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Sandia SSA R&D Capability

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Overview

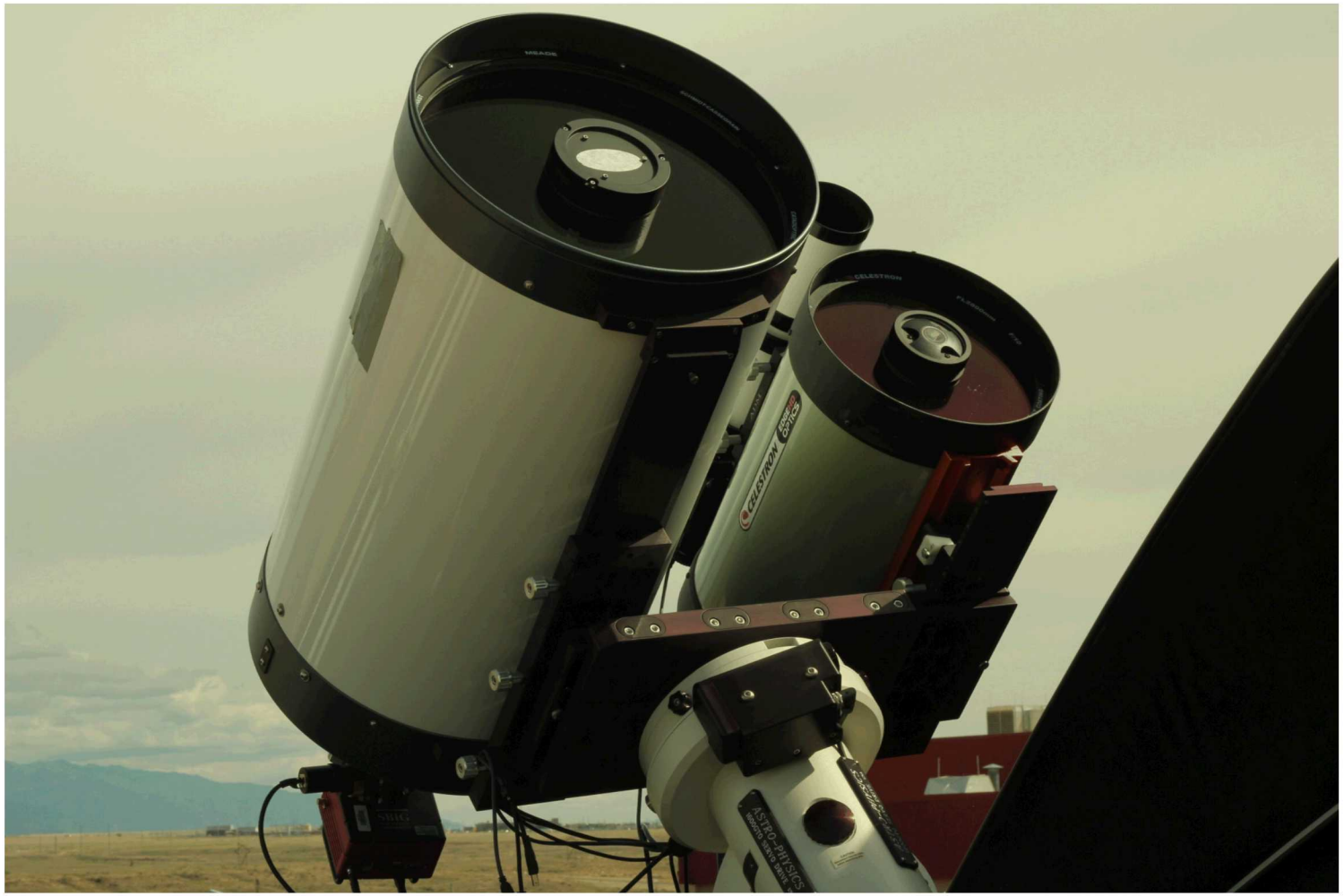
Sandia Engineering Nights Goals

Sandia SSA Capabilities

- Background
- Facilities
- Sensors
- Data Storage and Dissemination

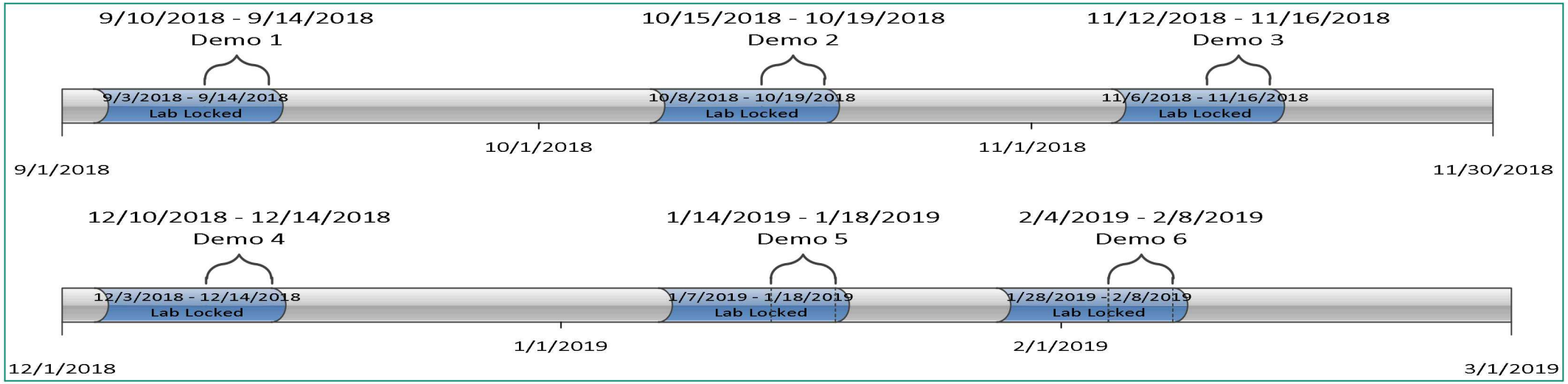
Engineering Nights Implementation Plan

Conclusions

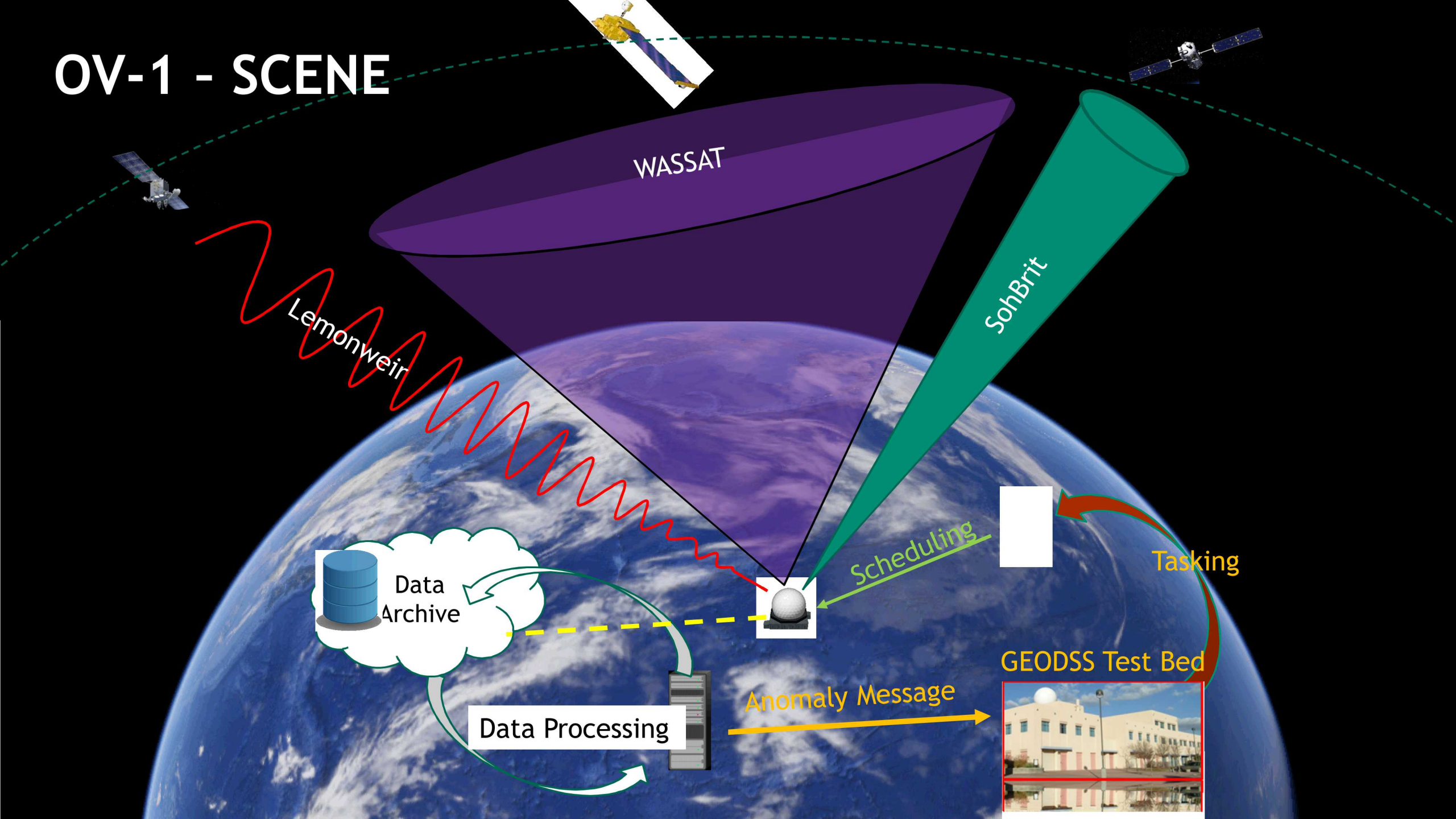


