

Adaptive Sensor Fleet (ASF)

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Adaptive Sensor Fleet (ASF)

Supervisory control system that is designed to use a collection of heterogeneous robotic platforms to optimally perform observations of dynamic environments driven by high-level goals.

Objectives / Benefits:

Enable instruments to rapidly respond to dynamic science events through science goal driven autonomy.

Automatically optimize target selection and instrument operation based on near real-time science data analysis and predictive modeling.

Demonstrate multi-platform autonomous collaboration, driven by scientific goals to obtain measurements not currently possible.

The concepts addressed in the design of the ASF lay the foundation for a dynamic “Sensor Web” using stationary, surface moving (water or land), airborne, and spacecraft instruments to generate a dynamic network of sensors to achieve the defined science goals.



Scientific Value / Need

What benefit does ASF provide?

- Observations through high-level goals
- Supervisory fleet management of robotic platforms (coordination)
- Analysis of environmental science data to use in decision making process (collaboration)
 - Optimal path planning and replanning
 - Identification of science phenomena
 - Adaptation to dynamic environments



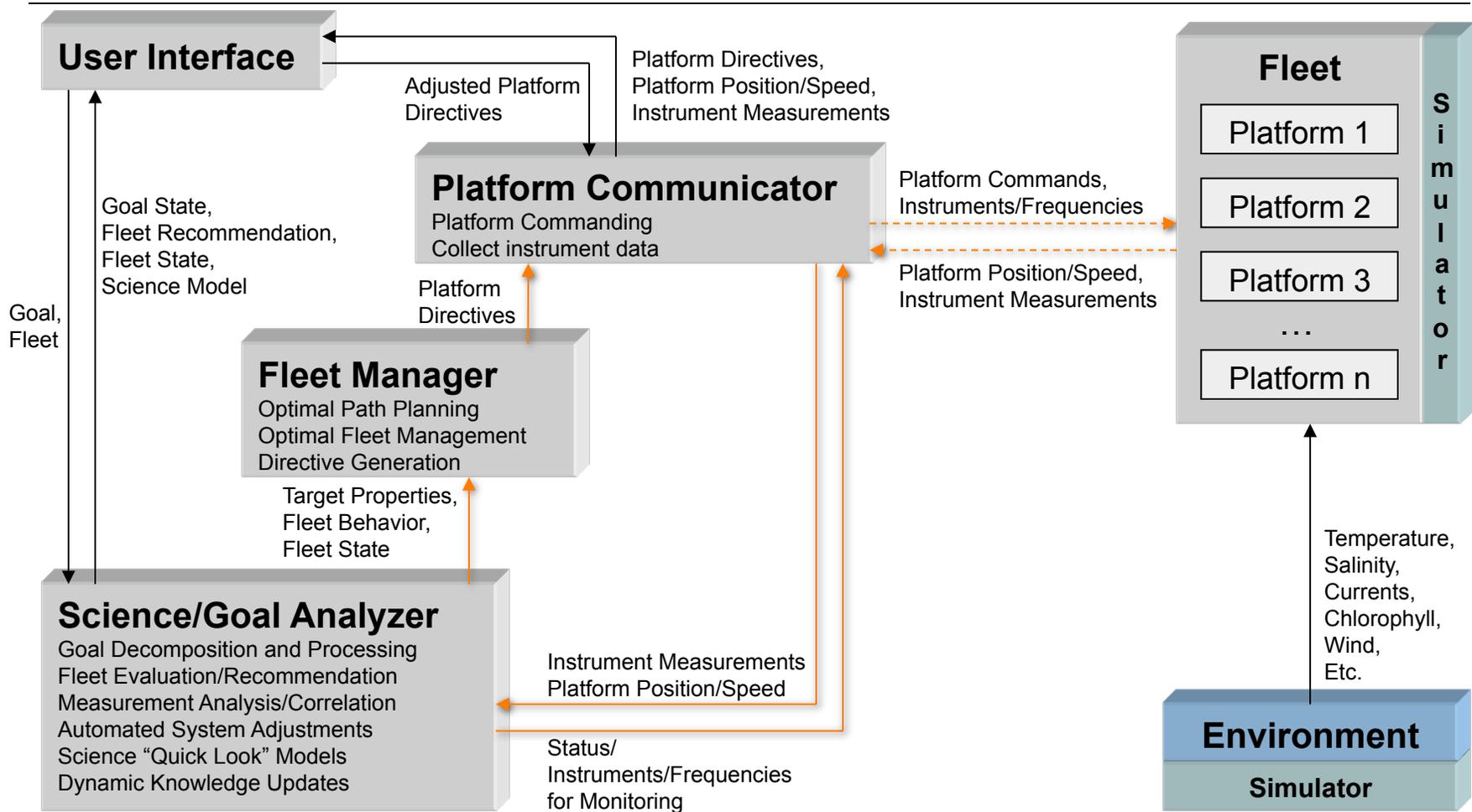
Scientific Value / Need

How does ASF fit into NASA's goals?

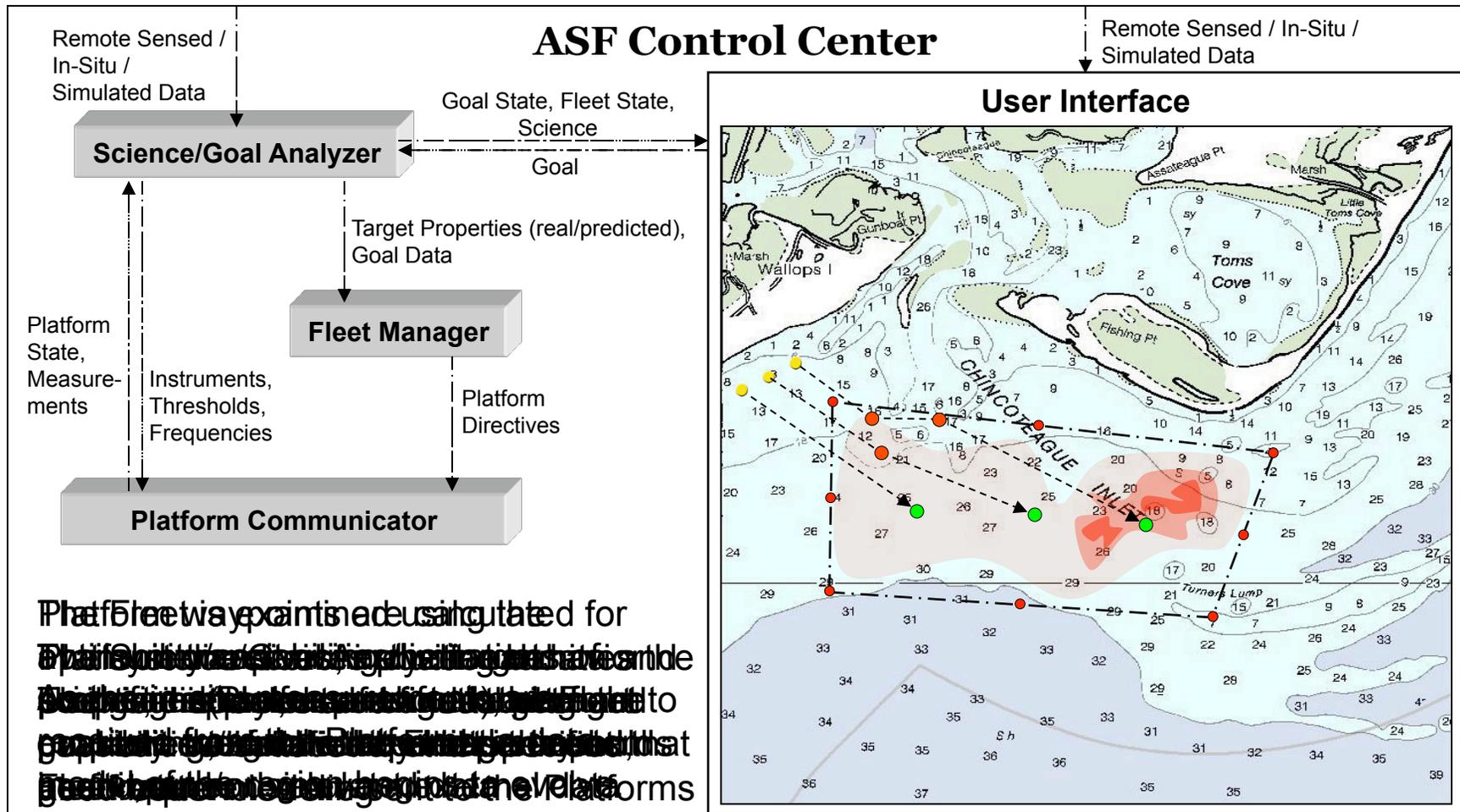
- Addresses “**sensor web**” concepts by utilizing existing and future platforms and sensors to perform:
 - Collective automated science collection (group behavior), and
 - Automated analysis of dynamic or unknown environments
- Optimization of resources
- Optimization of platform and sensor abilities
- Applying these concepts to real-world domains



