HICO

# HICO Mission Planning and Operations

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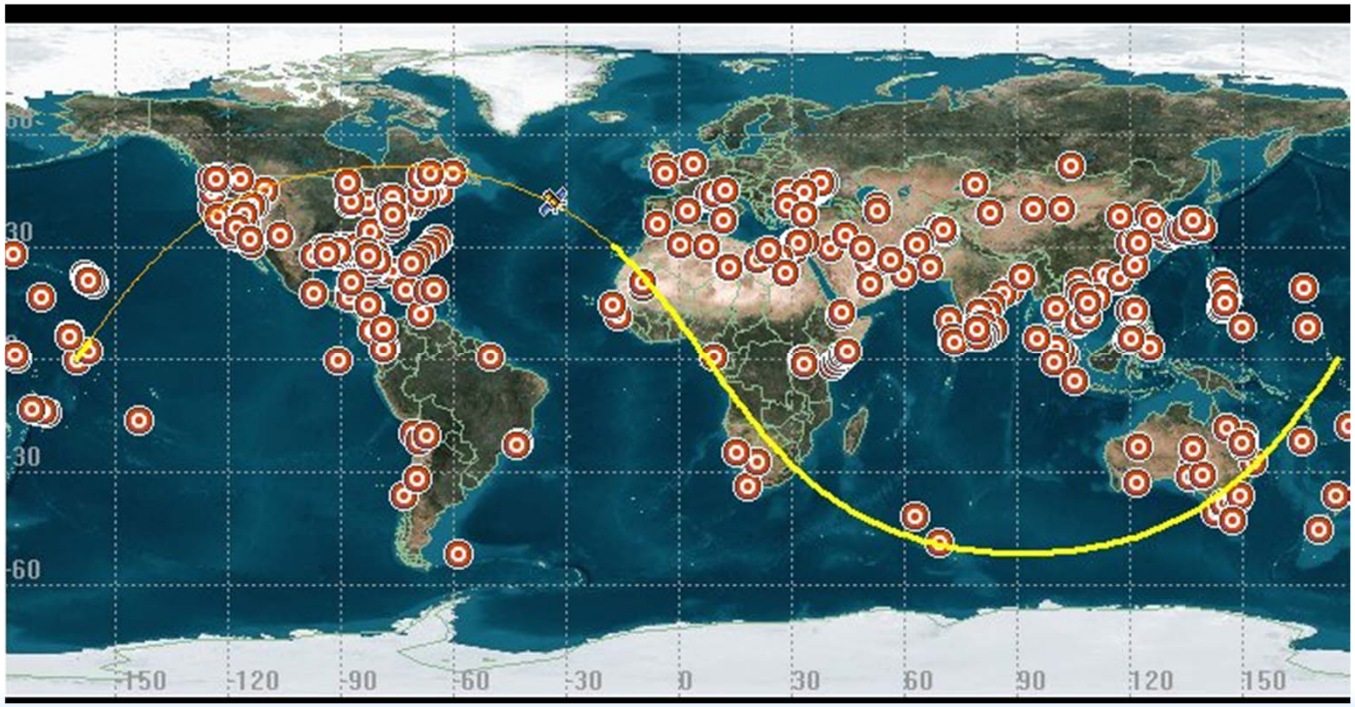
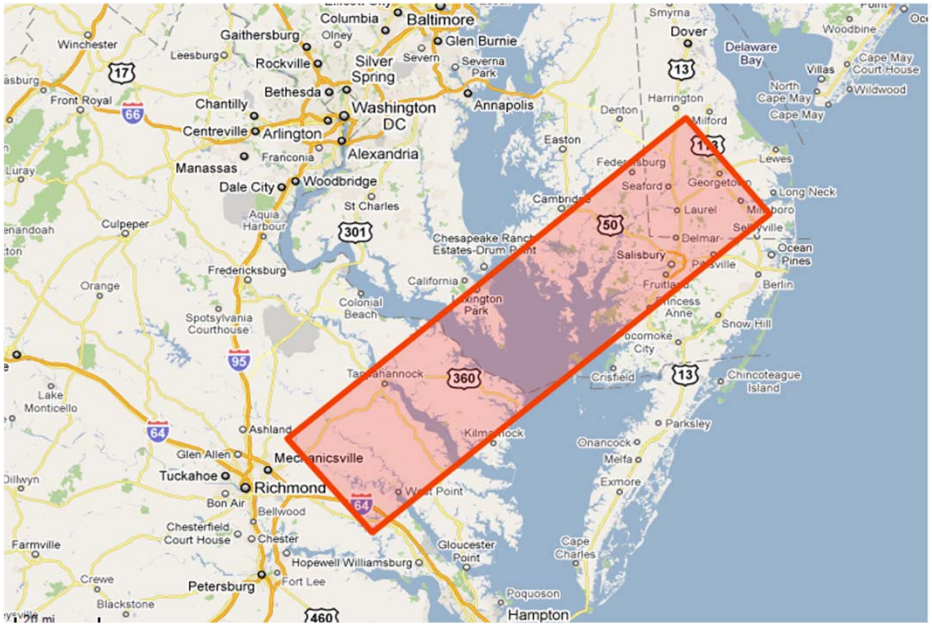
# Selecting Targets: Part 1

