



EarthDaily
analytics

EarthDaily Constellation for Intelligence, Surveillance, and Reconnaissance (ISR)

Everywhere. Everyday.



Agenda

1. Introductions
2. EarthDaily Analytics Technology
3. EarthDaily Analytics ISR Analytics
4. Tipping and Cueing
5. EarthDaily Constellation

The EarthDaily Analytics Product Suite

We are a **vertically-integrated** software and analytics space company developing **world-first** technologies in data services, satellite processing, machine learning and **actionable insights**.

We are uniquely positioned for Intelligence, Surveillance, and Reconnaissance (ISR) applications by providing a baseline change detection system, capable of monitoring cast swaths of land for change.



EarthDaily Constellation



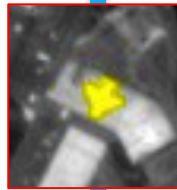
EarthPipeline



EarthMosaics



Earth Data Store



EarthAnalytics (ISR)

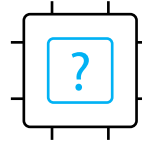
Current market challenges...



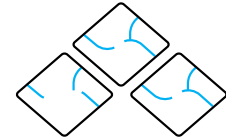
Higher chances of getting cloud-contaminated pixels due to low-frequency revisits, whereas we offer daily revisits at 10:30am.



Coverage not as broad or flexible like ours, covering over all maritime offshore regions and all land areas.



Data unreliability leads to limited ML capabilities. Unlike EDC which will enable automatic trigger and alert incidents, enhancing operational efficiency.



Radiometry quality not fulfilling most customer needs for subtle change and alerting, where EDC is focused on quality first for data products.

EDA's Core product suite is fundamental to effective analytics solutions by solving these challenges.

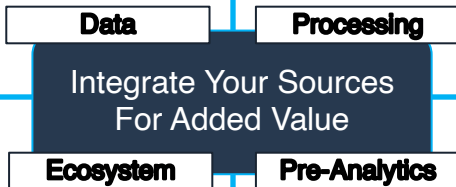
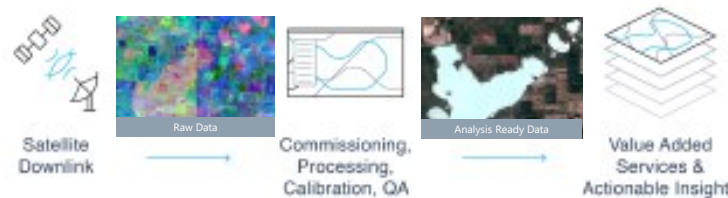
EarthDaily Constellation

EarthDaily Constellation is a systematic collection mission, always nadir looking, and always-on over land and select maritime areas

- 22 highly calibrated, diverse spectral bands
- ~100% Earth's landmass covered daily, no tasking
- 10 years design life
- Launching in 2025

EarthPipeline

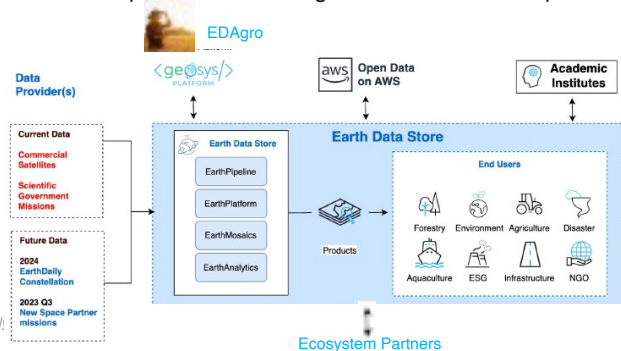
World's first ground processing service, EarthPipeline automatically transforms raw downlinked data into Analysis Ready Data to power automated actionable insights.



Integrate Your Sources For Added Value

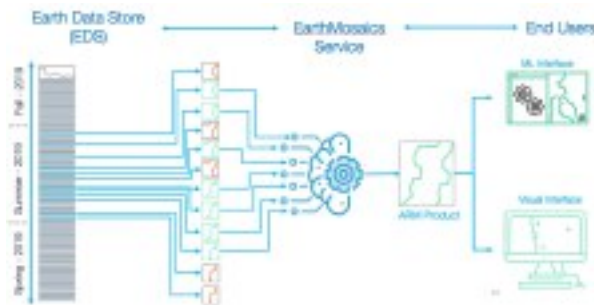
Earth Data Store (EDS)

EDS is a New Ground Solution for New Space and bundles EDA services to provide scientific-grade calibration and processing.



EarthMosaics

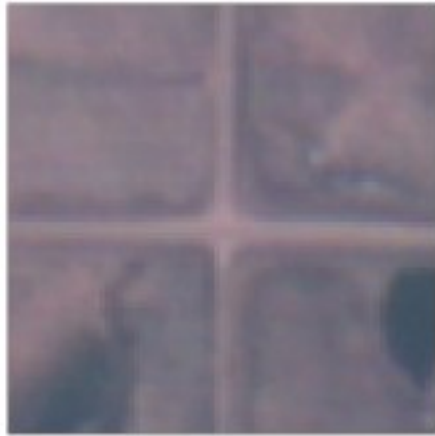
EarthMosaics are cloud-free, temporally coherent mosaics with pristine geolocation and radiometric quality to minimize false positives in change detection and easily align with other datasets.



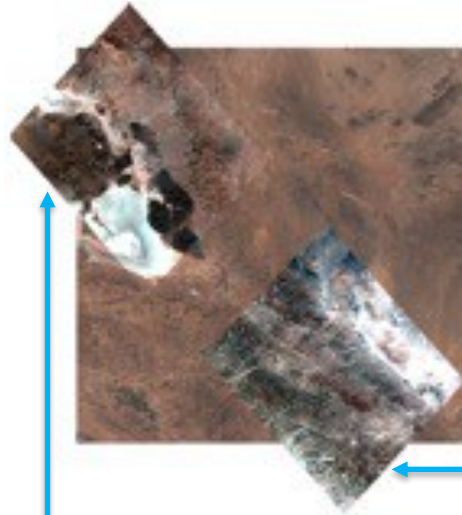
EO User Challenges - A Long Complex Road

Main Data Challenges:

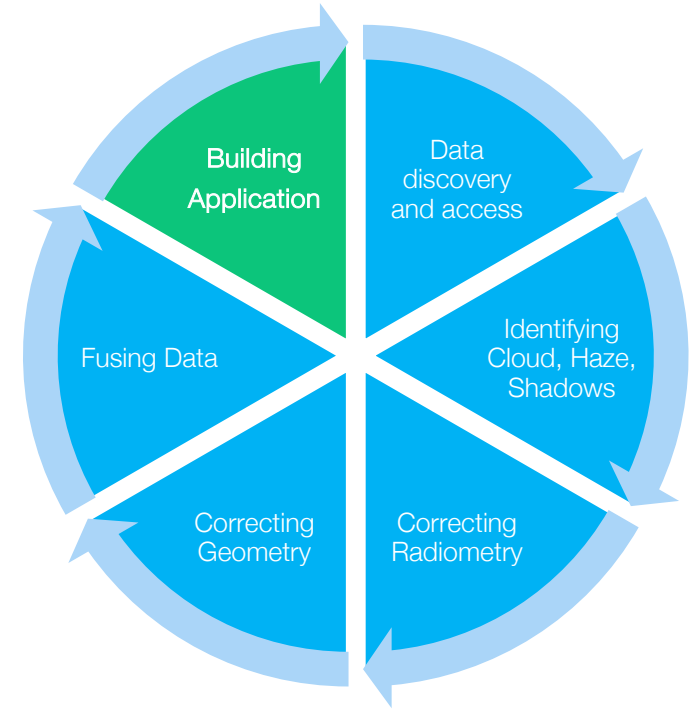
1. Data Quality
2. Data Interoperability
3. Data Accessibility



Poor Geometry

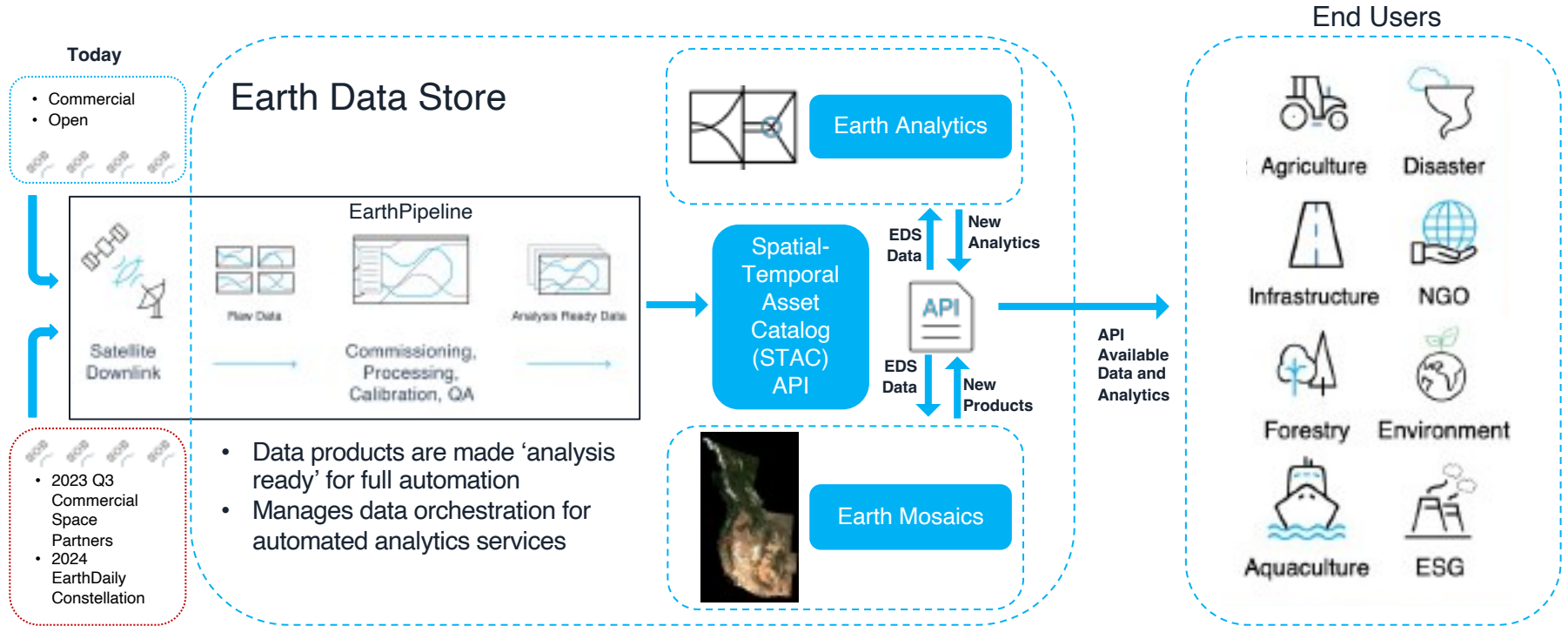


Poor Radiometry

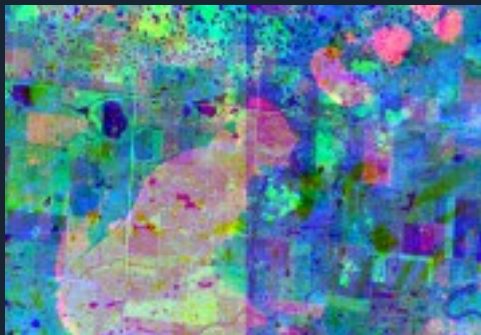
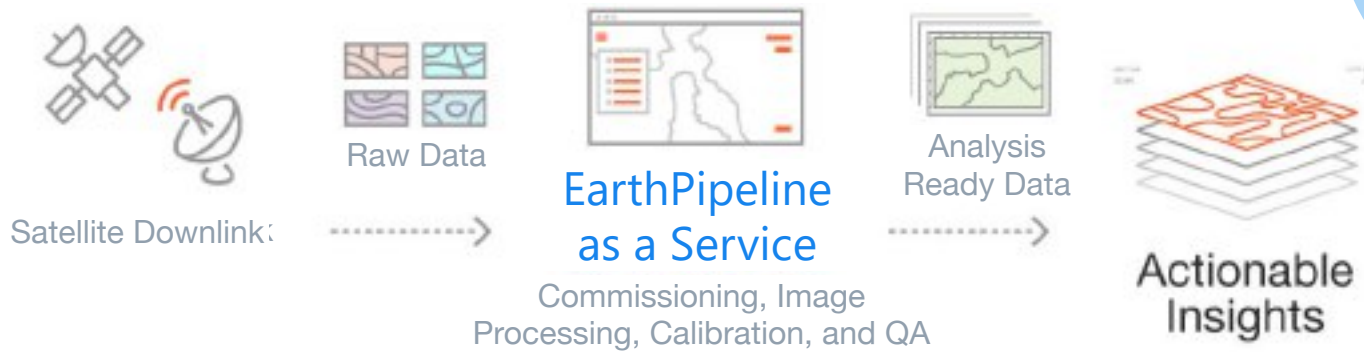
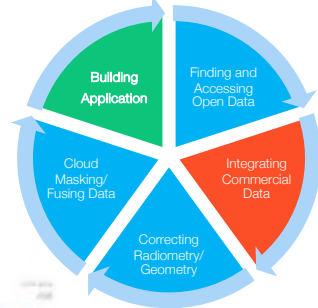


