



# InSPIRE

Innovation Summit for  
Preparedness & Resilience

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Taxonomies, Ontologies,  
and Schema's O My!

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# Meet the presenters



Carmen  
Zapata



Paul  
Doherty



Trent Tinker

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# Objective

Learn how taxonomies, ontologies, standards, and data schemas impact GIS and enables secure, interoperable, and open geospatial applications.



# Agenda

- Intro
- What are taxonomies and ontologies?
- Making of standards
- Break
- Data schemas for operations
- Panel Discussion

# Why?

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Kevin Kay, NAPSG Foundation

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## Think about this

What is technology you use today that you think can be harnessed by public safety?



## What are these?



# In public safety

## Fire Hydrant & Standpipe Adapters

189 products

Fire hydrant and standpipe adapters connect fire hoses to the water source when thread size, gender, or diameter on each are incompatible. They also connect hoses to fire trucks and other water sources in industrial plants and municipal garages.



Aluminum Rigid Fire Hydrant & Standpipe Adapters | Aluminum Swivel Fire Hydrant & Standpipe Adapters | Brass Rigid Fire Hydrant & Standpipe Adapters | Brass Swivel Fire Hydrant & Standpipe Adapters | Chrome-Plated Rigid Fire Hydrant & Standpipe Adapters | Steel-Shank Fire Hydrant Couplings | Fire Hydrant & Standpipe Ball Valve Adapters

### Aluminum Rigid Fire Hydrant & Standpipe Adapters



Aluminum rigid fire hydrant and standpipe adapters do not rotate as the hose is moved, making them less likely to loosen or break than swivel adapters. Aluminum is lighter than brass and provides excellent corrosion resistance and good pressure capacity to withstand water flow when the hydrant is in use.

#### Female x Genderless

Fitting Size	Fitting Connection Type	Tightening Method	Shape	Price
2-1/2 in x 4 in	NH x 50oz	Rocker Lug	Straight	\$252.19
2-1/2 in x 5 in	NH x 50oz	Rocker Lug	Straight	\$365.34
4 in x 4 in	NPT x 50oz	Rocker Lug	Straight	\$284.45
4 in x 5 in	NH x 50oz	Rocker Lug	Straight	\$293.61
4 in x 5 in	NPT x 50oz	Rocker Lug	Straight	\$384.84
4-1/2 in x 4 in	NH x 50oz	Rocker Lug	Straight	\$330.33
4-1/2 in x 4 in, 4-1/2 in x 5 in	NH x 50oz	Rocker Lug	Straight	\$549.88
4-1/2 in x 4 in, 4-1/2 in x 5 in	NH x 50oz	Rocker Lug	Straight	\$549.88
4-1/2 in x 5 in	NH x 50oz	Rocker Lug	Straight	\$419.67
6 in x 6 in	NPT x 50oz	Rocker Lug	Straight	\$495.98
6 in x 8 in	NPT x 50oz	Rocker Lug	Straight	\$542.83

#### Female x Male

Fitting Size	Fitting Connection Type	Tightening Method	Shape	Price
1 in x 7 in	NPTM x NH	Rocker Lug	Straight	\$29.73
1 in x 7 in	NPTM x NH	Rocker Lug	Straight	\$30.99
1 in x 7 in	NPT x NH	Rocker Lug	Straight	\$41.84
1 in x 7-1/2 in	NH x NH	Rocker Lug	Straight	\$47.87
1 in x 7-1/2 in	NPTM x NH	Rocker Lug	Straight	\$47.51
1 in x 7-1/2 in	NPTM x NH	Rocker Lug	Straight	\$54.28
1 in x 7-1/2 in	NPTM x NPTM	Rocker Lug	Straight	\$63.71
1 in x 7-1/2 in	NPTM x NPTM	Rocker Lug	Straight	\$73.01
1 in x 7-1/2 in	NH x NH	Rocker Lug	Straight	\$85.92



BK Radio  
BKR9000



L3 Harris XL-200



Motorola APX NEXT



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# In the future



Bard

vs



CHAT-GPT

vs



BingAI

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# Think about this

- What is *critical infrastructure* and how do you categorize it?
  - PPD definition
  - DHS Critical Infrastructure Sectors
    - 16? 18?
  - FEMA Lifelines
    - Ongoing changes
- *How do I convey the information to partners?*



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# Starting with a solid foundation



**Common  
“language”**



**Easier Data  
Sharing**



**Additional  
Insights**

# **Taxonomies and Ontologies**

Carmen Zapata, Sr. Advisor, Infrastructure  
Security Division, CISA

# DATA & INFO SHARING: TAXONOMIES & ONTOLOGIES IN CRITICAL INFRASTRUCTURE PROTECTION

CARMEN ZAPATA, CISA SR. TECHNICAL ADVISOR  
INNOVATION SUMMIT FOR PREPAREDNESS & RESILIENCE (INSPIRE 2023)



# Bottom Line Up Front (BLUF)

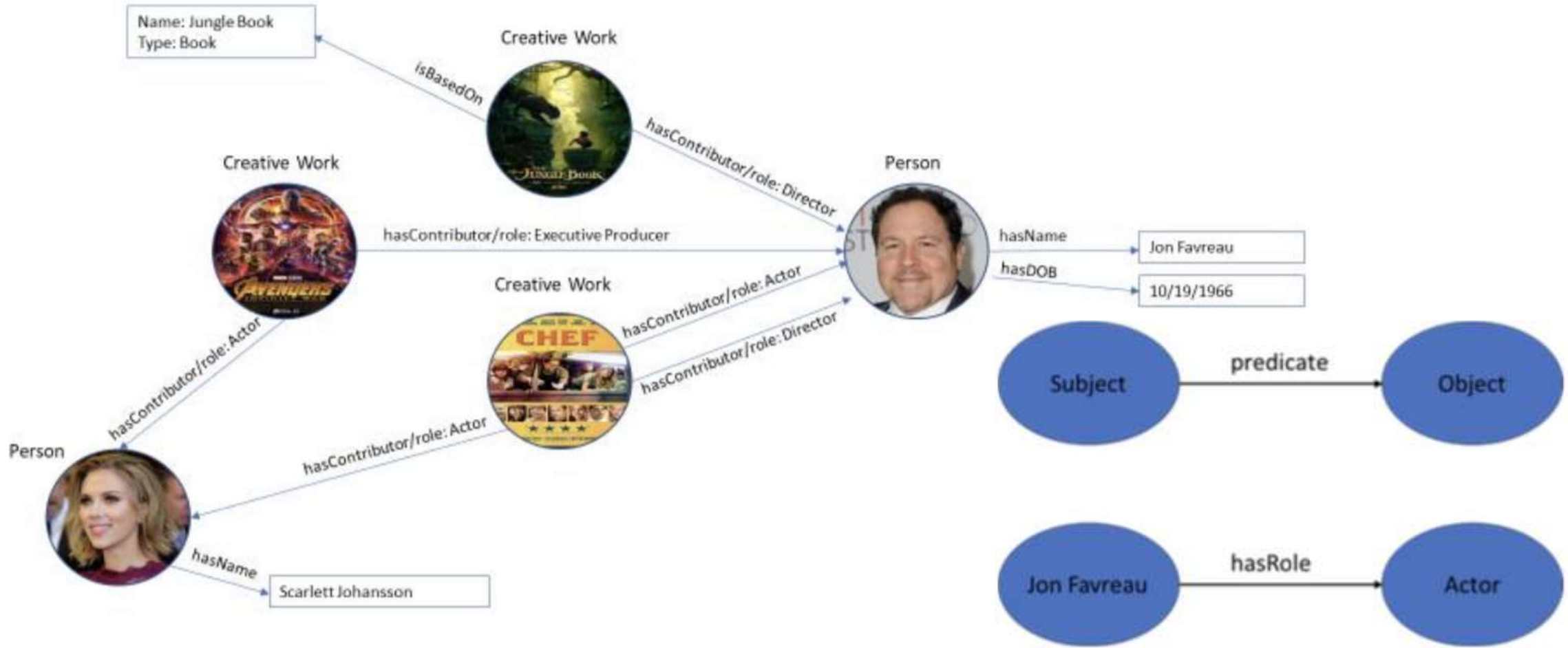
Using an ontological approach, we use the Infrastructure Data Taxonomy (IDT) in a spatial knowledge graph to analyze and manage risks to Critical Infrastructure (CI).

## Key Topics Include:

- Defining taxonomy/ontology
- Uses of the Infrastructure Data Taxonomy (IDT)
- Current work to update the IDT
- Data Compilation Risks



# Icebreaker



Source: A-Creative-Works-Ontology-for-the-Film-and-Television-Industry-Final-2018-9-24.pdf (movielabs.com)

Carmen Zapata, Sr. Advisor  
February 5, 2024

# Background

- The Cybersecurity and Infrastructure Security Agency (CISA) works with partners to defend against today's threats to build a more secure and resilient infrastructure for the future
- Mission: Lead the National effort to understand, manage, and reduce risk to our cyber and physical infrastructure
- Six divisions: Infrastructure Security Division (ISD), Emergency Communications Division (ECD), Cybersecurity Division (CSD), National Risk Management Center (NRMC), Integrated Operations Division (IOD), and Stakeholder Engagement Division (SED)
- Critical infrastructure: Assets that are so vital that their incapacity or destruction would have a debilitating impact on the Nation's physical security, economic security, public health, or public safety





# Challenge of Critical Infrastructure

- Critical infrastructure space represents a massive range of:
  - Industries and asset types, assessment and modeling data types, for both big data for cyber and wide data for physical infrastructure, emergency communications, and risk
  - Data uses and users (e.g., field personnel recording information, analysts exploring data, local to federal governments making decisions based on data)
- Assets are often difficult to clearly define and could have multiple classifications, (e.g. dams and corn) as well as classifications under multiple sources of classification (e.g., North American Industry Classification System [NAICS], National Critical Functions [NCF])
- Challenge: Creating a standard definition of every part of the critical infrastructure to achieve a clear, common understanding of critical infrastructure, applicable to any field in an environment with a variety of assets, data, and uses/users makes effective analysis and collaboration difficult

**A unified and optimal approach to critical infrastructure analysis, security, and resilience requires a common nomenclature for critical infrastructure assets that is regularly updated and widely distributed**



Carmen

# Ontology in Critical Infrastructure Protection

- We need to understand how things that make up infrastructure relate to one another
- We all have different questions that relate to risk
- Different parts of DHS choose the parts of the ontology that help to answer different stakeholder questions
- In determining risk to critical infrastructure, an ontology describes the interdependencies between functions or nodes



Carmen Zapata and Chris Goodrich presenting to CBP in 2021



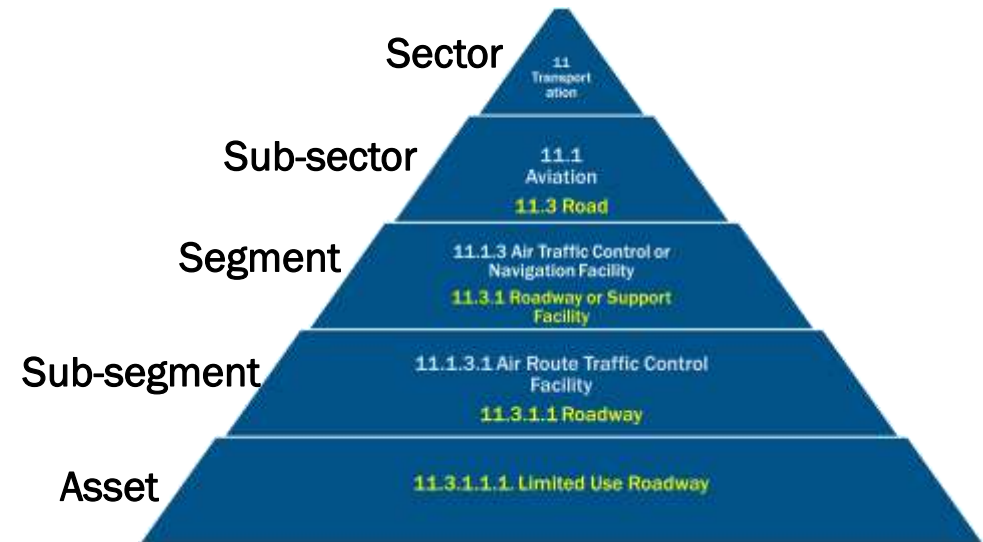
# Building an Ontology

- Ontologies are most useful when they can be combined or linked to other ontologies
- Basic Formal Ontology (BFO) is a top-level ontology developed for the purposes of promoting interoperability among domain ontologies. The structure is based on a division of entities into two distinct categories resembling nouns and verbs: continuant (objects and spatial regions) and occurrent (spanning of time)
- Steps to building an ontology:
  - Define the scope; determine what's important in enough detail for the business case but loose enough to include a break down or decomposition of the classes
  - Identify various classes (people, places, products, organizations, functions, etc)
  - Determine the relationships between the classes
  - Identify attributes for the classes through a related taxonomy



# Taxonomy vs Ontology

- Taxonomy is a controlled vocabulary that details the hierarchy of parts that make up a whole
- Controlling the vocabulary allows for more accurate data collection of the taxonomy as the population of entities must be defined by the taxonomy
- Ontology is a controlled vocabulary that describes the relationship between nodes and is not necessarily part of a hierarchy – however, **ontologies can define relationships across more than one taxonomy**
- Ontologies are suited for modeling analytical problems



Infrastructure Taxonomy V 4

# Risk Analytic Workflow

1. Define the analytic question
  - How can we quickly identify vulnerable Critical Infrastructure assets that share similar vulnerabilities with a known disrupted asset?
2. Understand the problem
  - Identify critical infrastructure assets
  - Identify data containing vulnerability information for infrastructure assets
  - Build Knowledge Graph (KG) to visualize the relationships between assets
3. Analyze the problem
  - Add IDT to KG to serve as the “connective tissue” between all CI assets
  - Map geographic context to understand spatial relationships and patterns



# Infrastructure Ontology

## Things

- Sector
- Transportation
- Sub-Sector
- Maritime
- Segment
- Port
- Sub-segment
- Deep Draft Port
- Asset
- Dry Bulk Cargo Terminal

## Attributes

- Importing
  - Soybeans
  - Grain Products
  - Bulk Grains
  - Animal Feed
- Depends on functions
  - Material Handling
  - Equipment
  - Port entry/exit scheduling
  - Ground transporting product
  - Staff access control
  - Maintenance
- Support to Asset
  - Electricity
  - Fuel
- Vulnerability
  - Cyber attack

## Primary Dependencies

- Provide raw materials for
  - Animal feed
  - Food processing
  - Biofuel production
- Hazard Mitigation
  - Cyber defenses
  - Entry control actions
- Interrupted functions
  - GPS for crane service
  - Port arrival/departure
  - Ground transportation
  - Staff productivity

## Secondary Dependencies

- Support production of
  - Livestock
  - Methane
  - Food Products
- Negative effects
  - Can't offload ships
  - Congested ports
  - Throughput reduction
  - Staffing difficulties

Performs  
Primary role

Are used for

Material  
Support to

Is supported by

Is influenced by

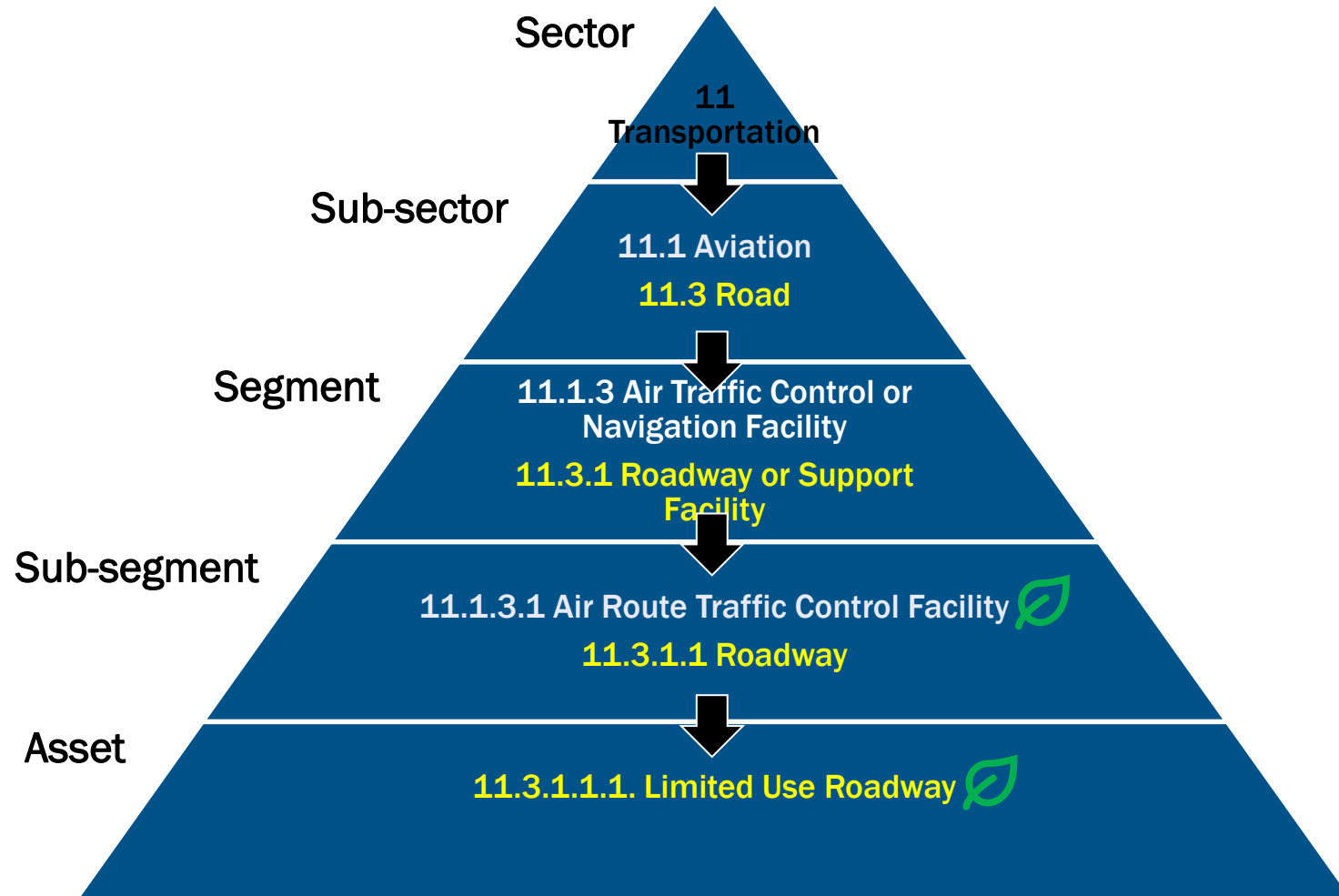
Is influenced by

Is influenced by

Is dependent on

Is reduced by

# IDT v.4 Levels



*This represents only a select portion of the Energy sector.*

## 18 Sectors (2011 IDT)

- Agriculture and Food
- Banking and Finance
- Chemical and Hazardous Materials Industry
- Commercial Facilities
- Communications
- Dams
- Defense Industrial Base
- Emergency Services
- Energy
- Government Facilities
- Healthcare and Public Health
- Information Technology
- Manufacturing
- National Monuments and Icons
- Nuclear Reactors, Materials, and Waste
- Postal and Shipping
- Transportation
- Water

