The Role of Imagery in A Modern GIS

Richard Cooke
Esri

GIS

. . . and The Geographic Approach

Are Powerful Means for . . .

Creating Understanding . . .

Exploring Alternatives . . .

Finding Solutions . . .

and Reaching Agreement

Creating Agreed Upon Understanding

Providing . . .

. . . A Foundation for Positive Action

The Geographic Approach

A Way of Thinking and Problem Solving
That Integrates Geographic Science & Information

An Inclusive and
Multidisciplinary Process

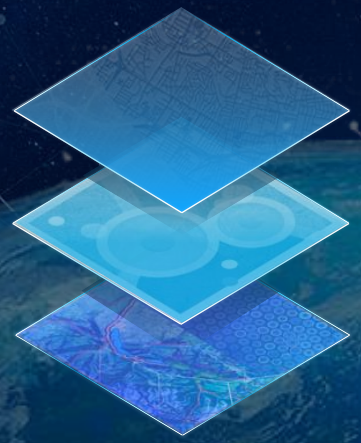
Science Based

Holistic

Integrated

Collaborative

Understandable



Providing a Framework for
Understanding and Applying
Our Knowledge

Impacting Every
Sector of Our Society

GIS Enables The Geographic Approach

A Process for
Creating Understanding
& Facilitating
Collaboration

Data Collection

Visualization & Mapping

Analysis & Modeling

Planning & Geodesign

Decision Making

Action

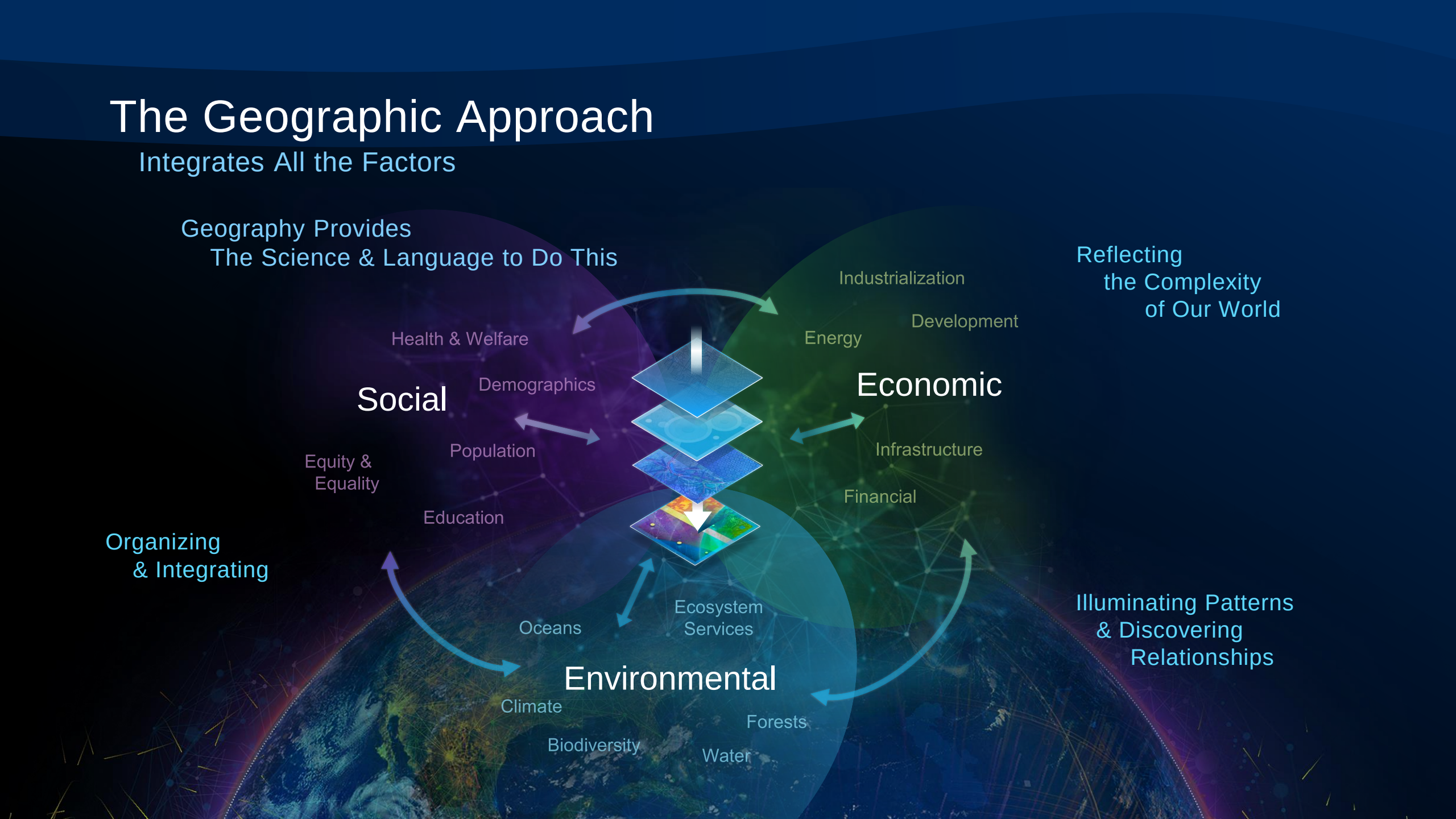
Linking Science to Action

The Geographic Approach

Integrates All the Factors

Geography Provides
The Science & Language to Do This

Reflecting
the Complexity
of Our World



Organizing