- Request through OSU web site
- Choose coordinates for image center (may need multiple targets to cover area of interest)
  - HICO swath simulator (shows image box for nadir view angle)
- Names: describe location, abbreviate if possible (i.e. FortPierceInlet_FL)
- Latitude range: +/- ~52 deg
- ~2 weeks to get new targets into system from the time NRL-DC receives target info

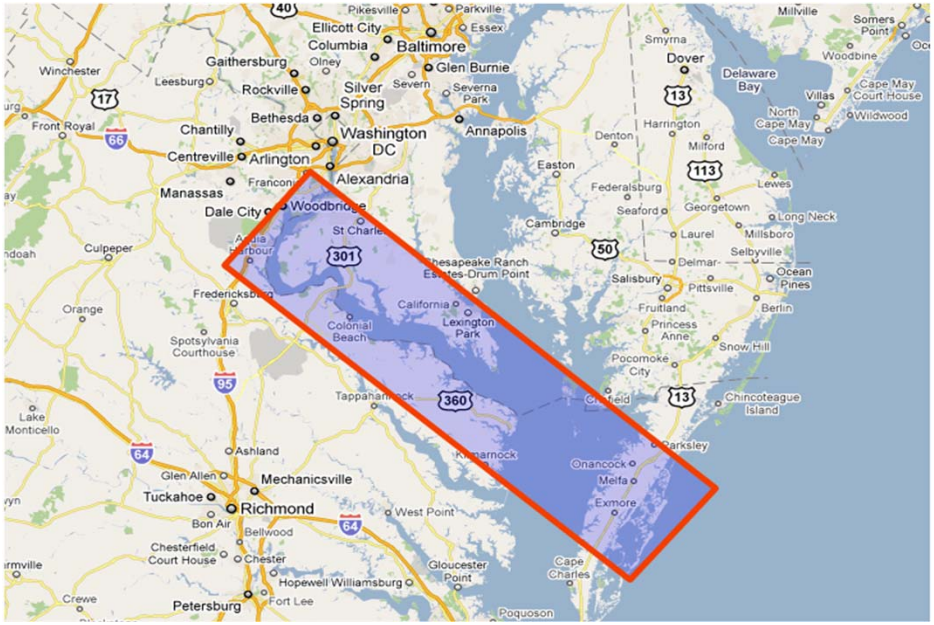


# Selecting Targets: Part 2

Ascending Pass




Descending Pass




- Ascending/Descending passes
  - 1 set of coordinates is appropriate for some targets
  - Other targets have 2 sets of coordinates (TargetName_asc, TargetName_des)
    - Sometimes only 1 set of coordinates for a target that is only to be imaged during one type of overpass

