Virtual Mission Operations Center VMOC

Disaster Response

"Intelligent Controller for Integrating Distributed Emergency Response Satellite Operations."
IEEE Aerospace conference March 2013

Today's Objective

- **Present the current emergency operations image tasking process**

- **Demonstrate the streamlined/automated workflow that could be implemented using the VMOC**

    Details are available in the paper, "Secure, Autonomous, Intelligent Controller for Integrating Distributed Emergency Response Satellite Operations," IEEE Aerospace conference, March 2013.

USGS

- As a part of an international relief effort, the USGS coordinates data collection in response to emergencies (hurricanes, typhoons, forest fires, floods, earthquakes, …)

- Access to free sensor data is currently provided by a whole host of national, military, and international providers (each with different interface requirements)

- Due to the complexity and uniqueness of space systems, considerable manual coordination is required to obtain data products, creating bottlenecks and delays in obtaining critical information
  - Example: following hurricane Katrina it took 5 days and a lot of phone calls to obtain the first overhead images

- NRL, USAF TENCAP, HDDS, & NASA have been exploring system concepts to alleviate these issues
  - e.g., Possible use of NGA: standard for the procurement of commercial imagery.
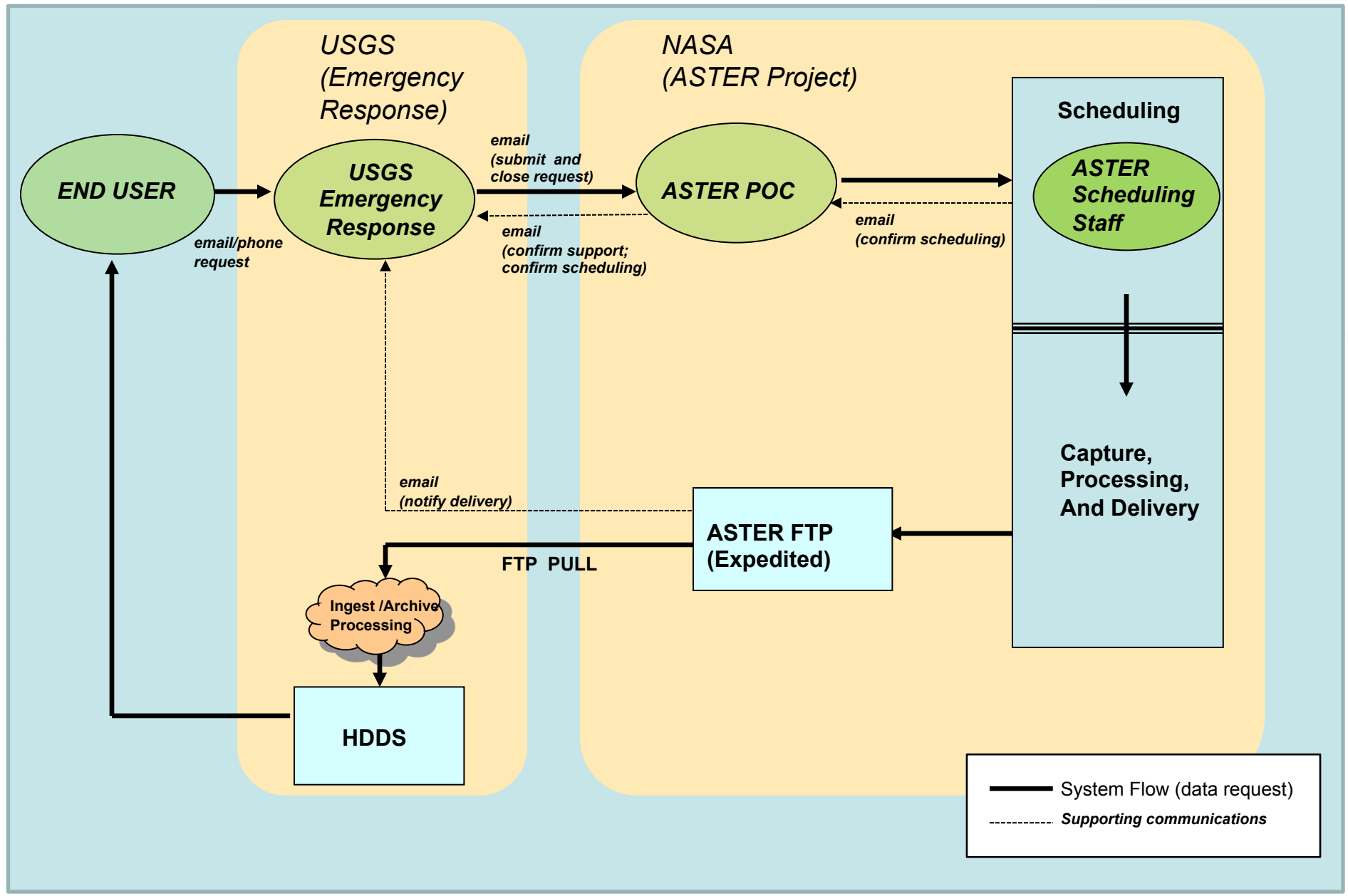
Background