## 560 Asset Types

### Examples:

- River Ferry (Transportation)
- Local Broadcast Station (Communications)
- Public Safety Dive Team (Emergency Services)
- Marine Bulk Terminal (Chemical and Hazardous Materials Industry)
- Credit Union Office Building (Banking and Finance)

# IDT Structure

Definitions of data elements → Common understanding and clear communication across partners

Connection to other sectors → Holistic understanding of assets and cross-sector dependencies

Defined data paths → Easy reference, connection, and sharing of data across systems

Unique identifier → Clear mapping across datasets and versions

Mapping to NAICS codes → Explicit connection to industry and economic activity

IDT Path	IDT Description	IDT ID	Cross-sector Reference	NAICS Code
<b>11 TRANSPORTATION</b>	The Transportation Sector is comprised of a multitude of networks of transportation systems. Systems vary in size and complexity, but all modes of transportation have one element in common - they have defined origin and destination points, and the assets that comprise the system of interest exist for the sole purpose of facilitating the flow of either people or products. For the purposes of this taxonomy, assets are comprised of nodes and linkages. One example of a node is a rail yard; one example of a link is the portion of rail track that joins two rail yards. Hence, users of the transportation portion of this taxonomy must first think in terms of specifically defined systems and the flow of either people or products through the defined systems. The individual concepts provided in this taxonomy, are the physical elements that comprise the systems.	785		
<b>11.1 AVIATION</b>	Assets involved in the aviation industry.	786		
<b>11.1.1 Aviation Conveyance</b>	All types of aircraft.	787		481
<b>11.1.2 Airport</b>	Fields for handling aircraft landings and takeoffs.	788		48811

STRUCTURE → INTEROPERABILITY → COLLABORATION





# IDT Update Underway

- Last IDT, the IDT v4 was released in 2011
- IPT update necessary for multiple reasons
  - Presidential Policy Directive (PPD)-21 updates sector list from 18 to 16 sectors
  - National Infrastructure Protection Plan refresh
  - Establishing CISA and the Sector Risk Management Agencies
  - NCF implementation



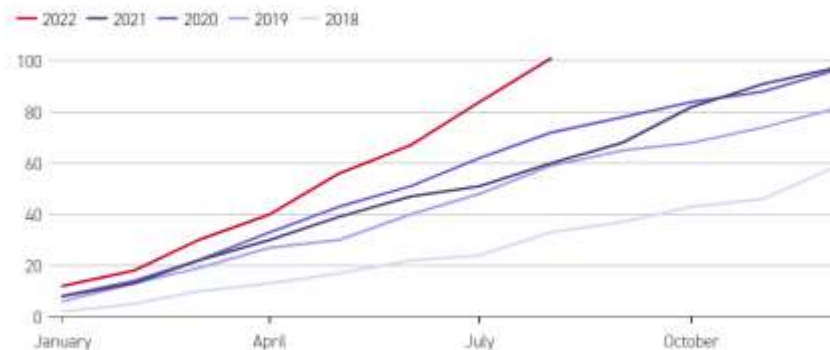
# Data Compilation Risks

- Compiled CI Data can be used for attack planning;
- The Critical Infrastructure Data Compilation Technical Risk Assessment (CIDACTRA) evaluates the threats, vulnerabilities, consequences, existing mitigations, and proposed mitigations for the compilation of various types of critical infrastructure data.
- **Intended output:** Guidance including potential mitigation activities that public and private data compilers can consider to keep their data from being used for nefarious purposes.

**Key Trend:**  
**+71% increase in 2022 attacks on US electrical infrastructure<sup>3</sup>**

## Power grid attacks are on the rise this year

Cumulative number of reported human-caused attacks on power grid infrastructure in the past five years



Source: DOE  
Catherine Morehouse / POLITICO

“According to prosecutors, they used **open-source information on the national infrastructure grid** to pick five electrical substations around Baltimore that would, if attacked on the same day, create a “cascading failure” in the system.” –The Washington Post, 2/6/23<sup>1</sup>



# CIDACTRA Risk Register and Decision Trees

- The current exploratory Risk Register consists of 80 (16 sectorsx5 compilation roles\*) data compilation scenarios. Preliminary scores exist for the following scenario attributes:

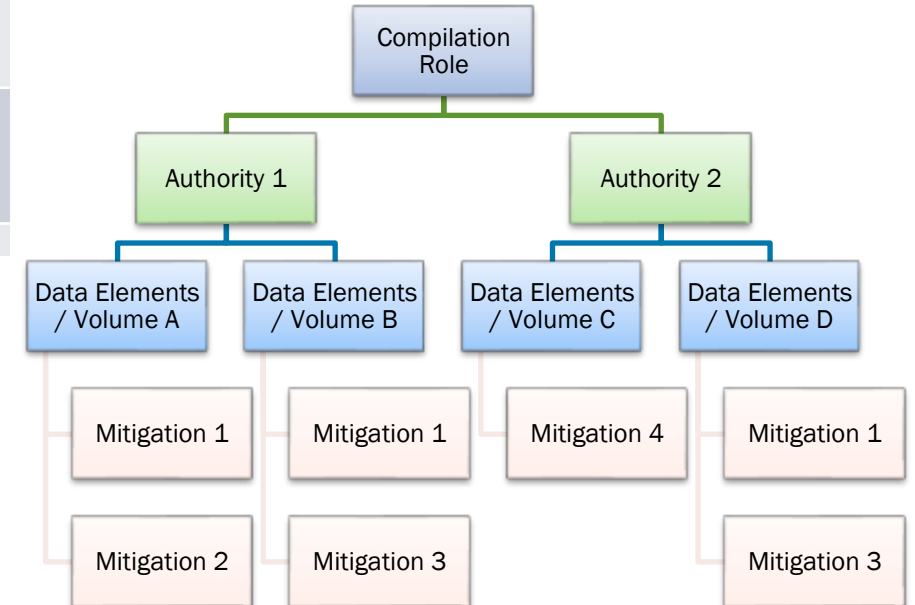
Role	Sector	Authority	Completeness of CI Data	Existing Mitigations (Preventing/ Deterring Compromise)	Likelihood of Compromise (Given Intent)	Impact of Compromise
Federal Government	Dams			Minimal, many open sources (NID widely available)		
Federal Government	Energy			Information Protection Regime		
Federal Government	Food and Agriculture			Information Protection Regime; login/password		
Hobbyist	Dams			None		

\* Compilation Roles: Federal Government, SLTT Government, Private Owner/Operator, Data Broker, Hobbyist

Analysis is in progress

Analysis is in progress

- Mitigation Decision Trees



# Useful Links & Contact Information



Infrastructure Data Taxonomy | <https://www.cisa.gov/resources-tools/resources/infrastructure-data-taxonomy>CISA

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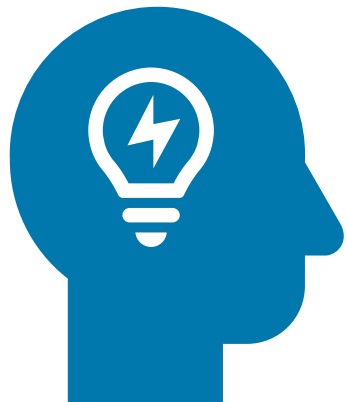
Carmen Zapata, Sr. Advisor

Cybersecurity and Infrastructure Security Agency (CISA), Infrastructure Security Division (ISD)

Email: [carmen.zapata@cisa.dhs.gov](mailto:carmen.zapata@cisa.dhs.gov) | Office: 703-603-4708



# Questions/Comments



# Fictitious Scenario

```
# Document Information
SPDXVersion:SPD-2.2
DataLicense: CC0-1.0
DocumentNamespace: https://fictitiousSBOMs.org
Vision_2023_.exe-3.2.0.11-23958635-2358234a93875-23948724bb78-43b54
SPDXID: SPDXRef-Documnet
Creator: Organization: Dead in the Water Technologies
Created: 2020-12-28T17:21:34Z
DocumentComment: <text>Oh the humanity! AHHH! We've made a terrible mistake!</text>

# Package
PackageName: PI Vision_2019
SPDXID: SPDXRef-DITWtechnologies-PI Vision-2019-.exe-3.2.0.11
PackageVersion: 3.2.0.11
PackageFileName: PI Vision-2019-.exe
PackageSupplier: Organization: Dead in the Water Technologies
PackageDownloadLocation: NOASSERTION
FilesAnalyzed: true
PackageVerificationCode: cfas2489we58965237skdf48JDK73649209w8e987JE587
PackageChecksum: MD5: asfier8wersidfsd8f6sdvsdc786asr876
PackageChecksum: SHA1: f987459edg987sdf656as309sdgs07fb0df9g70vc09dg79as8
Relationship: SPDXRef-DITWtechnologies-PI Vision-2019-.exe-3.2.0.11 CONTAINS Lunar Gust Origin API v2019.4 HFS
```

## Problem:

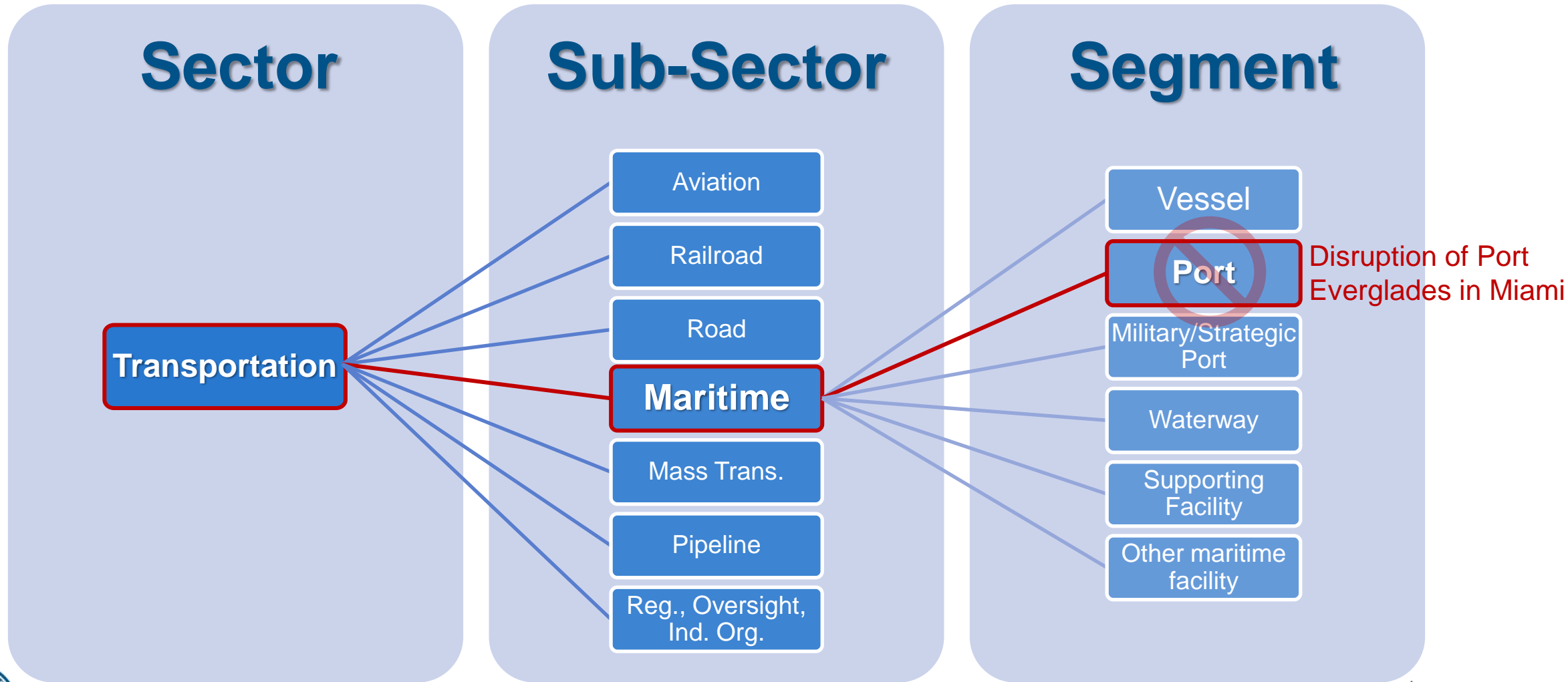
The Software Bill of Materials (SBOM, left) shows that the Integrated Master Scheduler (IMS) controlling logistical operations for Port Everglades is vulnerable to attack through the Lunar Gust API.

## Solution:

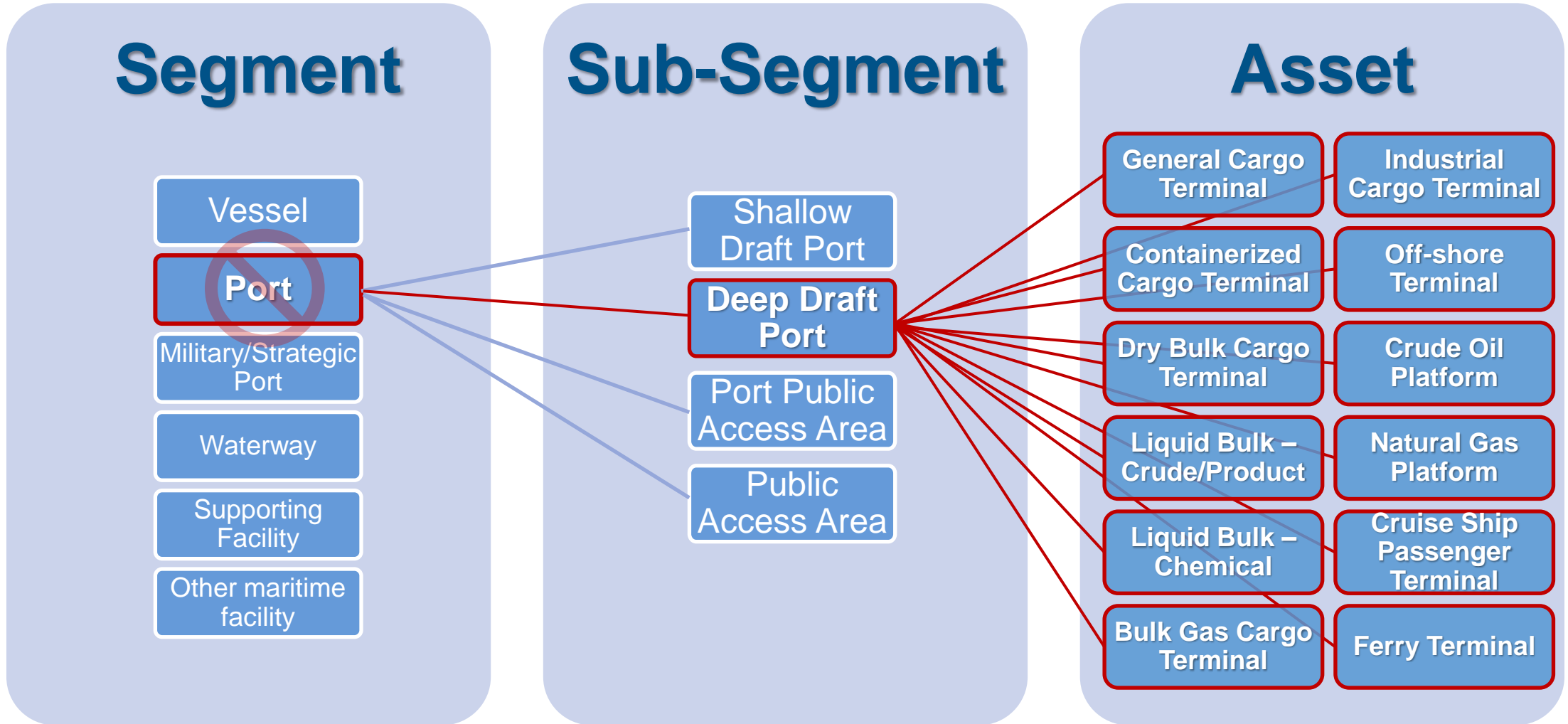
1. Use the IDT modelled in a graph database to visualize relationships of 'downstream' Sub-Segments and Assets to the Major Port and
2. Use a GIS to visualize the affected physical features in geographic context.