& Integrating

Illuminating Patterns
& Discovering
Relationships

ArcGIS Vision

A Comprehensive Geospatial System – Supporting Multiple Communities

Open & Interoperable

Software, SaaS and PaaS

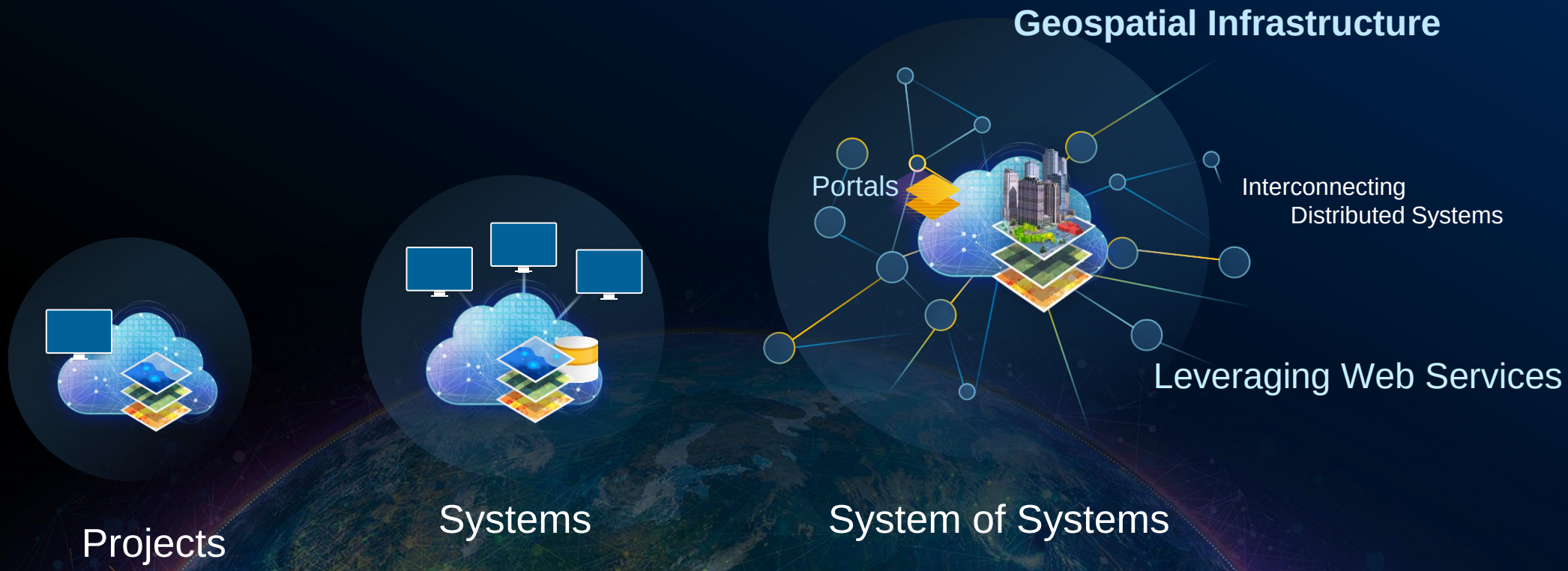
Powering Personal Productivity . . .
and Enterprise Systems

What Is a GIS?

A System for Managing, Sharing and Applying Geographic Information

GIS Is Advancing – Becoming Interconnected

Creating Geospatial Infrastructure



. . . And Creating a Whole New GIS Pattern

ArcGIS Is an Enterprise System

Supporting Hundreds of Interconnected Workflows

- Cross Cutting
- Shared
- Transactional
- Real-Time

Empowering Many Forms of Collaboration and Communication

ArcGIS

Integrates and Manages All Types of Data

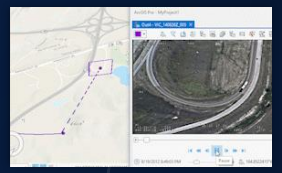
Making Them Available and Usable Across the System

Imagery and Remote Sensing Are Enriching GIS

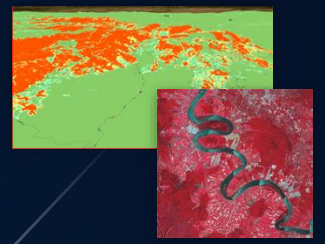
Transforming All Aspects of Geospatial Work

Oriented Imagery

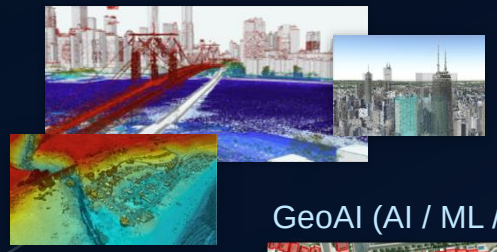
Video



Dynamic Image Processing



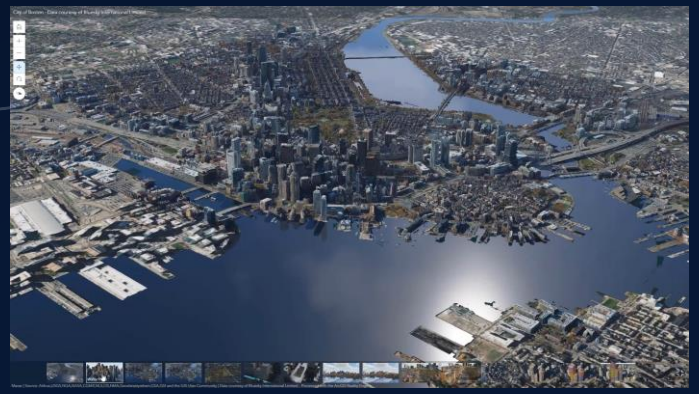
3DVisualization



GeoAI (AI / ML / DL)