- **USAFSBL and General Dynamics developed the Virtual Mission Operations Center to support theater warfighters. It was implemented on a classified system, but could easily be fielded for civil applications**

- **USGS was contacted by US Air Force Space Battle Lab during Hurricane Katrina in 2005 to discuss ways to improve their workflows for ordering disaster imagery**
  - **The current process requires expert knowledge on what systems are available for tasking, how to task those systems, what tasking information needs to be provided and in what format for each system (as they are all different), and who to contact to ensure the task was issued and whether or not the task was executed (often there is no feedback).**

- **VMOC Deployed Locations**
  - **SIPRNet ATO SOC-11 Schriever AFB (ORS-1 launched 29 Jun 2011)**
  - **SIPRNet ATO Blossom Point Gnd Station (TacSat-4 launched 27 Sep 2011)**
  - **NASA GRC**

- **NASA grant money was used to develop an unclassified demo version of the system for civil satellite tasking**
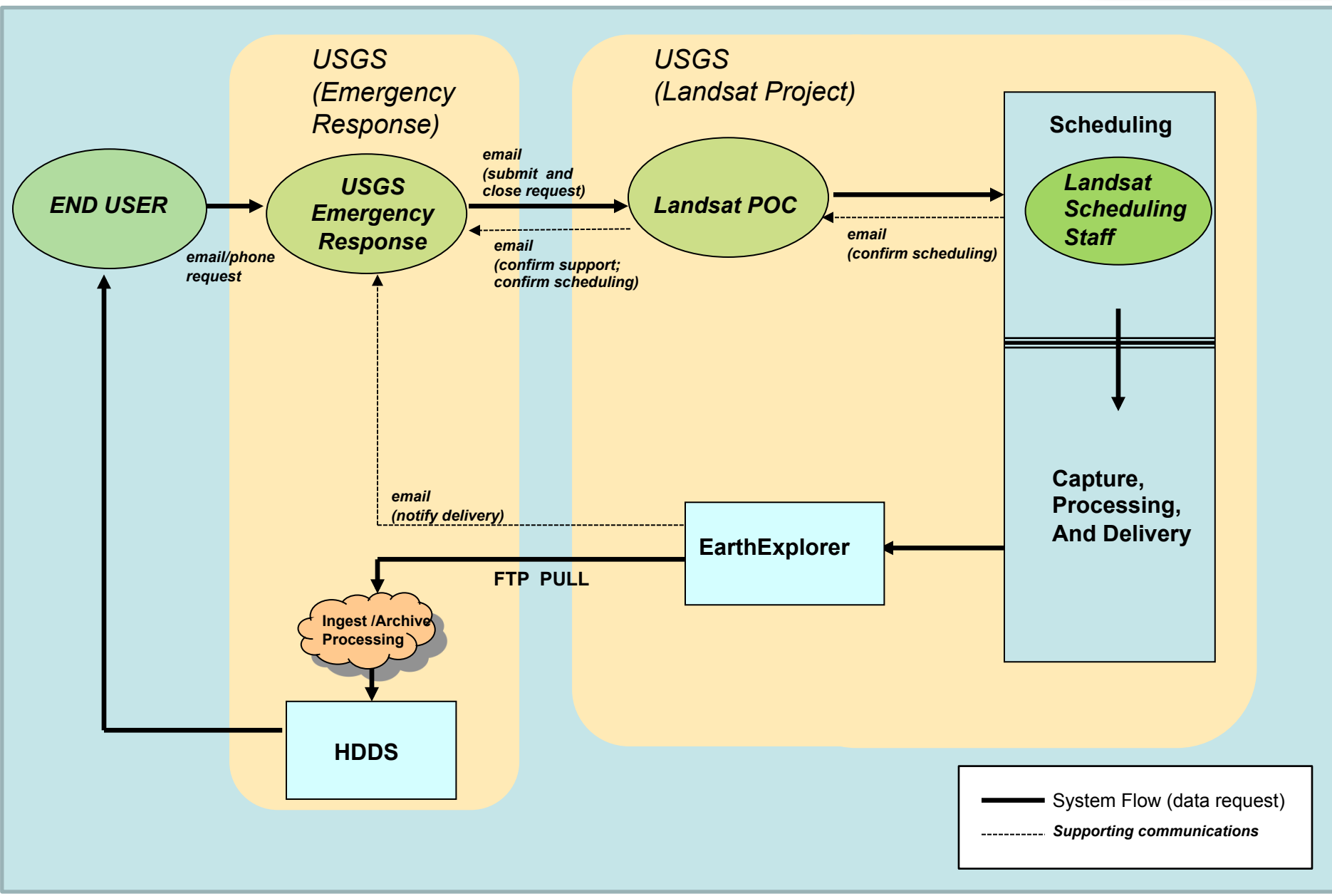
What is VMOC?