# IDT Relationships



# IDT Relationships





# Demo



# Interoperability and open standards

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Trent Tinker, Director, Open Geospatial Consortium



Open  
Geospatial  
Consortium

# A Problem-Solving Community

Trent Tinker  
Nov 16 2023





# What is OGC?

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**A hub for thought leadership, innovation, and standards for all things related to location**

## **Our Vision**

Building the future of location with community and technology for the good of society

## **Our Mission**

Make location information Findable, Accessible, Interoperable, and Reusable (FAIR)

## **Our Approach**

A proven collaborative and agile process combining consensus-based standards, innovation project, and partnership building

# 29 years of community Impacts

Community: 550+ Members

Problem solvers & innovators

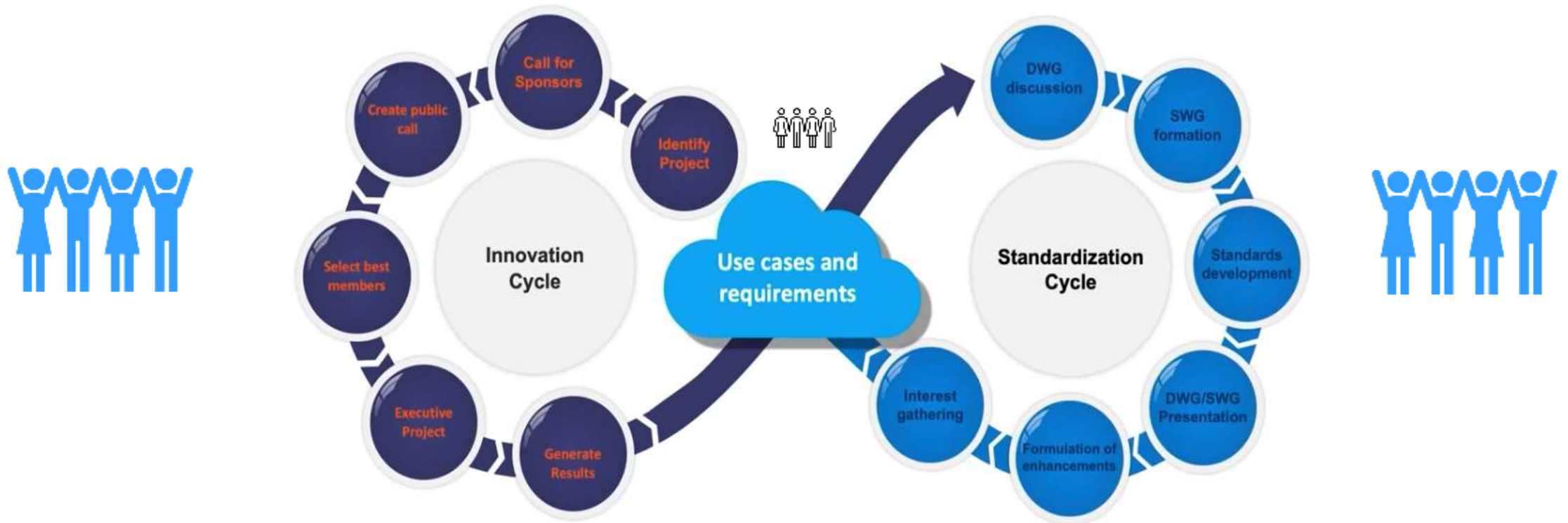
Creating value with geospatial

Deliverables to the world

# Community, Standards and Innovation: A proven process with an agile methodology

## Collaborative Solutions and Innovation Program (COSI)

## Standards Program





# Who Are Our Members?

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## Commercial

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Business Development

Global: Brand Exposure

Competitive Technical Advantage

Funding for Innovation

## Government

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Innovation & Market Support

International Partnerships

Trusted Advice

Operational Policy

Support & Certification

## Research & Academia

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Applied Research Partners

International Collaboration

Funding for Innovation

Citations

# Who Are Our Members?

**Strategic (9 members)**

**Principal (17 members)**

**Voting (68 members)**

**Community (425 members)**





# Membership Levels

<b>Community</b> <i>Join to Participate</i>	<b>Voting</b> <i>Join to Influence</i>	<b>Principal</b> <i>Join to Lead</i>	<b>Strategic</b> <i>Join to Invest</i>
<p>Benefits:</p> <ul style="list-style-type: none"> <li>- Access to 70+ Standards Working Groups and 50+ Domain working Groups.</li> <li>- Participation in developer code sprints.</li> <li>- Eligibility for funding in Collaborative Solution &amp; Innovation activities.</li> <li>- Access to member events, such as webinars, meetings, workshops, and summits.</li> <li>- Networking benefits with the world's experts on leading edge knowledge and innovative data and technology practices.</li> <li>- Increased exposure of your brand and offerings to potential partners, investors, and customers via the OGC website.</li> </ul>	<p>Community level plus:</p> <ul style="list-style-type: none"> <li>- Access to standard setting, voting and decision processes from beginning to end.</li> <li>- Ability to influence which standards are advanced, considering your area of business activity.</li> <li>- Ability to influence which standards are implemented, considering your specific business needs.</li> <li>- Ability to access one of the world's best and largest technical community of experts, to help resolve some of your most pressing interoperability challenges.</li> <li>- Recognition for technical leadership and influence.</li> </ul>	<p>Voting levels plus:</p> <ul style="list-style-type: none"> <li>- Seat on the Executive Planning Committee.</li> <li>- Final approval of identified and emerging data, technologies, and associated standards at the front-end of the OGC technology roadmap.</li> <li>- Final approval of globally relevant standards in a highly competitive industry.</li> <li>- Access to and shaping of leadership opportunities in specific testbeds and pilots for global technology and innovation potential.</li> <li>- Approval of Board of Directors.</li> <li>- Networking at the executive level of the consortium.</li> </ul>	<p>Principal levels plus:</p> <ul style="list-style-type: none"> <li>- Seat on the Strategic Advisory Committee.</li> <li>- Power to define the requirements and priorities of the OGC Collaborative Solution &amp; Innovation program.</li> <li>- Leverage of pooled resources to accelerate the pace of activities and standards directly relevant to your mission and your market.</li> <li>- Ability to mobilize world-class experts to prototype solutions specific to your use cases.</li> <li>- Ability to outsource your research needs to global experts.</li> <li>- Demonstration of the highest level of commitment to open standards, FAIR principles and collective problem solving.</li> </ul>

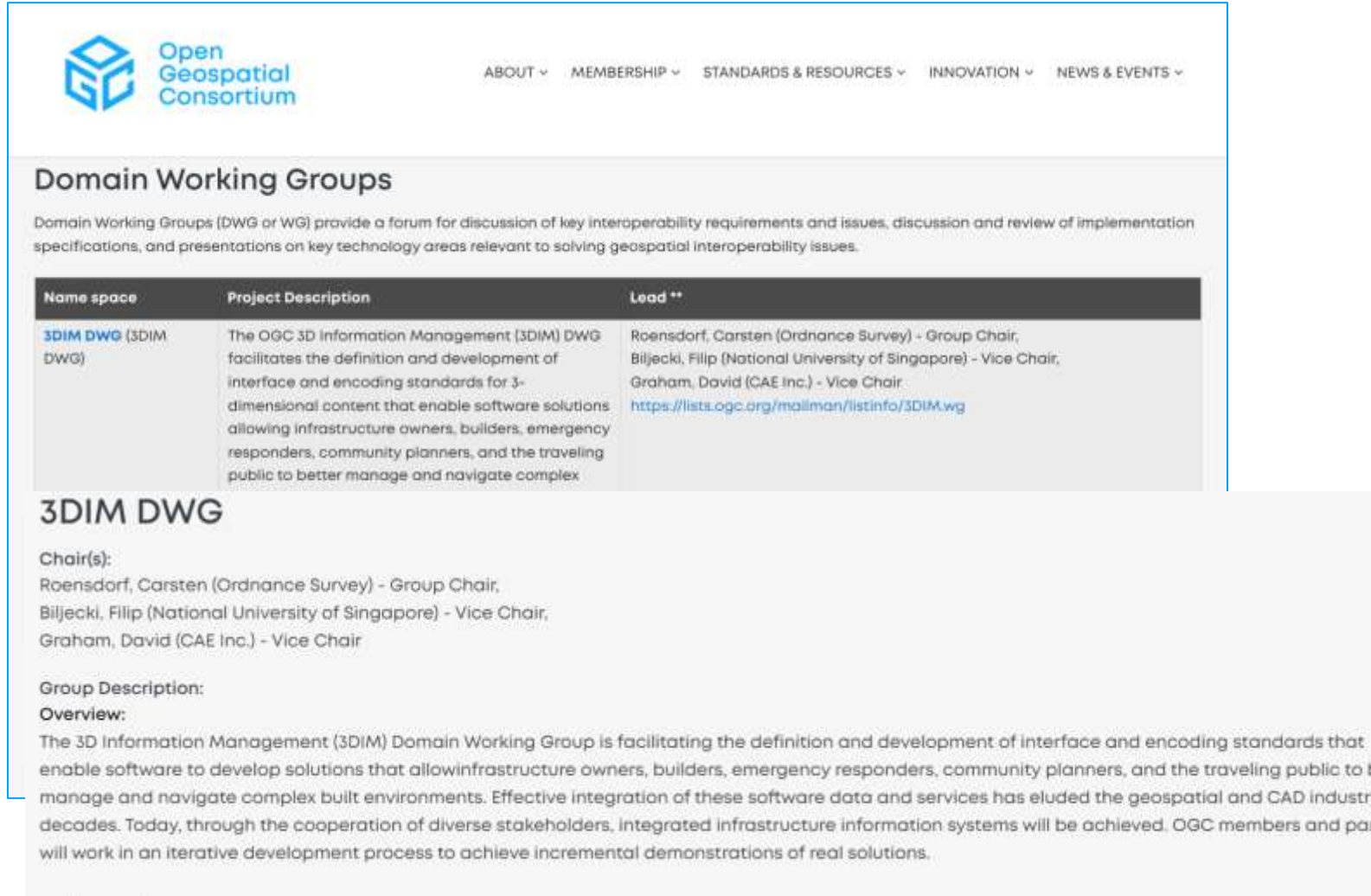
# Engaging with Communities

# Member Meetings - 3 Per Year



# Join Working Groups (Ideas)

- 3-Dimensional Info Management – connect to Citymodels, Underground etc
- Urban Digital Twins
- Energy and Utilities
- Defense and Intelligence
- Geo for the Metaverse
- Simulation and Gaming
- GeoAI DWG + Training Data Standard
- Full List



The screenshot shows the Open Geospatial Consortium website. The header includes the logo and navigation links: ABOUT, MEMBERSHIP, STANDARDS & RESOURCES, INNOVATION, and NEWS & EVENTS. The main heading is "Domain Working Groups". Below this is a paragraph explaining that Domain Working Groups (DWG or WG) provide a forum for discussion of key interoperability requirements and issues, discussion and review of implementation specifications, and presentations on key technology areas relevant to solving geospatial interoperability issues.

Name space	Project Description	Lead **
<a href="#">3DIM DWG</a> (3DIM DWG)	The OGC 3D Information Management (3DIM) DWG facilitates the definition and development of interface and encoding standards for 3-dimensional content that enable software solutions allowing infrastructure owners, builders, emergency responders, community planners, and the traveling public to better manage and navigate complex	Roensdorf, Carsten (Ordnance Survey) - Group Chair, Biljecki, Filip (National University of Singapore) - Vice Chair, Graham, David (CAE Inc.) - Vice Chair. <a href="https://lists.ogc.org/mailman/listinfo/3DIM.wg">https://lists.ogc.org/mailman/listinfo/3DIM.wg</a>

**3DIM DWG**

**Chair(s):**  
Roensdorf, Carsten (Ordnance Survey) - Group Chair,  
Biljecki, Filip (National University of Singapore) - Vice Chair,  
Graham, David (CAE Inc.) - Vice Chair

**Group Description:**  
**Overview:**  
The 3D Information Management (3DIM) Domain Working Group is facilitating the definition and development of interface and encoding standards that enable software to develop solutions that allow infrastructure owners, builders, emergency responders, community planners, and the traveling public to better manage and navigate complex built environments. Effective integration of these software data and services has eluded the geospatial and CAD industry decades. Today, through the cooperation of diverse stakeholders, integrated infrastructure information systems will be achieved. OGC members and partners will work in an iterative development process to achieve incremental demonstrations of real solutions.

**Participate in the COSI Program**

# 2021 COSI Program in Numbers

Sponsor or participate in an Innovation Initiative



**Over 90  
Participating  
Organizations**

**21 Innovation  
Program  
Initiatives**

**\$2.1M USD  
Support for  
OGC Members**

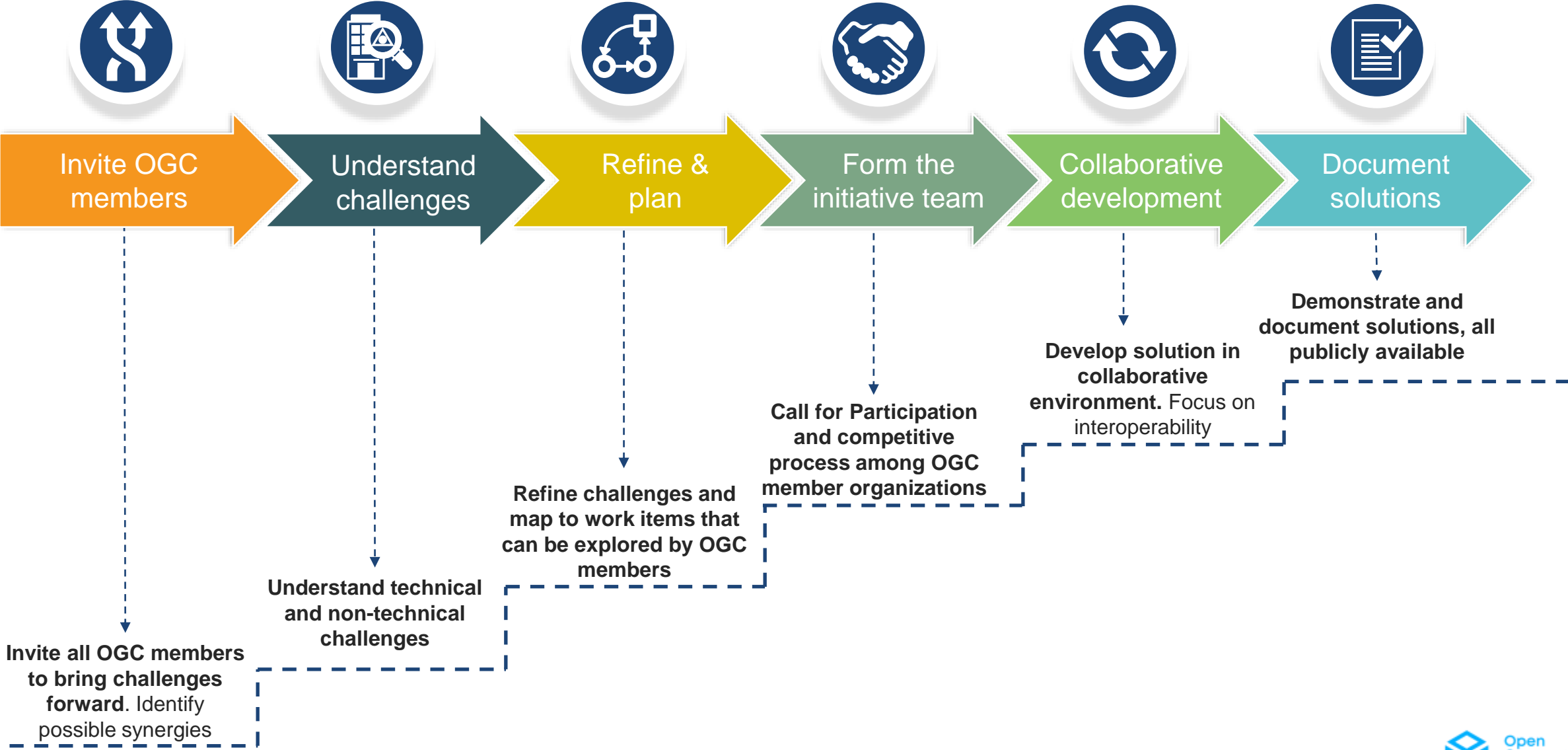
# Active Initiatives



There are more!