Image Basemaps

Reality mapping



Advancing
Geospatial Science

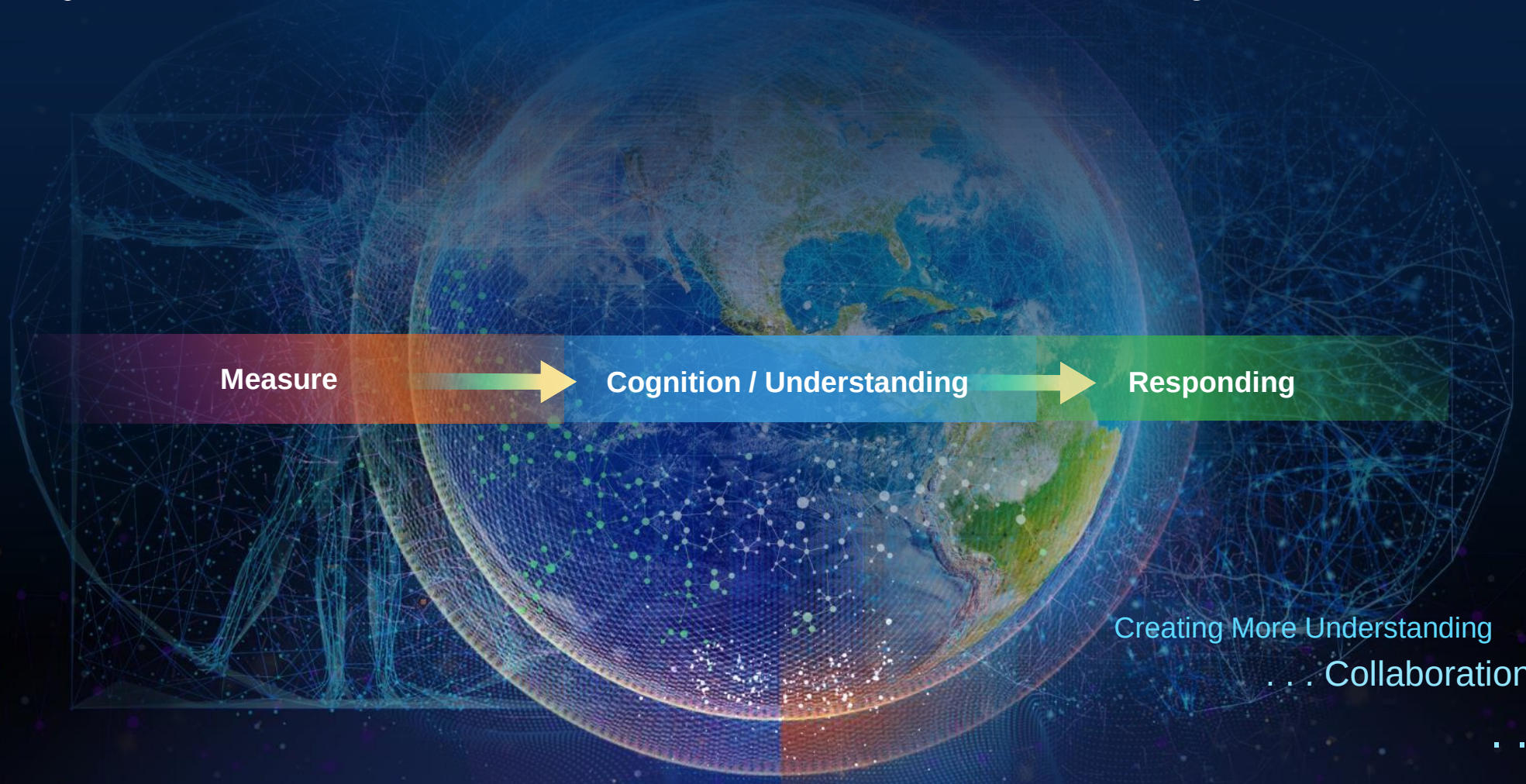
Integrating Massive & Timely Content

Imagery and Remote Sensing Measures and Monitors the Earth

It shows us the health of our planet

. . . and enables our projects

A Key Part of our Planet's Central Nervous System



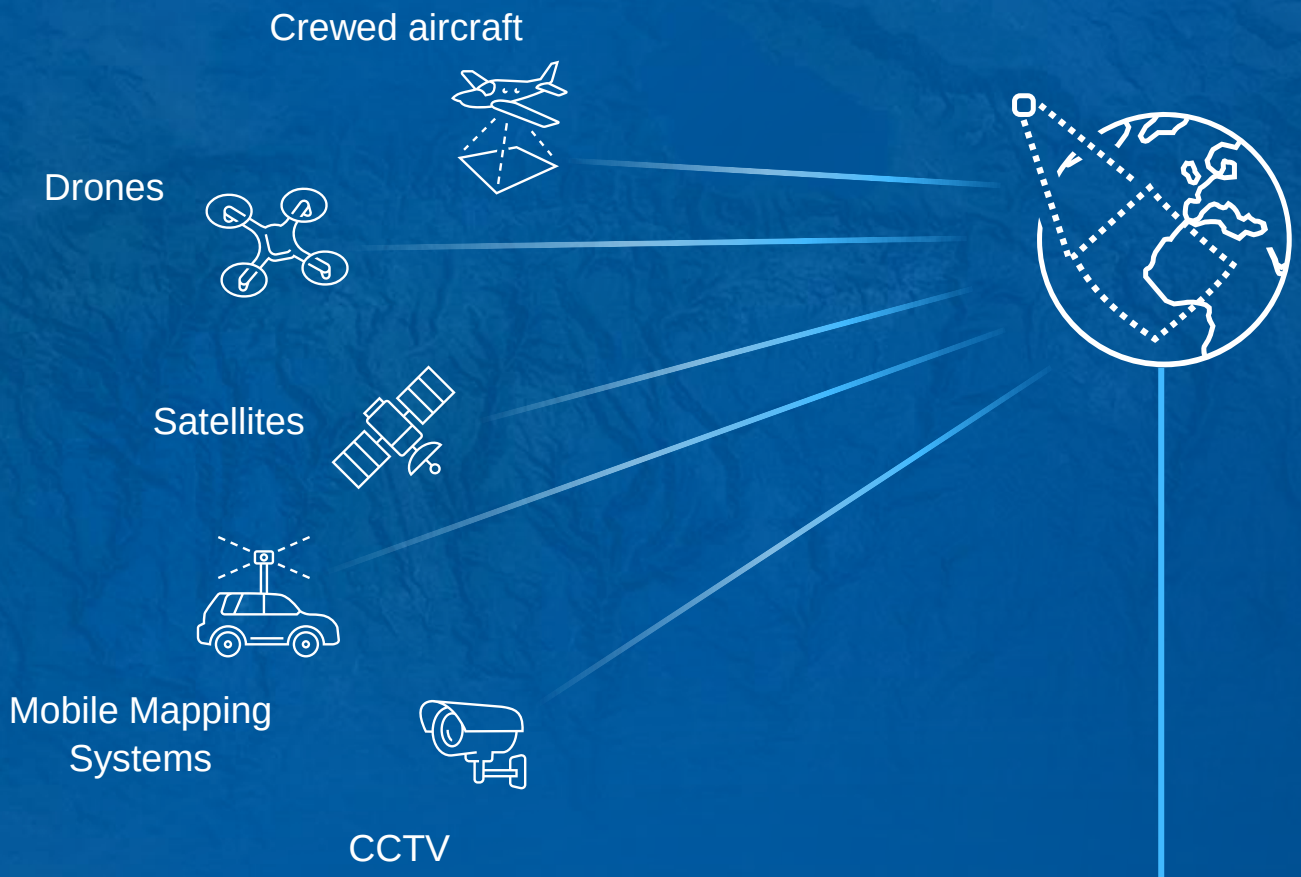
Creating More Understanding

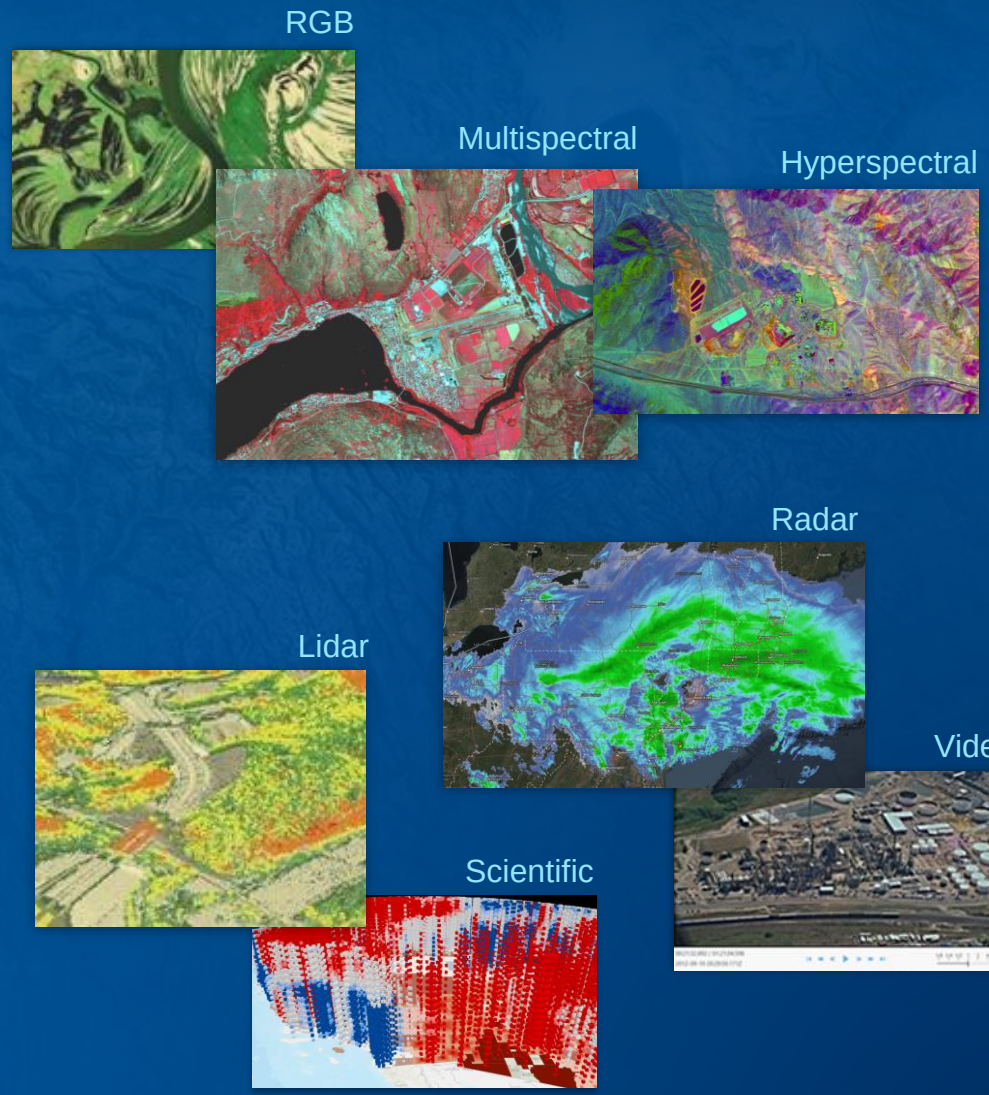
. . . Collaboration and

. . . Action

. . . Remote Sensing is Foundational

Today, you have **more sources** for **imagery** and other **remotely sensed data** than ever before.





Using Imagery as an Enterprise Data Asset

Analysis & Observations

Inspection

Monitoring

Construction Progress

Economic Development

Asset Management

Damage Assessment

Natural Disaster

Intelligence

Flood Monitoring

Project Status

Visualizations

Reality Mapping

Site Models

New Construction

Basemaps

Simulation

Ortho Photos

Viewsheds

Surface Drainage

Site Planning

Facility Modeling

Terrain Analysis