- **Virtual Mission Operations Center (VMOC)**
  - **Sensor Visualization, Tasking, and Scheduling Tool**
  - **The VMOC is a collection of web-based tools designed to integrate flight systems and automate flight processes**

- **This particular VMOC implementation streamlines the USGS process for discovering satellite services and submitting orders for satellite imagery during disasters**

- **VMOC captures the USGS expert's knowledge and automates tasking**

- **VMOC ensures that the first responders are provided with the "right data"**
  - **Not every possible scene, just the scenes that are actually needed for a given set of circumstances**
    - **Reduces costs by only requesting data that is needed**
  - **Good steward of resources (reduced data requests) – makes this a more partner friendly system**
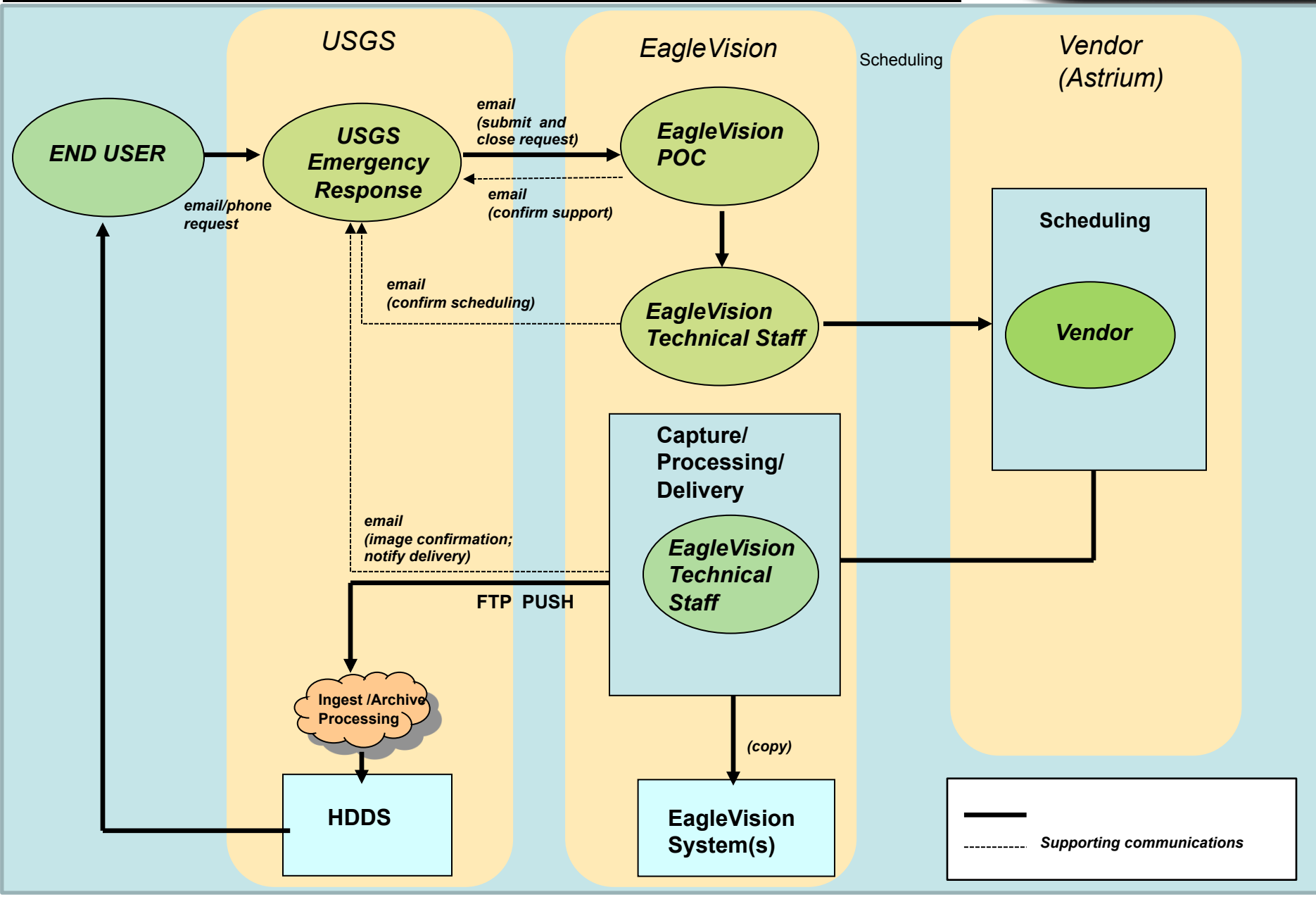 - **VMOC reduces system latency and improves operational responsiveness**
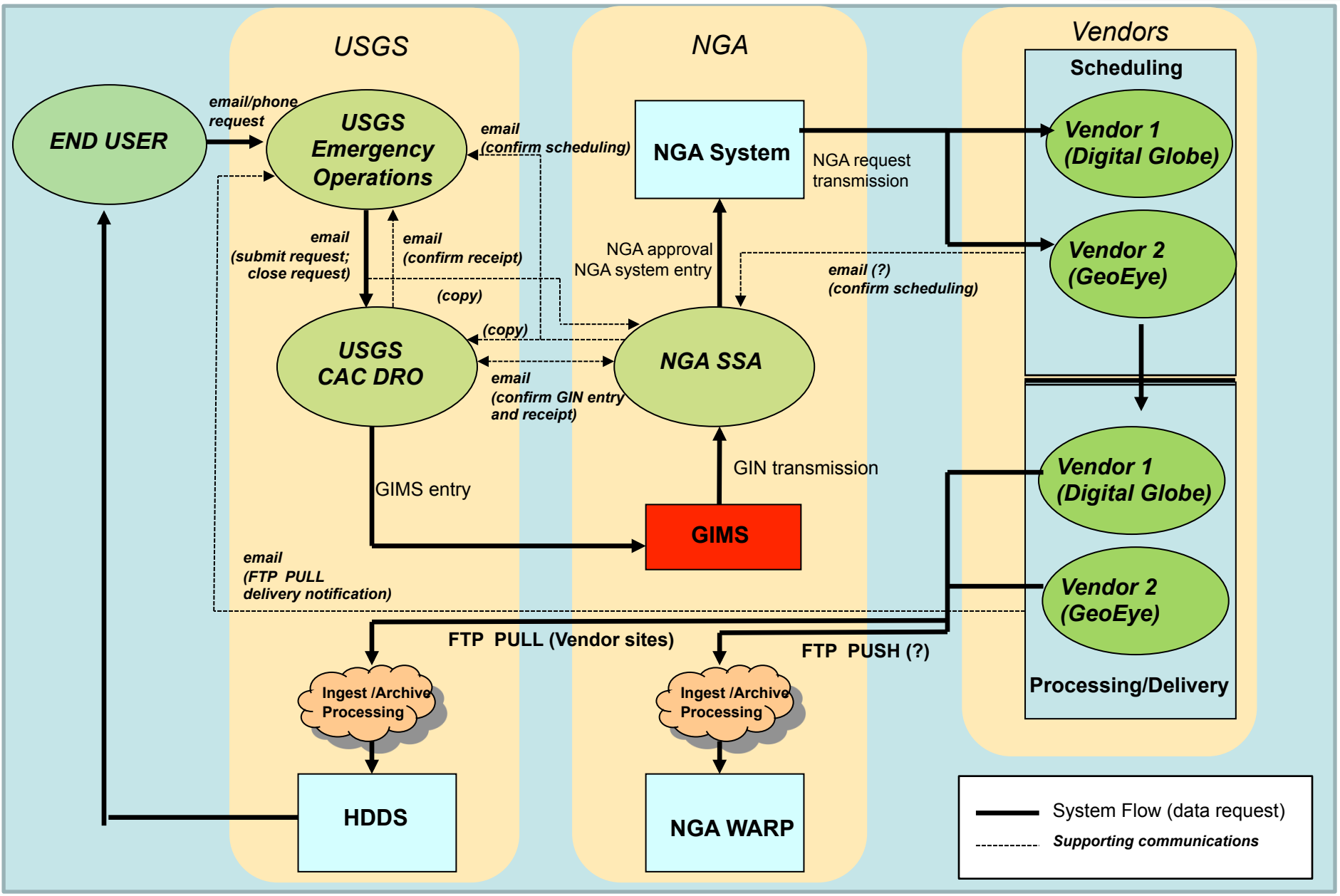
EMERGENCY REQUEST FLOW: Landsat via USGS

