HawkEye 360

HAWKEYE 360: RF FOR ARCTIC DOMAIN AWARENESS

RICHARD HOLMQUIST, AMERICAS SALES EXECUTIVE

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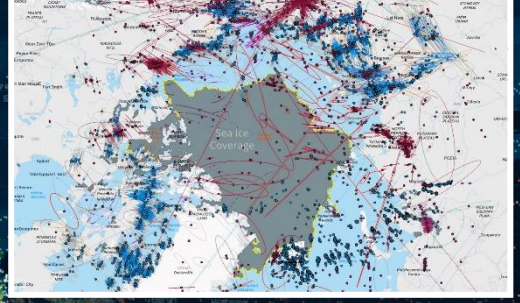


REGIONAL PATTERN ANALYSIS

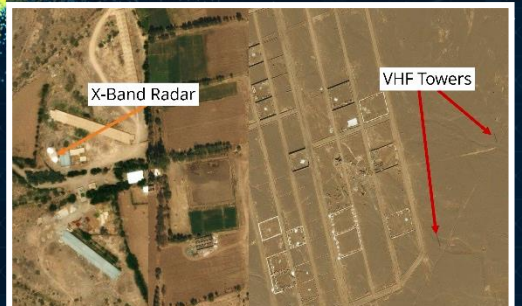
MARITIME DOMAIN AWARENESS

GLOBAL SIGNAL COVERAGE FOR CRITICAL GLOBAL INSIGHTS

- **L-band Mobile Satellite Devices**
- **UHF GMRS/FRS Push-to-Talk Radios**
- **X-band Marine Navigation Radars**
- **VHF Marine Radios**
- **S-band Marine Navigation Radars**
- **Independently Geolocated AIS**

PATTERN OF LIFE MAPPING

TACTICAL MAPPING



ANOMALOUS RF ACTIVITY ID

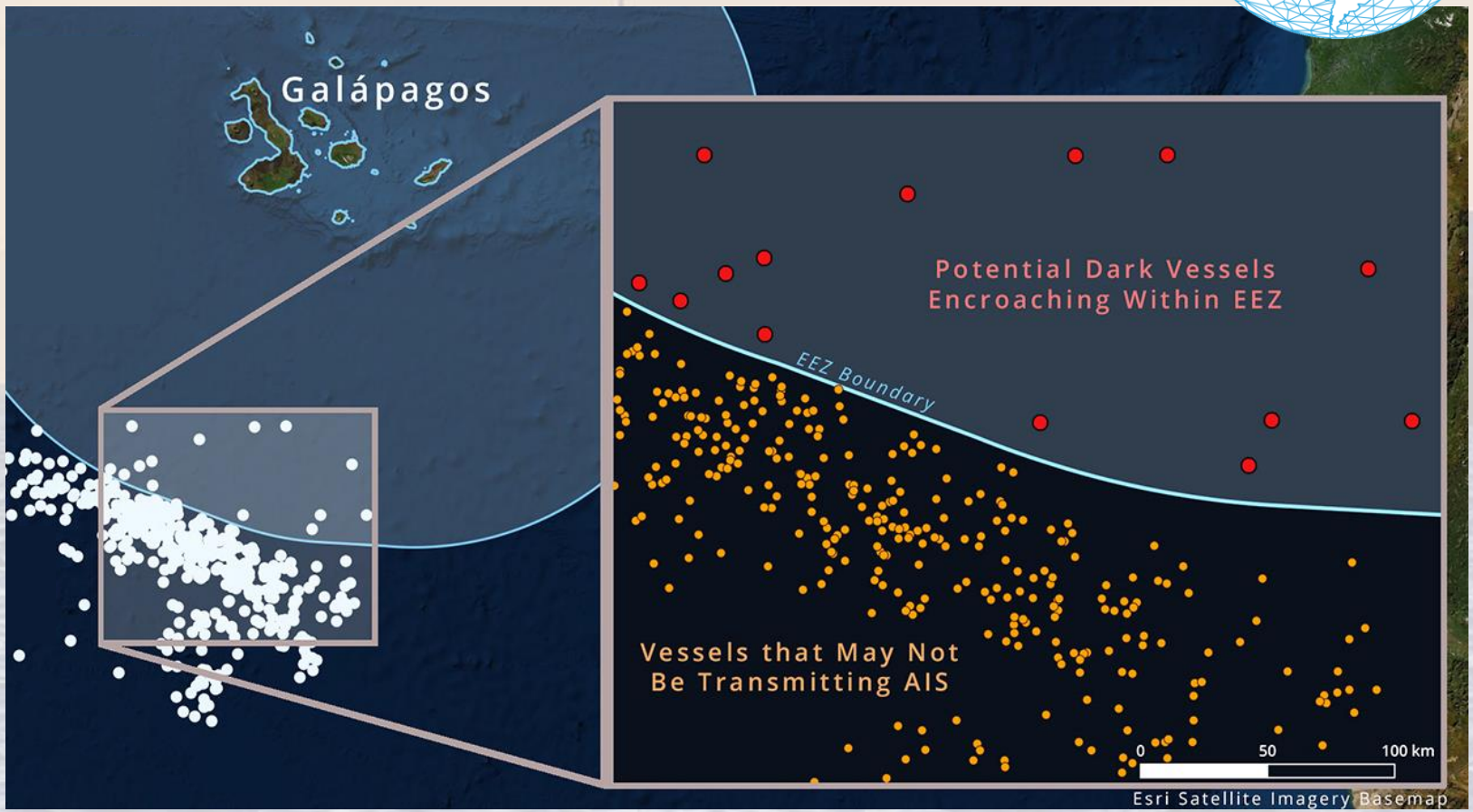
Maps created using Esri base-maps and ArcGIS® software