Spatial Pattern Detection

Built Environments

Natural Environments

Urban Growth

Weather Trends

Impervious Surfaces

Elevation Change

Vegetation Management

Land Cover

Foundation Content

ArcGIS Is a Comprehensive Imagery System

Supporting All Aspects of Imagery

Mapping

- Drone, Aerial & Satellite
- True Ortho
- 3D Mesh & Point Cloud

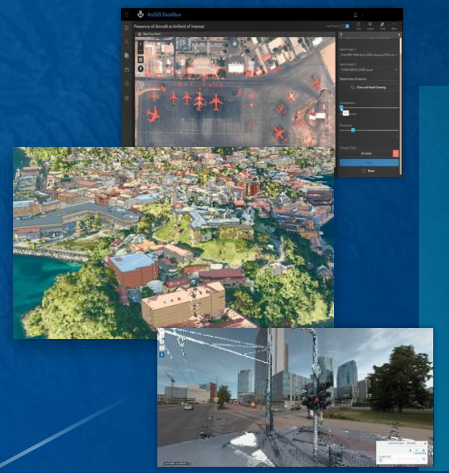
Analysis

Hundreds of Tools

- Classification
- Change Detection
- Raster Analytics
- GeoAI

Many Innovations

Visualization



Multiple Experiences

- Image Exploitation
- Voxels
- Oriented Imagery
- Map & Image Space
- Multidimensional (Data Cubes)
- Stereo
- Video

Pro, Enterprise & Online

Data Management

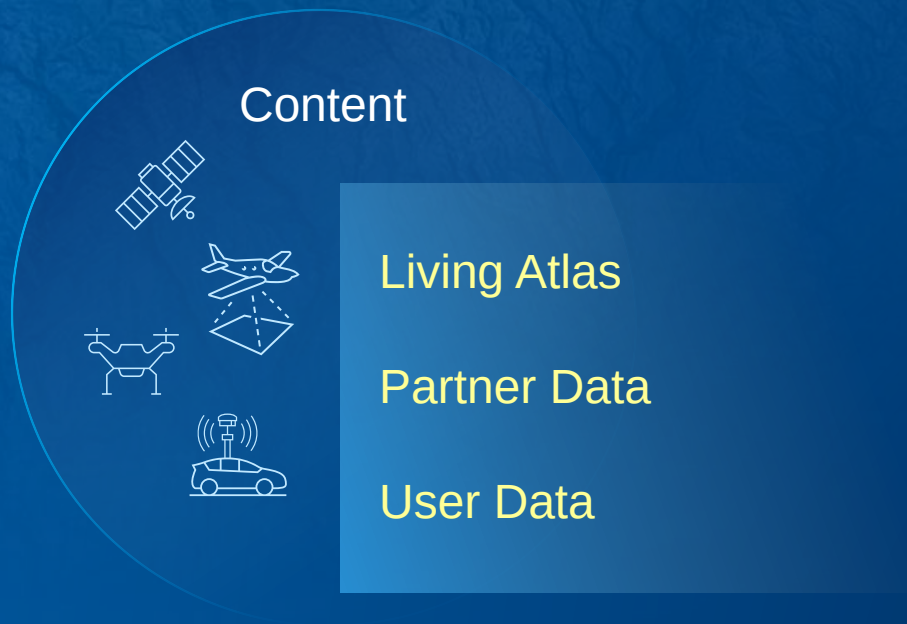
Living Atlas

Partner Content

- All Formats & Types (Video Coming)
- Online Hosting
- Search & Discovery
- Tiled and Dynamic Services
- Open Standards

Transforming Remotely Sensed Content Into Useful Information

ArcGIS supports the **discovery, acquisition,** and **creation** of imagery and remote sensing data.



