About IHRM

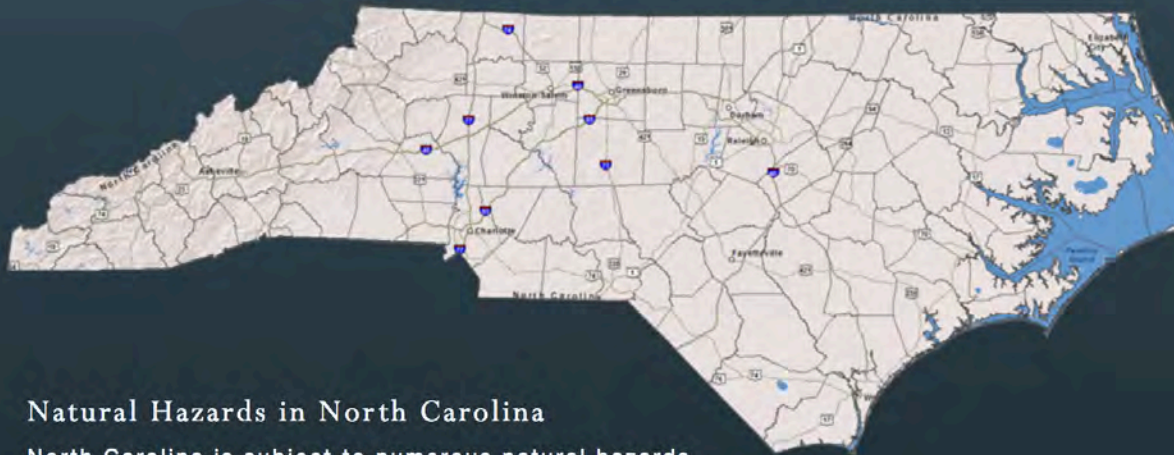
Who am I? General Public

Enter all or part of your address and click search button.

Address, City, or ZIP



Select a hazard to learn more:

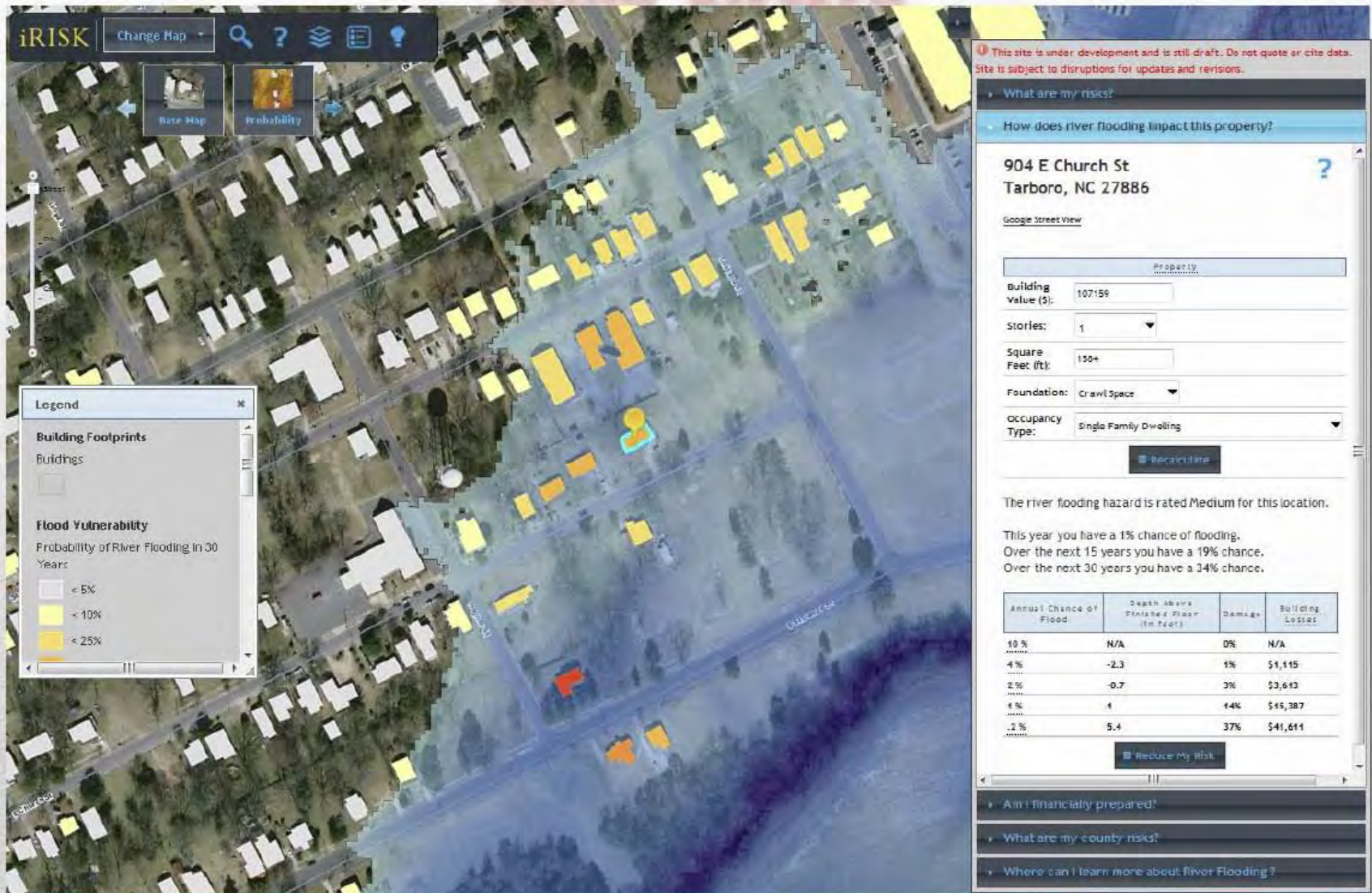


Natural Hazards in North Carolina

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



Using GEOINT to Address Assymmetric Threats





USGS Earth Resources Laboratory
Remote Sensing & Image Analysis
National Center for Earth-Surface Dynamics
Earth Resources Laboratory
USGS

Legend

- Urban areas
- Forest
- Water
- Wild fire

Scale

0 1000 meters

North Arrow

Metadata

File Name: Coimbra_25_Aug_2005.tif
 File Size: 10.5 MB
 File Type: TIFF
 File Date: 2005-08-25
 File Time: 14:30:00
 File Path: C:\Users\jroberts\Documents\Coimbra_25_Aug_2005.tif
 File Format: GeoTIFF
 File Version: 1.0
 File Author: USGS
 File Contact: jroberts@usgs.gov
 File Description: Coimbra, Portugal, Wild Fire, August 25, 2005
 File Keywords: Coimbra, Portugal, Wild Fire, August 25, 2005
 File Subject: Wild Fire
 File Topic: Coimbra, Portugal, Wild Fire, August 25, 2005
 File Type: Image
 File Format: GeoTIFF
 File Version: 1.0
 File Author: USGS
 File Contact: jroberts@usgs.gov
 File Description: Coimbra, Portugal, Wild Fire, August 25, 2005
 File Keywords: Coimbra, Portugal, Wild Fire, August 25, 2005
 File Subject: Wild Fire
 File Topic: Coimbra, Portugal, Wild Fire, August 25, 2005

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 the 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.*