Sandia Engineering Nights Goals

- Goal 1:
  - Collect on GEO satellites using Sandia designed wide area search sensor
  - Store and process images, correlate results against satellite catalog
  - Notify GEODSS testbed of anomalies
- Goal 2:
  - Sandia identifies anomaly, notifies GEODSS testbed
  - GEODSS confirms anomaly, updates Sandia
  - Sandia tasks RF antennas, SOHBRIT responsive telescope
  - Collect data in RF and filtered optical



OV-1 - SCENE


WASSAT
Lemonweir
SohBrit
Scheduling
Tasking
Data Archive
Data Processing
Anomaly Message
GEODSS Test Bed

Sandia SSA Capabilities - Background

2013: Intern project using Celestron telescope

2014: Acquired dome, first automated collections
- Human Intervention during collects

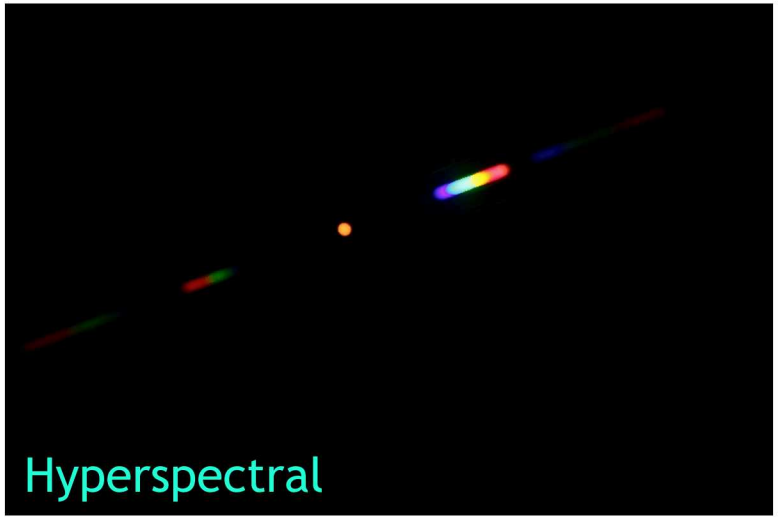
2015: Successful full streak collects of LEO targets