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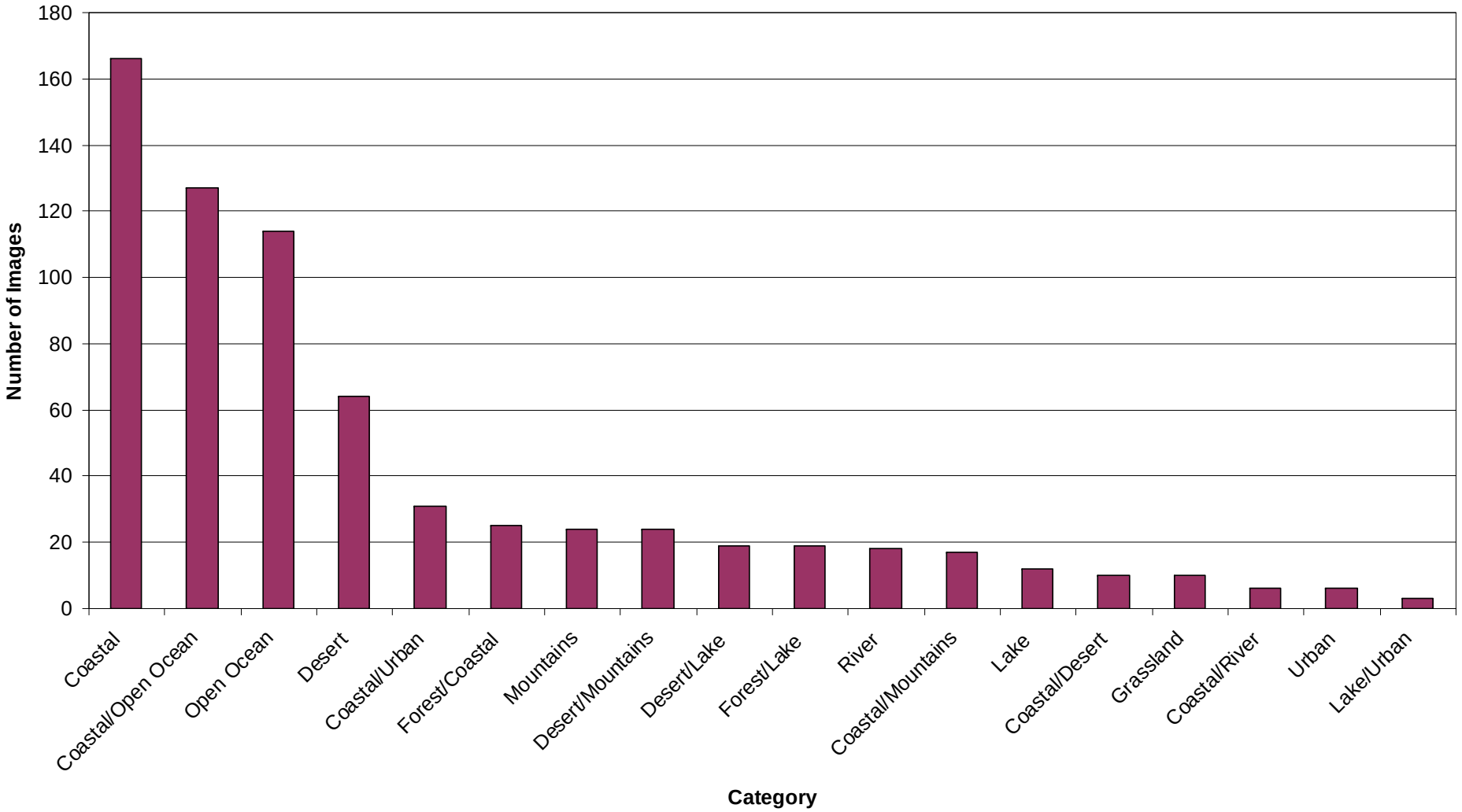
## Usable HICO Images
## (as of 30 August 2010)