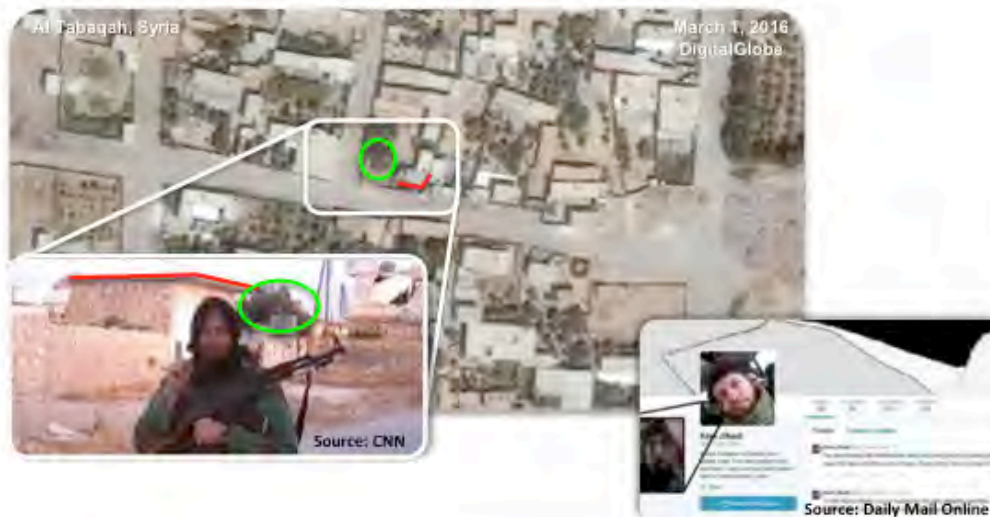
Imagery Intelligence Report

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

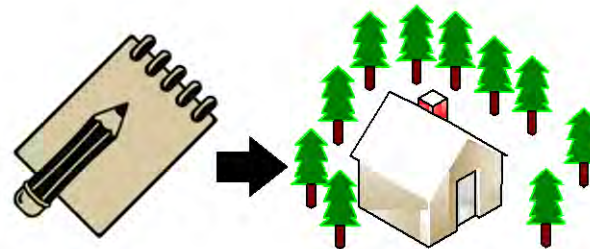
Describe:

- 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:

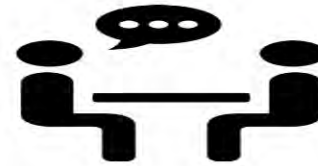
- Subject is guided to the location of interest via a geospatial application with accurate, recent imagery
- Additional information can be gathered about areas adjacent to the location of interest during the maptracking process
- Maptracking can be utilized for vetting of the subject, verification of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