USGS

EagleVision

Scheduling

Vendor (Astrium)

END USER

email/phone request

USGS Emergency Response

email (submit and close request)

EagleVision POC

email (confirm support)

email (confirm scheduling)

EagleVision Technical Staff

Scheduling

Vendor

Capture/ Processing/ Delivery

EagleVision Technical Staff

email (image confirmation; notify delivery)

FTP PUSH

Ingest /Archive Processing

(copy)

HDDS

EagleVision System(s)

Supporting communications

EMERGENCY REQUEST FLOW: High-Res Commercial via NGA

USGS Tools Desired

- **USGS is particularly interested in tools designed to:**
    - **Perform first order analysis of which satellite assets will be available over a given location under a given set of circumstances**

    - **Recommend, via established configurable priorities, which of the potential sensor (and associated processing centers) would best be able to provide the data needed for a particular emergency**

    - **Have machine-to-machine negotiations**
        - **Determine if a particular asset is available for use**
            - **Currently tasking via standard vendor specified formats**
        - **Schedule following authorization**

    - **Disseminate data to interested parties Hazard Data Distribution System (HDDS)**

    - **Provide feedback status and situational awareness**
        - **Example: FedEx Tracking**
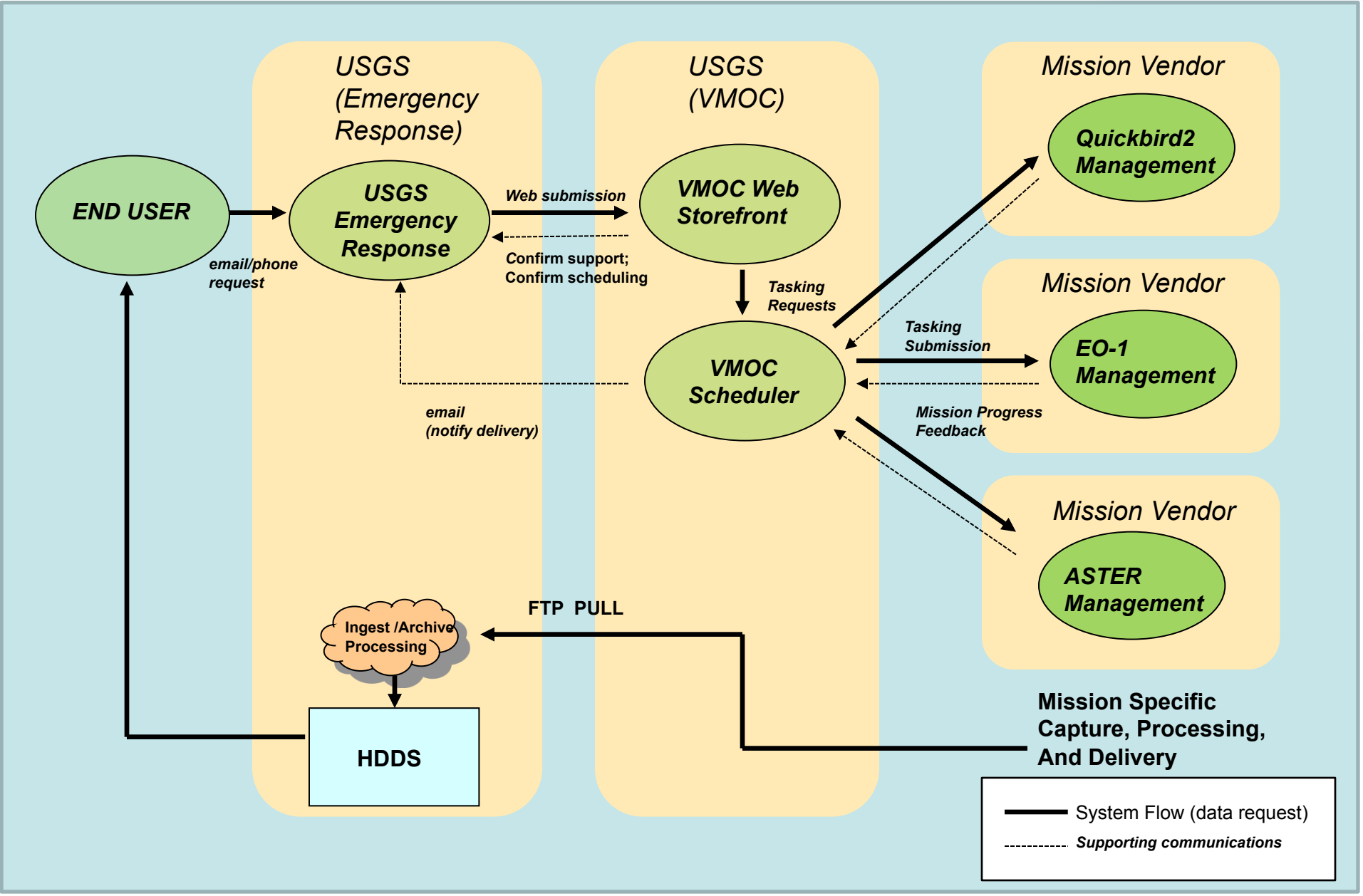
VMOC Web Based Tools