2016: Acquired new dome and mount

2017: First fully automated collections, paper published

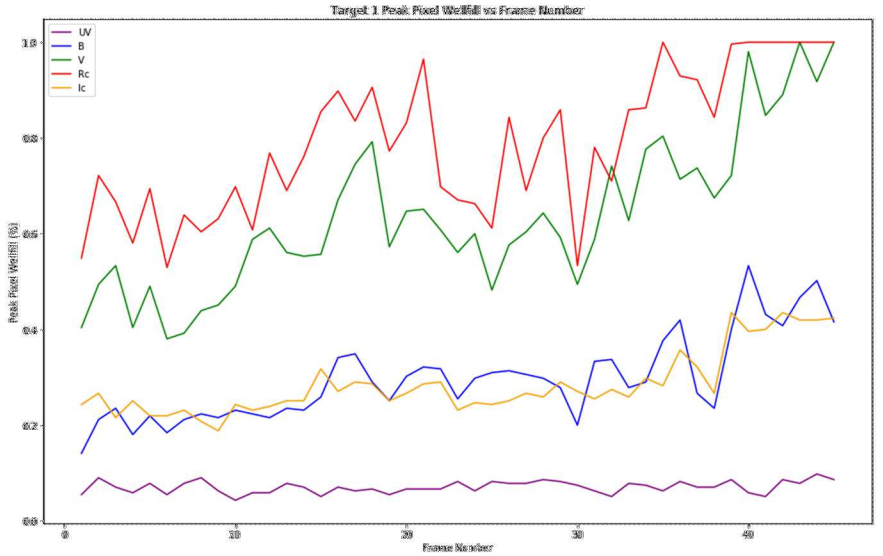
2018: Data storage/dissemination system integrated

Manually-captured image streak of the International Space Station (ISS) (~2013)



Past publications

AMOS 2017: Sohbrit: Autonomous COTS System for Satellite Characterization



Sandia SSA Capabilities - Facilities

Automated dome at Sandia Area IV Facility

- Automated AstroHaven 12’ Dome
- Weather Station
- Astro Physics Mount
  - Slew up to 5°/second
- Numerous cameras
- 80mm, 11in, 16in telescopes
- Filter wheel
  - UV, B, V, Rc, Ic, Hyperspectral

Sandia SSA Capabilities –WASSAT Sensor

Prototype sensor used for Geosynchronous satellite belt stare collections

Four COTS EO cameras (1/4 used for Engineering Nights)

- Provides 20/80 degrees of coverage

Engineering Nights Use:

- Primary cueing sensor for Phase I anomaly detection
- Sensor performs collect and saves data to file
- Anomaly detection and position algorithm run on data set
- Data populated into Anomaly message
- Message sent to GEODSS Test Bed

Sandia SSA Capabilities – Sohbrit Sensor

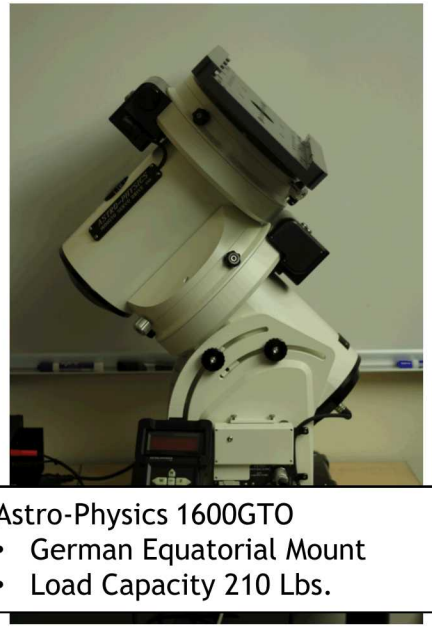
11-inch Schmidt-Cassegrain Telescope

- Primarily used to characterize GEO satellites through extended observation
- 16 inch and 3 inch telescopes also available

Performs automated collection, processing and dissemination

ASI 1600MM Camera

Wide Open, U, B, V, Rc, Ic and hyperspectral grating filters rotated through filter wheel



Astro-Physics 1600GTO
- German Equatorial Mount
- Load Capacity 210 Lbs.