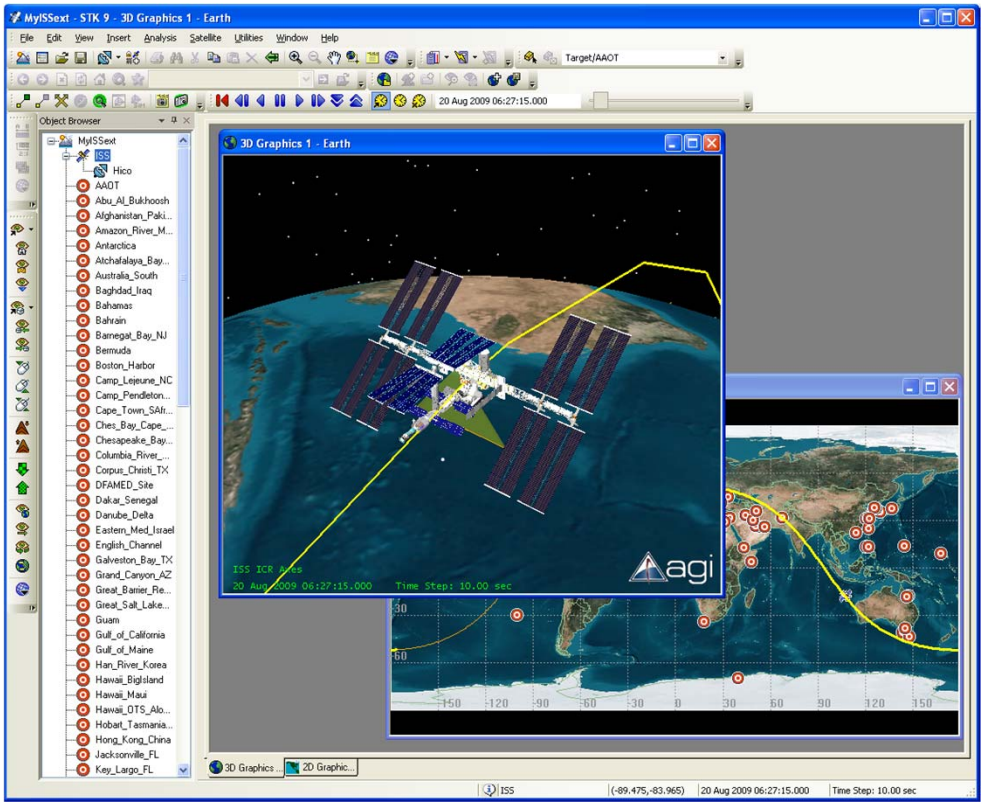


# Scheduling and Commanding

## Satellite Tool Kit (STK)

Analytical Graphics Inc.