The Living Atlas is curated with relevant and proven imagery data sources.

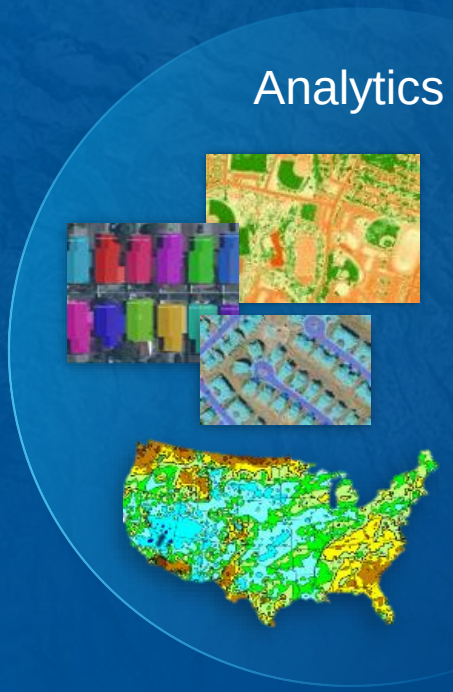
Partnerships are bringing expanded data sources into ArcGIS.

Your data is supported throughout the ArcGIS System, allowing you to derive custom insights based on your needs.

Reality Mapping capabilities support the acquisition and creation of authoritative foundation content.

Organizations **manage** Imagery and Remote Sensing data as part of their System of Record.

We **derive** insights and information that can inform decision making and create critical information.

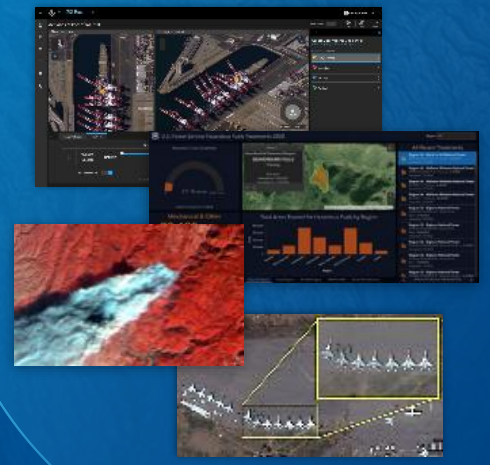


Informing the System of Insight

- Model Strategy for AI/ML
- Raster Analytics Refresh
- Cloud-based Workflows

You **visualize imagery, share insights, and disseminate information** that can inform decision making, update the GIS and create critical new information.

Visualization

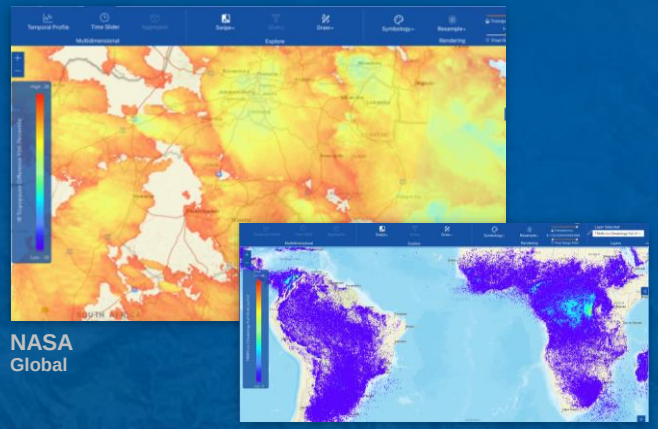


Imagery within the System of Engagement

- Drone Inspection Apps
- Oriented Imagery
- Job Status Tracking

Applications of Imagery and Remote Sensing

Mapping and Analysis of Severe Hailstorms



NASA
Global

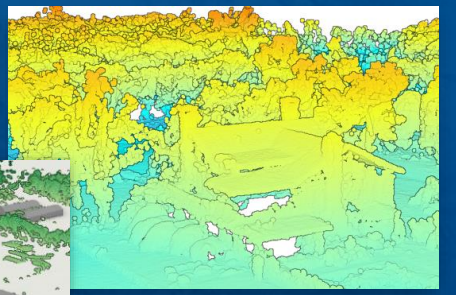
Transmission Towers Visualization
(Lidar)

DOE | BPA
Northwest US

Fire Hot Spots
(MODIS)

Imagem
Brazil

Visualizing Point Clouds

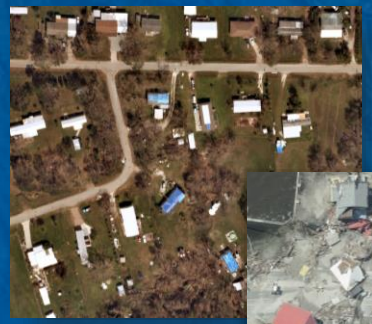


GEO Jobe
Harpeth Valley, Nashville, Tennessee

Visualizing
Wind Breaks

USDA Forest Service
Antelope County, Nebraska

Tornado Damage
Assessment
(10cm Image Capture)



Near Space Labs
Arcadia, Florida

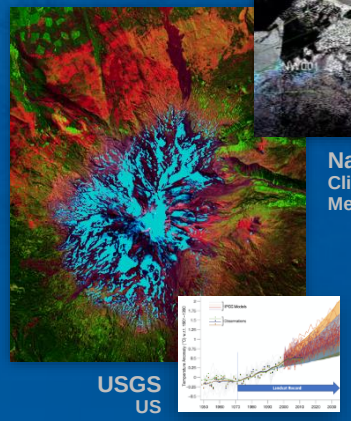
Hurricane
Impact Mapping

Vexcel Imaging US
Hurricane Ian, Florida

Change Analysis
(Lidar)