80/20 Rule 

Analytics Workflow

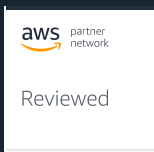


EarthPipeline Delivers Turn-Key Scientific-Grade GS Services



Raw Downlinked Data

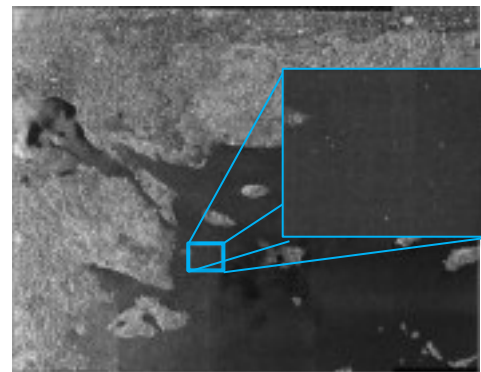
EarthPipeline automatically transforms raw downlinked data into Analysis Ready Data to power automated actionable insights



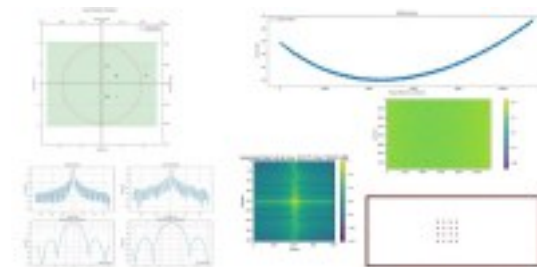
Analysis Ready Data

Advanced SAR Processing

- SAR Processing supports:
 - Supports X-Band, L-Band and C-Band
 - Variety of reconstruction algorithms (RDA, BP, ECS)
 - Variety of acquisition modes (Stripmap, ScanSAR, Spotlight)
 - Multi-looking (time/freq-domain, Lee/Frost filters)
 - Variety of levels (slant range, ground range, ortho)
 - Variety of radiometrically calibrated backscatter coefficient normalization units ($\beta_0/\sigma_0/\gamma_0$)
 - Multiple bands and polarizations
 - RPC model for slant and ground range products
 - Comprehensive metadata suite
 - Faraday rotation detection with atmospheric path delay compensation (L-band Quad Pol)
 - SAR GCP Marking for poor ephemeris scenarios



PALSAR ScanSAR over Aegean Sea
(Zoom in shows ships)

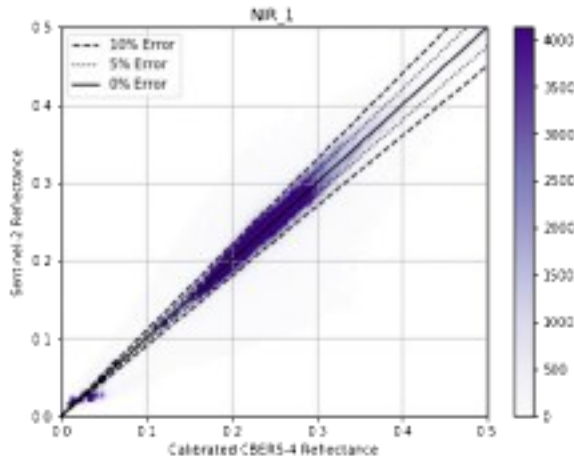


SAR QA Measures

EarthPipeline Validated on Real-World Scenes

Automated QA to Validate SLA

- Geolocation and band registration evaluated on every product



Radiometry evaluated on calibration sites

Theia ~3300 Product Test	Initial Error	EarthPipeline Ortho
Geometric Error RMSE	1+ km	4.3 m

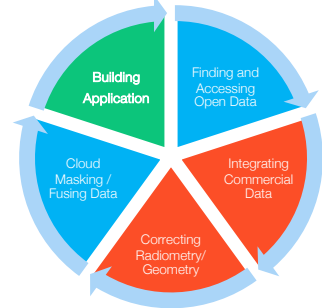
Processed Theia Products

Theia	Blue	Green	Red	NIR
RMSE	5.1%	4.9%	3.9%	4.4%

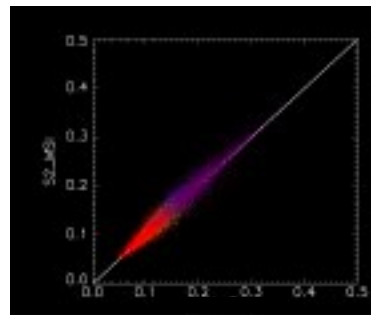
Sample Theia Metrics Validated on Different Scene Types



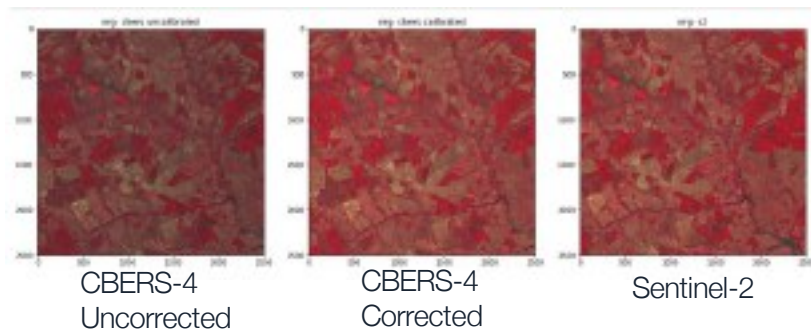
EarthPipeline – Making Data Ready for AI



Geolocation	Band Registration
<p>Data Provider: 146.9m RMSE</p>	<p>Data Provider: Max 0.56px RMSE</p>
<p>EarthPipeline 4.3m RMSE</p>	<p>EarthPipeline: 0.12px RMSE</p>



Validated by USGS



CBERS-4 \$200M+ Satellite	NIR (%)
Pre-correction	21.5
Post-correction	1.8

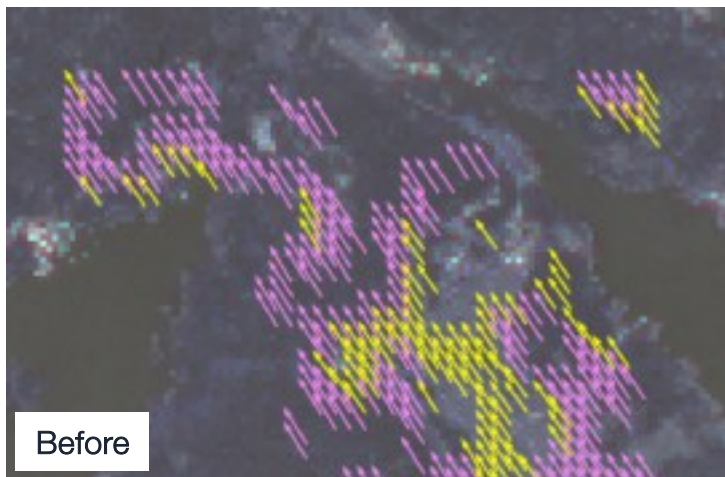
**Location errors
exacerbate
automated change
detection reliability**