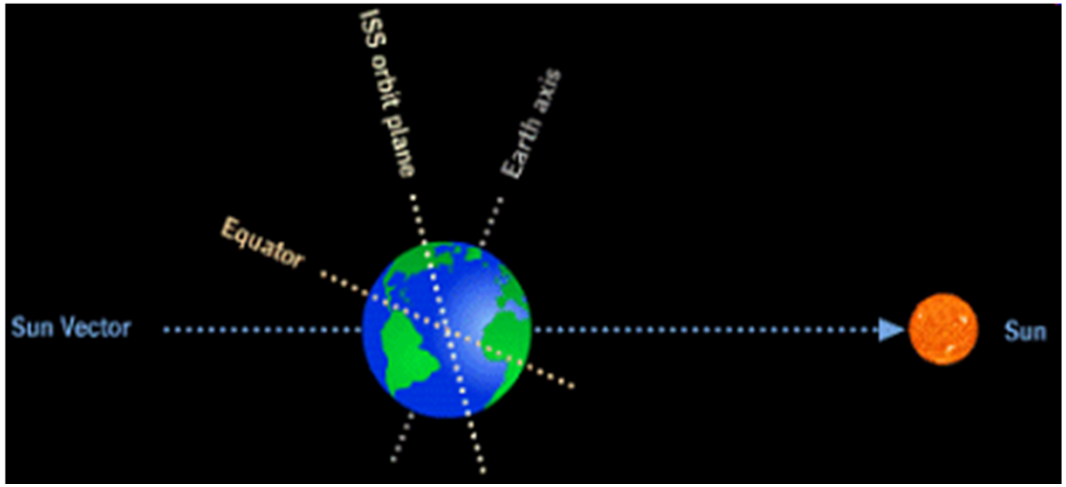
220 Valley Creek Blvd, Exton, PA 19341

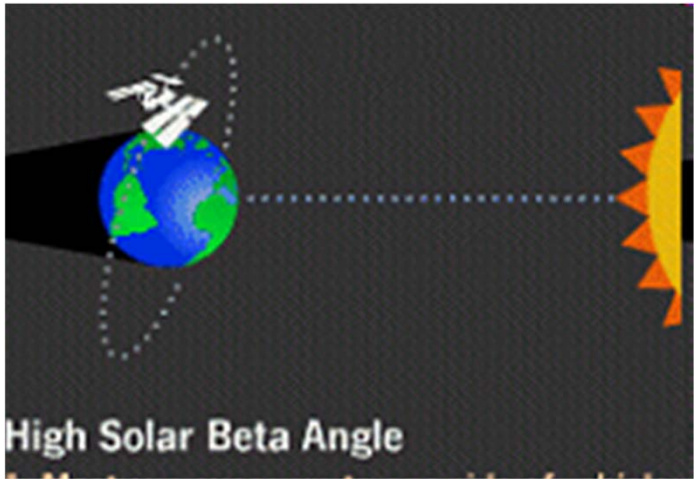


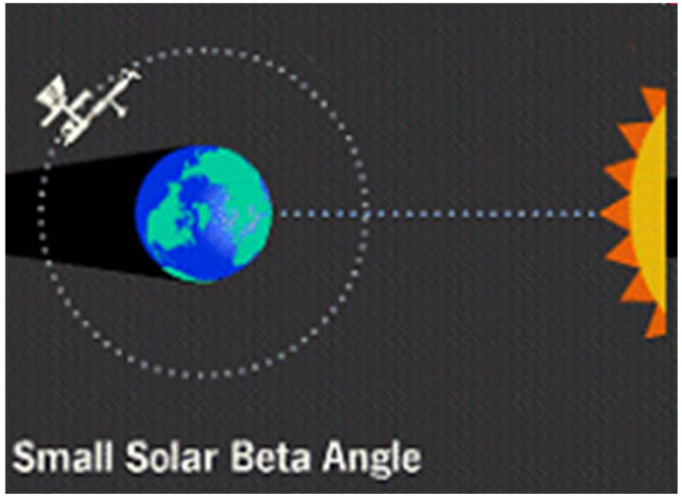

- STK calculates all possible observations in a particular time period by combining:
  - targets
  - ISS predicted attitude
  - ISS predicted ephemeris
  - HICO FOR
  - light/activity constraints
- Planning Committee determines which targets will be imaged
  - 1 image/orbit
  - Schedule generated 1-2 weeks ahead of time
- Commands uploaded daily (weekdays only)
  - Using most recent predicted ISS attitudes & ephemerides
    - Updated 3x/week
  - Include time and pointing angle
  - No real-time commanding

# Scheduling Constraints

Images from: http://suzymchale.com/ruspace/issnav.html




- Timing
  - Target request to image collect
    - Min: ~2 weeks
    - Max: Depends on orbit, target priorities, etc
  - Image take to data release
    - ~4-7 days
- ISS orientation
  - +XVV (flying forward)
  - -XVV (flying backward)
- Revisit time
  - Depends on latitude, drag, orbit adjustments, lighting, etc
  - Not Sun-synchronous, polar orbit
- Solar Beta angle
  - Measured from orbital plane to Sun vector
  - High angle precludes HICO from taking imagery for lengthy period of time

# Mr. Murphy

Tokyo Bay, Feb 3, 2011

What happened to my data?

1. No image
   - ISS activities: command not sent (~14%)
   - Computer lockup/motor pos error: image not taken (~21%)
     - Frequent soft reboots
   - Requestor will be notified
2. Image file exists, but looks funny
   - Image is missing data packets
     - If downlink was interrupted, retransmit to retrieve full image
   - Solar panels got in the way
     - Usually only happens during low sun angle periods (<1%)
   - Clouds
   - Pointing/wander issues…
   - Requestor will receive data files