Geospatial Debriefing

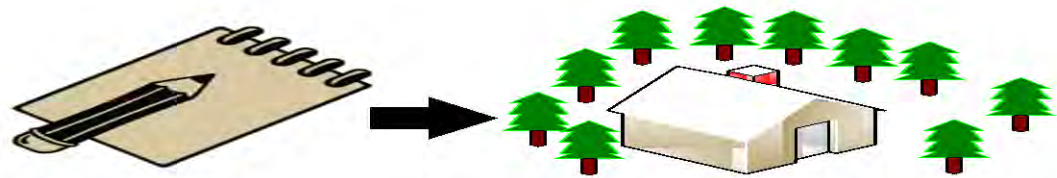
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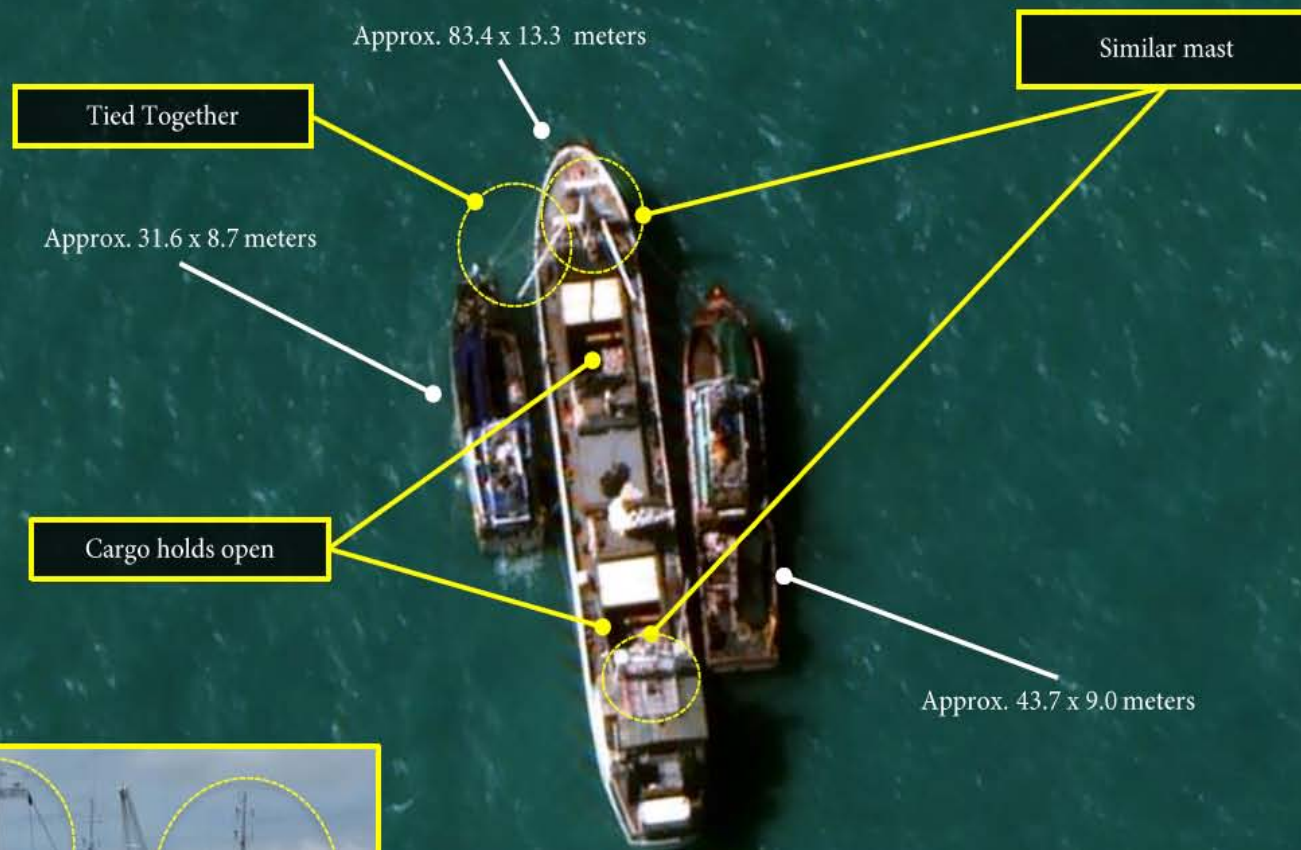
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Machine Learning



Deep Learning over Earth: GeoVisual Search

The screenshot displays the Descartes Labs GeoVisual Search interface. On the left, a search bar contains the text "Search" and "Aerial Imagery (NAIP)". Below it, a map of the United States shows numerous red dots indicating search results. A "Click box to search" instruction is visible on the map. The main area shows a large aerial image of a rural landscape with green fields and a winding road. A red box highlights a wind turbine in the center. To the left of the main image, a grid of 15 smaller images shows various wind turbines, representing the "Top 1000 Closest Matches". The Descartes Labs logo is in the top right corner. The URL "search.descarteslabs.com" is displayed at the bottom. The USGIF logo is in the bottom right corner.

Search Aerial Imagery (NAIP)