Functional Architecture



Operational Concept

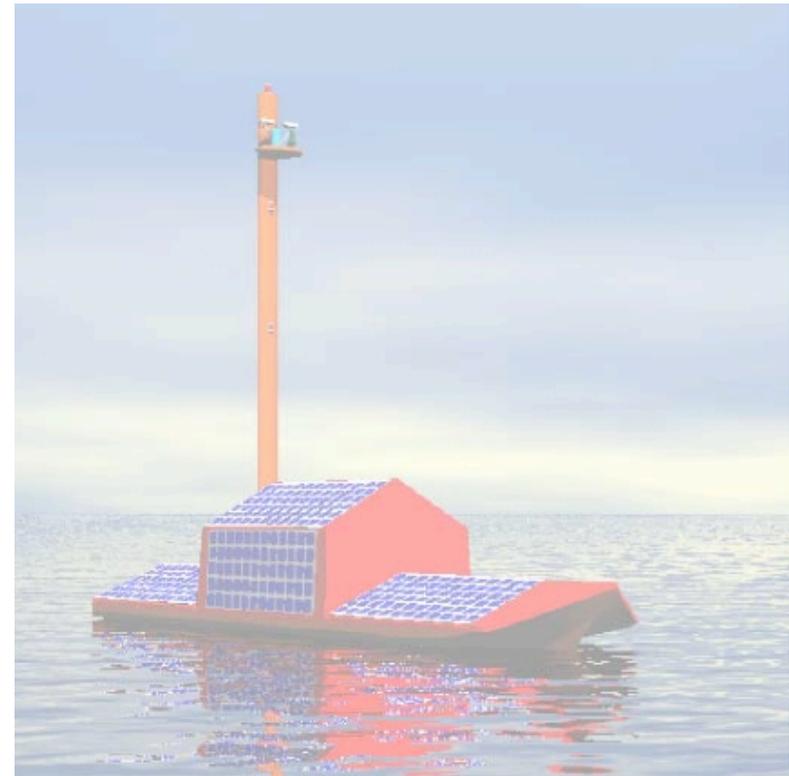


The flight way points are simulated for
 Platform State, Measurements
 Instruments, Thresholds, Frequencies
 Platform Directives

Application

Ocean Atmosphere Sensor Integration System (OASIS)

- The OASIS objective is to provide low-cost (\$50K each) mobile, self-navigating surface platforms for ocean sensors, as an alternative to buoys. Benefits of OASIS focus on the ability to navigate to make measurements, and then return home to recalibrate, and reuse instruments which may otherwise be discarded. This will generate significant cost savings for NASA especially in the area of data Calibration / Validation of remote sensing satellite measurements.
- OASIS provides a perfect low-cost domain to demonstrate the capabilities of ASF.
 - Remote commanding
 - Semi-autonomous
 - Science Collection
 - Heterogeneous
- Water test demonstration OASIS craft under ASF control planned for FY05.