CHINESE FISHING FLEET ENCROACHES ON THE GALAPAGOS ISLANDS

GOING BEYOND AIS TO REVEAL VESSEL ACTIVITY

- Hundreds of Chinese fishing vessels
- Encroaching on the sensitive Galapagos
- Ships turn off AIS to remain hidden
- Other RF signals evidence of dark vessels in EEZ

Identifying suspicious vessel behavior



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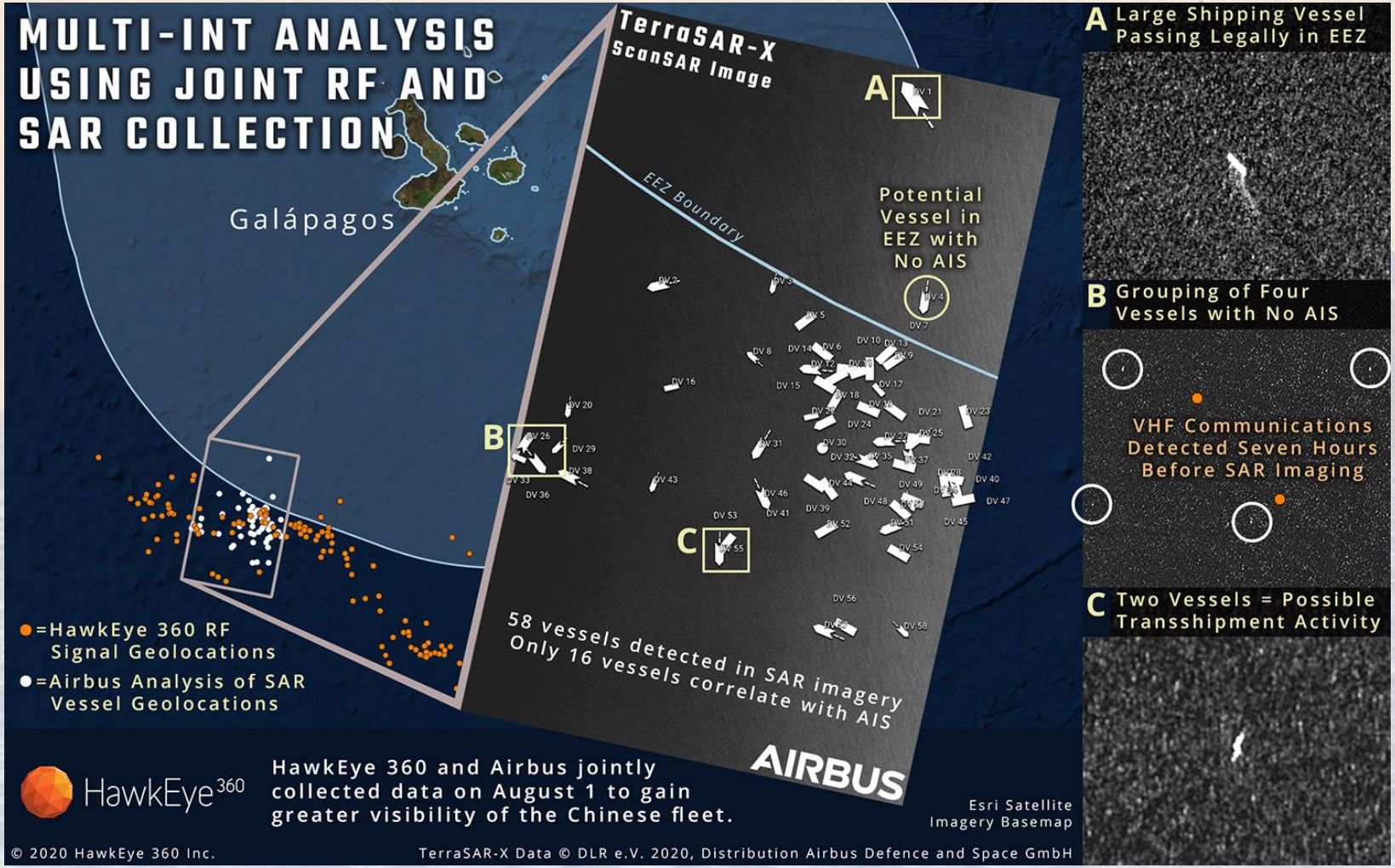
COMBINING RF WITH SAR TO IMPROVE UNDERSTANDING