<https://www.ogc.org/projects/initiatives/active>

# High Level OGC Initiative Process

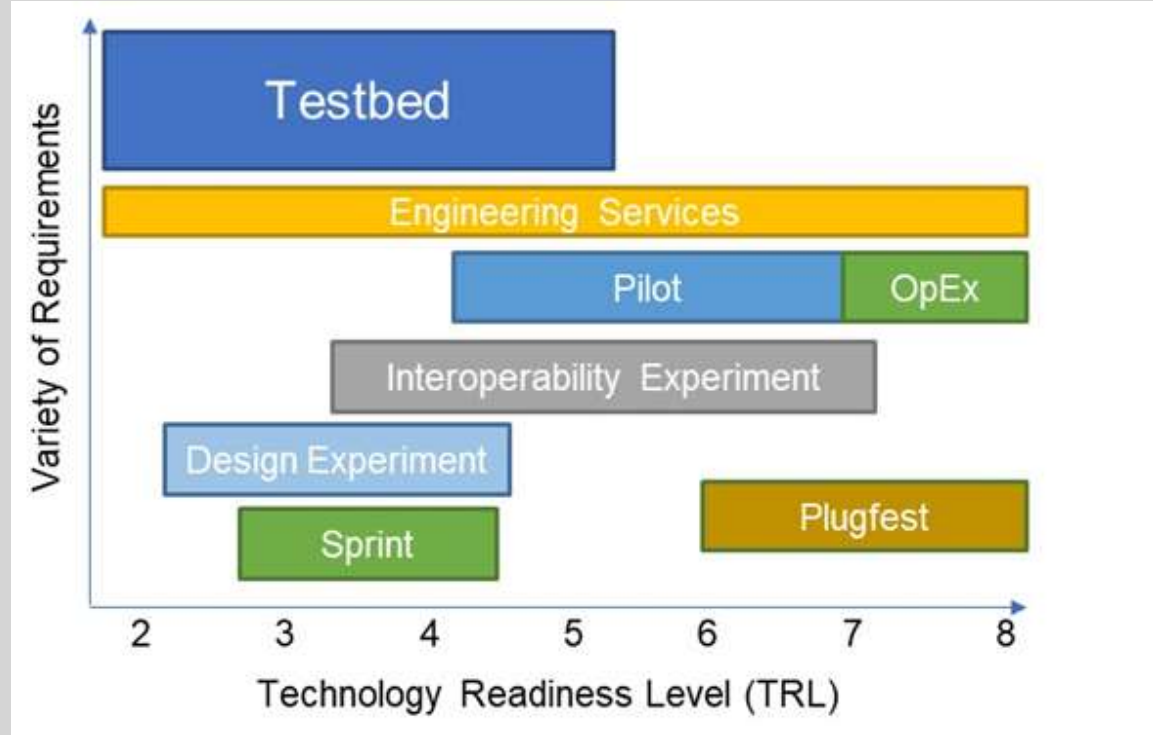




# OGC COSI Program

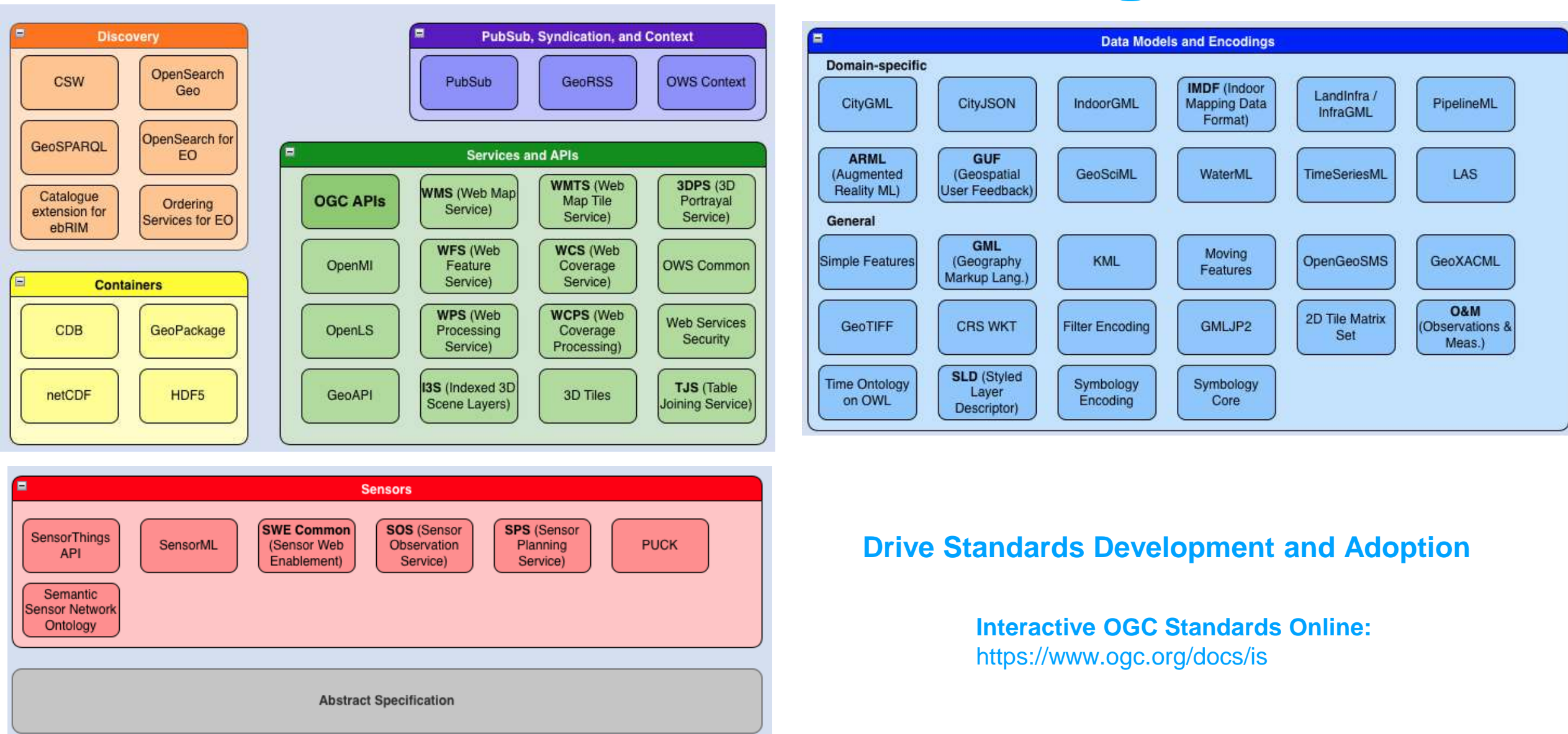


- Data to Decisions
- Somewhere -> Location -> Place
- Right Information to the Right Person at the Right Time
- Balancing Present and Future



# The OGC Standards Program

# Standards Architecture Diagram



Drive Standards Development and Adoption

Interactive OGC Standards Online:  
<https://www.ogc.org/docs/is>

# Standards Working Groups

[3D GeoVolumes SWG \(3DGeoVol SWG\)](#)

[3D Portrayal SWG \(3DP SWG\)](#)

[CDB SWG \( CDB SWG\)](#)

[CityGML SWG \(CityGML SWG\)](#)

[Coverages SWG \(CoveragesSWG\)](#)

[CRS SWG \(CRS SWG\)](#)

[CRS Well Known Text SWG \(CRS WKT SWG\)](#)

[Discrete Global Grid Systems SWG \(DGGS SWG\)](#)

[Environmental Data Retrieval API SWG \(EDR-API SWG\)](#)

[EO Product Metadata and OpenSearch SWG \(EO PMOS SWG\)](#)

[Features and Geometries JSON SWG \(FeatGeoJSON SWG\)](#)

[Features API SWG \(FeatAPI SWG\)](#)

[GeoAPI SWG \(GeoAPI SWG\)](#)

[Geocoding API SWG \(GeocodeAPISWG\)](#)

[GeoPackage SWG \(GeoPackage SWG\)](#)

[GeoPose SWG \(GeoPose SWG\)](#)

[GeoSciML SWG \(GeoSciML SWG\)](#)

[GeoSPARQL SWG \(GeoSPARQL SWG\)](#)

[Geospatial User Feedback SWG \(GUFswg\)](#)

[GeoSynchronization 1.0 SWG \(Geosync SWG\)](#)

[GeoTIFF SWG \(GeoTIFF SWG\)](#)

[GeoXACML SWG \(GeoXACML SWG\)](#)

[GML 3.3 SWG \(GML 3.3 SWG\)](#)

[GMLJP2 SWG \(GMLJP2-SWG\)](#)

[Groundwater SWG \(GroundwaterSWG\)](#)

[HDF SWG \(HDF SWG\)](#)

[Hydrologic Features SWG \(HydroFeat SWG\)](#)

[IndoorGML SWG \(IndoorGML SWG\)](#)

[KML 2.3 SWG \(KML SWG\)](#)

[Land and Infrastructure SWG \(LandInfraSWG\)](#)

[Moving Features SWG \(MovFeat SWG\)](#)

[MUDDI SWG \(MUDDI SWG\)](#)

[NetCDF SWG \(NetCDFSWG\)](#)

[O&M SWG \(OM SWG\)](#)

[OGC API - Common SWG \(OGC API-Common\)](#)

[OGC API - Maps SWG \(OGC API - Maps\)](#)

[OGC API - Processes SWG \(OAPIProc SWG\)](#)

[OGC API - Records SWG \(API Records SWG\)](#)

[OGC API - Styles SWG \(Styles API SWG\)](#)

[OGC API - Tiles SWG \(OAPITileSWG\)](#)

[OWS Common - Security SWG \(ComSecuritySWG\)](#)

[OWS Context SWG \(OWScontextSWG\)](#)

[PipelineML SWG \(PipeML SWG\)](#)

[Points of Interest SWG \(PoI SWG\)](#)

[PubSub SWG \(PubSub SWG\)](#)

[Routing SWG \(Routing SWG\)](#)

[Sensor Model Language \(SensorML\) 2.0 SWG \(SensorML2.0SWG\)](#)

[SensorThings SWG \(SensorThings\)](#)

[Simple Features SWG \(SF SWG\)](#)

[Styles and Symbology Encoding SWG \(Styles SE SWG\)](#)

[Temporal WKT for Calendars SWG \(TemporaWKT\)](#)

[TimeSeriesML SWG \(TimeSeriesML\)](#)

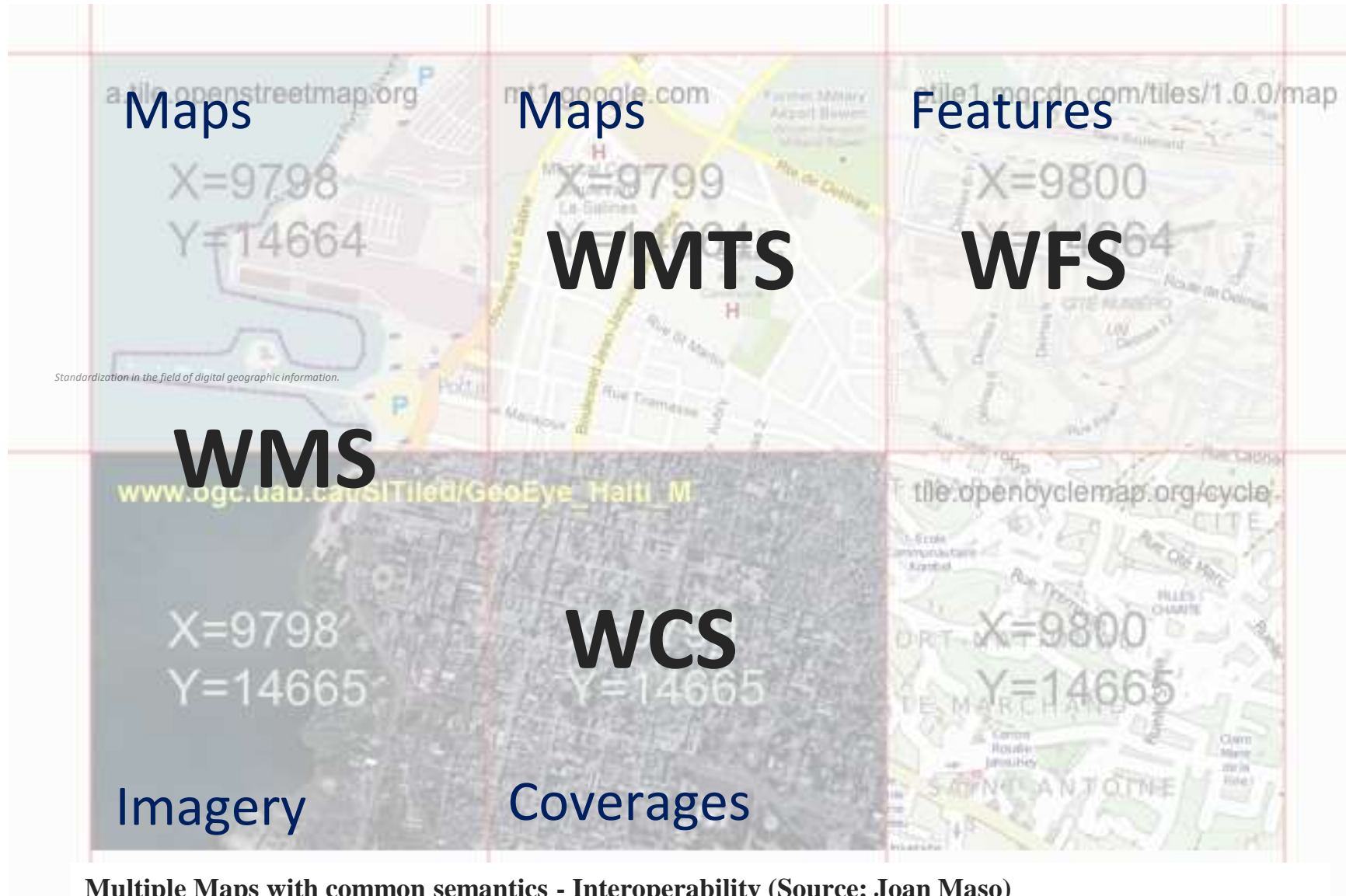
[Training Data Markup Language for AI SWG \(TrainingDML SWG\)](#)

[WaterML 2.0 SWG \(WaterML2.0SWG\)](#)

# OGC APIs - <https://ogcapi.ogc.org/>

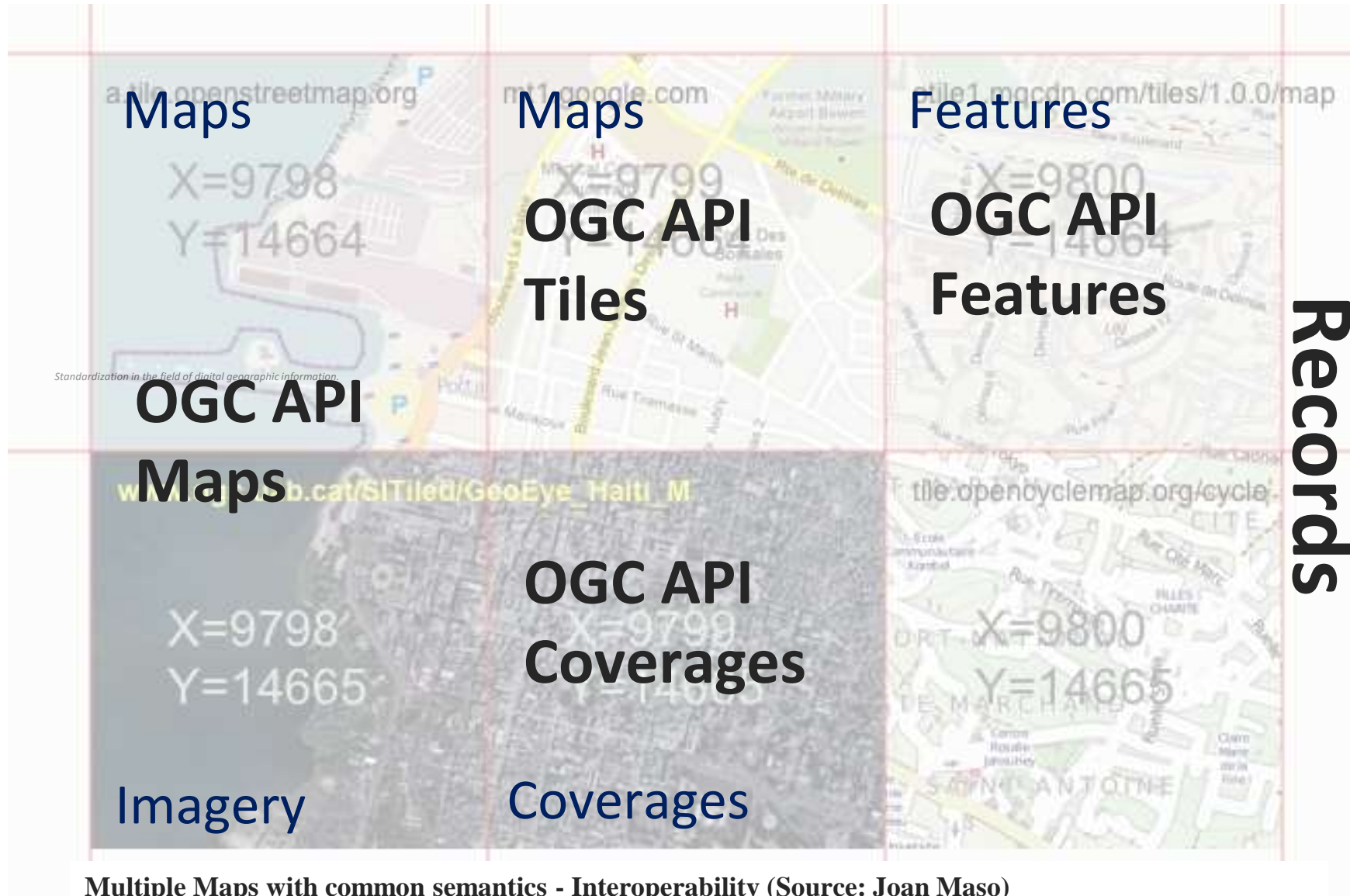
- “Building blocks” that can be used to assemble novel APIs for web access to geospatial content
- Ultimately will replace and enhance the existing OGC Web Service standards
- Defined with OpenAPI and published in discrete, easily implementable parts
- Ensure that geospatial data are “web native”