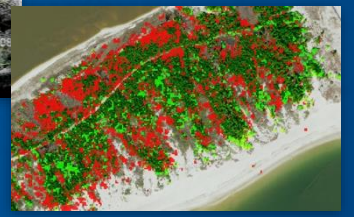
National Park Service
Cliff Dwellings,
Mesa Verde National Park

Climate Change
(Landsat)



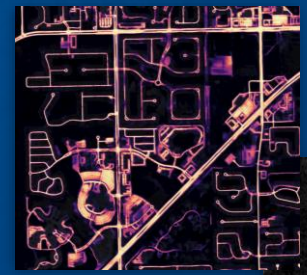
USGS
US

Vegetation Change
(Lidar and GeoAI)



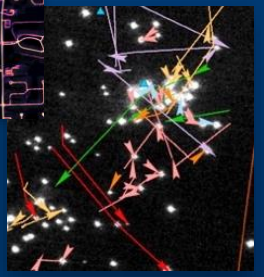
Florida Department of Environmental Protection
Little St. George Island, Florida

Vehicle Traversability
(Deep Learning)



SeerAI
Cape Coral, Florida

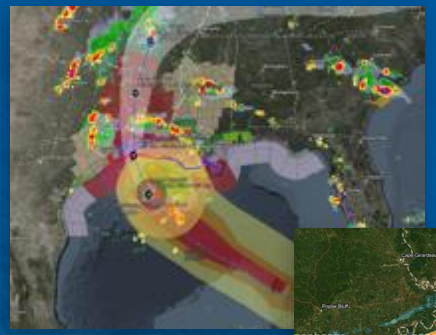
Illegal Fishing
(Radio Frequency)



HawkEye 360
Arabian Sea

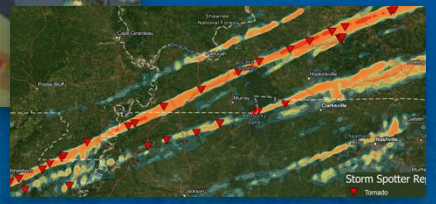
Applications of Imagery for Disaster Preparation and Response

Hurricane Tracking & Assessment



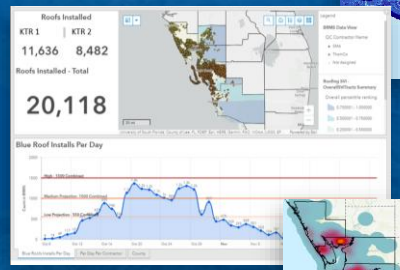
Bent Ear Solutions
Southeastern US

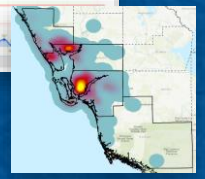
Real-Time Tornado Analysis



DTN
Kentucky | Missouri | Arkansas | Tennessee

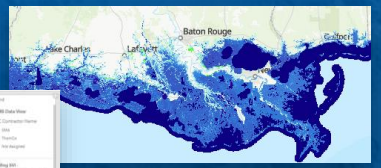
Blue Roof Management System





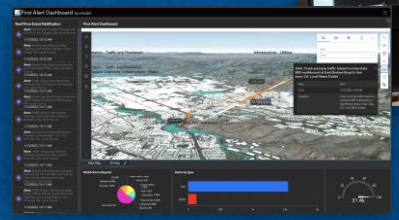
USACE
Florida

Sea Level Rise



North Point Geographic Solutions
Texas | Louisiana | Mississippi

First Alert Flooding Dashboard

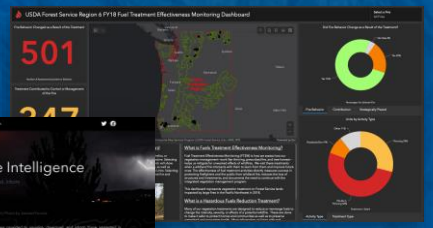


Dataminr
California

Real-Time Flood Inundation Mapping

NOAA | NWC
US

Wildfire Fuel Monitoring



USDA
Pacific Northwest

Wildfire Hub

Bureau of Land Management
Nevada

Situation Awareness

DHS | FEMA
FEMA Region 6
Texas | Louisiana | Arkansas | Oklahoma | New Mexico

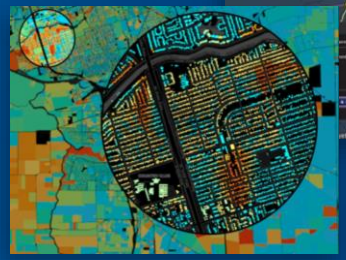
Emergency Response Dashboard

Port of New Orleans
Louisiana

Weather & Outages

Integral GIS
Northeast US

Property Flood Risk Mapping



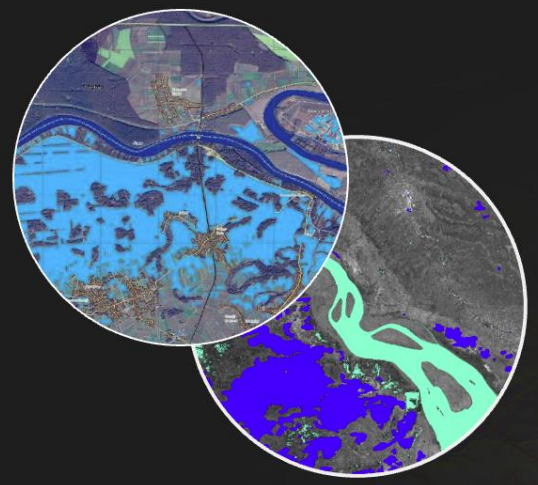
CoreLogic
Stockton, San Joaquin County, California

Flood Preplanning

First Due
Fairfax, Virginia

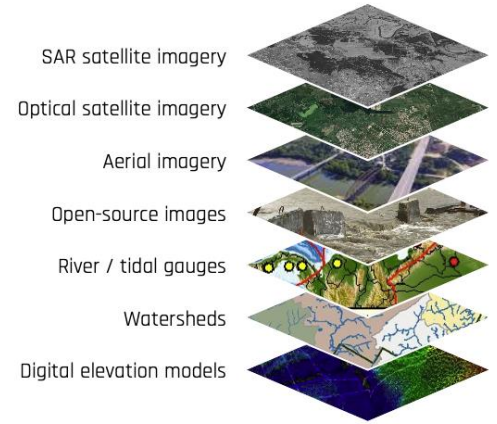
Integrating Data Sources and Leveraging AI

Flooding



- SAR Amplitude workflow
  - More images might be used
- Suitable for AI/ML
- Eligible for an automatic processing.