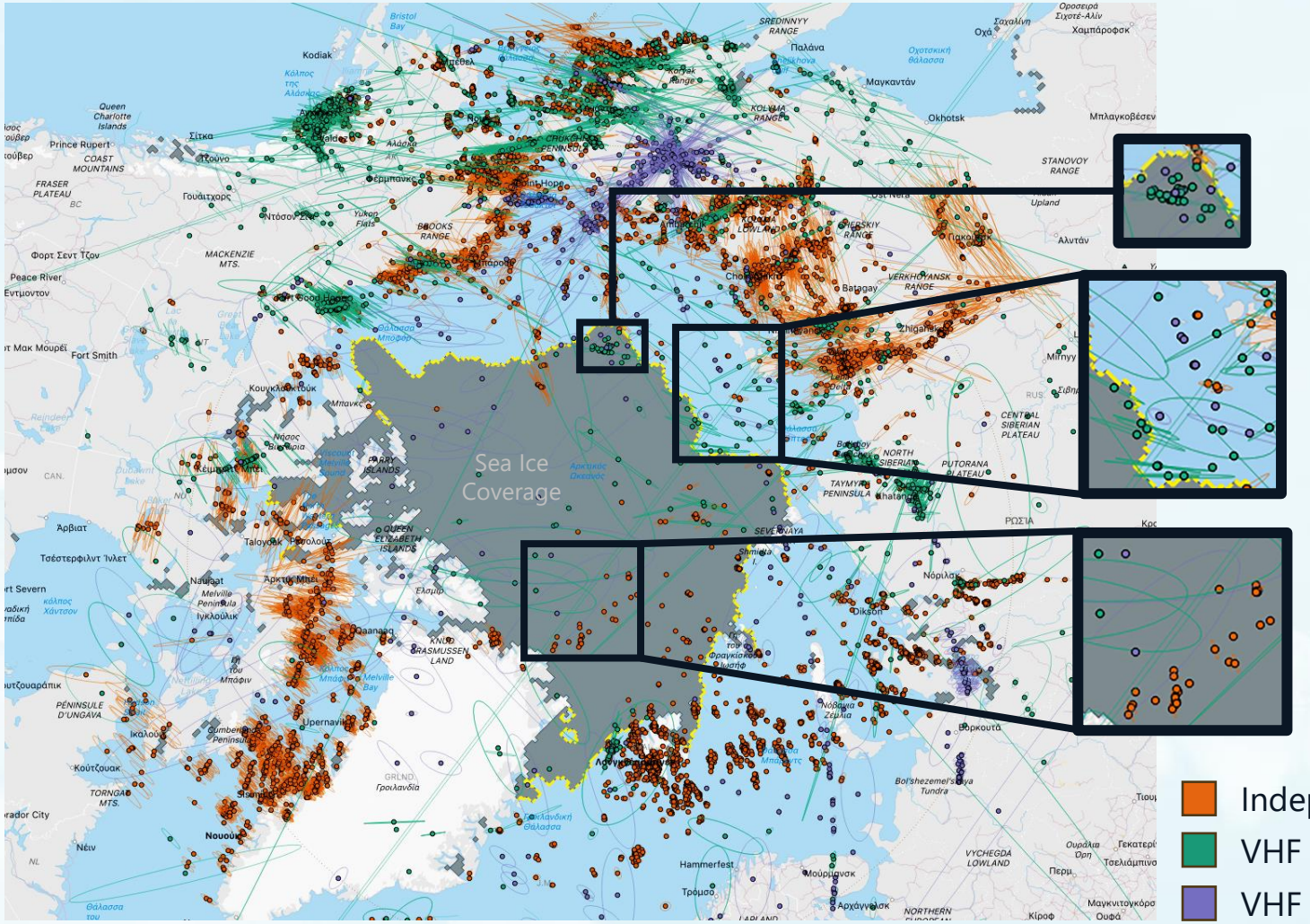
- Tasked partner Airbus SAR to capture image
- Many vessels don't appear on AIS, one in EEZ
- Discovered VHF comms between dark vessels
- Found example of transshipment activity

Rich analysis through Multi-INT approach



EXPOSING ENCROACHMENT THROUGH ARCTIC RF PATTERNS

INTENSE ARCTIC ACTIVITY



- Summer data over the Arctic reveals busy season
- Approaching minimum sea ice extent for year
- Data captures interesting maritime activity:
  - Concentrations of VHF comms
  - Vessel routes not visible in AIS
  - Movement across the sea ice

Independent AIS Geolocations
VHF Channel 16 Geolocations
VHF Channel 70 Geolocations

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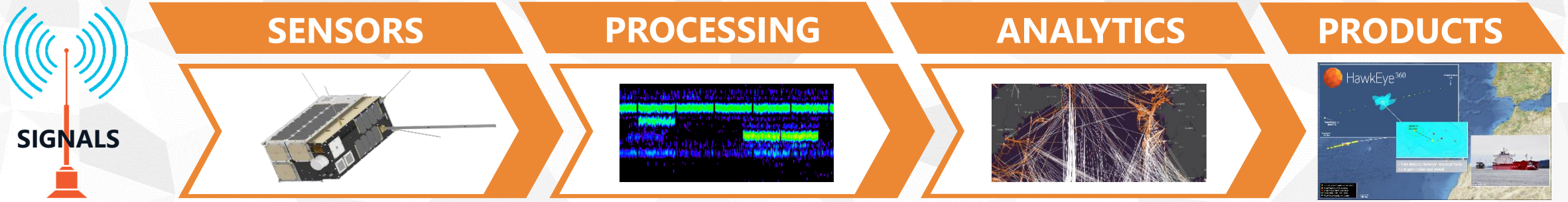
REMOTE RUSSIAN OUTPOST

- VHF signal pattern seen on Arctic island
- Contains documented Russian outpost
- Tipped BlackSky to capture this image
- Understanding these patterns can lead to identifying new facilities

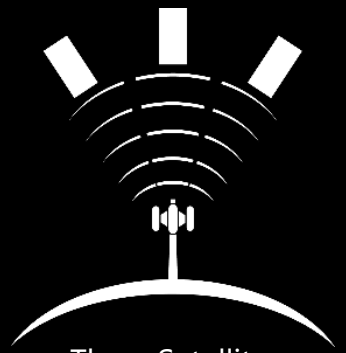
COMPANY OVERVIEW

- Provider of global RF data and analytics
- Proven end-to-end operational capability
- 1st cluster operational since Feb 2019
- 2nd cluster launched Jan 2020; IOC 26 March
- Baseline constellation on-orbit in 2022
- Average revisit rate at 40°N Latitude:
  - CY2021 - 75 minutes
  - CY2022 - 45 minutes
- $137M raised (private equity/venture debt)