# Legacy OGC Web Service Standards



Multiple Maps with common semantics - Interoperability (Source: Joan Maso)

# OGC API Standards

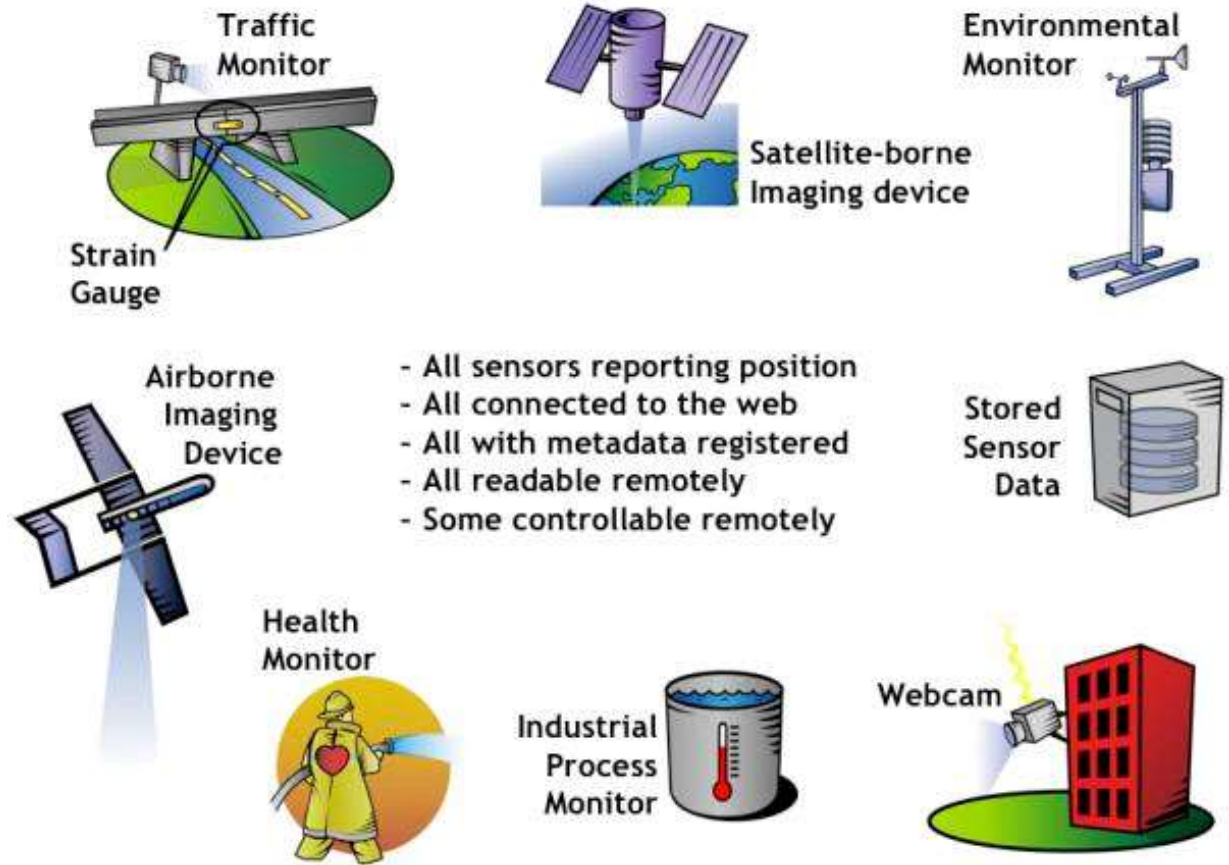


Standardization in the field of digital geographic information

Multiple Maps with common semantics - Interoperability (Source: Joan Maso)

# OGC Sensor Web Enablement

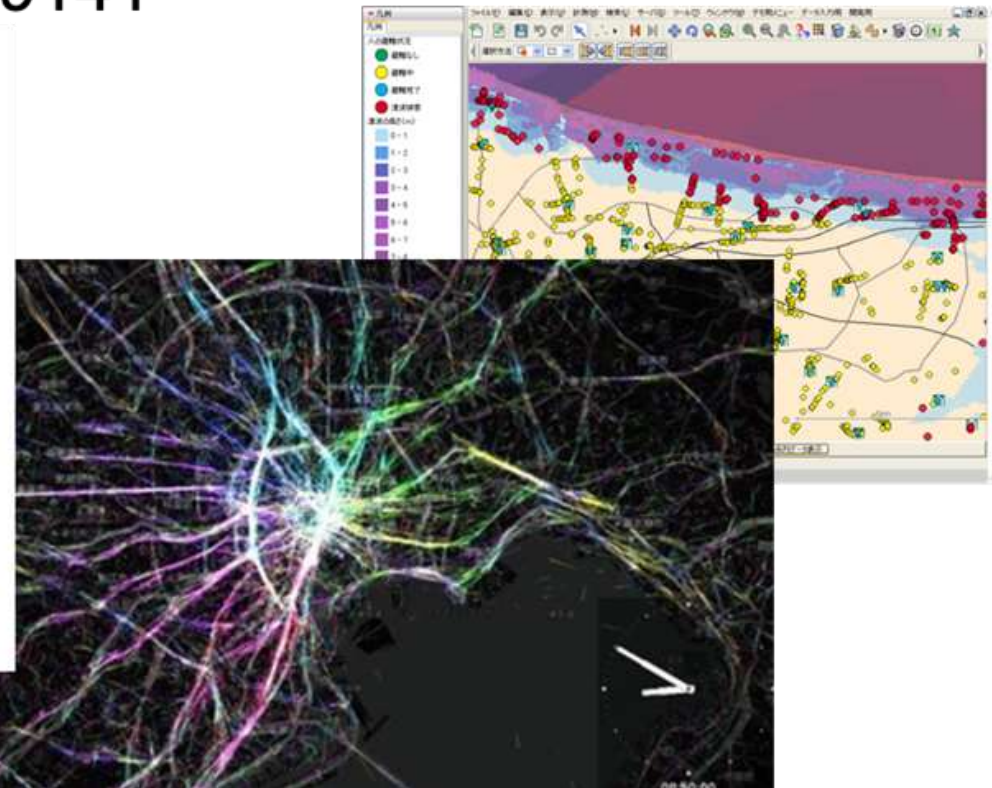
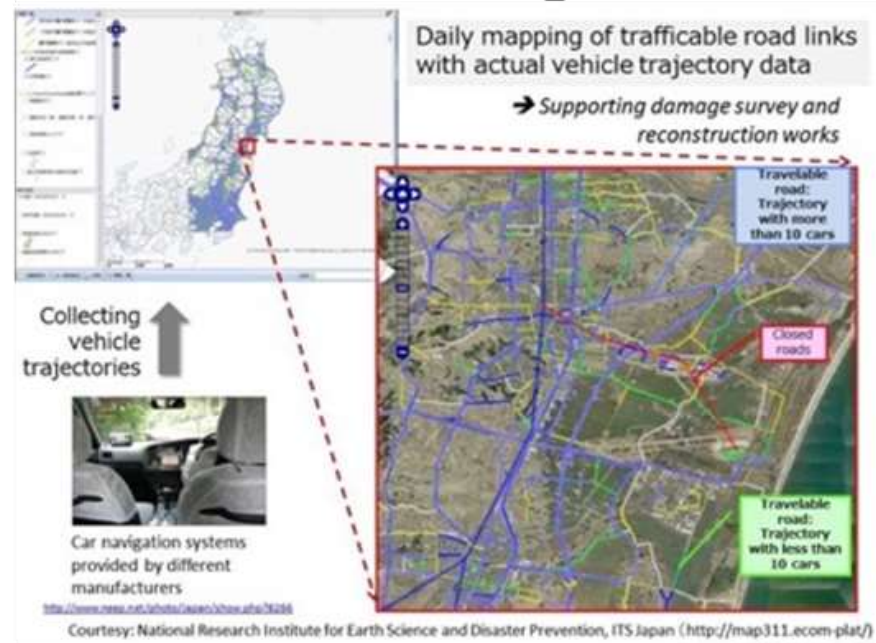
- Sensors connected to and discoverable on the Web
- Sensors have position & generate observations
- Sensor descriptions available
- Services to task and access sensors
- Local, regional, national scalability
- Enabling the Enterprise



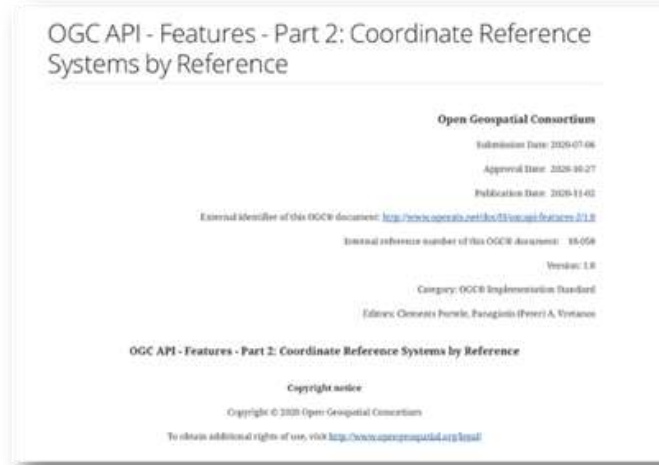


# OGC Moving Features Encoding Standard

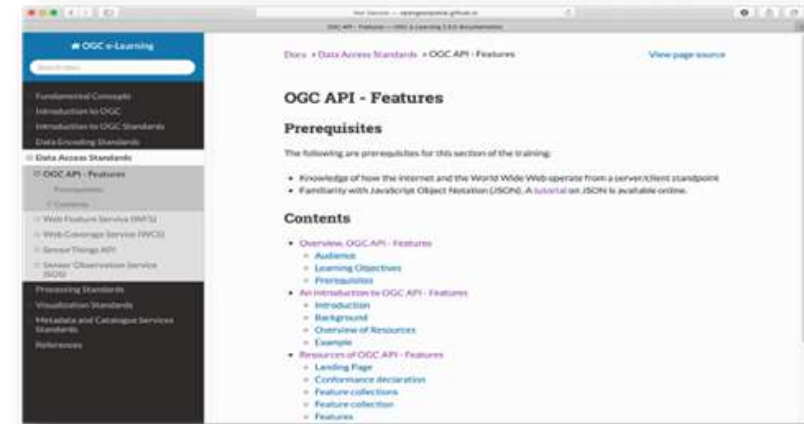
- "Moving features" data describes such things as vehicles, pedestrians, airplanes and ships.
- This is Big Data – high volume, high velocity
- CSV and XML encodings of ISO 19141



# Standards and augmentation



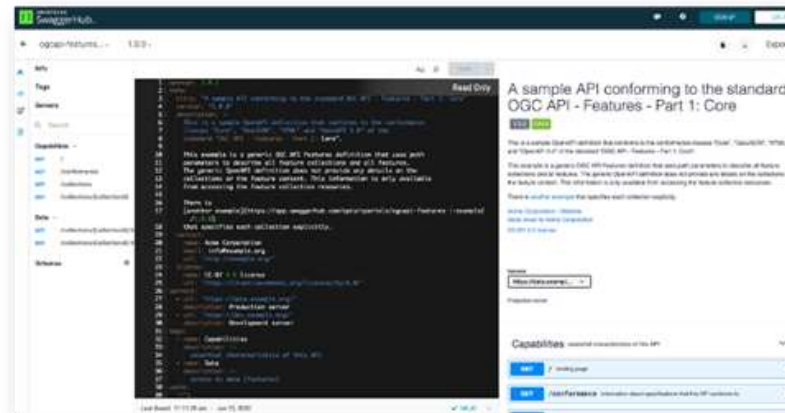
Core + Extensions



e-Learning



Adoption by alliance partners



Examples



Compliance Testing Tools

# Code Sprints

NOVEMBER 29- DECEMBER 1 2022

ABOUT TRACKS SPEAKERS FAQ

Map tiles by Stamen Design, CC BY 3.0, Map data by OpenStreetMap contributors

## WEB MAPPING CODE SPRINT

🚧 OGC API - Tiles, Maps, Styles and OGC Styles & Symbology

TELL ME MORE REGISTER


JULY, 12-14 2022

ABOUT TRACKS SPEAKERS FAQ

Feel me on GitHub



Mentor Stream



Main Track

## VECTOR DATA CODE SPRINT

🚧 OGC API Features, Moving Features, Routes and 3D GeoVolumes

TELL ME MORE REGISTER

ABOUT TRACKS SPEAKERS FAQ

Feel me on GitHub

# OGC Compliance Testing Resources

- Executable Test Suites
- TEAM Engine
- <http://cite.opengeospatia/teamengine>

Specification	Version	Test Suite Revision	Status
Catalogue Service - Web (CSW)	2.0.2	<a href="#">1.16</a>	Final
Catalogue Service - Web (CSW)	3.0.0	<a href="#">1.0</a>	Final
GeoPackage	1.0	<a href="#">1.0</a>	Final
Geography Markup Language (GML)	3.2.1	<a href="#">1.25</a>	Final
OGC KML	2.2	<a href="#">1.12</a>	Final
Sensor Observation Service (SOS)	1.0.0	<a href="#">1.13</a>	Final
Sensor Observation Service (SOS)	2.0	<a href="#">1.12</a>	Final
Sensor Planning Service (SPS)	1.0	<a href="#">1.7</a>	Final
Sensor Planning Service (SPS)	2.0	<a href="#">1.10</a>	Final
SensorThings API	1.0	<a href="#">1.0</a>	Final
Simple Feature Access - SQL (SFS)	1.1	<a href="#">1.6</a>	Final
Simple Feature Access - SQL (SFS)	1.2.1	<a href="#">1.4</a>	Final
Web Coverage Service (WCS)	1.0.0	<a href="#">1.11</a>	Final
Web Coverage Service (WCS)	1.1.1	<a href="#">1.10</a>	Final
Web Coverage Service (WCS)	2.0.1	<a href="#">1.12</a>	Final
Web Feature Service (WFS)	1.0.0	<a href="#">1.11</a>	Final
Web Feature Service (WFS)	1.1.0	<a href="#">1.29</a>	Final
Web Feature Service (WFS)	2.0	<a href="#">1.26</a>	Final
Web Map Service (WMS)	1.1.1	<a href="#">1.14</a>	Final
Web Map Service (WMS)	1.3.0	<a href="#">1.19</a>	Final
Web Map Service (WMS) - Client	1.3.0	<a href="#">1.2</a>	Final
Web Map Tile Service (WMTS)	1.0.0	<a href="#">1.0</a>	Final

# List of Certified and Implementing Products



## Implementation Statistics

Historically, there have been:

7677 Product Specification Implementations

2096 Compliant Product Specification Implementations

The table provides a summary of implementing and historically compliant products. Click on a Specification to view currently associated registered products. You can also click the column headers to sort the table.

Visit the [compliance page](#) and fill out the form to contact the OGC staff for further information about the Compliance program.

Join the OGC

Total = # of implementations. Comp = # of OGC certified compliant products.

Filter:

Total	Comp.	Specification	Abbreviation
488	182	<a href="#">Web Map Service (1.1.1)</a>	WMS 1.1.1
399	202	<a href="#">Web Map Service (WMS) Implementation Specification (1.3.0)</a>	WMS 1.3.0
324	130	<a href="#">Web Feature Service (WFS) Implementation Specification (1.1.0)</a>	WFS 1.1.0

# Disaster Pilot 2023

# DP23 Focus

## On:

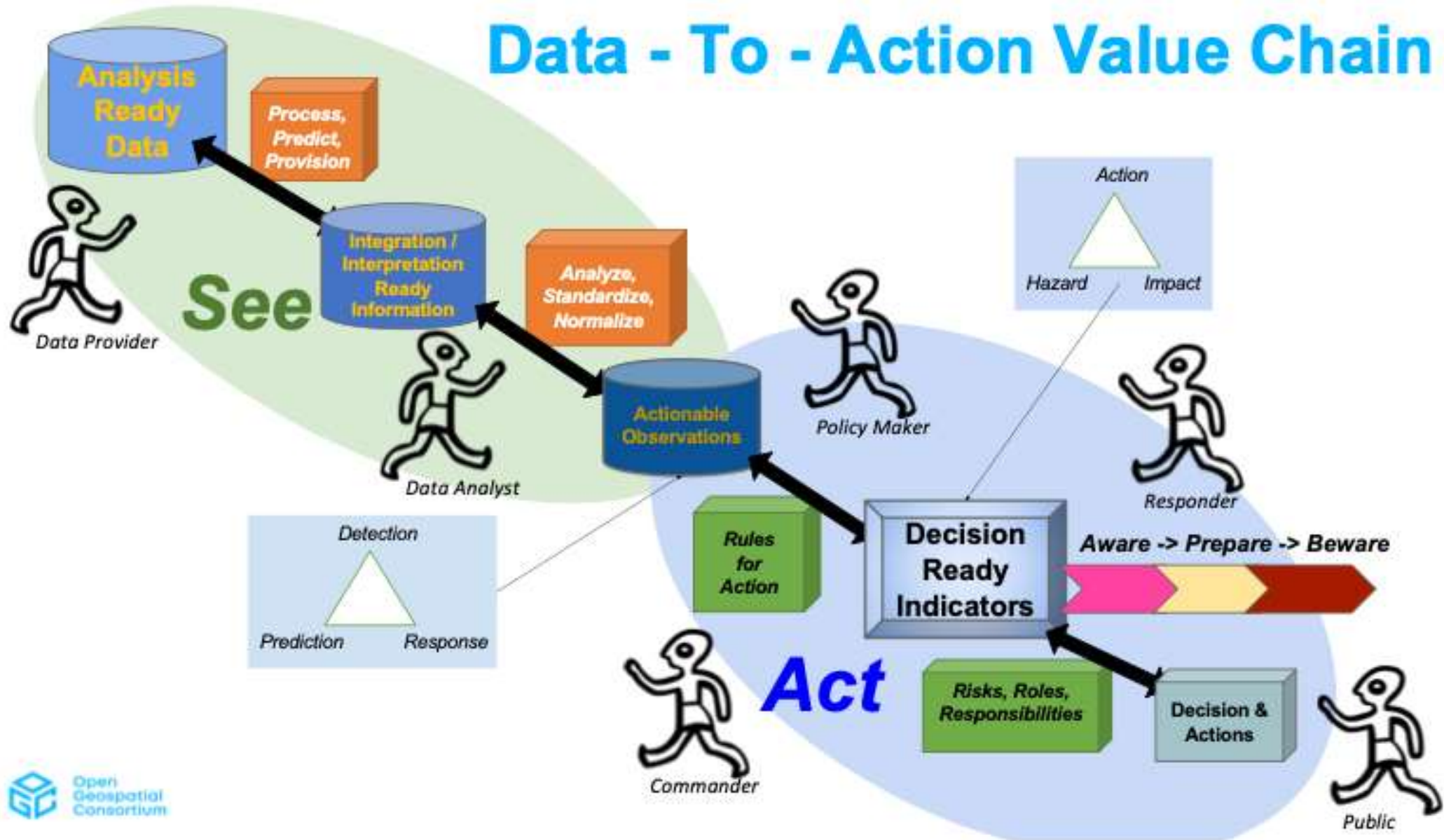
- Stakeholder collaboration on data-to-decision workflows,
- Readiness, resilience, and timeliness of data collection and processing to support critical disaster management decisions,
- Flexible and scalable deployment of workflows and applications necessary to support disaster practitioners in their day-to-day and minute-to-minute responsibilities.
- Publication and visualization tools to promote a broader understanding of the wide range of scales in both geography and time over which coordinated actions are needed for disaster resilience.
  - *Disaster management efforts can be ineffective when collaborative workflows are not put into place well before disaster has already struck. The result is reactive rather than proactive decision making that is less than fully informed.*

## For:

- Drought, impacts, and consequential disasters (e.g. wildland fires) in Manitoba, Canada
- Wildland fires, impacts, and contributing factors (e.g. drought) in the Western United States.