Sandia SSA Capabilities – Lemonweir Sensor

Passive RF sensor capable of monitoring RF emissions from satellites

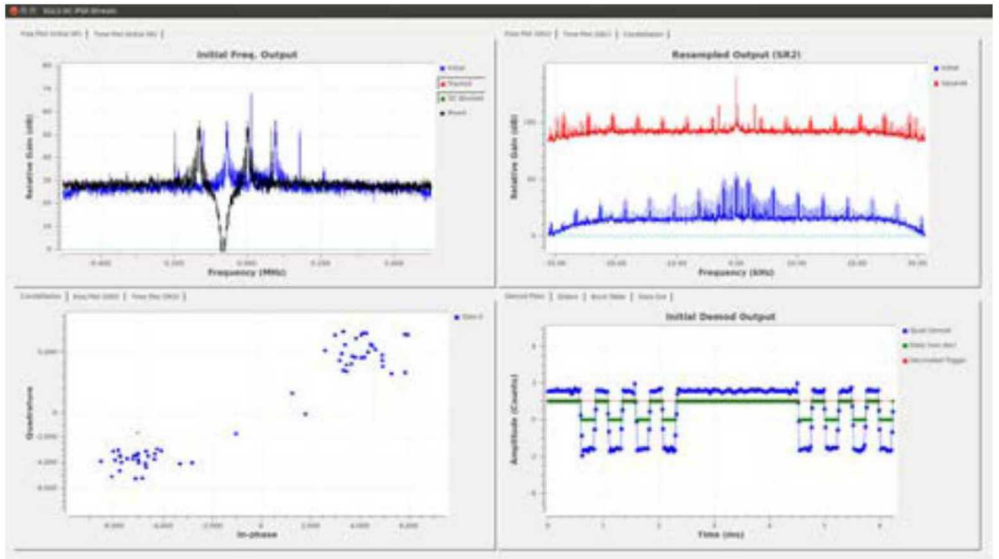
- Array of four 14-foot dishes and one 8-foot dish
- Operates in space operations band (2.2-2.3 GHz)