24+ Million Emitter Geolocations Since Feb 2019

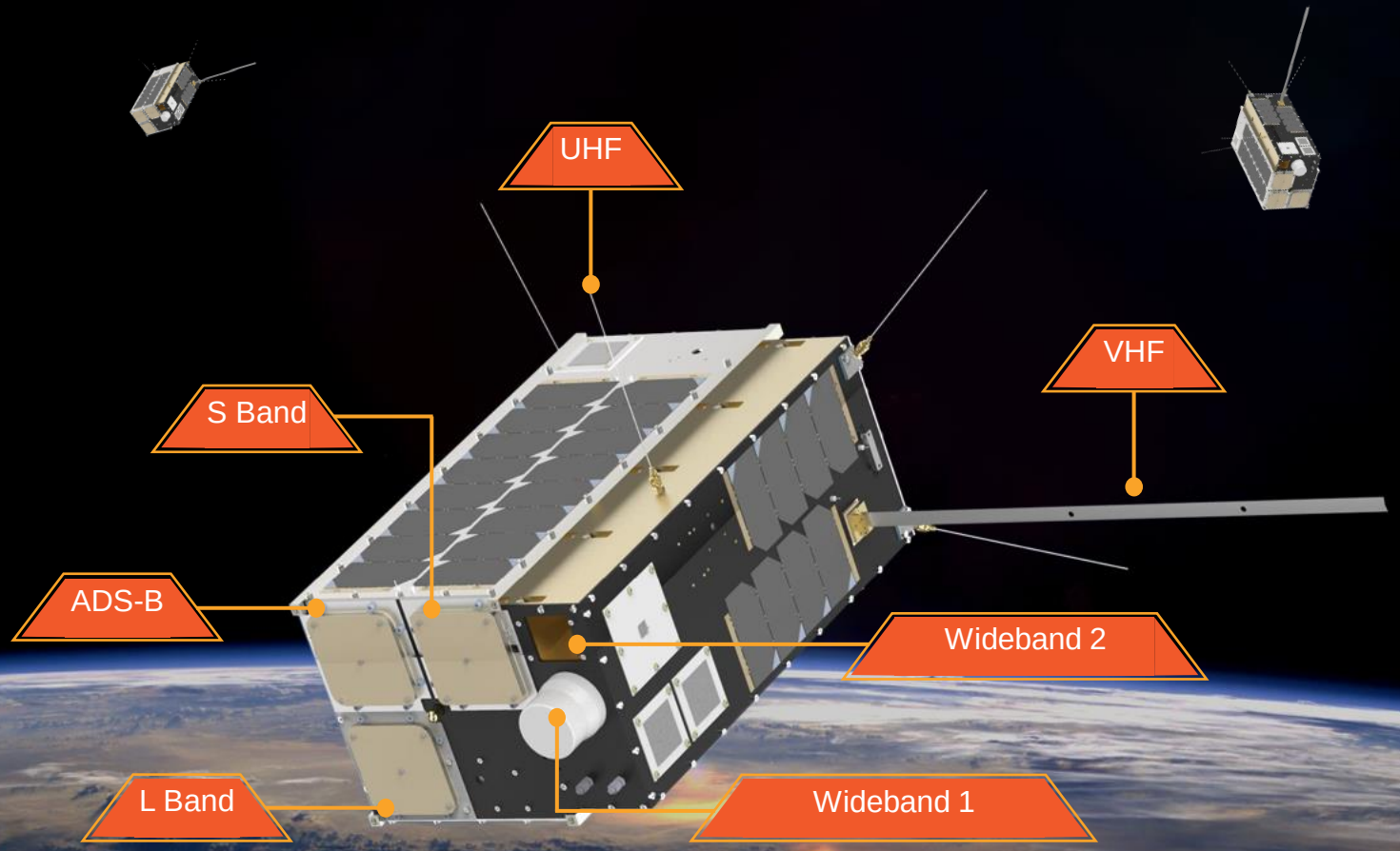


CLUSTER 1 SPECIFICATIONS



Three Satellites
Formation Flying
250 km Spread

144 MHz to 15 GHz
Frequency Range



Polar Orbit
575 km

Dimensions
27 x 20 x 40 cm
Mass 15 kg

Satellite Cluster Launched December 3, 2018