EarthPipeline Improves Data Quality for Automated Change Detection

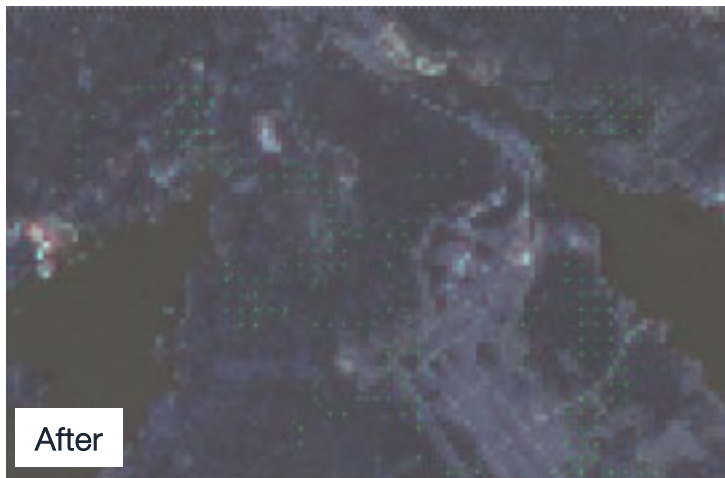
**Change Detection
reliability is optimized
when geolocation
errors are removed**



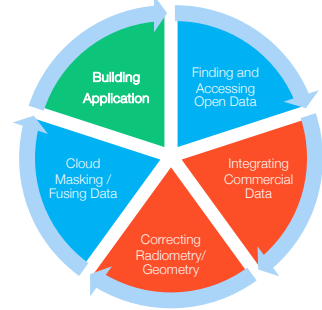
Systematic Maxar WorldView
Before/After Errors



Sentinel-2 Before/After Errors

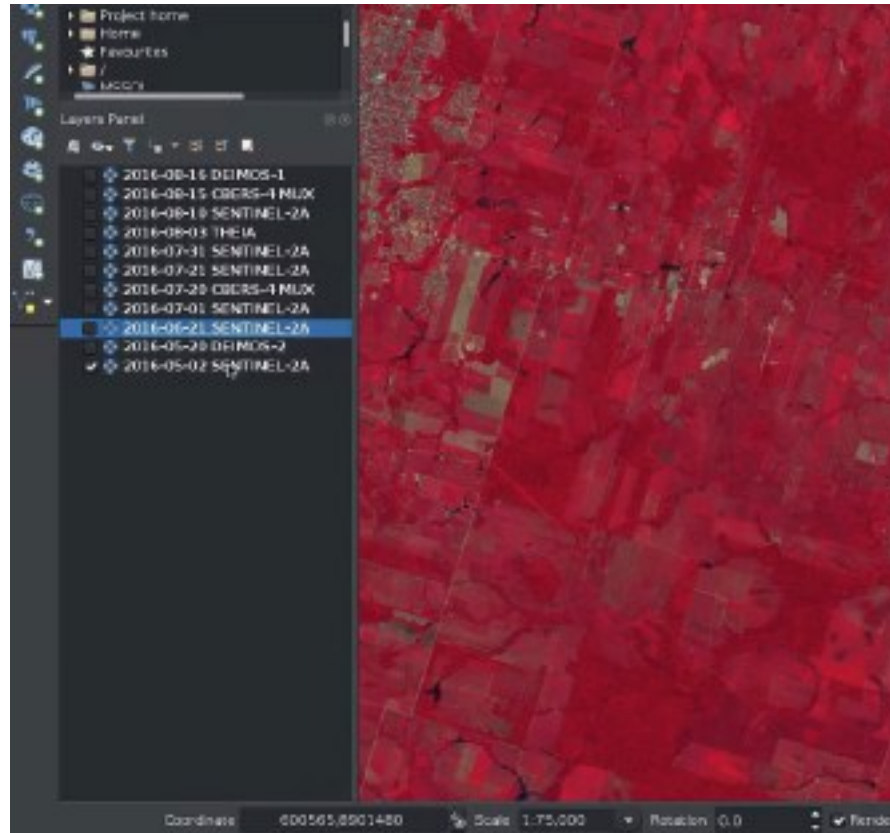


EarthPipeline Heterogeneous Data Normalization

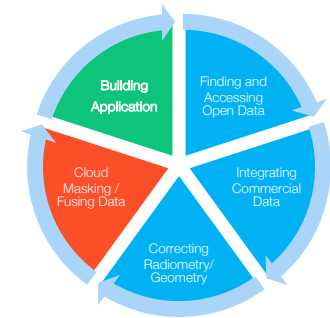


Normalized temporal stack of multi-resolution scenes:

- Deimos-1 (22m)
- CBERS-4 (20m)
- Sentinel-2 (10m)
- Theia (5m)
- Deimos-2 (1m)



EarthMosaics - AI-Ready Mosaics



- **Radiometric Accuracy**
 - Cloud filtering, radiometric balancing
- **Geometric Alignment**
 - Improved Sharpness, suitable for time series analysis
- **Highly Customizable**
 - Bands, AOI, TOI, ground features

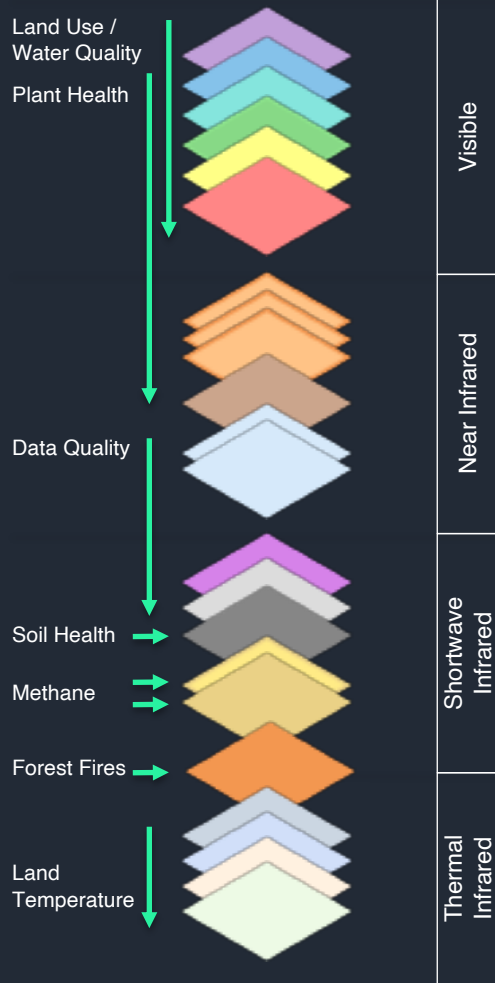


Space Segment

EarthDaily Constellation is a systematic collection mission, always nadir looking, and always-on over land and select maritime areas.