Determine if satellite is in view / out of view

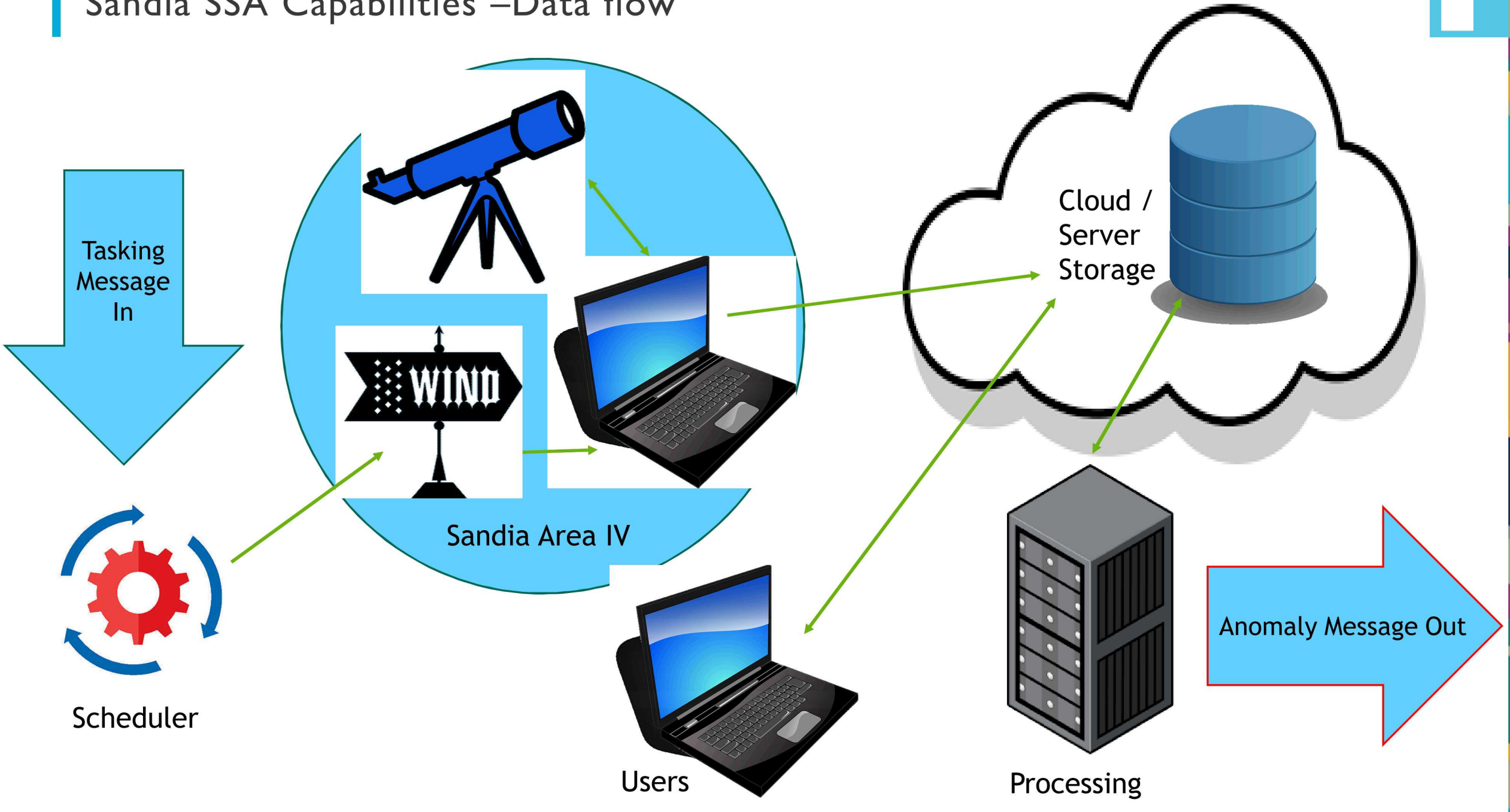
- Based on SNR of received signal using differing beamwidth antennas