CLUSTER 2 SUCCESSFULLY LAUNCHED

Advanced Commercial RF Sensing Satellites

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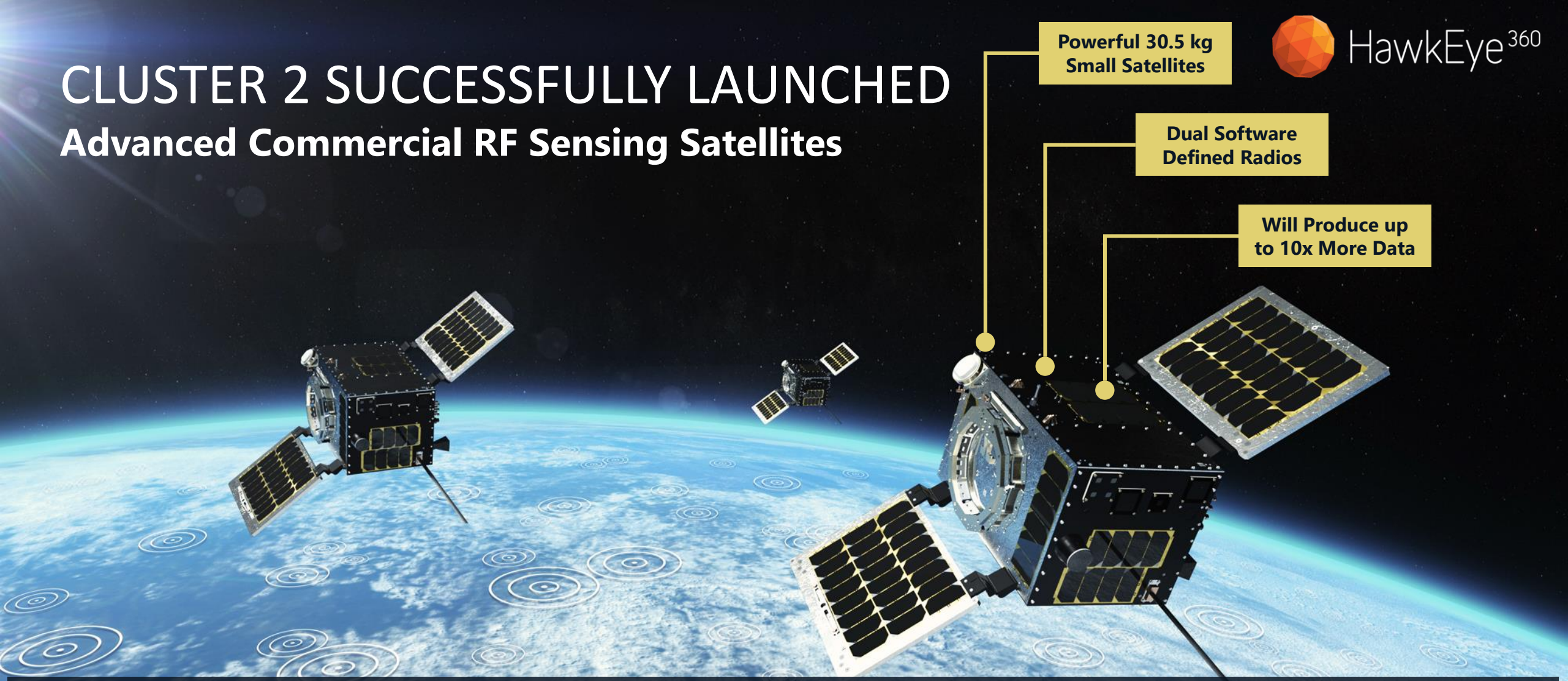
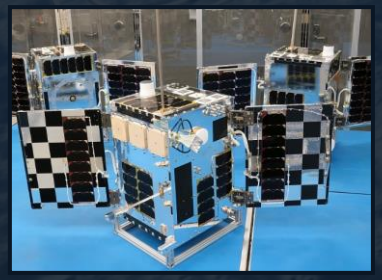
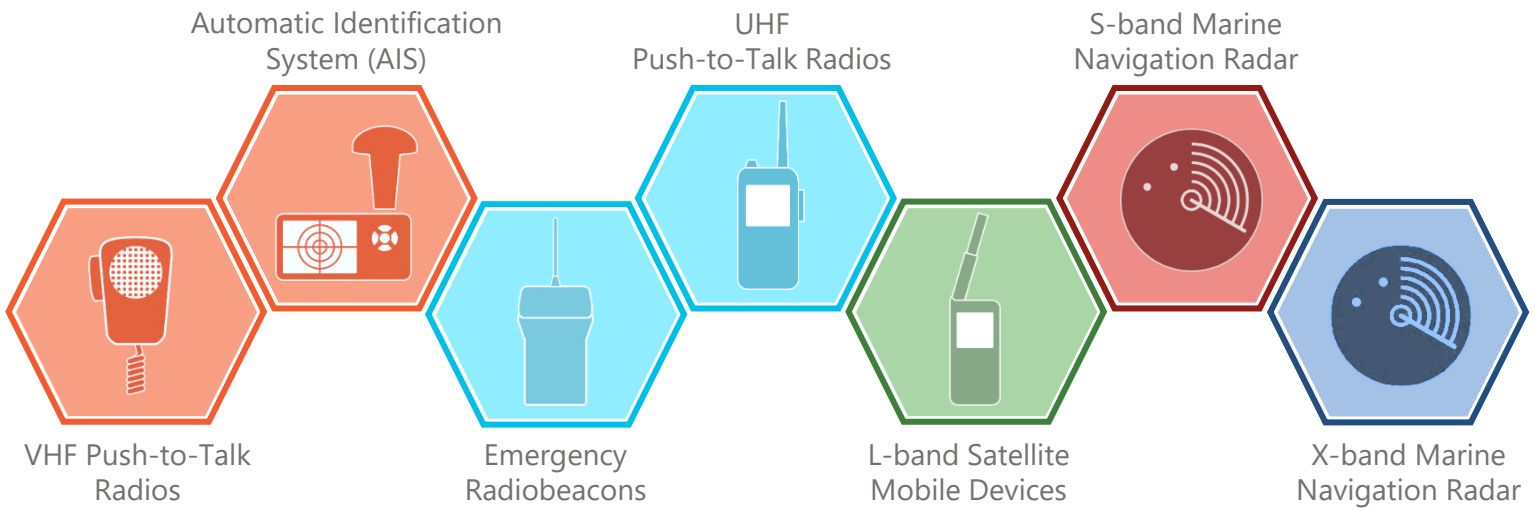
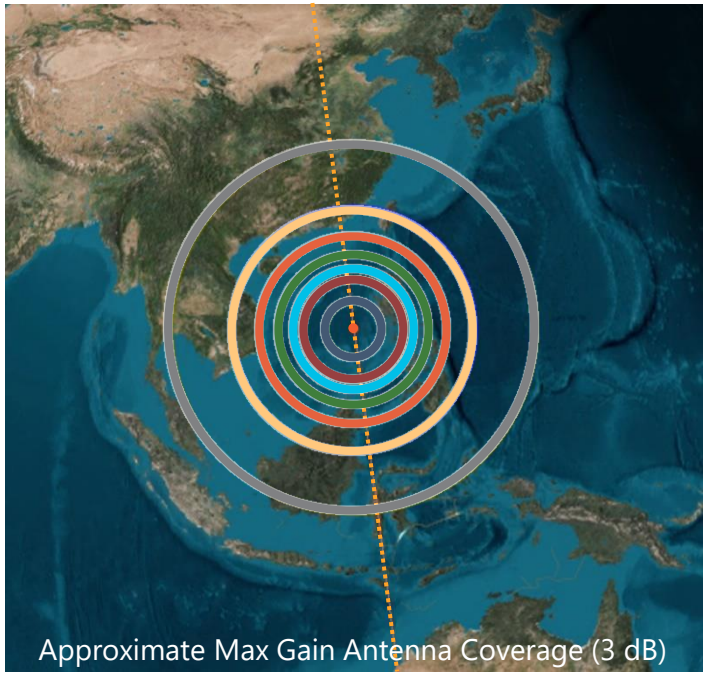