Click box to search

Top 1000 Closest Matches: 0

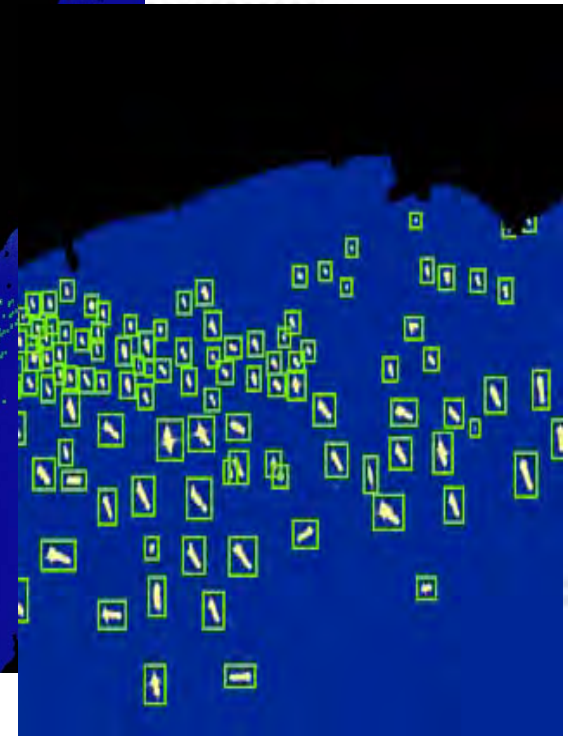
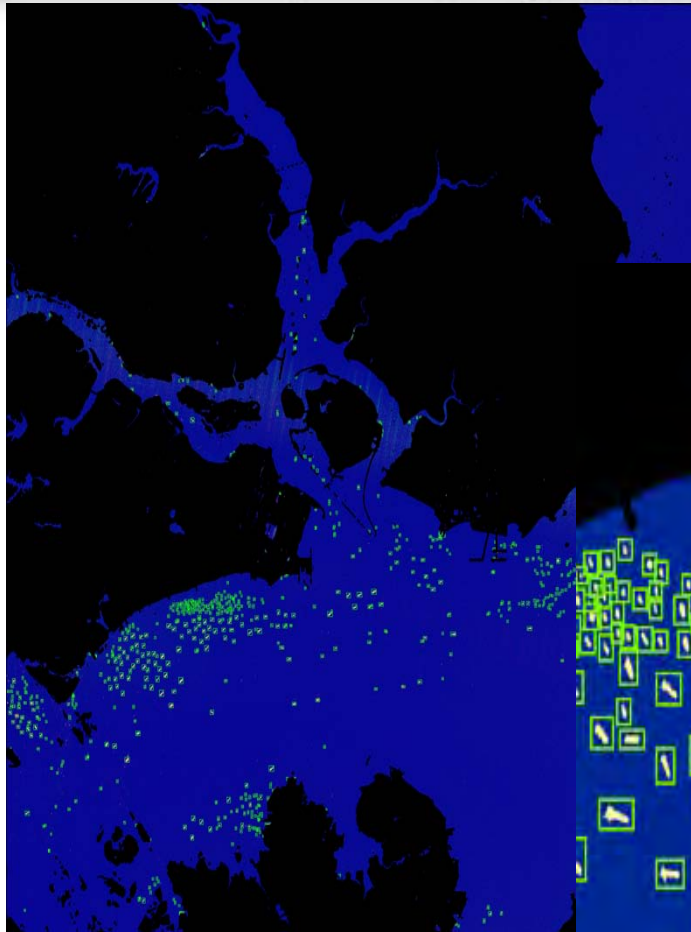
Clear Results