- **Integrated Mission Security and Situational Awareness**
  - **Right person access to the right system, command, or data at the right time**
  - **CM support to mission operations, senior mgmt, and data response teams to quickly ascertain assets that can support specific needs or requests**
  - **Ensuring that integrated system security is not compromised**

- **Operations automation**
  - **Low cost machine-to-machine interfaces and interactions**
  - **Reduced latency and improved operational responsiveness**
  - **Support disparate systems communication and cross-command**
  - **Allow "Requests for Effects" enabling tasking by non-space professionals**

- **Technology Readiness**
  - **TRL-9: DOD sys on the SIPRNET tasking TacSat-4 and ORS-1**
  - **TRL-7: The USGS Demo system is currently being implemented in an unclassified environment and is located at Glenn Research Center and has new features relative to the DOD system**

Today's Demonstration

- **Use Collection Requirements (CR) Management to create collection events (Tasking)**
  - **Polyline**
  - **Multipoint**
- **Submit**
- **Approve**
- **Run Scheduler**
- **Show Schedule**
- **Show resulting HDDS data products**
- **Now look under the hood**

Not practical to show in a quick demonstration.
- **Orbital dynamics dictates when a sensor can take data.**
- **Approving may result in a bill.**

Contact List

- **NASA Glenn Research Center**
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