Determine if satellite is transmitting telemetry

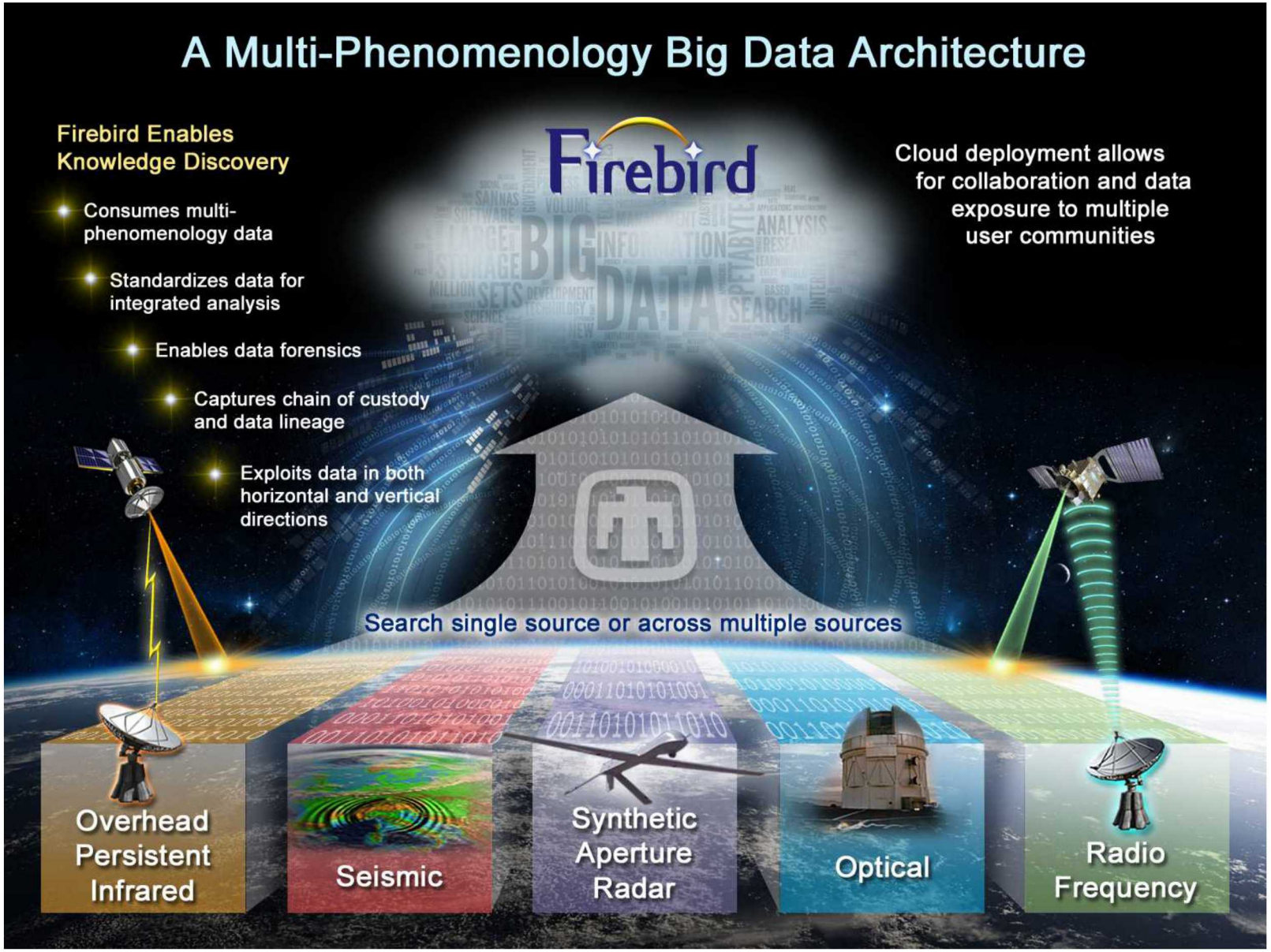
- Center frequency (same or different/new)
- Modulation type (same or different/new)
- Length of transmission (typical or atypical)
- Data Rate (same or different/new)
- Data Patterns (same or different/new)
  - Framing / Sync Use (same or different/new)
- Communications Mode
  - Streaming, Bursting, Tracking signal only



