



# **Landsat Project Status**

## **Landsat Science Team Meeting**

**July 15, 2008**

**Presented By:**

**Kristi Kline, PMP**

**Landsat Project Manager, U.S. Geological Survey/EROS**

**[kkline@usgs.gov](mailto:kkline@usgs.gov), (605) 594-2585**

U.S. Department of the Interior

U.S. Geological Survey

---

# Mission Status

# Landsat 5 Status

---

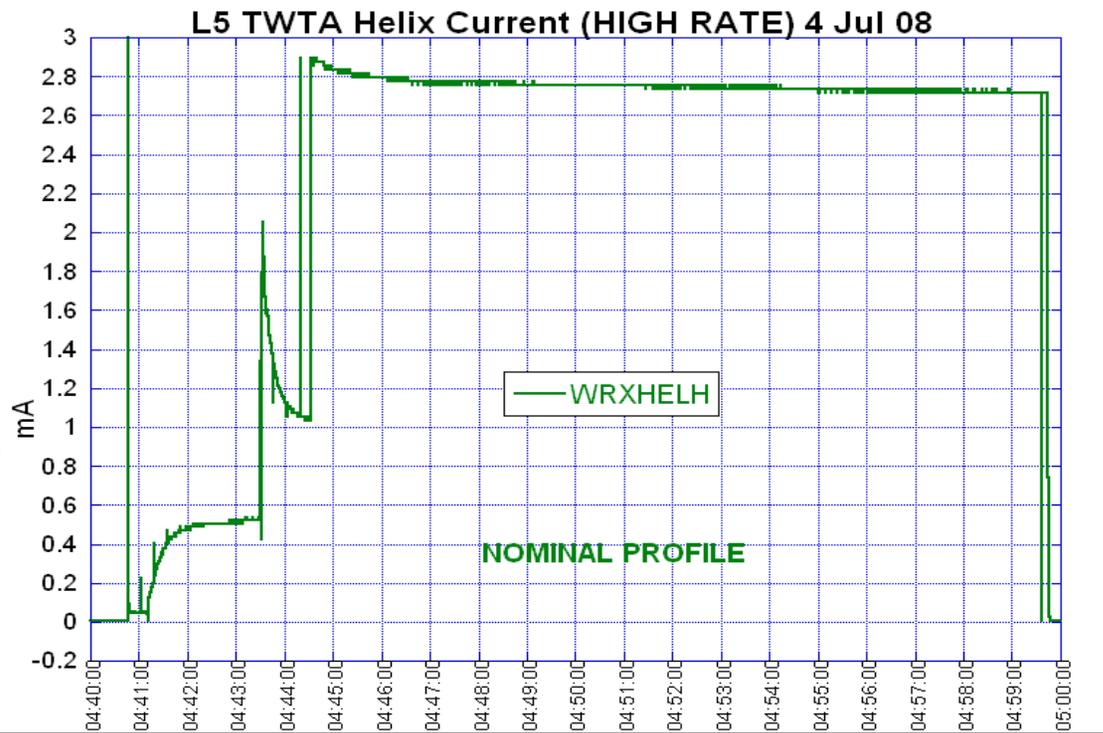
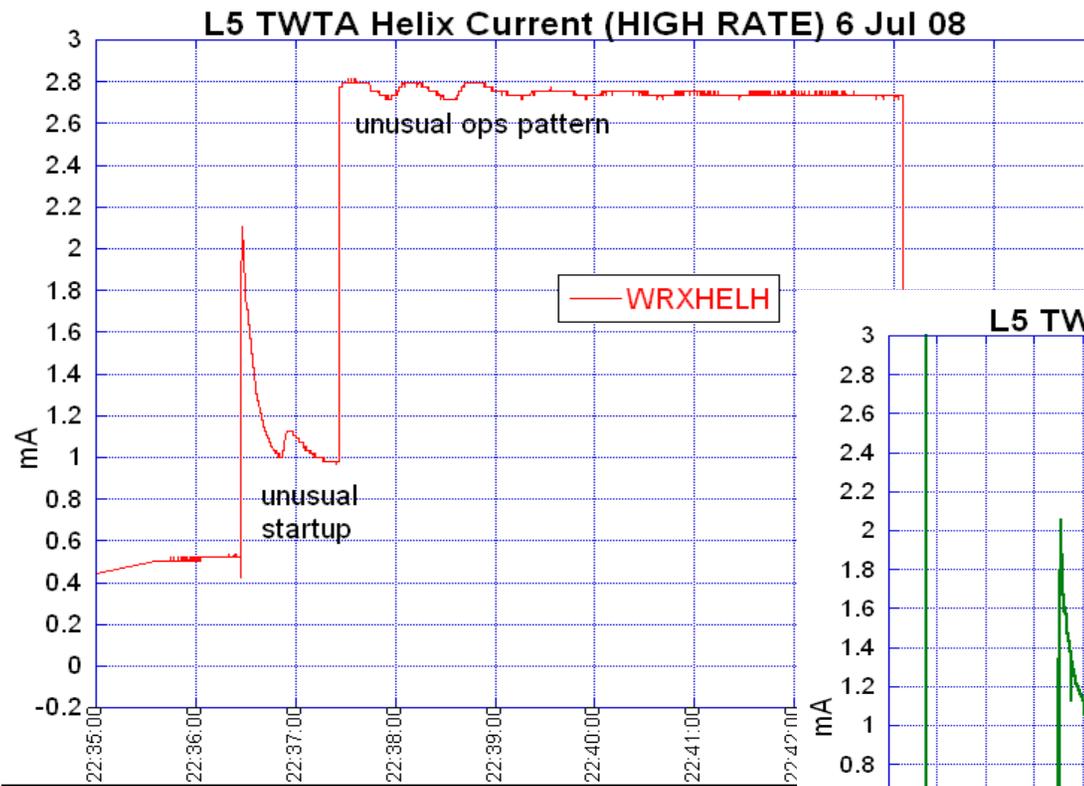
- **On-board Computer (OBC) Fix**
  - ◆ Fixes an erroneous halt command that could cause safe hold situation
  - ◆ Halt of the OBC would likely result end of mission
  - ◆ Same changes made on other mission with similar bus (EUVE, CGRO, and UARS NSSC-1)
  - ◆ No date yet on installation – working on implementation plan
- **Attitude testing**
  - ◆ Goal: Improve pointing accuracy by calibrating the gyros
    - Due to Solar Array issue, L5 must pitch (not during imaging) to increase charging
    - Attitude issues have been seen in the past
  - ◆ 4 tests conducted (June 12-18) – 2 roll and 2 yaw tests
  - ◆ Star Catalog testing commences in July (2-3 weeks) to support improved attitude
    - Test 3-day updates versus the nominal 8-day updates