Number of Satellites	10
Launch Period	2024
Spacecraft	Arrow bus from Airbus
Design Life	10 years
Orbit	Sun-synchronous; 10:30 AM local time equatorial crossing time
Orbit Control	Precisely maintained for consistent viewing over mission life
Revisit	Daily systematic coverage of ~100% of Earth's landmass and select maritime areas, no tasking
Ground Sample Distance	VNIR: 5m SWIR: 95m Thermal: 120m
Spacecraft Mass	200 kg
Altitude	~630km
Viewing Angle	Nadir (always)
Delivery Method	Cloud distribution, API-first approach

EarthDaily Constellation Bands



1 Coastal	➤	Dust & Smoke, Ocean Colour: Water Quality and Organic Content
2 Blue	➤	Plant Senescence and Pigment, Soil Colour, Mineral Composition
3 Aqua	➤	Plant Pigments, Ocean Colour: Water Quality and Organic Content
4 Green	➤	Total Chlorophyll, Ocean Colour: Water Quality and Organic Content
5 Yellow	➤	Plant Pigments, Soil Contamination, Plant Growth and Stress
6 Red	➤	Plant Structure, Nitrogen, Moisture, Soil Colour
7 Red Edge 1	➤	Plant Stress, Fluorescence, Type
8 Red Edge 2	➤	
9 Red Edge 3	➤	
10 Near Infrared	➤	Organic Matter, Ocean Colour: Water Quality and Organic Content
11 Water Vapour	➤	Atmospheric Water Absorption, Crop Stress and Moisture
12 Water Vapour 2	➤	Atmospheric Water Vapour
13 SWIR 1	➤	Atmospheric Properties, Vegetated water content Cloud Properties
14 Cirrus	➤	
15 SWIR 2	➤	
16 Methane 1	➤	Methane characterization Methane characterization
17 Methane 2	➤	
18 Wildfire	➤	Radiative fire power, Wildfire detection and characterization
19 TIR 1	➤	Volcanos, Mineral composition, Surface temperature, Snow characterization, Soil and Vegetation Moisture, Urban Heat
20 TIR 2	➤	
21 TIR 3	➤	
22 TIR 4	➤	

EarthDaily Analytics ISR Analytics

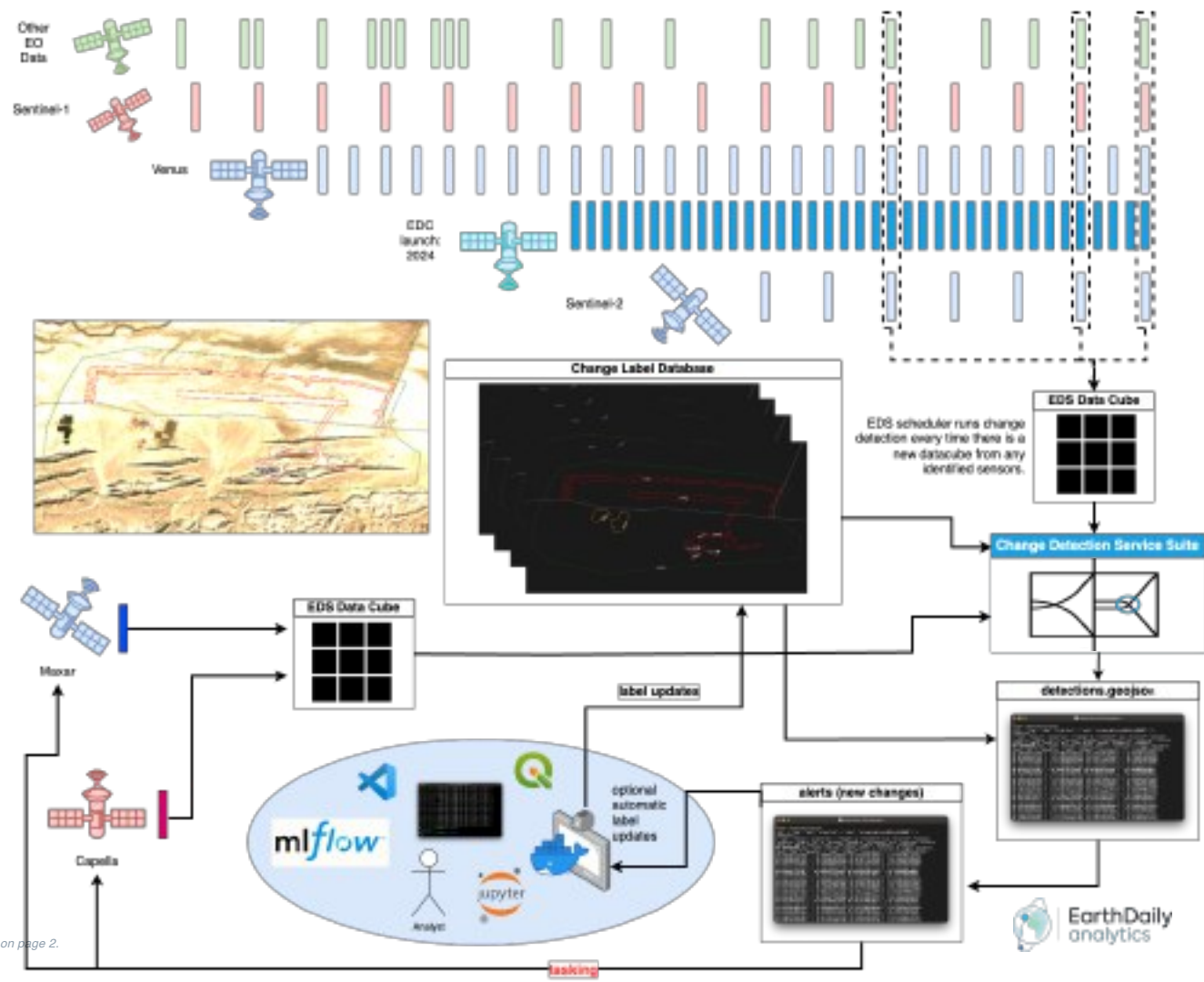


EDA's ISR Analytics Suite

Capability	Status	ML Models
Vessel Detection	Adaptable to custom training	Yolo v8
Landing Strip Detection	Adaptable to custom training	Yolo v8
Aircraft Change Detection	Adaptable to custom training	Custom CNN
Building Change Detection	Adaptable to custom training	CD-GAN
Human Fingerprint Change Detection	Adaptable to custom training	Custom Multipass XGBoost
Road Detection	Adaptable with custom training and simulation	Custom CNN / XGBoost
Vehicle Tracks in Field	Adaptable with custom training and simulation	Custom CNN / XGBoost
Vehicle Tracks in Snow	Adaptable with custom training and simulation	Custom CNN