Descartes Labs

search.descarteslabs.com

USGIF

Automated Ship Detections using Sentinel-1 Synthetic Aperture Radar



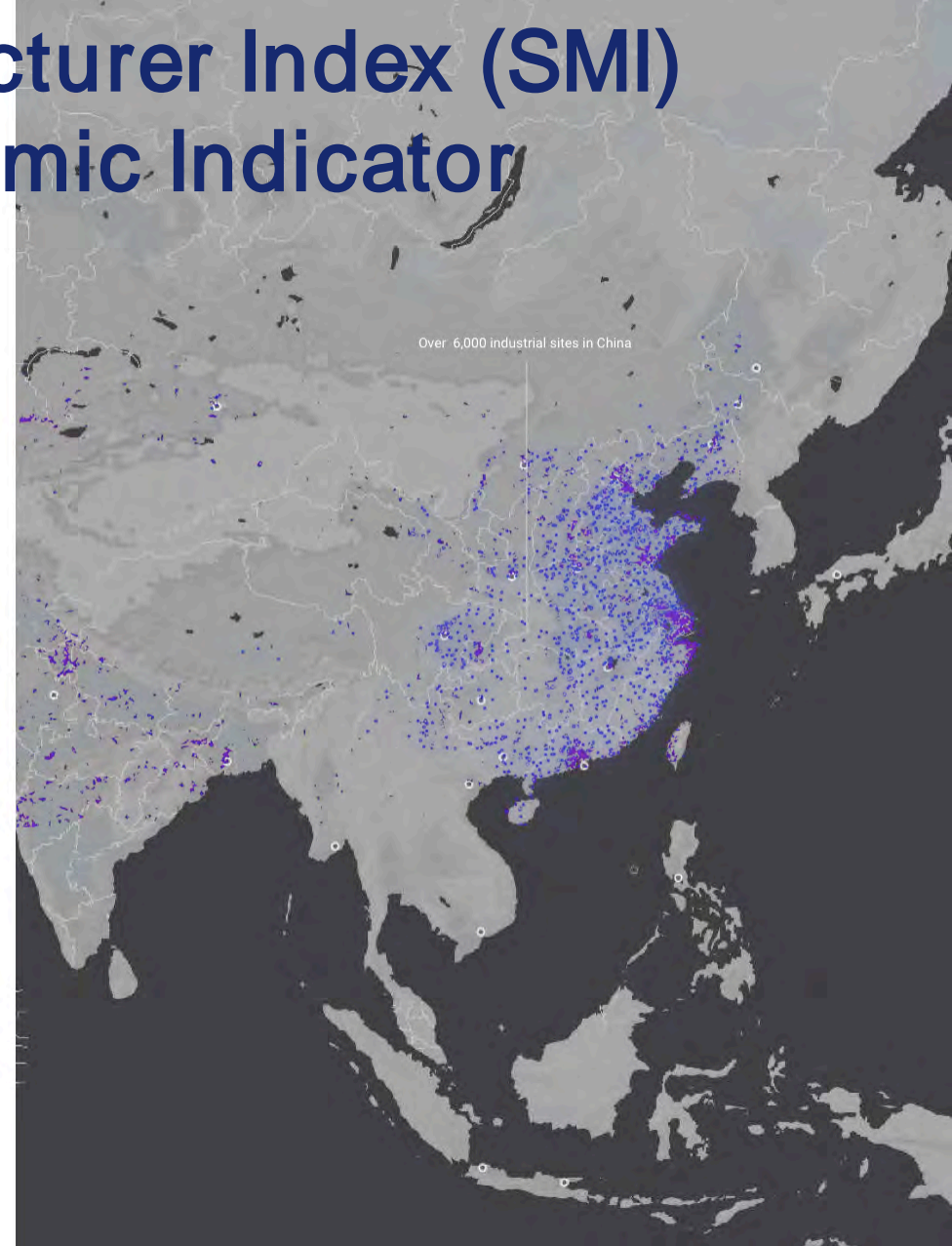
Satellite Manufacturer Index (SMI) as an Economic Indicator

4

$$\text{NDVI} = \frac{\text{NIR} - \text{VIS}}{\text{NIR} + \text{VIS}}$$

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.