Broad Bay, NZ Feb 10, 2011

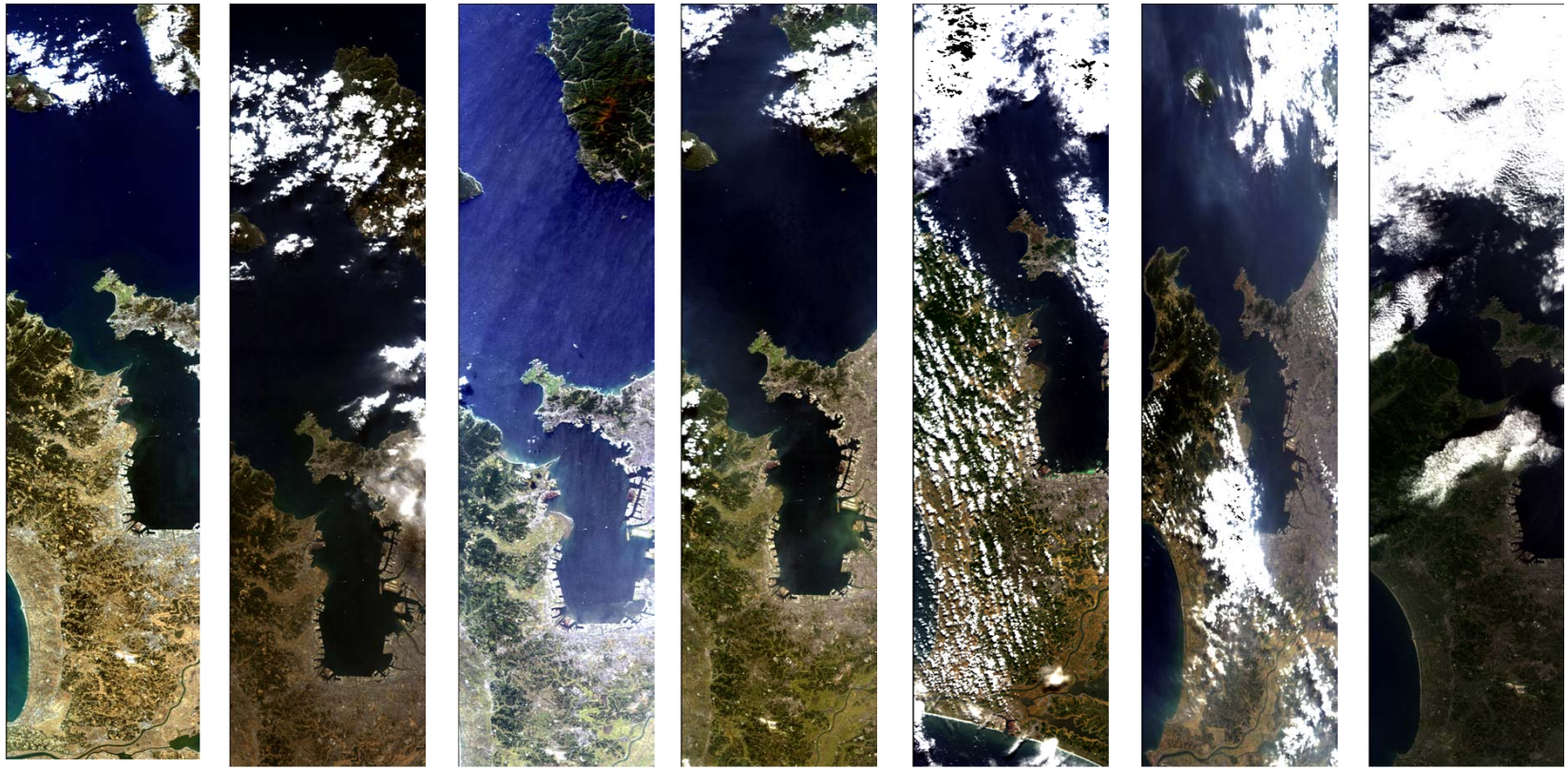
# Pointing Ability: Part 1

- Not related to geo-correction
- By the time the imagery is taken attitude and position predictions are hours to days old
  - Attitude predictions are for the mean Torque Equilibrium Attitude (TEA)
    - |Actual mean – predicted mean| in roll, pitch, and yaw are ~ 0.1°
    - Oscillations about TEA of about ±0.3° about each axis
  - Position predictions (updated 3x/week)
    - Accuracy affected by atmospheric drag (LEO), ISS maneuvers and solar activity
    - Typically the targeted location is near the center of the image
      - Monday, 2011 Jan 24 images: almost missed the targeted point (in the along track direction) due to 2 ISS maneuvers between predicted ephemeris release and image times
- Different clocks on the ISS slightly affect the positioning of the target within an image
- Pixel size and scene boundaries are also affected by off-nadir pointing angle and altitude of the ISS (periodically re-boosted)

Take home message: repeated images of the same location will not have the same spatial boundaries and this is principally due to the accuracy of the ISS orbital ephemeris prediction.

# Pointing Ability: Part 2

Examples of variations in scene boundaries: Tokyo Bay



| 2011 Jan 08 | 2011 Jan 04 | 2010 Nov 09 | 2010 Nov 05 | 2010 Sep 09 | 2010 Sep 05 | 2010 May 30 |
|---|---|---|---|---|---|---|
| Saturday | Tuesday | Tuesday | Friday | Thursday | Sunday | Sunday |
| Alt: 352 km | Alt: 352 km | Alt: 357 km | Alt: 357 km | Alt: 353 km | Alt: 355 km | Alt: 343 km |
| VZA: 2.3° | VZA: 22° | VZA: 6.1° | VZA: 19° | VZA: 15° | VZA: 41° | VZA: 12° |

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# Summary

- What we need
  1. Target coordinates and name, if new site
  2. Timeframe of requested observations (ex. March 15 – April 15), if applicable

- What we will do
  1. Enter new targets in STK model
  2. Schedule imaging opportunities and notify requestor
  3. Send data files or notify requestor if image was not taken