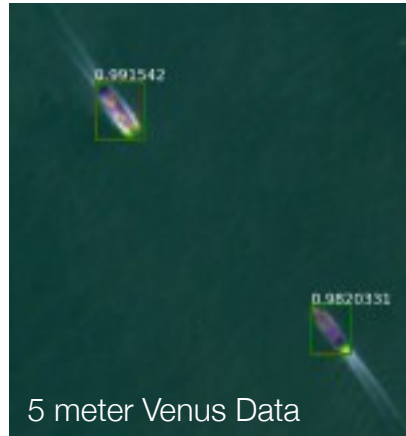
Earth Data Store Change Detection Service

- EDS processes **open and commercial satellite data from raw** to ensure quality and normalization, and post-processing on open data for normalization
- Automated analysis with identified sensors
- Automatic Tasking of high-resolution assets



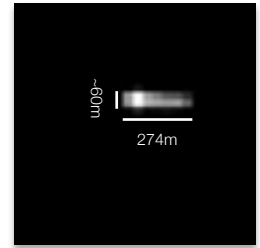
Automated Vessel Detection

- Open data for maritime surveillance today
- In 2024, EDC's Maritime Mode will be available for detecting offshore ships supporting
 - Broad maritime area coverage
 - Ongoing change and awareness



5 meter Venus Data

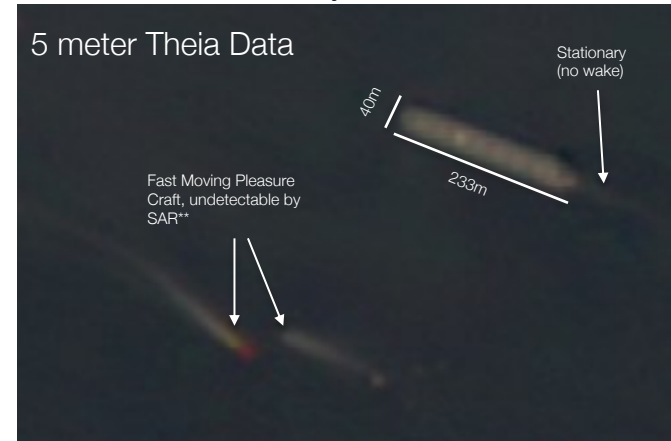
Synthetic
Aperture Radar
sees this* →



275m Tanker

With EarthDaily ↓

5 meter Theia Data



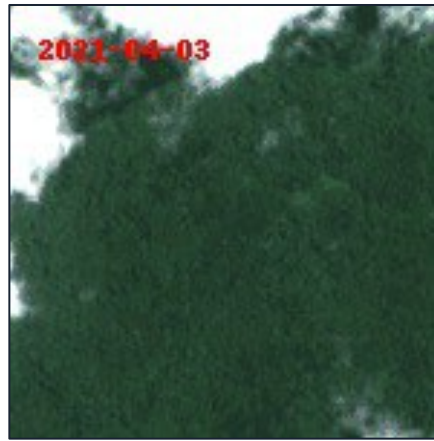
* RADARSAT - Ocean Surveillance ScanSAR Narrow

** Fiberglass material is minimally responsive to SAR

Landing Strip Detection

- Airstrips detections in rainforest and dry environments
- Airstrip detection over rainforests enabled with EDA's **EarthMosaics** product
- Detection across Biome regions, optimized for the landscape.

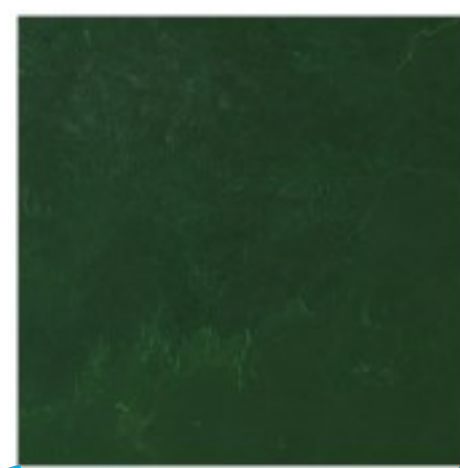
Automated Desert Airstrip Detection



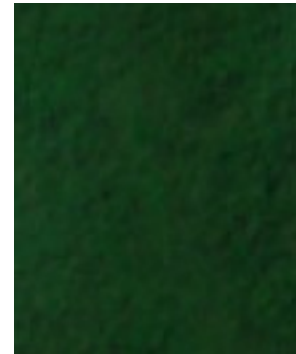
Available Data too cloudy



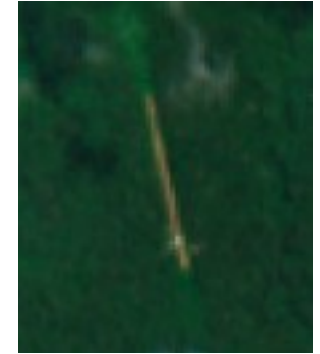
- Best available Pixel,
- Cloud-free,
- Seasonal Mosaics



EarthMosaics



2019

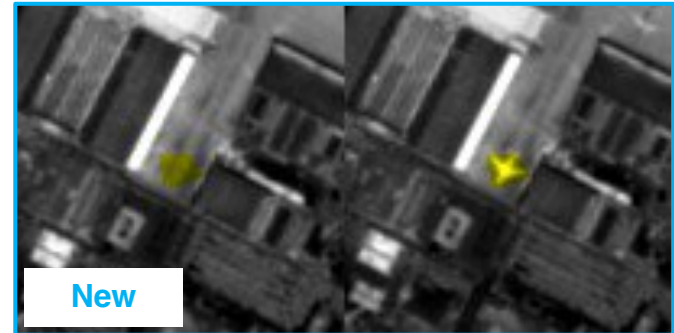
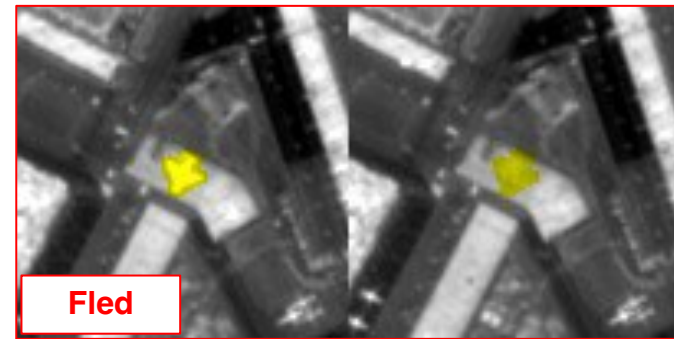


