



HICO Status and Operations

HICO Users Group

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HICO Transition to NASA

Tech Demo Phase 1



In September 2009 HICO began operating on ISS as a Tech Demo payload sponsored by the National Lab and DOD-STP.

The objective was to prove out an inexpensive, quick developed, visible and near infra-red hyperspectral imaging instrument to monitor the coastal regions and to demonstrate its scientific application.

By December 2012 all the goals had been exceeded. Over 7000 images were collected and dozens of national and international science users were engaged.

DOD-STP

NRL

HICO

ISS Facility Phase 2

In January 2013 HICO was transitioned to NASA/ISS funding and Program Management

1. HICO converted from a PI-led instrument to a NASA imaging facility
2. NASA gained immediate hands-on access to a hyperspectral instrument on the ISS to meet the needs of a growing number of researchers and to gain experience for any future hyperspectral facility class instrument
3. Continued funding of NRL for HICO on-orbit operations





HICO Operations Tasks

- * **Tasking**

- * Most manpower intensive step
 - * Includes both periodic planning/coordination as well as daily detailed duties to actually create the tasking commands sent to the system

- * **Processing**

- * Processing raw HICO imagery has been automated as much as possible

- * **Data Storage**

- * NRL and NASA Ocean Color Website

- * **Data Dissemination**

- * Ocean Color (GSFC)====> public distribution
- * OSU ====> distribution to original requestors; special products

- * **Data Quality Assessment and Improvement**

- * Calibration and Characterization
- * Resolving Radiometric and geometric calibration issues



HICO Operations: Tasking

- * Master target list (currently 550 sites) includes sites in current research proposals plus many sites likely to be of general interest
 - * New sites added when research proposal submitted through OSU web site is reviewed and approved
 - * New, simpler proposal requirements now in place
- * Planning starts 10-14 days before collections
 - * Updated ephemeris of ISS dictates which sites will be visible to HICO
 - * Sites selected by committee consisting of NRL and OSU, which represents most academic and international researchers
 - * Priority given to active field work, evolving environmental phenomena, rarity of clear weather target acquisition, best viewing geometry
- * Tasking commands sent by NRL contractor to ISS via NASA communications link every work day
 - * Many more activities involve actively downlinking data and ensuring complete transmissions and rebooting the collection program after frequent computer lock-ups



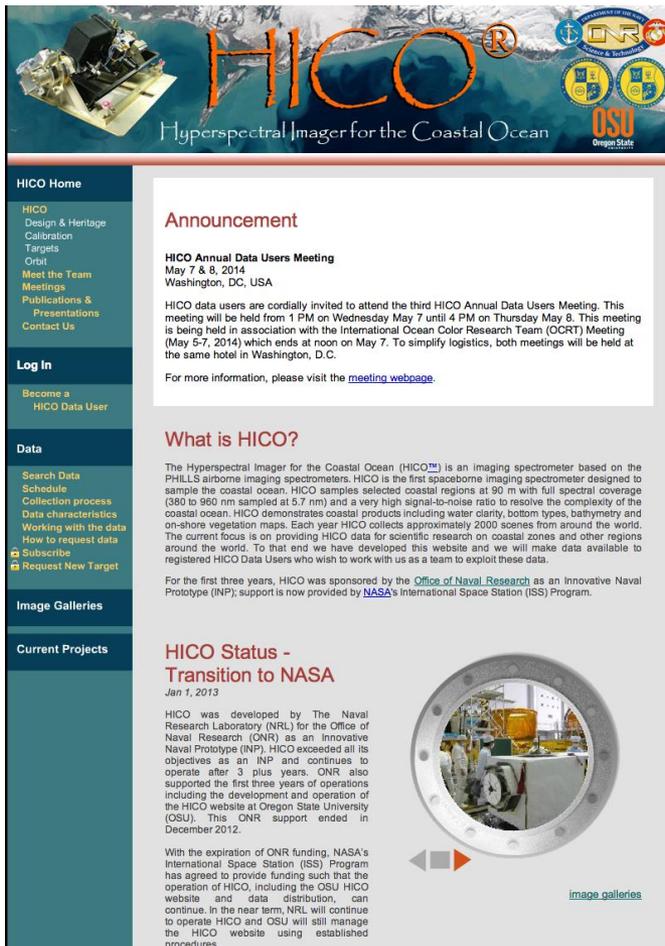
HICO Operations: Processing and Storage

- * Automated processing at NRL and at NASA Goddard
 - * Calculate at-sensor radiance and geopositioning
 - * Improved geopositioning implemented last year
- * Data stored at NRL and NASA Goddard
 - * Subset stored at Oregon State University