- US Headquartered Innovation in Herndon, Virginia
- Deploying Privately Funded Constellation (21 satellites)
- Supporting Defense and Security Users with RF GEOINT
- Cluster 1 Satellites have Produced 25+ Million Points

SIGNAL COVERAGE





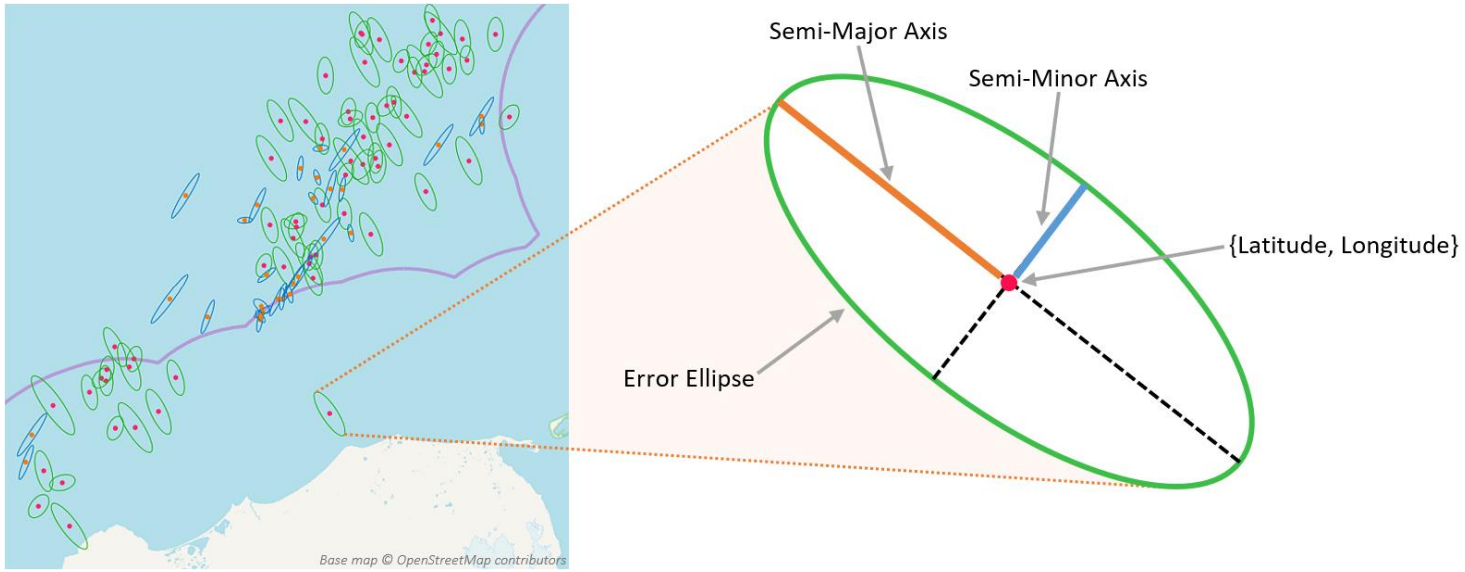
Satellites cover most of the frequency range from 144 MHz to 15 GHz