2022

Automated Rainforest Airstrip Detection

Aircraft Detection and Change

- Ongoing monitoring and detection of aircraft over Airfields
- Aircraft detection on focused sites of strategic interest with classification of status.
 - Red Fled
 - Blue New
 - Purple Stayed



Automated Building Change Detection

- Time Series detection of new Building Construction
 - Tested on 5m Venus data

*New
Building
Footprint
Detection*



Predicted
Change
(Modern
ML -
Resilient
to false
positives)



Truth

Predicted
Building
Change
(Classical
ML)

Due to medium resolution, it does not capture perfect building shape

Automated Human Fingerprint Change Detection

- High Priority Areas for active monitoring and change.
- Monitoring known military sites for expansion and changes
- Includes building or land changes

Parchin Military Complex, Iran



Sentinel-2, 2017, 10m



Sentinel-2, 2023, 10m



Military Facilities – Building and Human Fingerprint Detection

- Ongoing (and Retrospective Capacity) looks over vast remote landscape for new and intermittent development
- Monitoring for changes with large coverage satellites (e.g., Sentinel-2 today and EarthDaily in 2024)



Building a new Facility - Summer 2021, Sentinel-2



Automated Change Detection – June 2021, Sentinel-2

Tearing Down the Site - Spring 2022 Sentinel-2

Time Series detections of vehicle Trails and Paths

Field campaign captured multispectral signatures of vehicle tracks in **grass** and **snow**

- Will apply these spectral signatures to generate simulated data and train ML



Tipping and Cueing

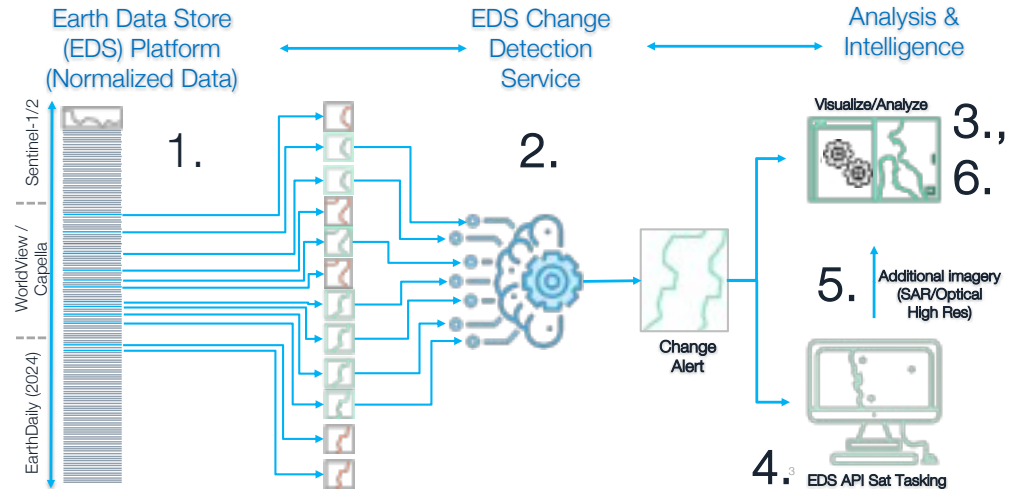


Finding the Needle in the Haystack (Tipping and Cueing)

Land and Maritime Ongoing
Periphery awareness and
change detection

Steps

1. Broad EDC Monitoring
2. Change Detection Service
3. Visualization / Validation
4. Automated Tasking
5. Automated Downloading
6. Visualization / Validation



Supports WorldView and Capella Today

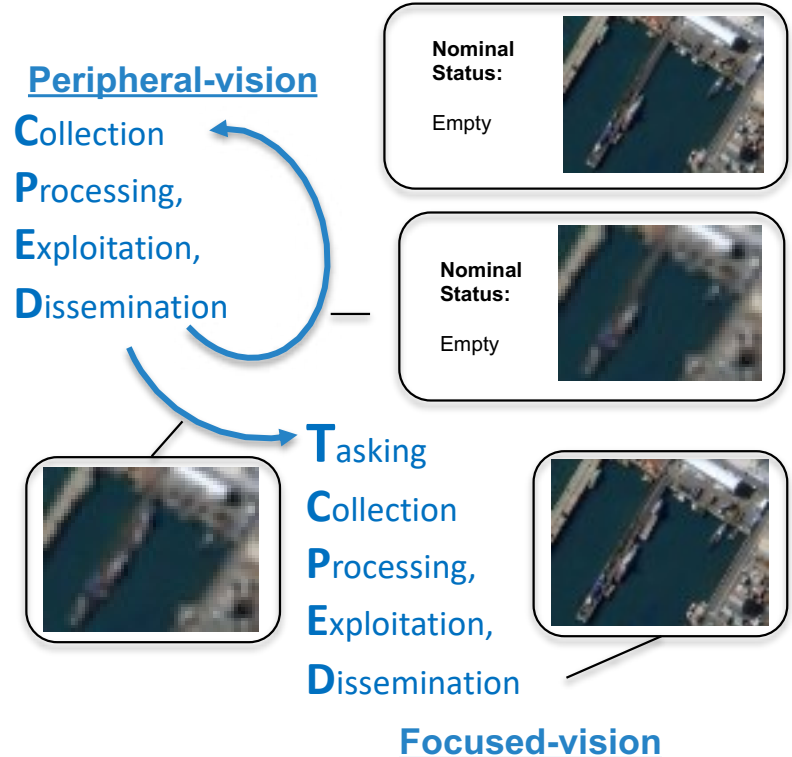
Tipping and Cuing

EarthDaily Constellation is ideal role for peripheral vision

Intelligence, Surveillance, and Recognizance (ISR) is evolving past traditional **'focused-vision'** and **'peripheral-vision'** requirements.

Use Peripheral vision to establish a baseline and detect change.

Task high high-resolution assets as needed on sites of notable interest for further recognition.