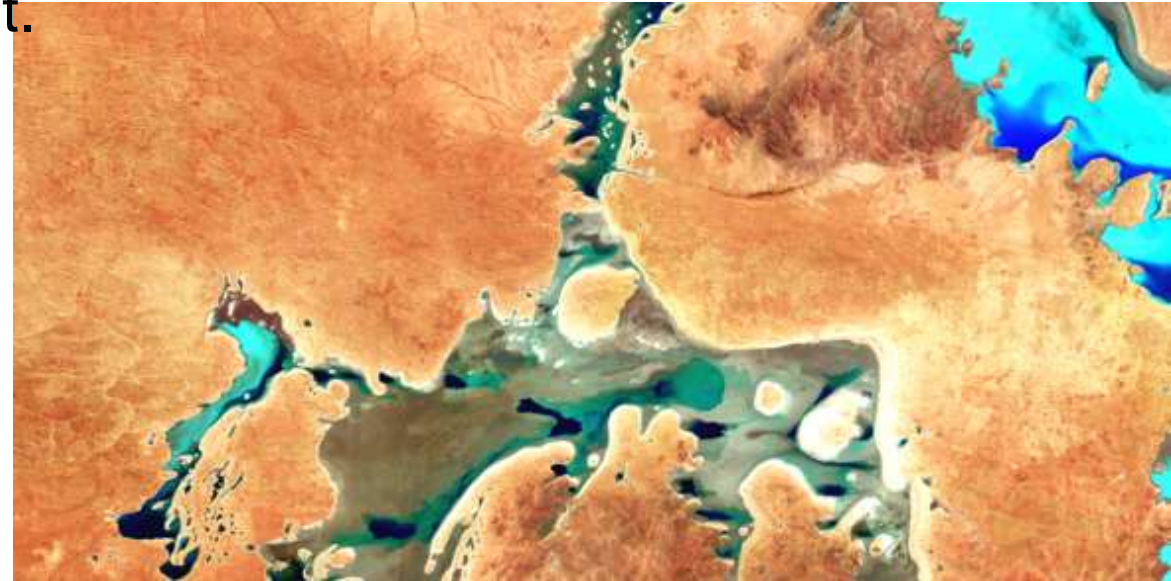
# Data - To - Action Value Chain





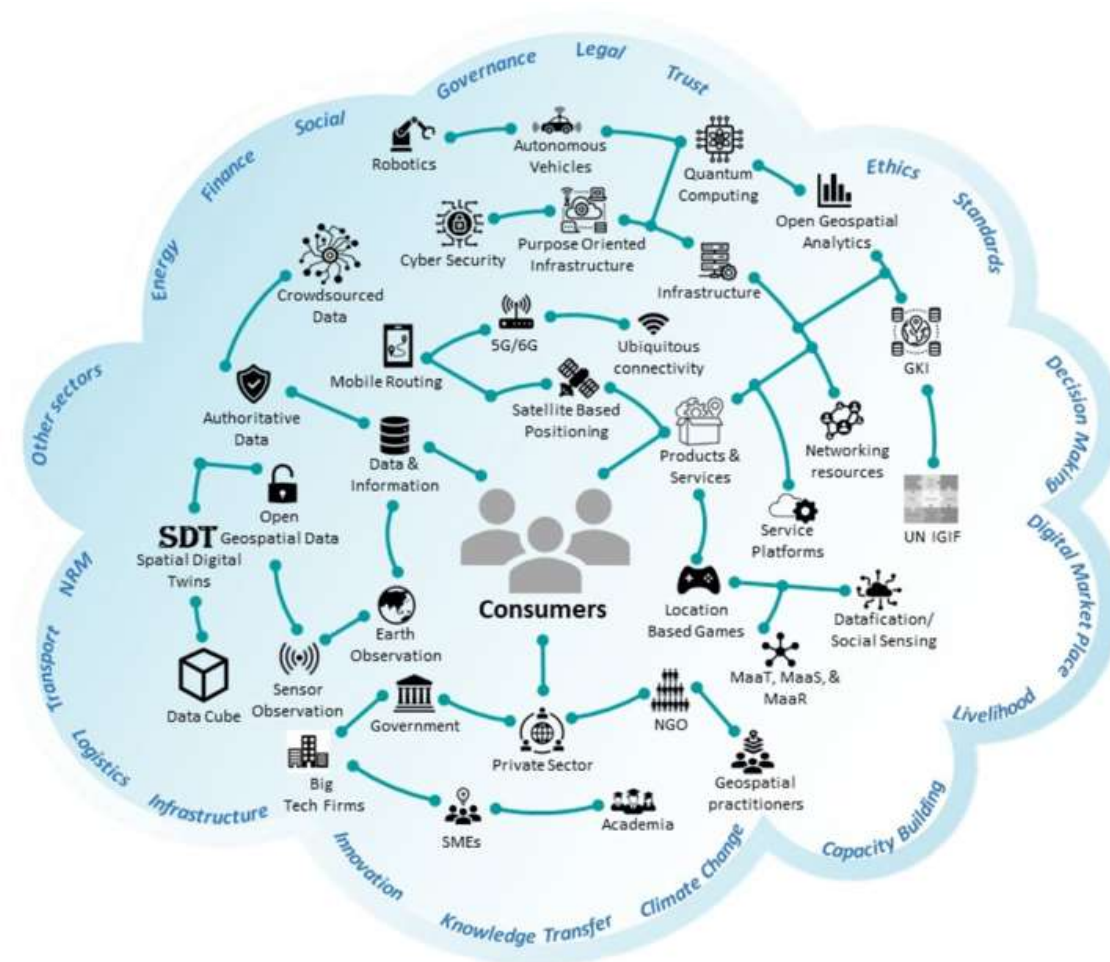
# Analysis Ready Data

- Estimated that data analysts spend up to 80% of their time identifying, selecting, and preparing datasets in order to analyze and integrate them.
- Analysis readiness aims to reverse this proportion by preparing data in advance for reusability across a range of analytical tasks.
- Ability to combine, concatenate, and intersect multiple datasets based on their compatible states of spatiotemporal referencing and phenomenon calibration.
- Collaborating with and starting from draft specifications of CEOS -- <https://ceos.org/ard/>
- [Collection 2 U.S. ARD](#) products created from Landsat 4-5 TM, Landsat 7 ETM+, and Landsat 8-9 OLI/TIRS data from 1982 - present.
- OGC Standards Working Group and ISO TC211 Working Group being set up
- Task in OGC Testbed-19 to investigate broad ARD interoperability.



**OGC RAINBOW**

# Interoperability in a complex evolving world



**A Geospatial Ecosystem**

# Introducing the OGC RAINBOW



How do we describe these many resources?

How do we discover these many resources?

How do we link these many resources?

# Introducing the OGC RAINBOW

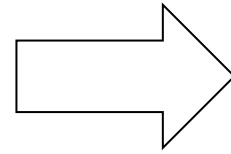


In OGC, we have a wide spectrum of resources

Outside of the OGC, there is an even wider spectrum of resources

Here is how it can work

# Introducing the OGC RAINBOW





# Thank You

---

## Community

- 500+ International Members
- 110+ Member Meetings
- 60+ Alliance and Liaison partners
- 50+ Standards Working Groups
- 45+ Domain Working Groups
- 25+ Years of Not for Profit Work
- 10+ Regional and Country Forums

## Innovation

- 120+ Innovation Initiatives
- 380+ Technical reports
- Quarterly Tech Trends monitoring

## Standards

- 65+ Adopted Standards
- 300+ products with 1000+ certified implementations
- 1,700,000+ Operational Data Sets
- Using OGC Standards



**BREAK**

---



# Search & Rescue, Schemas, and...Swine

Paul Doherty, PhD, Emergency  
Management Specialist, FEMA Urban  
Search & Rescue Branch

# Key Messages

1. You can't solve the data problem until you've understood the real-world problem.
2. People, Process...then Technology/Data.
3. Be flexible!

# Real-World Problem

Search and Rescue



National Urban Search and Rescue Response System Established in 1989



In the early years, focus was on building collapse



Mission expanded to include  
Wide Area Search and Water Operations



Search and Rescue is an inherently spatial problem

# People, Process, Tech

Search and Rescue





**People**



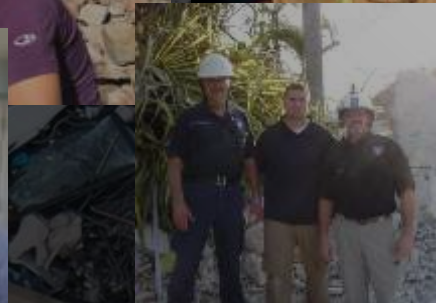
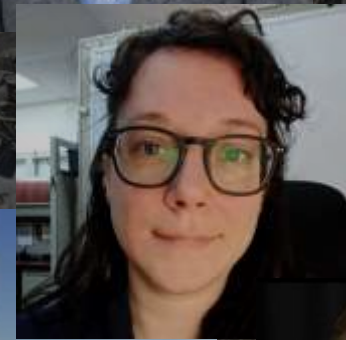
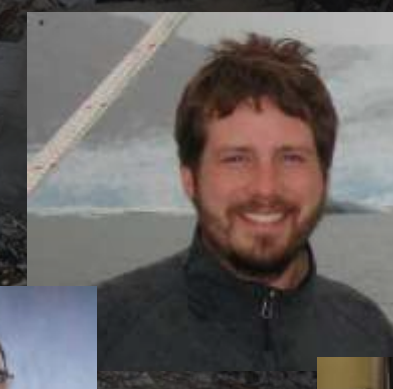
**Process**