HICO Operations: Dissemination

OSU <http://hico.coas.oregonstate.edu>



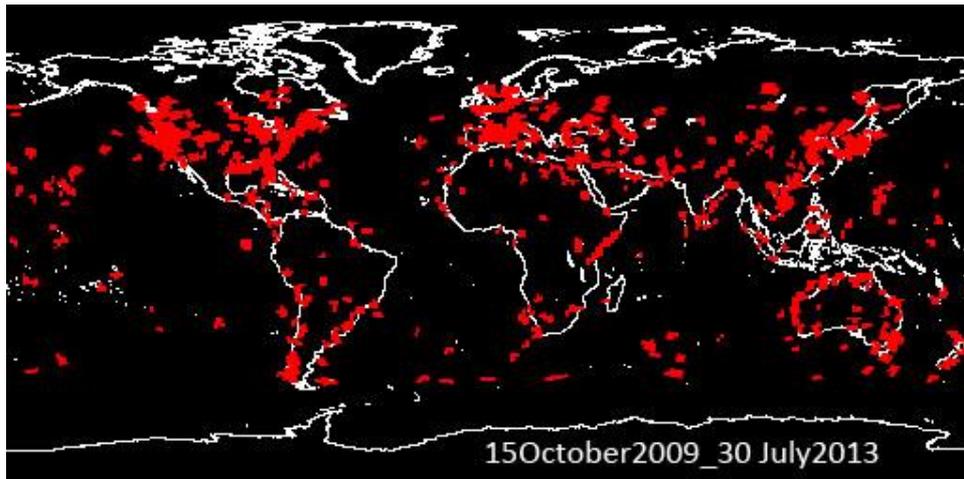
The screenshot shows the HICO website homepage. At the top, there is a banner with the HICO logo and the text "Hyperspectral Imager for the Coastal Ocean". Below the banner, there is a navigation menu on the left with categories like "HICO Home", "Log In", "Data", "Image Galleries", and "Current Projects". The main content area features an "Announcement" section for the "HICO Annual Data Users Meeting" held on May 7 & 8, 2014 in Washington, DC, USA. Below this, there is a "What is HICO?" section explaining the instrument's capabilities and its development by the Naval Research Laboratory (NRL) for the Office of Naval Research (ONR) as an Innovative Naval Prototype (INP). A circular image gallery is visible at the bottom right of the main content area.

- * Read background information, updates, information on projects, publications, and tips on using data
- * Browse data in the OSU archive
- * Request new collections
 - * Submit proposal
- * Data is in ENVI format with header



HICO Operations: Dissemination

NASA <http://oceancolor.gsfc.nasa.gov>

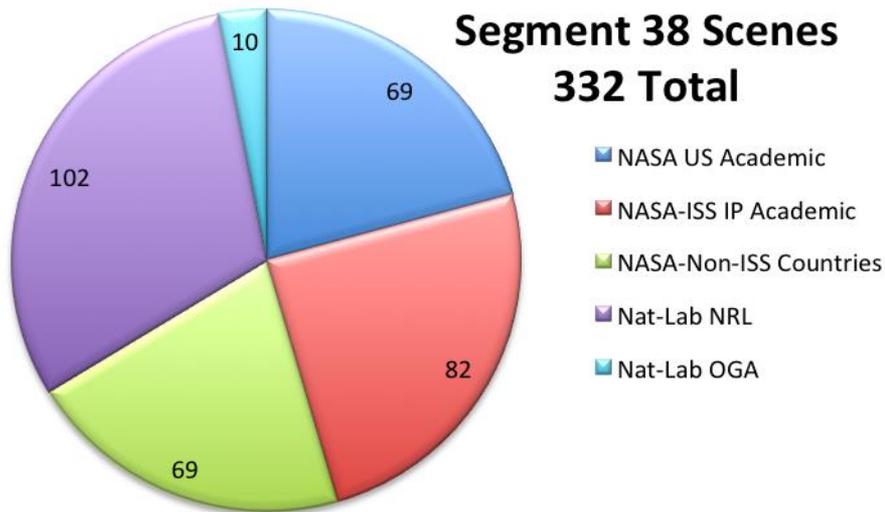


- * Browse and download existing imagery from NASA's Ocean Color Website
 - * All archived and current data
 - * Co-located with other Ocean Color data: MODIS, VIIRS, etc.
 - * Only registration required
- * Code to convert hdf into ENVI
- * Level 1b data is in hdf format, which includes
 - * Radiometrically corrected image cube
 - * 3-band rgb image
 - * Navigation file containing each pixel latitude/longitude plus sensor attitude
 - * Quality flags