GEOLOCATION DATA

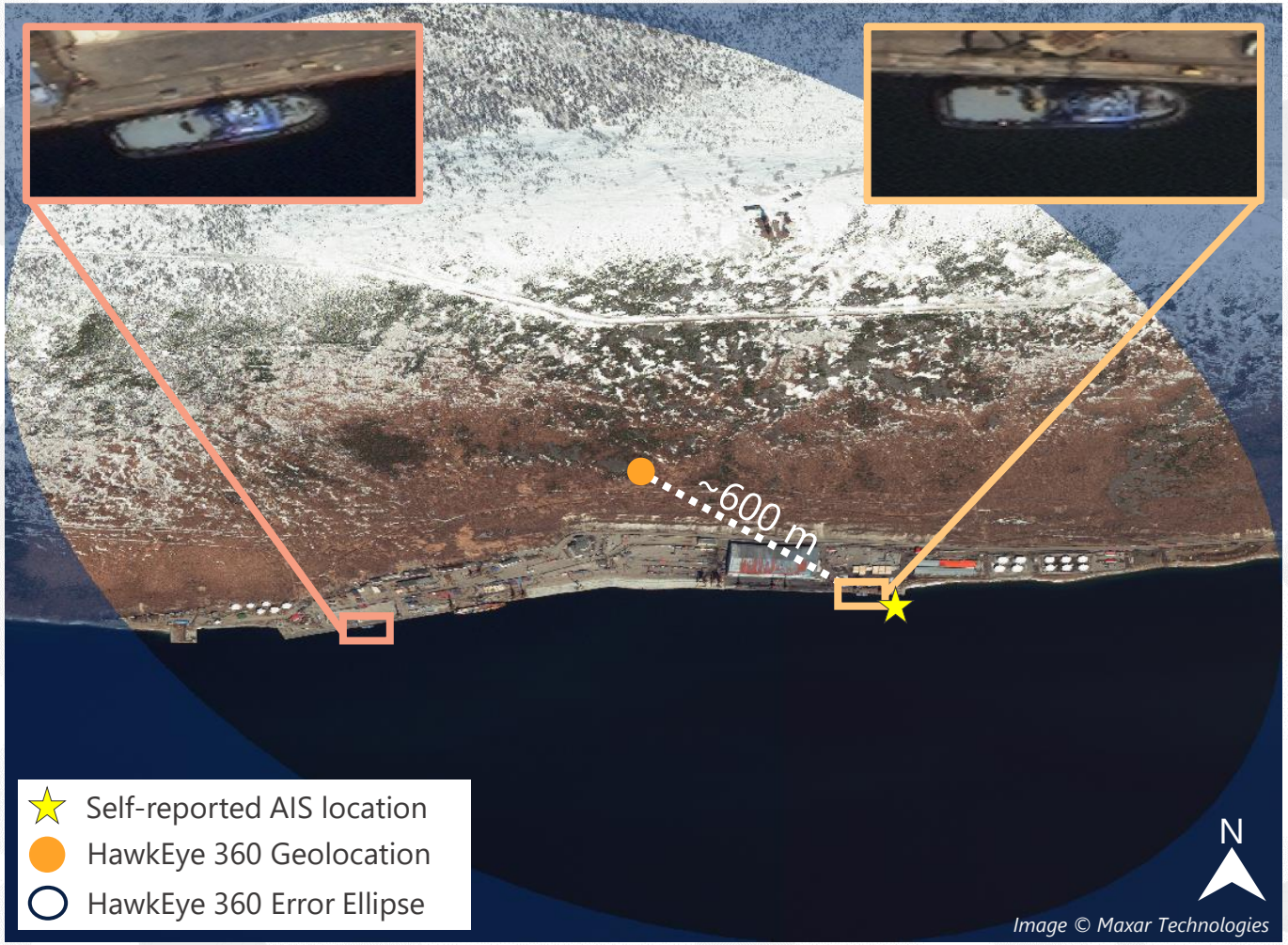
RFGeo™

Each signal data point includes coordinates, error ellipse, and attributes

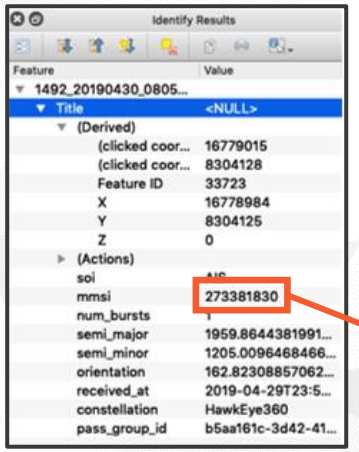
- Location accuracy varies based on:
  - Type of signal
    - Power
    - Antenna type
    - Directionality of signal
  - Signal to Noise Ratio
  - Geometry of measurement
- Ellipse is designed to contain the emitter with 95% probability
- Data delivered as a GeoJSON file for use in common GIS tools



HAWKEYE 360 / MAXAR COOPERATIVE COLLECTION



- HawkEye 360 geolocated vessel signal
- Maxar identified matching satellite image for same day and hour
- MMSI was vessel Aleksandr Solzhenitsyn



MAXAR

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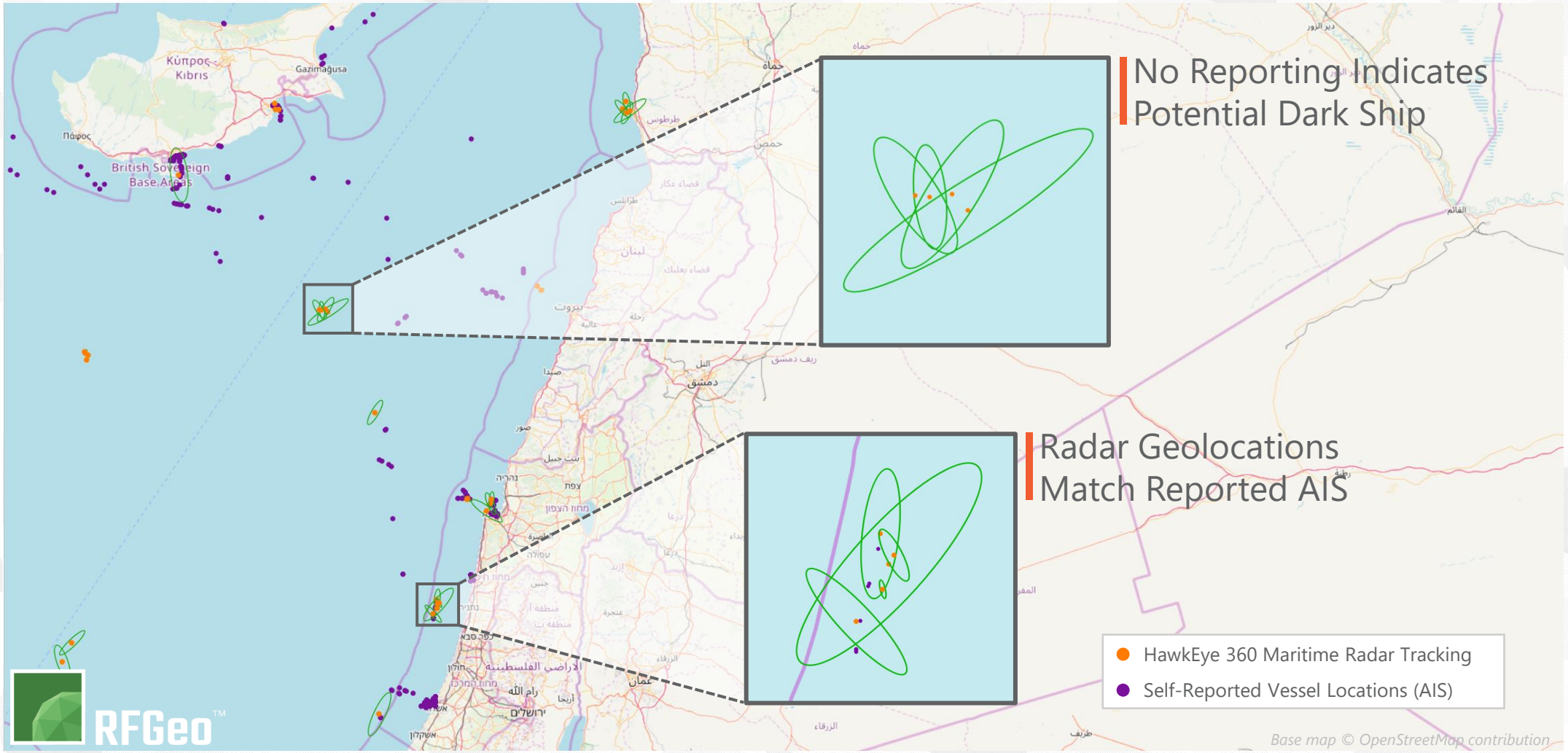
MARITIME RADAR GEOLOCATION