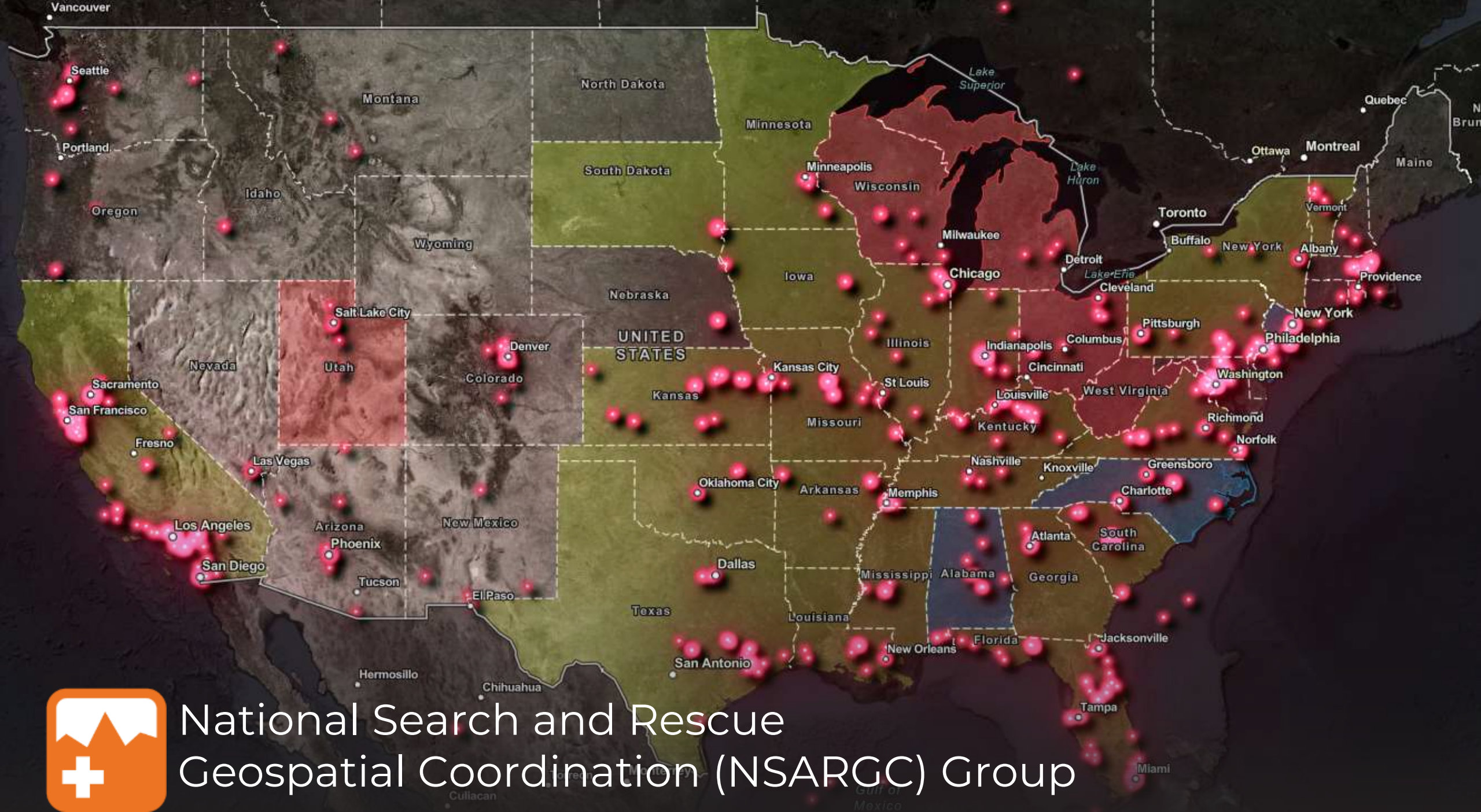


**Technology**

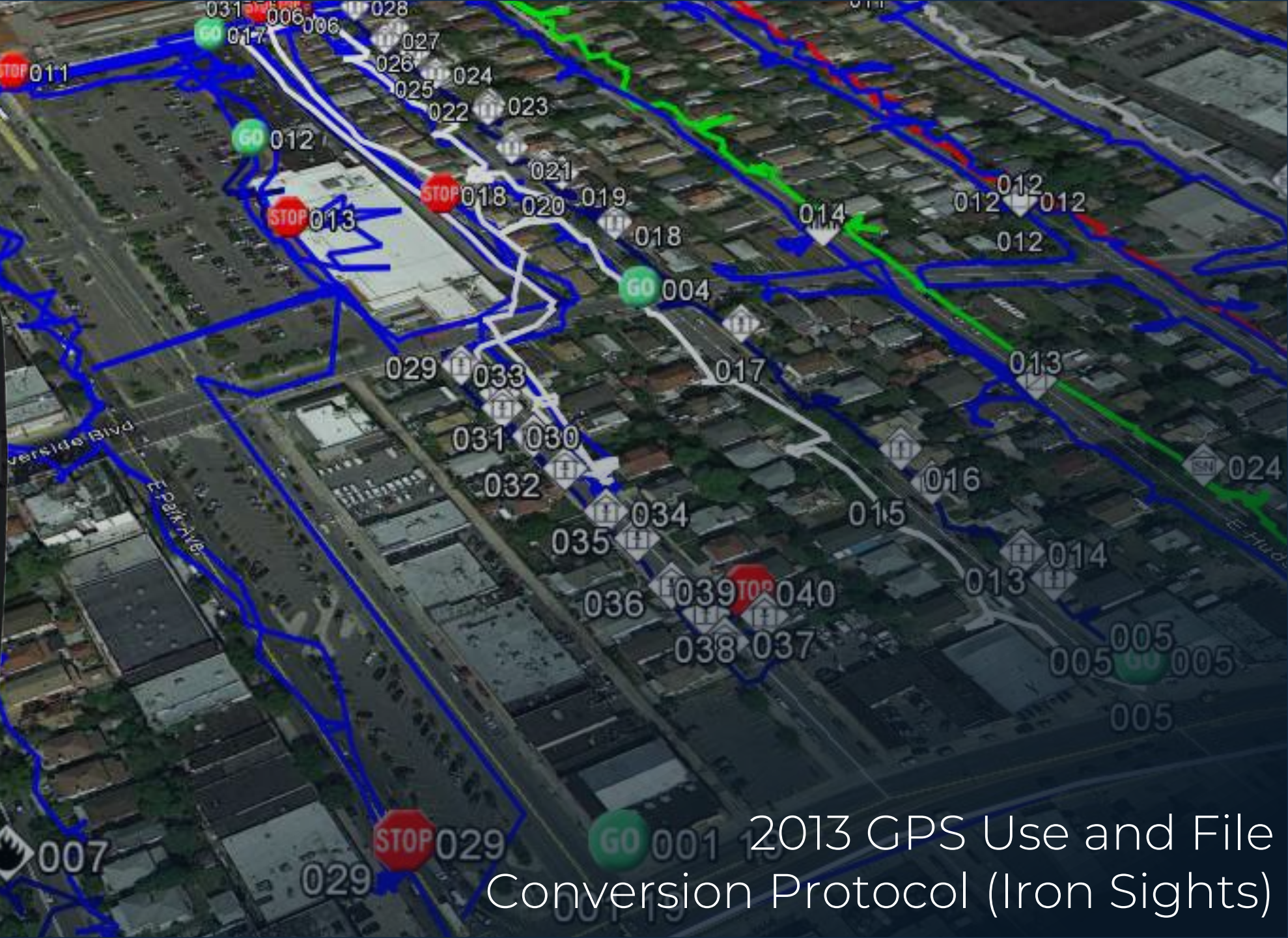


Supported by DHS Science and Technology

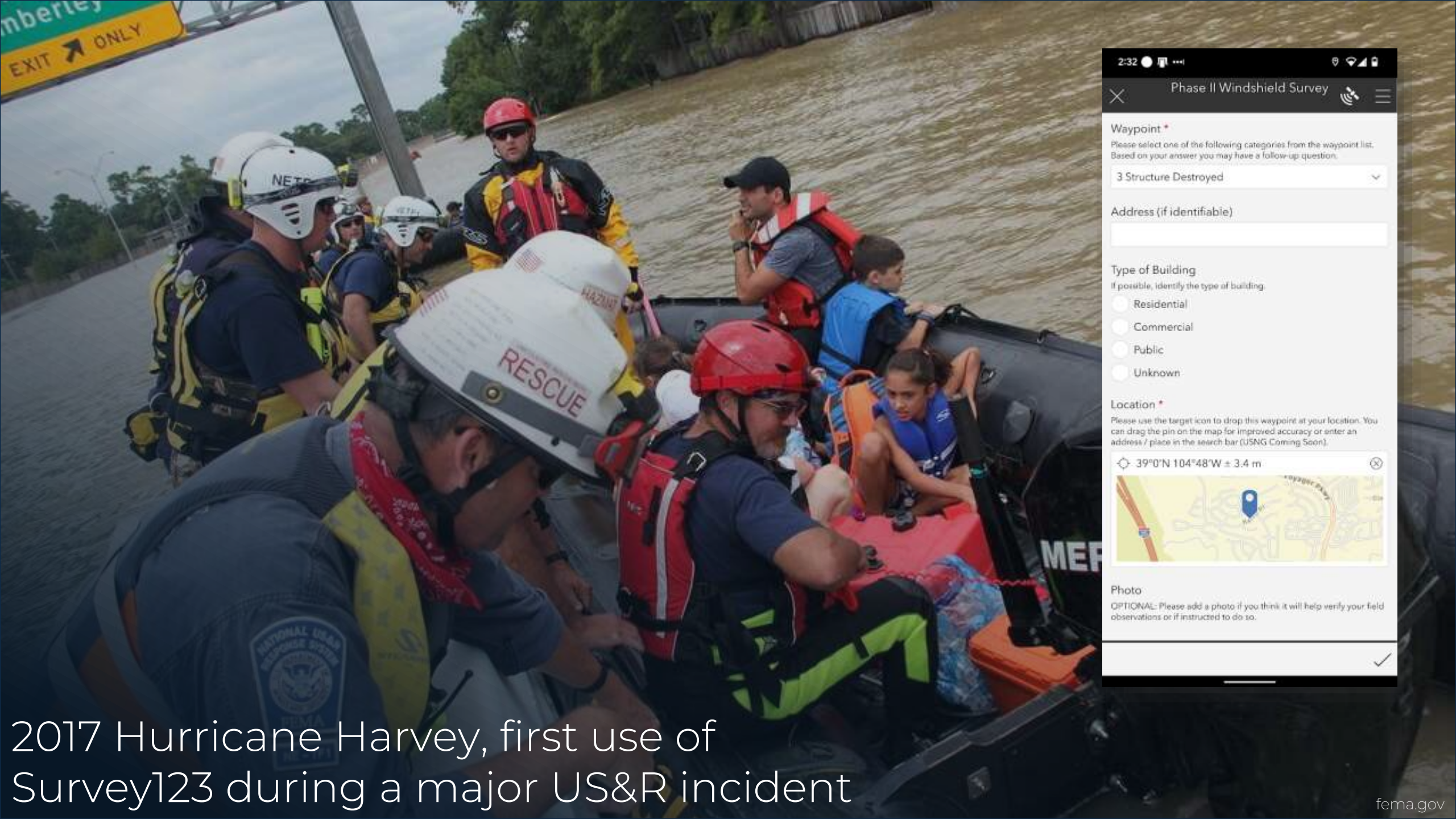




# National Search and Rescue Geospatial Coordination (NSARGC) Group



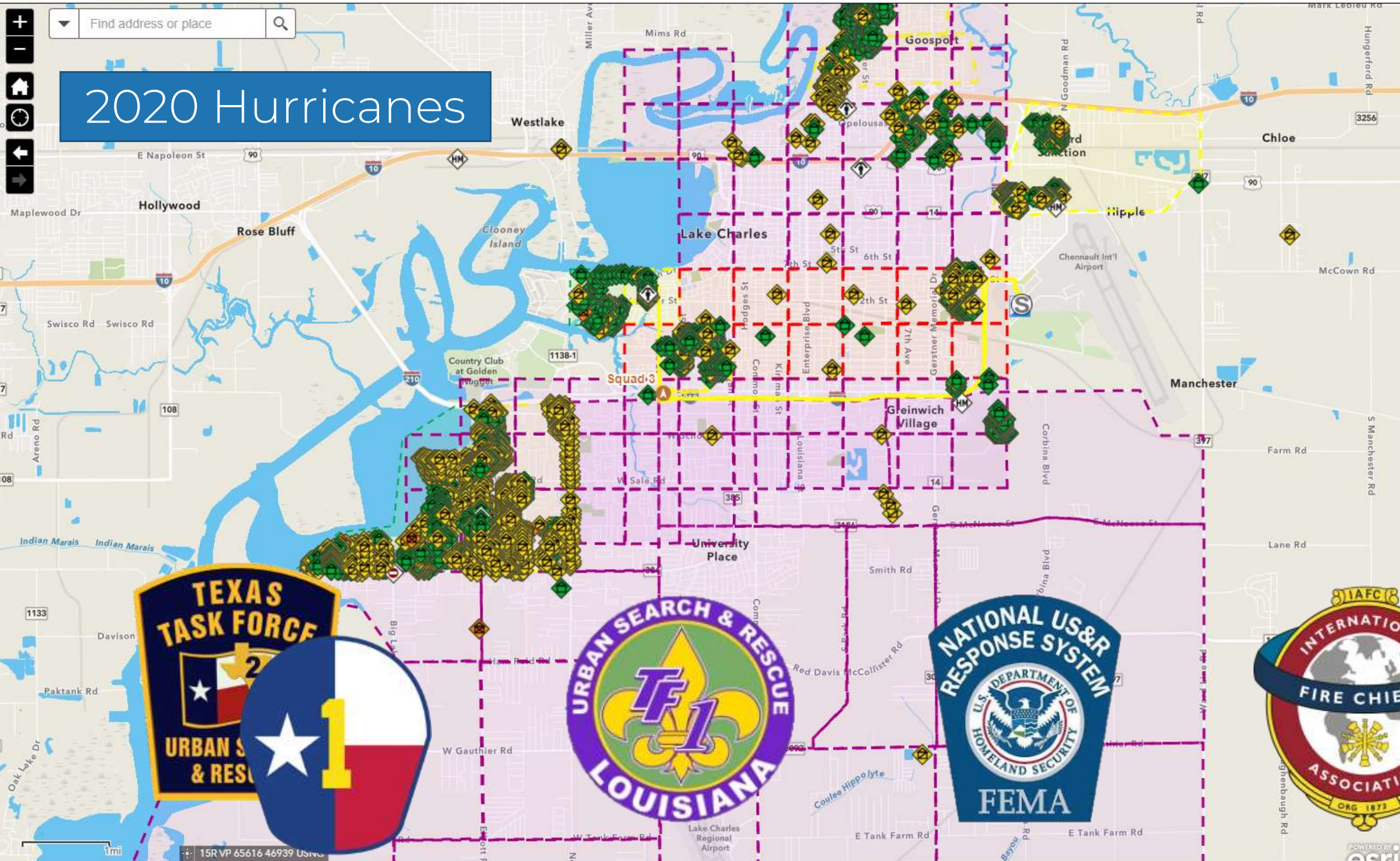
2013 GPS Use and File Conversion Protocol (Iron Sights)



2017 Hurricane Harvey, first use of Survey123 during a major US&R incident

Find address or place

# 2020 Hurricanes

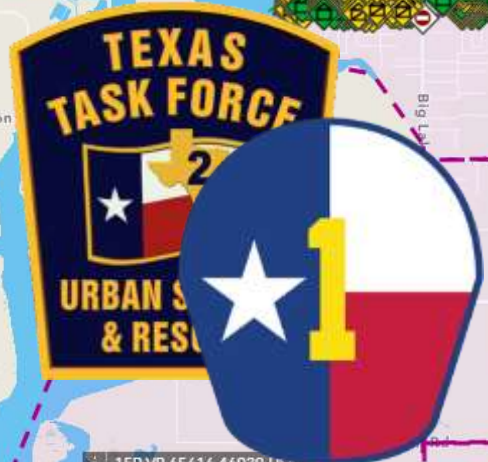


## Instructions

### About

### Legend

- TXTF Last Known Points
  - TXTF Last Known Point
- LATF Last Known Point
  - LATF Last Known Point
- IAFC Last Known Point
  - IAFC Last Known Point
- IAFC Surveys
  - Structure, no damage
  - Structure, damaged
  - Structure, failed
  - Structure, destroyed
  - Assisted
  - Evacuated
  - Rescued
  - Victim, detected
  - Victim, confirmed
  - Human remains
  - Human remains, removed
  - Shelter in place
  - Follow-up form
  - Fire incident
  - HAZMAT Incident
  - Flood/water level
  - Gate blocked
  - Gas Hazard
  - Animal issue
  - Targeted search
  - Location update
  - Incident command post
  - Staging
  - Safety zone
  - Helicopter LZ
  - Casualty Collection Point
  - Firehouse (originally marked on map)





**People**



**Process**



**Technology**



**Swine are data too**

# SARCOP Schemas

- Tracklogs
- Waypoints
- Rapid Structure Triage
- Search Segments
- Operational Areas
  - Incident Area
  - Branches
  - Divisions



*Field data collected so we can show what we have searched and identify where we should search next.*



# Tracklogs



Recon - Preliminary survey of the area (How Big and How Bad)



Hasty / Rapid Search - Fast paced and methodical search of the area.



Primary Search - Quick search of the structures likely to contain victims.

Secondary Search - Systematic search of every room of every structure in the assigned area of operation.



Low Coverage Secondary Search:

- Systematic search of every room and void space.



High Coverage Secondary Search:

- Exhaustive search of every room and void space.



Targeted Search - Searches of specific locations.


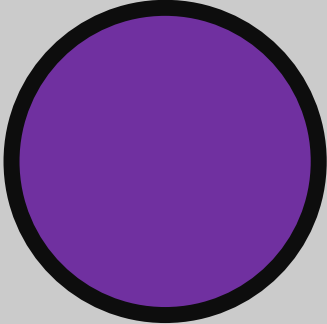


- Shelter locations
- High Occupancy locations
- Critical Infrastructure Facilities
- Areas of last refuge
- Locations of Special Needs Individuals or At-Risk Persons

For information on this topic, see 9P6130 - Planning Team Training – Module 4 and the Catastrophic Incident Search and Rescue ([CISAR](#)) Addendum



# Waypoints

Four themes of waypoint data collected during wide area search. All are recorded with \*USNG coordinates.

Search/Human Interactions*	Damage Observations	Hazards	Incident Support
			








\* [FEMA 092-5](#) Use of the United States National Grid

[Land Search and Rescue Addendum to the National Search and Rescue Manual](#), Version 1.0 of Nov 2011, see Geo-referencing, pp 4-43 thru 4-51



# Search/Human Interactions Completed






- By default, the following waypoints are considered “Completed” and do not require follow up.
- If necessary, they can manually be marked as needing follow up. An example would be a person sheltering in place, but they require additional resources.

Search/Human Interactions that Do Not Need Follow Up (By Default)		
	Searched Per Rules of Engagement (ROE)	This is a search that has been completed on a structure, vehicle, debris, or other site with no victims or survivors found.
	Rescued	Technical rescue that required moving survivor to a safe location utilizing <a href="#">NFPA 1006</a> (or equivalent) skillsets such as rope, structural collapse, or swiftwater rescue.
	Evacuated	Survivors transported to collection point or out of harm’s way.
	Assisted	Materials assistance provided to residents.
	Shelter in Place	Survivors have chosen to remain at current location.
	Human Remains Removed	Human remains removed from specific location.
	Animal Evacuation	Evacuation or rescue of pets / companion animals.









# Search/Human Interactions Need Follow Up

- By default, the following waypoints are considered to “Need Follow Up” and additional actions will need to be taken at that location.

Search/Human Interactions that Need Follow Up (By Default)		
	Victim Detected	Potential live survivor detected (including canine alert or intelligence).
	Victim Confirmed	Confirmed live survivor (visual, audible, physical confirmation) requiring <a href="#">NFPA 1006</a> (or equivalent) skillsets such as rope, structural collapse, or swiftwater rescue.
	Human Remains Detected	Potential human remains detected (including canine alert or intelligence).
	Human Remains Confirmed	Confirmed human remains (visual or physical confirmation).
	Targeted Search	Specific location that will require increased search effort (e.g., a 911 phone call, missing person report, etc.).



# Data Dictionary – Damage Observations

Symbol	Name	Description
	Destroyed	The structure is a <u>total loss</u> .
	Major	Structural damage or other significant damage that <u>requires extensive repairs</u> .
	Minor	Repairable <u>non-structural</u> damage.
	Affected	Damage to the structure is mostly <u>cosmetic</u> .
	Unaffected	No visible or reported damage.
	Unknown	Status of structure is unknown.

These categories are the same used in the initial and preliminary damage assessment (IDA/PDA) process. This is related to the observed damage, not the structural risk.

**Why use IDA/PDA categories?** This will help expedite disaster declaration and recovery processes for State and Local government.

New in 2023 - Damage observations can be used as a “2 for 1” to indicate a structure has been searched (or not searched). [See video](#) for explanation.

# Damage Observation Interoperability

- Reduce duplication of effort
- Enhance coordination
- Expedite declaration decisions

## Inspections/Assessments after a Disaster

Assessments are an essential part of the response and recovery process and are critical for assessing the size, scope, and severity of an event.

### THE CHALLENGE

When a home is damaged as a result of a natural or man-made disaster, numerous damage assessments are performed to assess the safety of the structure, quantify the damage, and determine financial aid from the government and/or insurance company. While each assessment is conducted for a specific purpose, this puts a significant burden on the survivors and community and often times delays recovery efforts.

### THE SOLUTION







Consistent standards and data sharing mechanisms are needed so various programs and agencies (e.g., state and local authorities, federal agencies, statutory authorities, non-profit organizations) can leverage the same data collected during the preliminary damage assessment. This will help avoid duplication of effort, conflicting information, and delays in bringing relief to the homeowner.





# Data Dictionary – Hazards















- Hazards are used when there is an obstacle or something dangerous you want others to be aware of in the field.
- The *Other Hazard* option is very flexible, just be sure to use the comments!
- Note: Do not use *Animal Hazard* for a pet rescue.

Hazards		
	Animal Hazard	Animal hazard related to aggression, location, or disease.
	Fire Incident	General fire occurrence.
	Hazardous Material Incident	Nuclear, biological, or chemical incident
	Flood/Water Level	Current location of water line.
	Route Blocked	Inaccessible route by land or water.
	Other Hazard	Other hazard not already identified.



# Data Dictionary – Other/Support

- *Situation Update* allows you to provide your chain of command current Conditions, Actions, Needs and location with comments, photo, and/or video.
- *Casualty Collection Point* is used for assembly, triage, medical stabilization, and evacuation of casualties.
- The new logistics icons are a subset from the [PMS936 standard](#) used in wildland fire and are adaptable to many US&R situations.