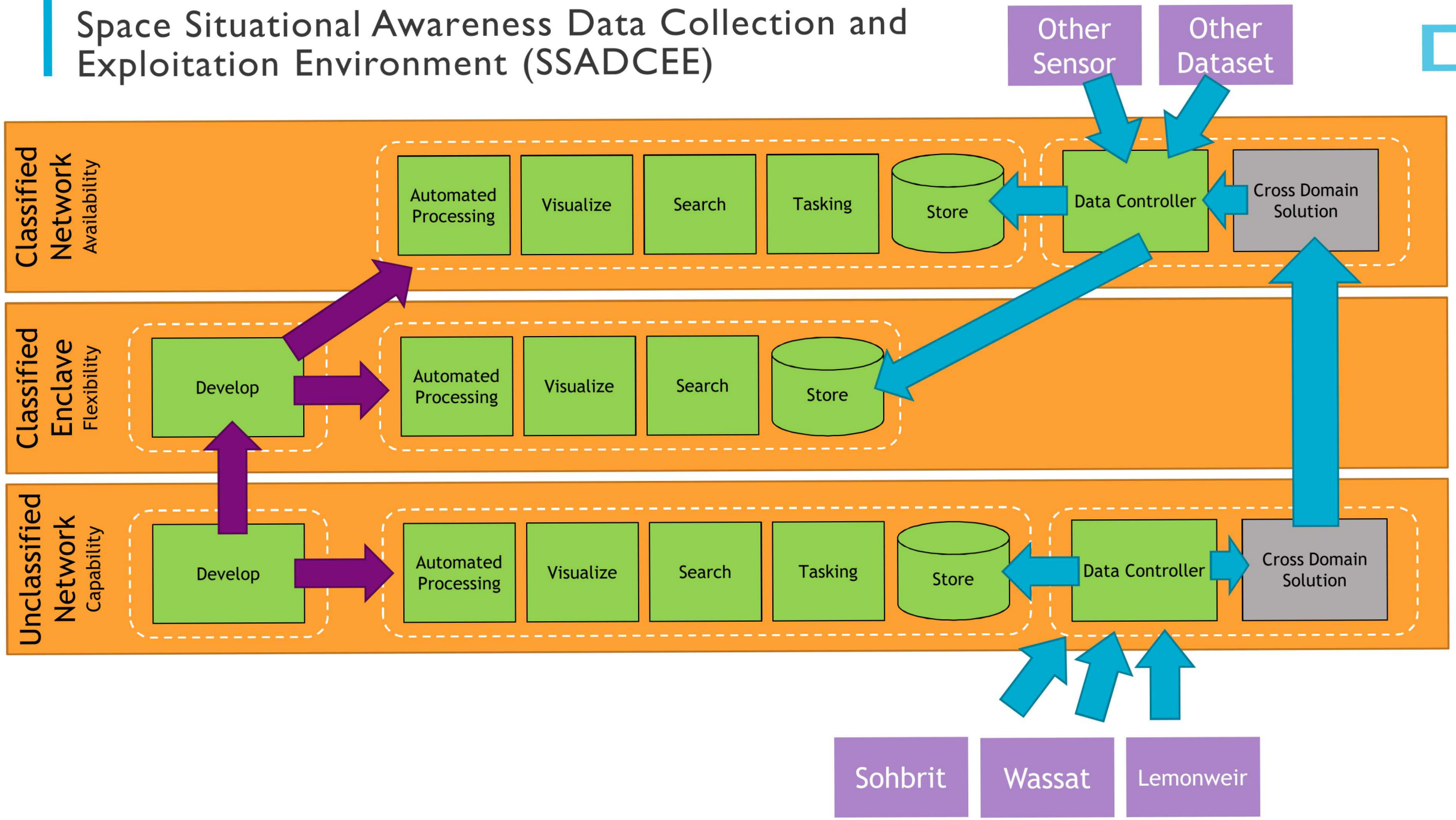
Sandia SSA Capabilities –Data flow



Sandia SSA Capabilities – Data Storage and Dissemination



Space Situational Awareness Data Collection and Exploitation Environment (SSADCEE)



Engineering Nights Implementation Plan

Engineering Nights Implementation Plan

Phase 1: Satellite Position Anomaly Notification

- Collect imagery of GEO satellite using WASSAT wide area search capability
- Detect satellite position anomaly
- Calculate position error
- Populate anomaly message and send to GEODSS Test Bed through SATCHAT

Phase 2: Conduct Follow-up Passive RF and Multi Spectral Collects based on Cueing from GEODSS Test Bed

- Send initial anomaly message to GEODSS Test Bed for a specific satellite
- Receive tasking message from GEODSS Test Bed
- Task and collect passive RF and multi-spectral collects based on follow-up tasking

Thanks

Please contact dpwoodb@sandia.gov with any additional questions or concerns.

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Back-Ups

Firebird Architecture