SPACE **KNOW**



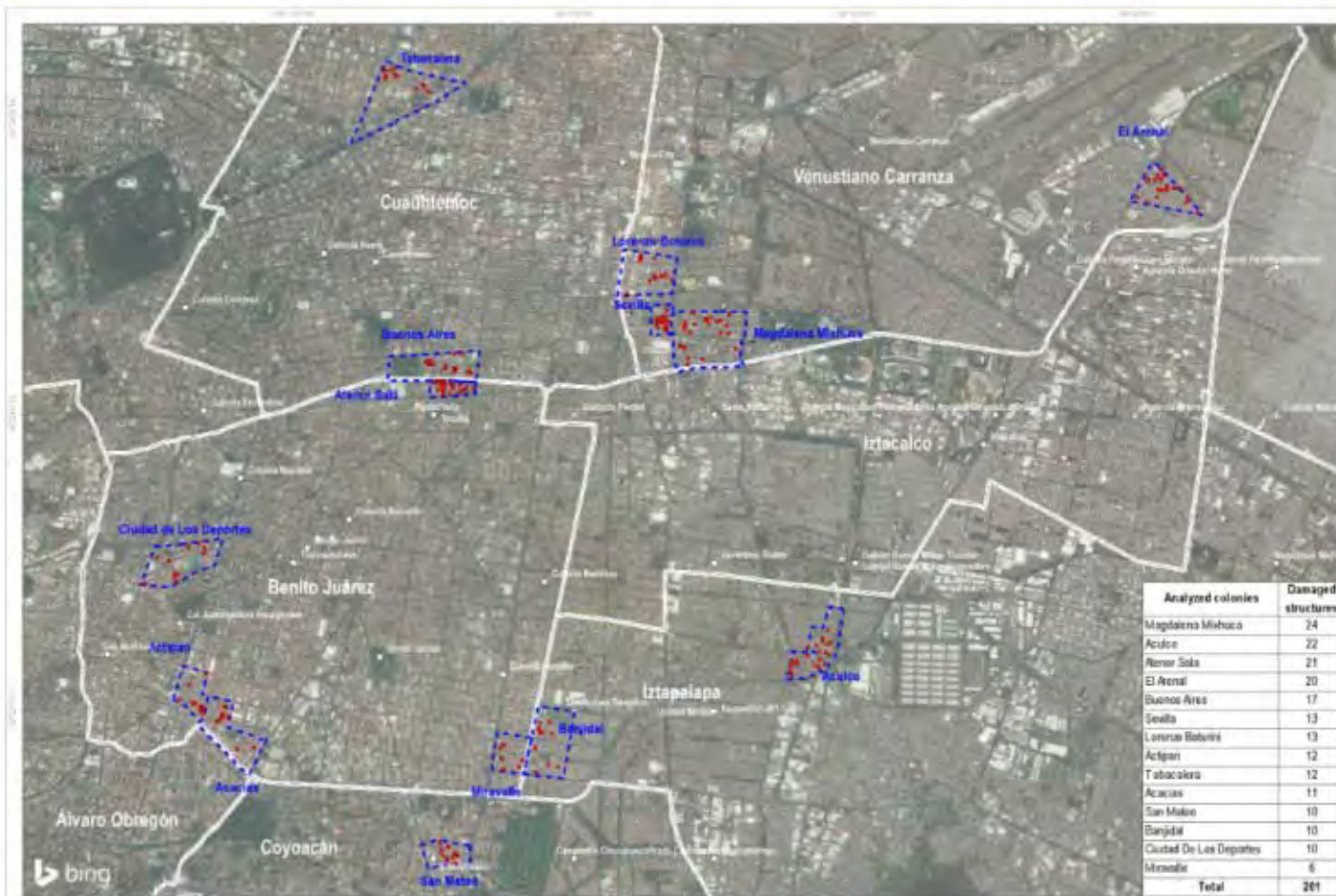


Damage Assessment in Mexico City, Mexico

This map illustrates satellite-detected, potentially damaged structures in some affected colonies located in Venustiano Carranza, Cuauhtémoc, Benito Juárez, Coyoacán 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 as post-event satellite imagery: WorldView-2 acquired as of 20 and 26 September 2017 and Pleiades 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 this map: 24 are located in Magdalena Mixhuca colony, 22 in Acacias, 21 in Alamos Salas and 20 in El Arenal. Please do not hesitate to send feedback to UNITAR - UNOSAT.

- Legend**
- Damaged structure
 - City/Town
 - Analyzed area/colony
 - Municipality boundary

Map Scale for A3: 1:50,000



The depiction and use of boundaries, geographic names and related data shown here are not warranted to be accurate nor do they imply official endorsement or acceptance by the United Nations. UNOSAT is a project of the United Nations Institute for Training and Research (UNITAR), providing satellite imagery and related geographic information, research and analysis to UN humanitarian & development agencies & their cooperating partners. This work by UNITAR-UNOSAT is licensed under a CC BY-NC 4.0.

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

The GEOINT Essential Body of Knowledge (EBK)

“...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**
- } Current Professional Certifications
- Visualization (includes cartographic principles)*
-
- Synthesis
 - Reporting
 - Collaboration
- } “soft skills”

*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)
http://trajectorymagazine.com/wp-content/uploads/2017/11/Trajectory_2017_Special_Edition.pdf
- Read State and Future of GEOINT (it's also free)
<http://usgif.org/education/StateofGEOINT>