AI POWERED MULTI-SOURCE INSIGHTS

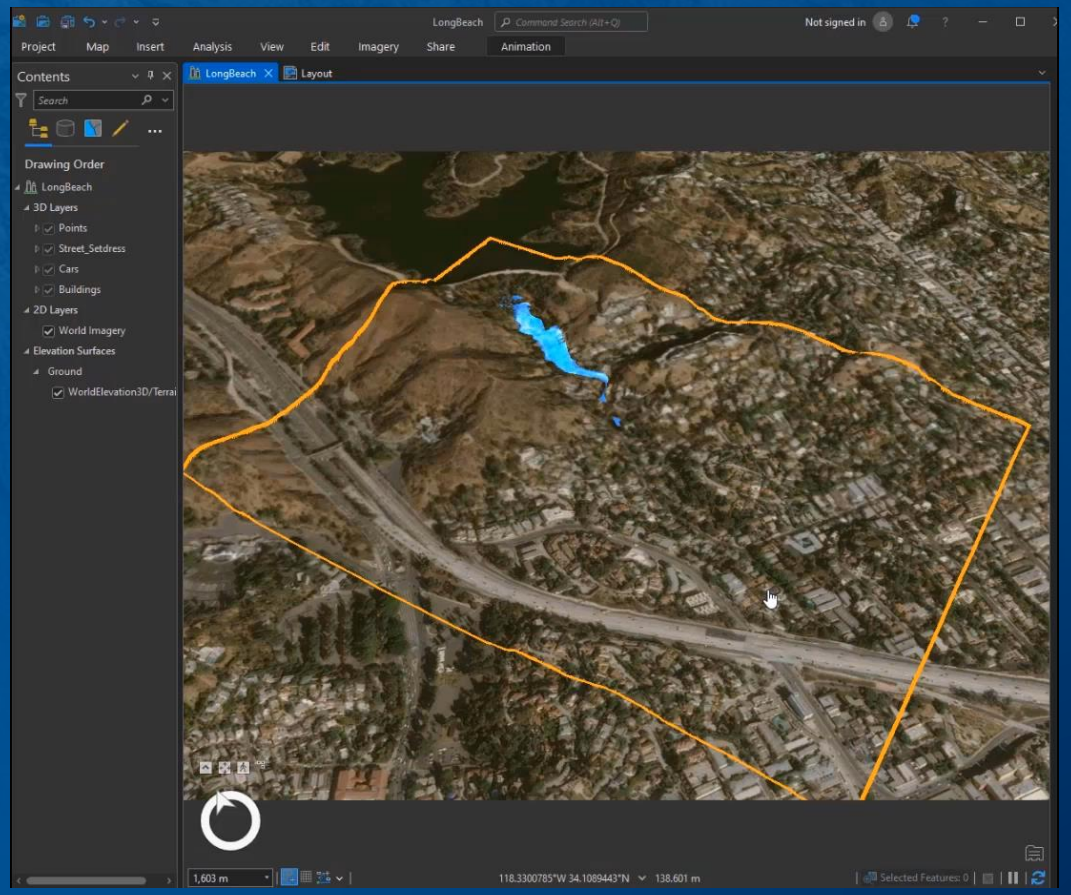


FLOOD DEPTH FOR IMPACTED BUILDINGS

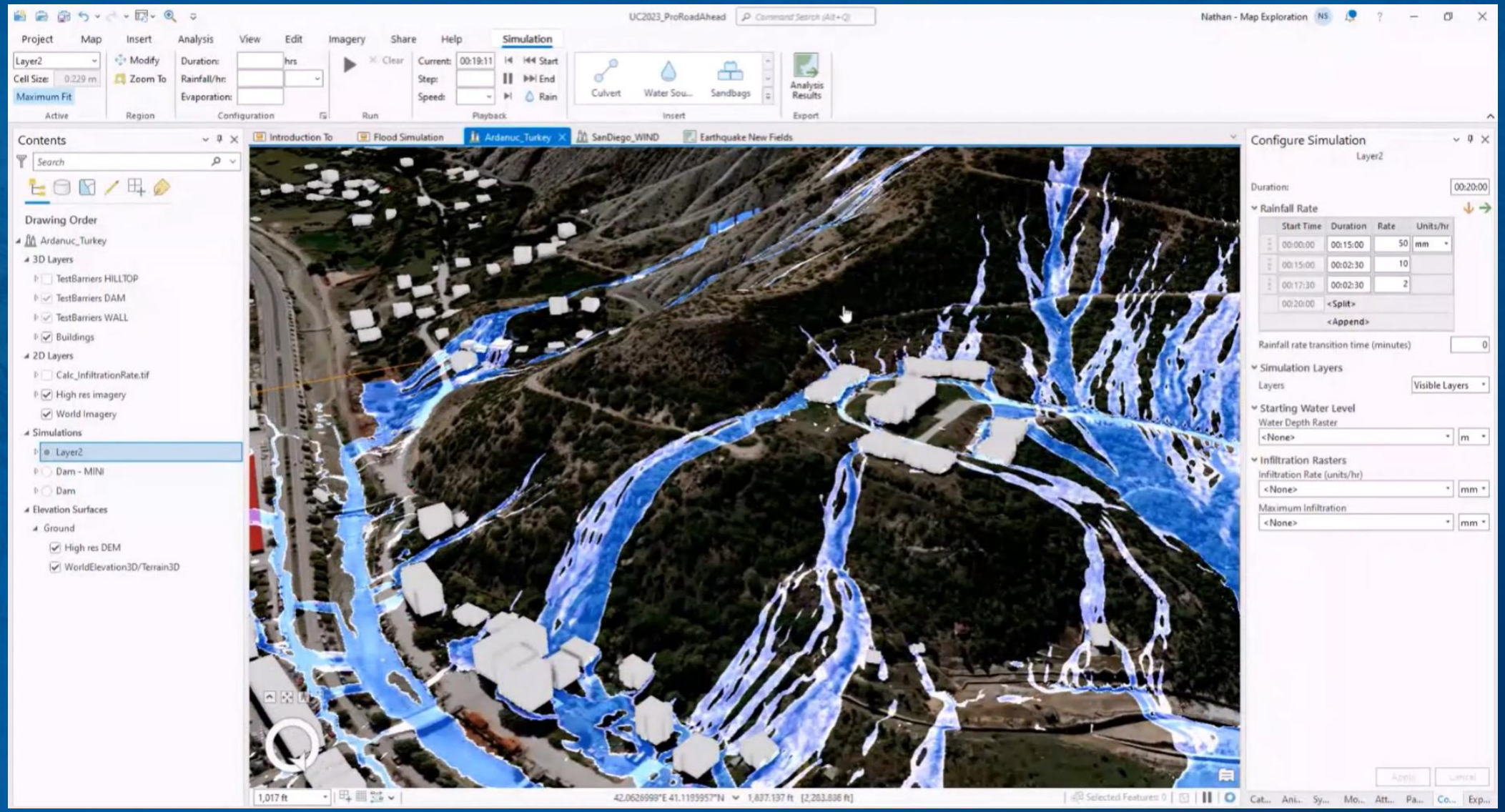
…Working With Partner To Solve Significant Challenges