Other/Incident Support		
	Situation Update	Used to provide a general situation update to include Conditions, Actions, Needs, and Location as needed. team.
	Lifeline Report	Report of status or issue affecting the continuous operation of critical government and business functions essential to human health and safety or economic security. Community lifelines are broken into: Safety and Security; Food, Water, Shelter; Health and Medical; Energy; Communications; Transportation; Hazardous Material. <a href="#">More Info</a>
	Casualty Collection Point	Location that is used for the assembly, triage (sorting), medical stabilization and evacuation of casualties. CCP must account for the rescued and provide for their needs, including medical care, tracking, shelter, food, and more.
	Extra 21	Mission specific placeholder to be determined.
	Extra 22	Mission specific placeholder to be determined.
	Extra 23	Mission specific placeholder to be determined.
	Extra 24	Mission specific placeholder to be determined.
	Aerial hazard*	A hazard for aircraft, such as towers and power lines.
	Airstrip or Airport*	Any area of land or water used or intended for landing or takeoff of aircraft.
	Helispot*	A natural or improved takeoff and landing area intended for temporary or occasional helicopter use.
	Helibase*	The main location within the general incident area for parking, fueling, maintenance, and loading of helicopters. It is usually located at or near the incident base.
	Medical*	Functional unit that is responsible for the emergency medical and occupational health care of incident personnel.
	Incident Command Post (ICP) *	Location at which primary command functions are executed. The ICP may be collocated with the incident base or other incident facilities.
	Drop Point*	A predefined location where personnel, equipment, and supplies will be delivered or picked up. This can also be used for water access for flood/swiftwater resources.

Updated for v9 SARCOP on April 28, 2023



# Data Dictionary – Other 21 - 24

- “Other” Waypoints/symbols are reserved for mission specific waypoints.
- This allows the system to adapt to field data collection and situational awareness needs not covered by the existing waypoints. They can be changed for each deployment.
- These can be determined by the Agency Having Jurisdiction (AHJ) and Incident Support Team (IST). If any are used, they should be clearly identified in your Search Data Documentation Requirements (SDDR).

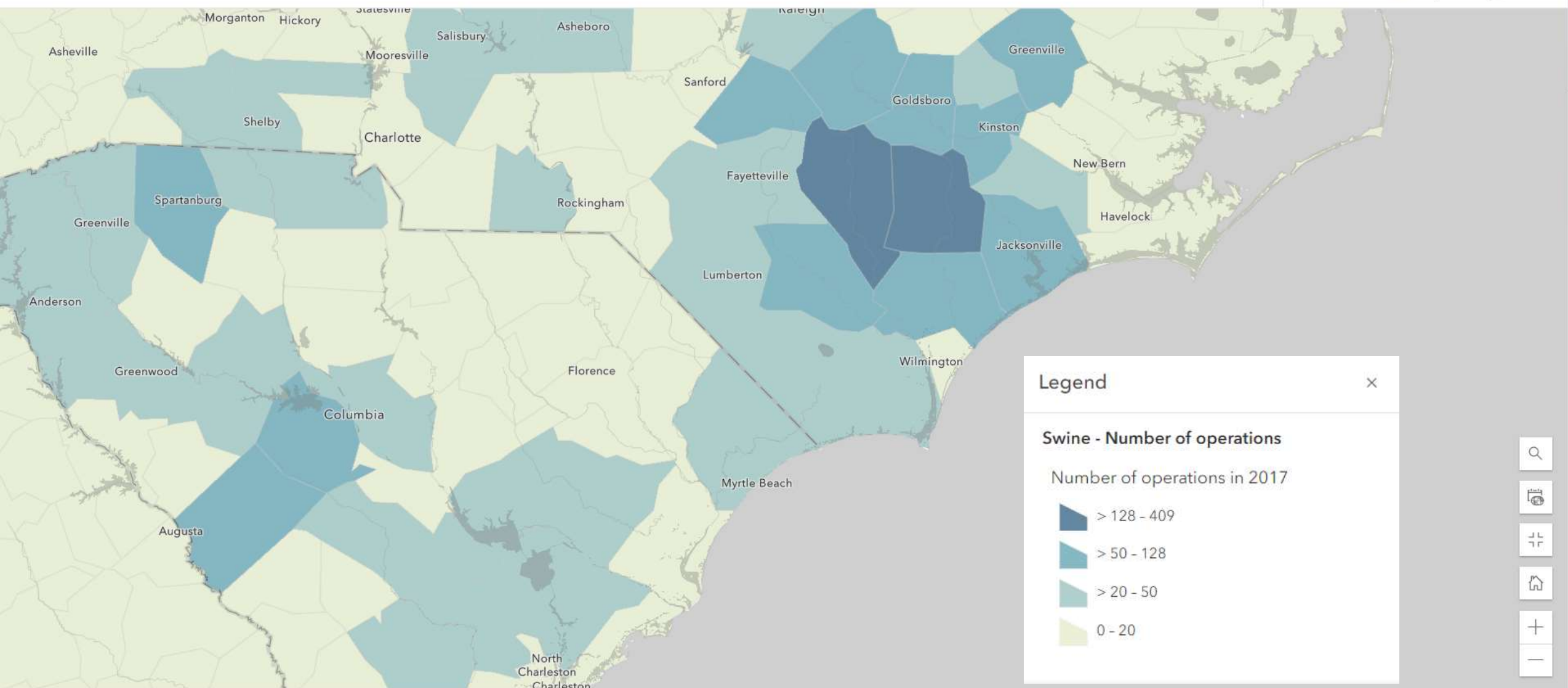


# A disgusting side effect of Florence: Escaped pig poop. Lots of it.



**Matthew Diebel**  
USA TODAY



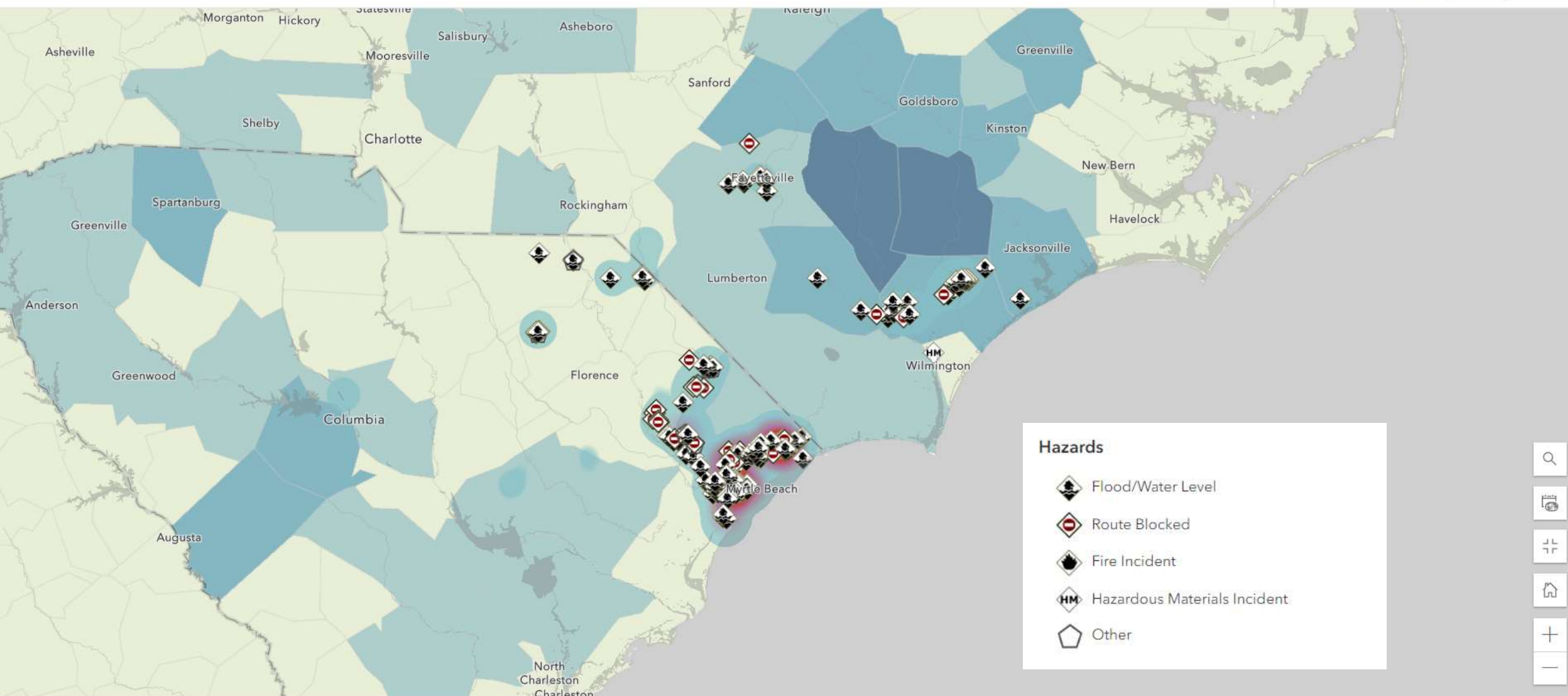


**Legend** [Close]

**Swine - Number of operations**

Number of operations in 2017

- > 128 - 409
- > 50 - 128
- > 20 - 50
- 0 - 20

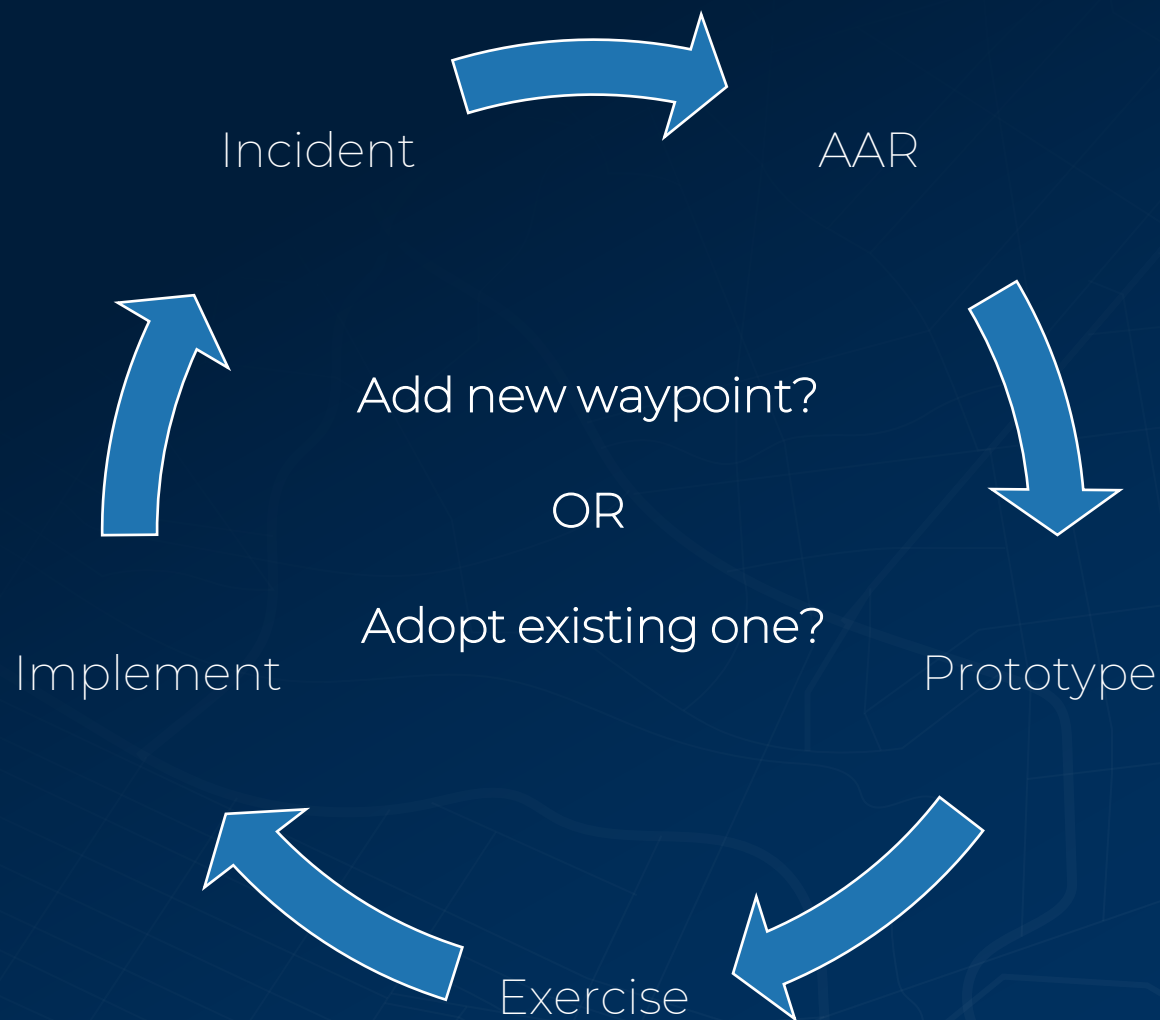


### Hazards

- Flood/Water Level
- Route Blocked
- Fire Incident
- Hazardous Materials Incident
- Other

# Extra Icons

- Swine Farms
- Vehicle Search
- Boat Ramps
- “Lily Pads”
- Internet Access
- Building Evidence
- Identifying Items
- More...



# Key Message

Swine are data too!

*Schemas must flex to the demands of disaster response and be revisited.*



# Conclusion

Has this approach worked?

# SAR Common Operating Platform (SARCOP)





\*Filtered views of SARCOP data can also be shared with emergency management and local government stakeholders via ESF9 Liaisons upon request.



Power Automate to Microsoft Teams & Planner

ArcGIS Partnered Collaborations

# SARCOP Interoperability

**TC** Tablet Command



ArcGIS REST

Network KML (Limited)

Read/Write

Read

ArcGIS Partnered  
Collaboration

Federal  
State  
Local  
Tribal  
Territorial  
INSARAG



Read/Write

Read



Network KML (Limited)  
ArcGIS Plug-in



\*SARCOP can integrate with other systems such as NIFC, Intterra, CalFIRE, SARTopo, TAK etc. – examples only, not an exhaustive list.

# SAR Common Operating Platform (SARCOP)



2021 To Today

**83** | Deployments Supported

**293** | Registered Exercises

**1,174** | NSARGC Community Members



# SARCOP Data Dictionary

Use the latest (click on link) [Data Dictionary](#) throughout the rest of this section.

This defines the intent of each waypoint and tracklog category.

**SARCOP Data Dictionary**

	Staging*	Locations set up at an incident where resources can be placed while awaiting a tactical assignment on a three (3) minute available basis. Staging Areas are managed by the Ops
	Internet Access*	A lo
	Repeater*	A ra diff
	Safety Zone*	A lo hang
	BoQ/Camp*	A gt equi pen
	Other Logistics*	Oth

	Ground Recon	Prel
	Aerial Recon	Prel
	Water Recon	Prel
	Hasty/Rapid Search	Fast
	Primary Search	Quick
	Secondary Low Coverage Search	Syst ope
	Secondary High Coverage Search	Exh ope thor
	Targeted Search	Sea infr risk
	Canine Search Team Live Find	Sea
	Canine Search Team Human Remains Detection	Sea
	Damage Observation	Mis

**Hazards**

	Animal Hazard	Animal hazard related to aggression, location, or behavior.
	Fire Incident	
	Hazardous Mat Incident	
	Flood/Water Level	
	Route Blocked	
	Other Hazard	

**SARCOP Data Dictionary**

**Search/Human Interactions that Do Not Need Follow Up (By Default)**

	Searched Per Rules of Engagement (ROE)	This is a search that has been completed on a structure, vehicle, debris, or other site with no victims or survivors found.
	Rescued	Technical rescue that required moving survivor to a safe location utilizing <a href="#">NFPA 1006</a> (or equivalent) skillsets such as rope, structural collapse, or swiftwater rescue.
	Evacuated	Survivors transported to collection point or out of harm's way.
	Assisted	Materials assistance provided to residents.
	Shelter in Place	Survivors have chosen to remain at current location.
	Human Remains Removed	Human remains removed from specific location.
	Animal Evacuation	Evacuation or rescue of pets / companion animals.

**Search/Human Interactions that Need Follow Up (By Default)**

	Victim Detected	Potential live survivor detected (including canine alert or intelligence).
	Victim Confirmed	Confirmed live survivor (visual, audible, physical confirmation) requiring <a href="#">NFPA 1006</a> (or equivalent) skillsets such as rope, structural collapse, or swiftwater rescue.
	Human Remains Detected	Potential human remains detected (including canine alert or intelligence).
	Human Remains Confirmed	Confirmed human remains (visual or physical confirmation).
	Targeted Search	Specific location that will require increased search effort (e.g., a 911 phone call, missing person report, etc.).

**Damage Observations**

	Unaffected	No visible or reported damage.
	Affected	Damage to the structure is mostly <u>cosmetic</u> .
	Minor	Repairable <u>non-structural</u> damage.
	Major	Structural damage or other significant damage that <u>requires extensive repairs</u> .
	Destroyed	The structure is a <u>total loss</u> .
	Unknown	The status of the structure is unknown.

Additional damage observation guidance can be found here: [Tool damage](#), [can-habit-damage](#), [DIA-FireNet-1006](#)





# Key Messages

1. You can't solve the data problem until you've understood the real-world problem.
2. People, Process...then Technology/Data.
3. Be flexible!

# THANKS!

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National SAR Geospatial Coordination  
Group (NSARGC)

<https://nsargc.napsgfoundation.org/>

@napsgfoundation



# 05 | Panel Discussion

# How can you do your part?

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Sign-up or learn more at:

- OGC Standards - <https://www.ogc.org/standards/>
- SARCOP Data Dictionary – [view here](#)
- Follow updates to the IDT - <https://www.cisa.gov/resources-tools/resources/infrastructure-data-taxonomy>

# THANKS!

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Do you have any questions?  
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@napsgfoundation