Application

CMU Personal Exploration Rover (PER)

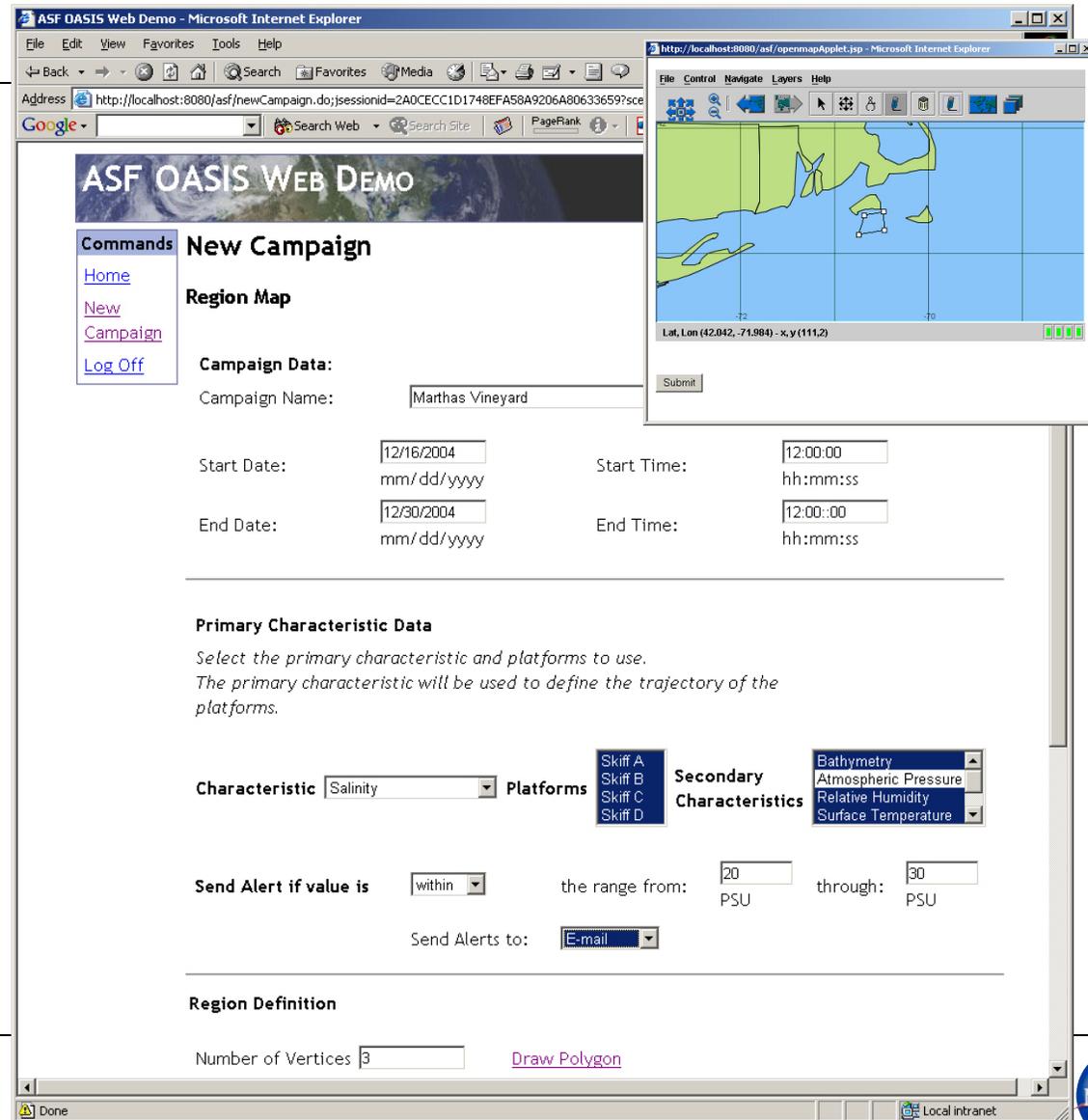
- The PER (\$5K each) was developed by Carnegie Mellon for educational purposes. It has a 360 degree camera, an infrared range finder and a ultra-violet light. Basic on-board software allows it to locate rocks via commands received through a wireless network interface.
- PER provides a low-cost domain to demonstrate ASF flexibility by applying concepts to alternate domains.
- Test demonstration planned for FY05.