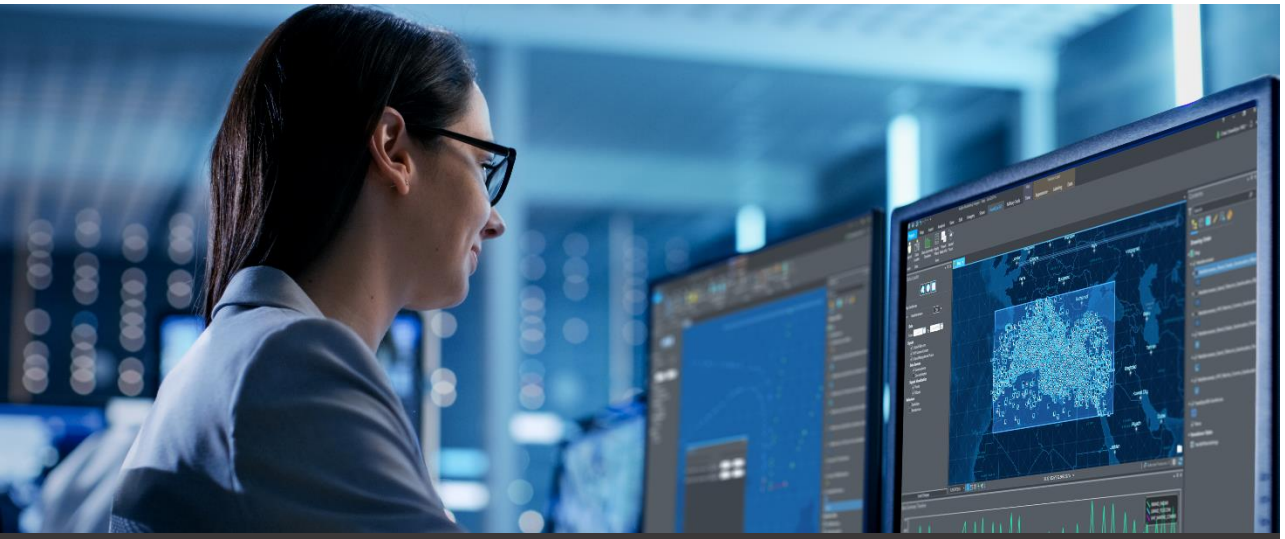
INTRODUCING MISSION SPACE

The First Commercial RF Analysis Platform

- Purpose-built to bridge the interpretation gap between the collection and analysis of radio frequency data.
- Aggregates HawkEye 360's portfolio of RF signal data and analytics into an intuitive web-based application
- Translates complex RF data sets into insights that facilitate the understanding of the meaning behind RF emissions.

MISSION SPACE™

ARCGIS PRO ADD-IN



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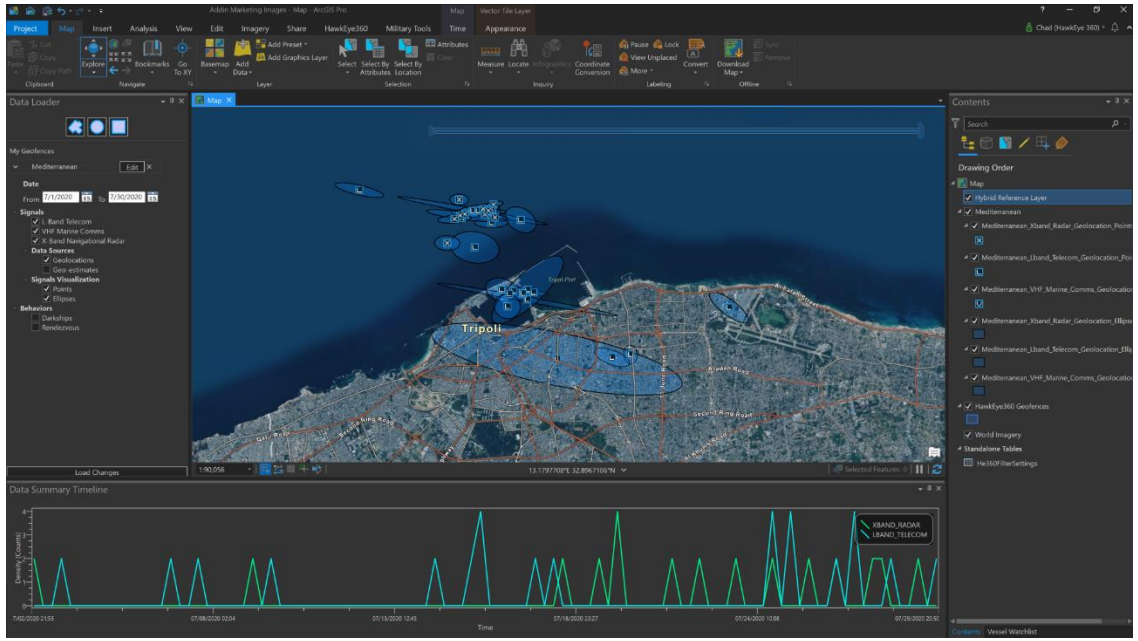
RF Data Explorer

Streamline RF Analysis for Esri ArcGIS Projects



- Aggregation of HawkEye 360's RF data and analytics leads to increased insights
- Enhanced visualization and workflow streamlines interpretation of RF data
- More easily integrate RF insights into multi-INT analysis

THANK YOU

If you would like to learn more, please contact us:

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