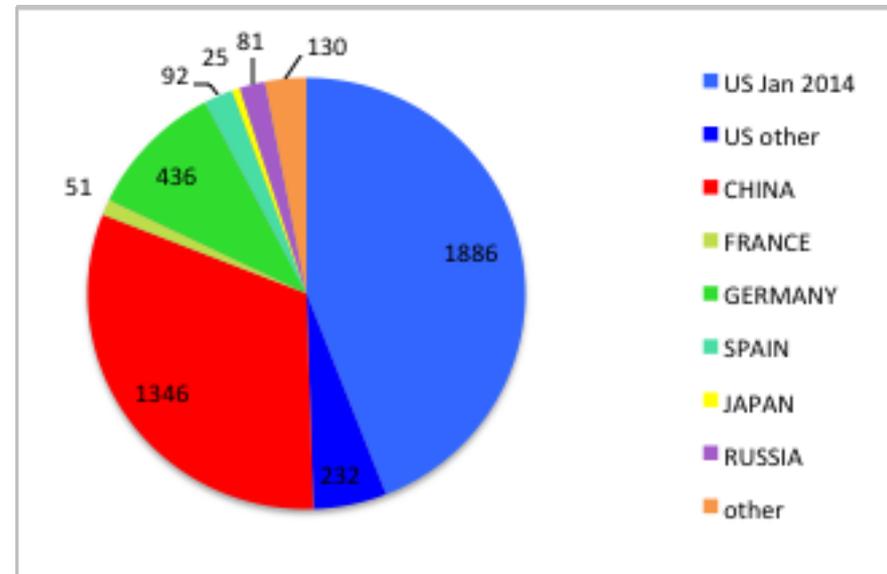
Usage Statistics

Scenes Collected by HICO
11 Nov 2013 – 12 March 2014



Tasking

Scenes Downloaded from
NASA's Ocean Color Website
July 2013 – January 2014



Dissemination



Computer Lockups

- * Computer locks up frequently since it is not radiation-hardened
 - * Irregular, but occurs approximately every 4 days
 - * Images are lost until computer is rebooted
 - * Significant lockup after Christmas required extra checks and processes before returning to operations
 - * Lost 6 weeks of data plus 3 weeks lost in December due to issues on ISS
 - * Operations normal since restoration on February 10, 2014



Opportunities for Users

- * CASIS sponsors several projects
 - * Recent call: Enabling Technology to Support Science in Space for Life on Earth
 - * www.iss-casis.org
- * Recent NASA ROSES (PACE Science Team) call included request for HICO algorithms



Recent Accomplishments & Events

- * Improved geolocation
- * Improved radiometric calibration being worked on
 - * Based on analysis of polarization effects at different view angles
- * Improved data downlink rate
 - * More flexible scheduling
 - * Can now take 2 images per orbit in some cases, or move to a backup site in case the primary has bad weather
- * HICO will be first chapter (after overview) in new book “Optical Payloads for Space Missions”, ed. Shen-En Qian
 - * Draft due to publisher (Wiley) in June



HICO Science Rationales on ISS

- * HICO currently provides the highest spatial resolution (~90 meters/pixel), publically available hyperspectral data for the coastal regions
- * HICO provides ocean color data that is useful for cross-calibration and validation of other ocean color sensors including NASA/MODIS and ESA/MERIS
- * HICO contributes to ISS humanitarian benefits through response to International Disaster Charter activations
- * HICO demonstrates capability and value of ISS as a hyperspectral imager platform; continued operation will encourage development of successor instruments through both SMD and CASIS funding calls



HICO Value to Taxpayers

- * HICO data is being used by the EPA to develop water quality indices intended to inform the public about potentially hazardous conditions, such as algal blooms
- * HICO is spurring National Lab utilization of ISS through CASIS RFP for new sensor development; proposals from commercial entities are in review
- * Data are publically available through the GSFC Ocean Color Web site (<http://oceancolor.gsfc.nasa.gov/>)
- * HICO data is currently being collected to support federally-mandated climate adaption and sustainability efforts at JSC; direct value to regional taxpayers and stakeholders through contribution to sustainable, efficient management of NASA coastal properties and functions