ASF Goal Definition

Goal definition:

- User specifies when the campaign will start and end
- User specifies the characteristics of the goal to be measured, along with the platforms to use for the observation
- User selects the region of interest to be modeled by specifying coordinates, or selecting a region on a world map.
- User submits the goal



ASF OASIS WEB DEMO

Commands: [Home](#), [New Campaign](#), [Log Off](#)

New Campaign

Region Map

Lat, Lon (42.042, -71.984) - x,y (111.2)

Campaign Name:

Start Date: mm/dd/yyyy

End Date: mm/dd/yyyy

Start Time: hh:mm:ss

End Time: hh:mm:ss

Primary Characteristic Data

Select the primary characteristic and platforms to use.
The primary characteristic will be used to define the trajectory of the platforms.

Characteristic:

Platforms:

Secondary Characteristics:

Send Alert if value is the range from: PSU through: PSU

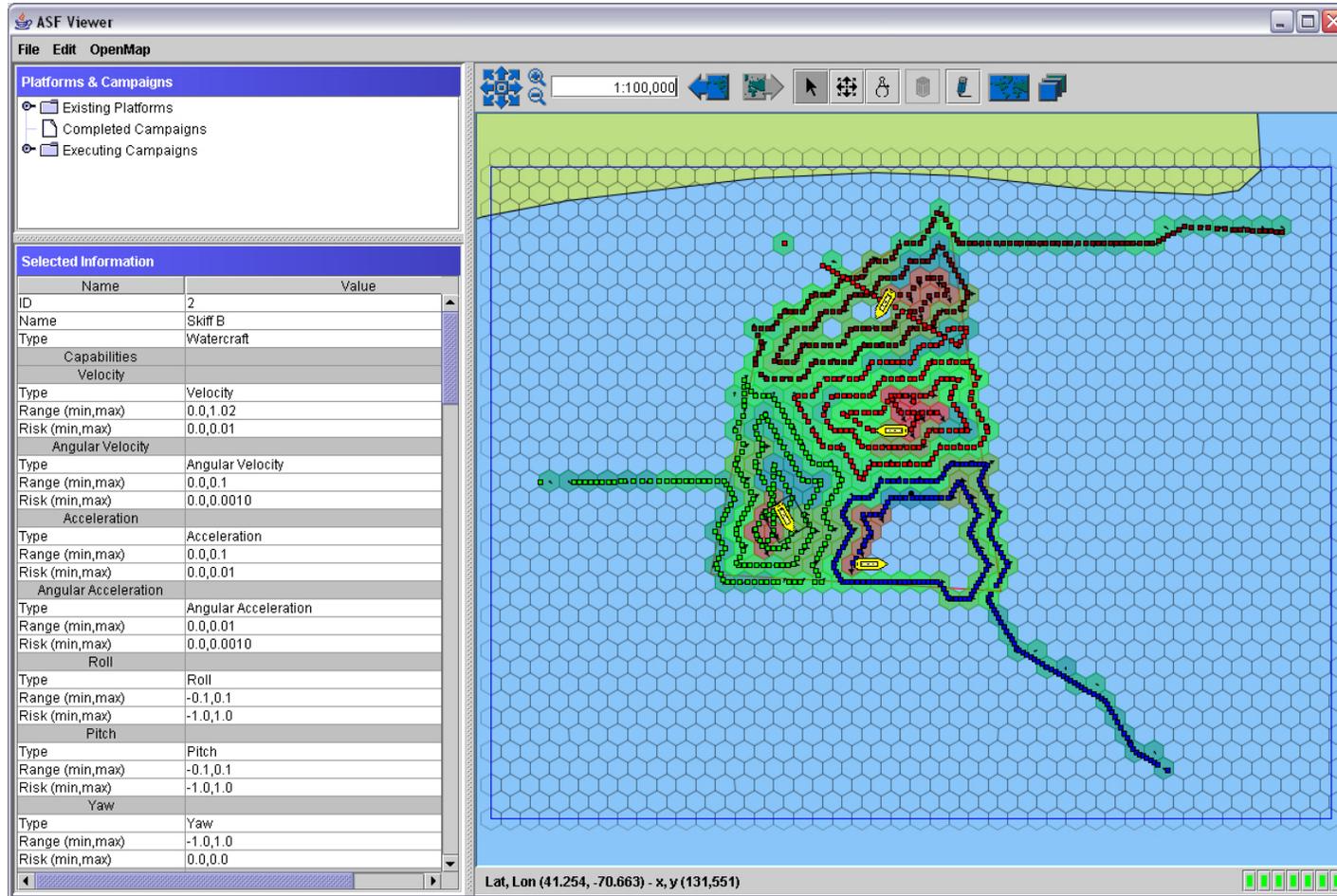
Send Alerts to:

Region Definition

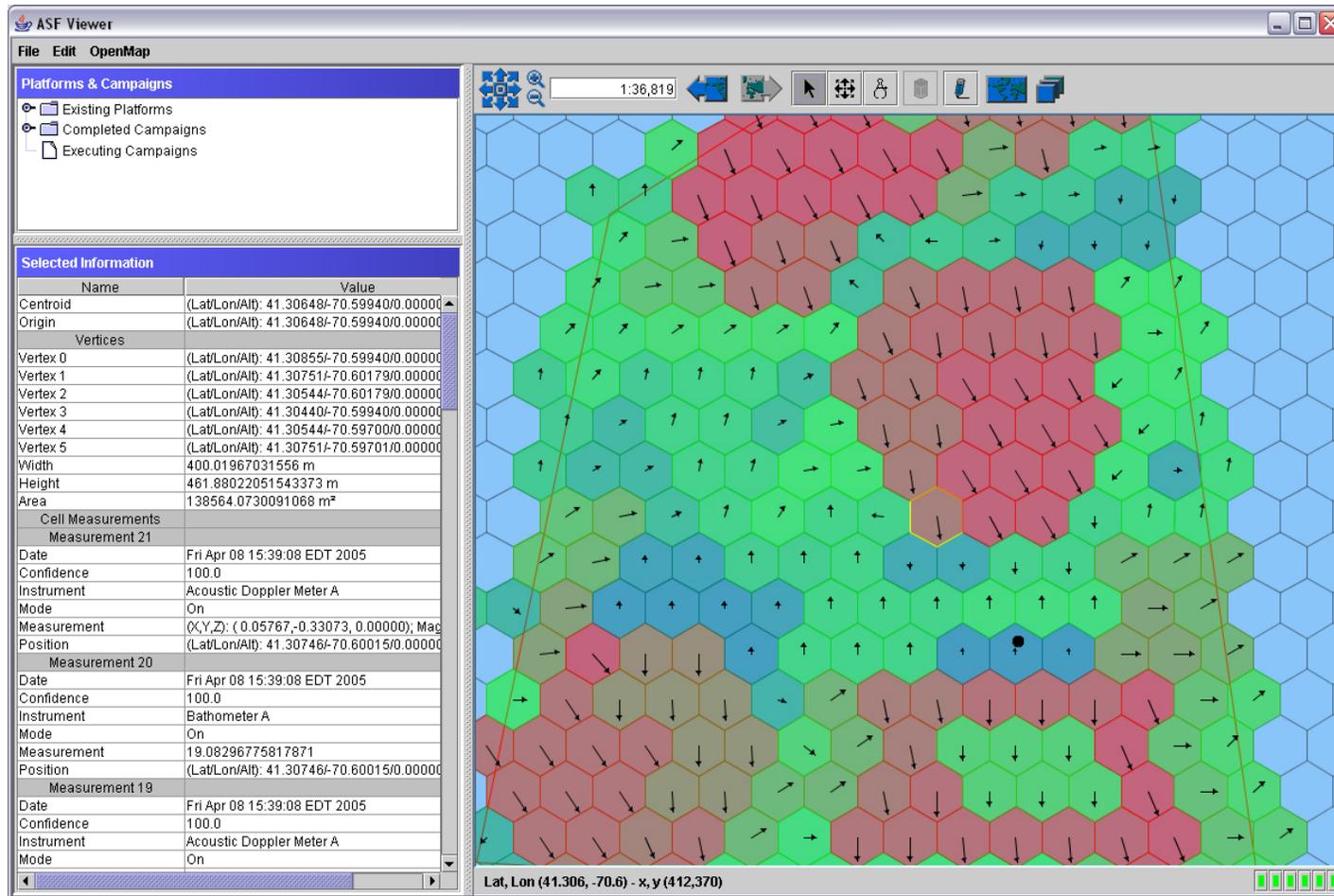
Number of Vertices [Draw Polygon](#)



ASF Operation Fleet Control



ASF Operation Science Collection



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ASF