Tipping & Cueing Full Integration Field Test

1. Baseline area monitored at 10 m GSD multi-spectral imagery

2. Algorithm detects new human based changes (i.e., tarp laid on the ground for test purposes)



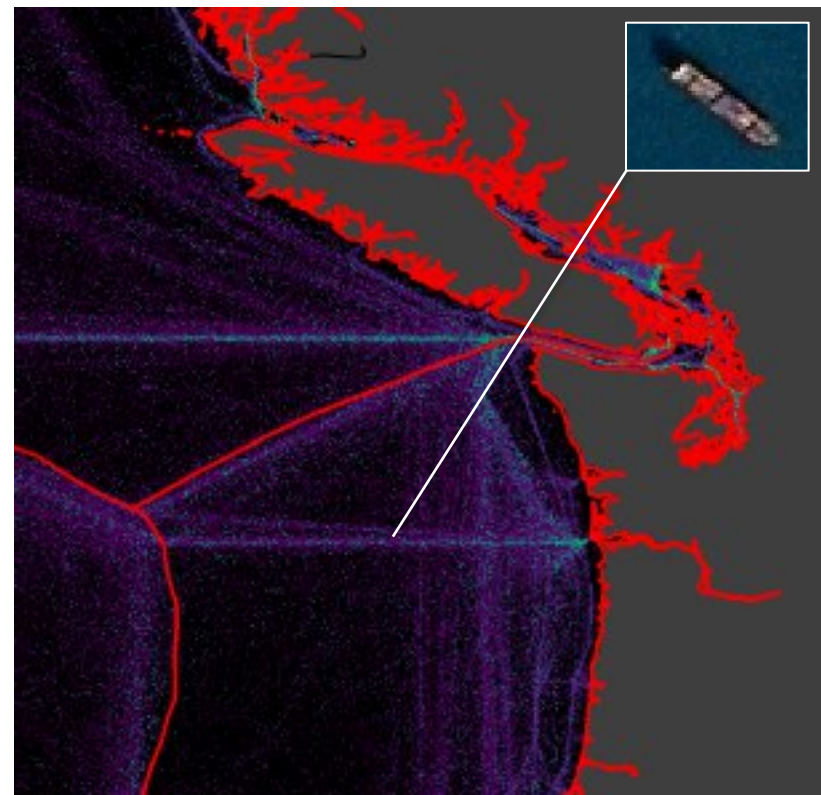
3. Automated tasking of high-res asset through tasking API

4. High resolution image acquisition and rapid access. Example shown is Worldview-3 30cm (Also integrated Capella X-Band SAR tasking API)

EarthDaily Constellation empowers:

Marine Domain Awareness

- Commercial optical satellite imagery for maritime surveillance
- EDC's Maritime Mode is optimized for detecting offshore ships
 - Broad maritime area coverage
 - Latency Priority
 - Ongoing change and awareness



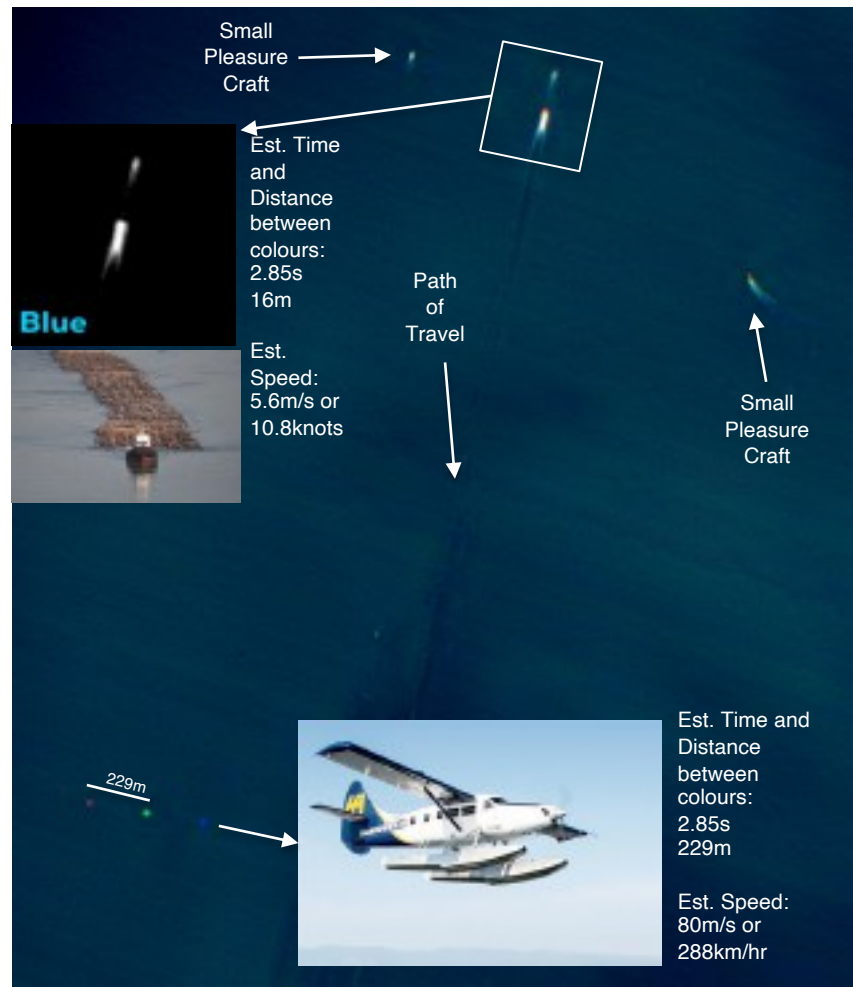
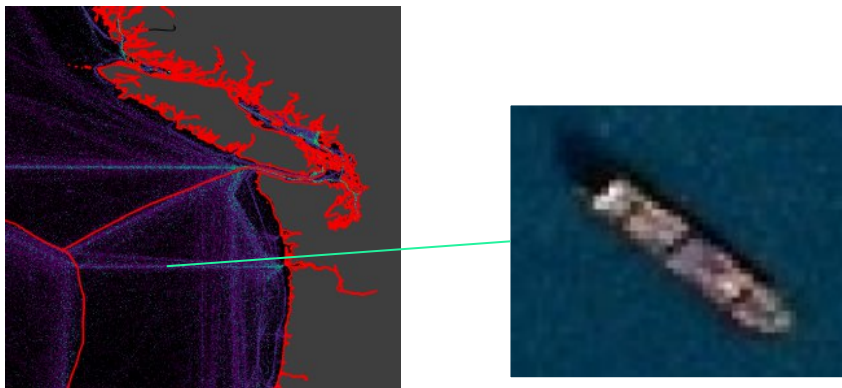
Illustrative Maritime Zone Monitoring Area

EarthDaily Constellation empowers: Marine Domain Awareness

Commercial optical satellite imagery for maritime daily intelligence in:

- Ship locations
- Activity characterization
- Ship spectral signatures

Example Maritime Zone Monitoring Area



Theia (EarthDaily Analytics) RGB at 5m



EarthDaily
analytics



Thank You