Flood Simulation

- **Provide Flood simulation capabilities for Pro users**
  - Predict and plan for potential flooding events
  - Fast simulation and playback
- Workflows
  - Define an AOI, configure, and run a simulation
  - Visualize results and review statistics
  - Compare multiple scenarios
  - Share videos, reports, and analysis results
- Epic Illustrations
  - 100/200/500-year floods
  - Burst pipes
  - Dam/levee failure



Flood Simulation



Pretrained GeoAI Models

Included with ArcGIS

- Cars
- License Plate Blurring
- Parking Lots
- Parking Spots
- Humans
- Crowd Counting
- Face Blurring
- Land Cover
- Buildings
- Roads
- Parcels
- Ag Fields
- Swimming Pools
- Well Pads
- Power Lines
- Transmission Towers
- Insulator Defects
- Wind Turbines
- Solar Arrays
- Solar Panels

- Ships
- Shipwrecks
- Oil Spills
- Cloud Masking
- Water Bodies
- Pavement Cracks
- Arctic Seals
- Elephants
- Seabirds
- Mangroves
- Palm Trees
- Trees
- Plant Leaf Disease
- Common Object Detection
- Text Parsing from Photo
- Object Tracking
- Segment Anything Model (SAM)

. . . and Many More

State & Local Government

AEC

Conservation

Transportation

Water

Commercial Business

Telecommunications

Insurance

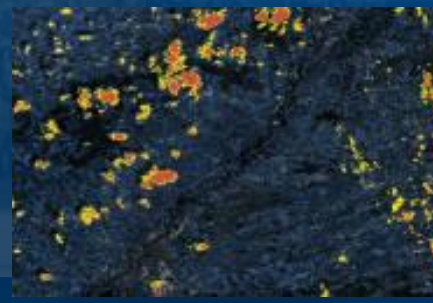
Utilities

Road Extraction (Global)

Wind Turbine Detection

Elephant Detection

Cloud Mask Generation



Building Footprints

Parking Spot Detection

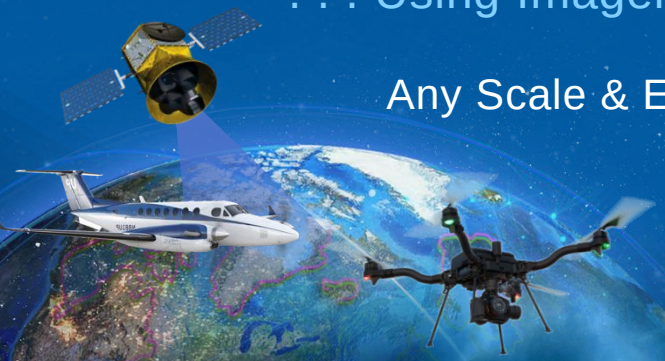
Solar Park Classification

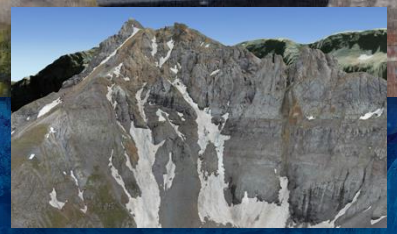
Land-Cover Classification

Reality Mapping

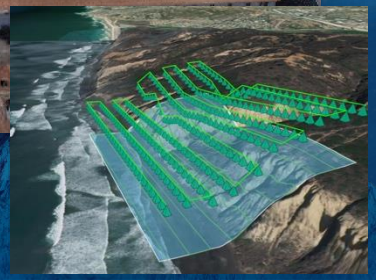
Creating Accurate 3D Representations . . . Using Imagery

Any Scale & Extent





Model the Environment



Terrain Following

Data Courtesy of Bluesky International

City- & Countrywide 3D Mapping from Aerial Imagery

ArcGIS Reality

- ArcGIS Reality Studio
- ArcGIS Pro Extension
- Site Scan for ArcGIS
- ArcGIS Drone2Map

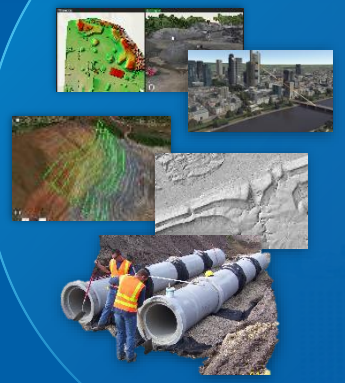
Outputs

- 3D Meshes
- True Orthos
- Orthomosaics
- Digital Surface Models
- Point Clouds

Fast and Massively Scalable . . .
Modernizing Photogrammetry and Map Production

Everything Powered by the ArcGIS Imagery System

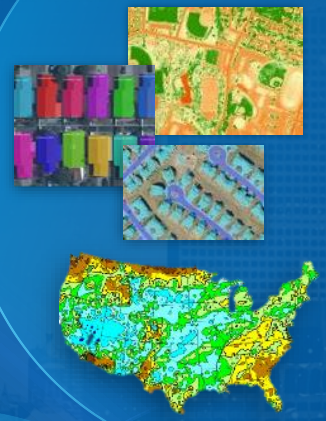
Reality Mapping



Foundation Content Creation

- Orthomosaic
- True Ortho
- Elevation
- Point Clouds
- Sites - Drones
- City - Aerial

Analytics



Informing the System of Insight

- Model Strategy for AI/ML
- Raster Analytics Refresh
- Microsoft PC Data Analytics
- Crop Yields
- Land Cover
- National Statistics

Content

Living Atlas Partner Data User Data

- Emerging Modality/Sensor Support
- 2D/3D additions to the ArcGIS Living Atlas
- Microsoft Planetary Computer Data available in ArcGIS Image
- Content Providers Alignment and Integration

Imagery Management

Imagery System of Record

- Turnkey Image Management
- Multi-source Image Management
- STAC Support

Visualization

Imagery within the System of Engagement

- Drone Inspection Apps
- Excalibur Expansion
- Oriented Imagery

Integrating imagery as geospatial data…
… to accelerate informed decision making