# Landsat 5 Status (Cont.)

---

- **Ranging support for Lunar Reconnaissance Orbiter (LRO)**
  - ◆ Assisting with certification of stations prior to launch of LRO
    - Hawaii certified; Australia in work; Germany and Sweden pending
- **MPS (Modular Power Subsystem)**
  - ◆ Battery 1 Failed in 2005
  - ◆ Battery 2 lost cell in October 2007
  - ◆ Resumed science operations in March 2008 with Battery 2 as primary and battery 3 secondary
  - ◆ Testing and analysis determined additional power and margin could be gained through a Battery 3-primary configuration
- **Traveling Wave Tube Amplifier (TWTA) – X-band downlink**
  - ◆ Unusual start-up profile began in June (see charts)
  - ◆ Working with Aerospace expert to analyze
    - May be result of a change in state of electronics associated with the TWTA
    - Operational currents have trended down since the start of this unusual profile
    - Advises to monitor the current for any further changes; change appears to be benign

# Landsat 5 TWTA Helix Current Profile



# Landsat 7 Status

---

- **Planned bMOC Exercises – Two passes on June 24**
- **Attitude Control System**
  - ◆ **Inertial Measurement Unit (IMU) Gyros**
    - Gyro 3 (of 3) shut down due to vibrations in 2005
      - ◆ Shut down, not failed. Possibility of recovery if needed.
    - Gyros 1 and 2 operating nominally with no trend to failure
      - ◆ Currents and biases not entirely stable, but no trend visible
    - Began work on a single-gyro flight capability in 2005
      - ◆ Have current capability to maintain pseudo-stable flight with maneuver capability with 1 gyro.
      - ◆ Working with Lockheed-Martin and Honeywell on rate estimator that will provide up to an order of magnitude better performance with greater consistency
        - Approach validated on simulator
        - Algorithm being refined to fit within in processor capability
        - Expect more updates/testing in July on the simulator to streamline code

# Landsat 7 Solid State Recorder Recovery

---

## ● Background

- ◆ 5 of 24 Printed Wire Assembly (PWA) boards shut down
  - Cause identified as pseudo-random event – likely power fluctuation resulting in autonomous shut down
  - Analysis concludes no “hard” failure likely on any of the boards
- ◆ FOT has NOT reset the autonomous current protection circuit or recycled the backplane power
- ◆ No additional impact to LTAP from latest board shutdown, but overall impact due to reduced on-board storage (21% capacity loss)
  - Full Capacity (all 24 boards): 100 scenes (378 Gbits)
  - Additional downlink needed to empty recorder
- ◆ Terra has SSR from same manufacturer (L3Comm)
  - Experienced same issue and successfully recycled backplane power and turned on PWA (unplanned activity)

# Landsat 7 Solid State Recorder Recovery

---

- **Recovery Plan**

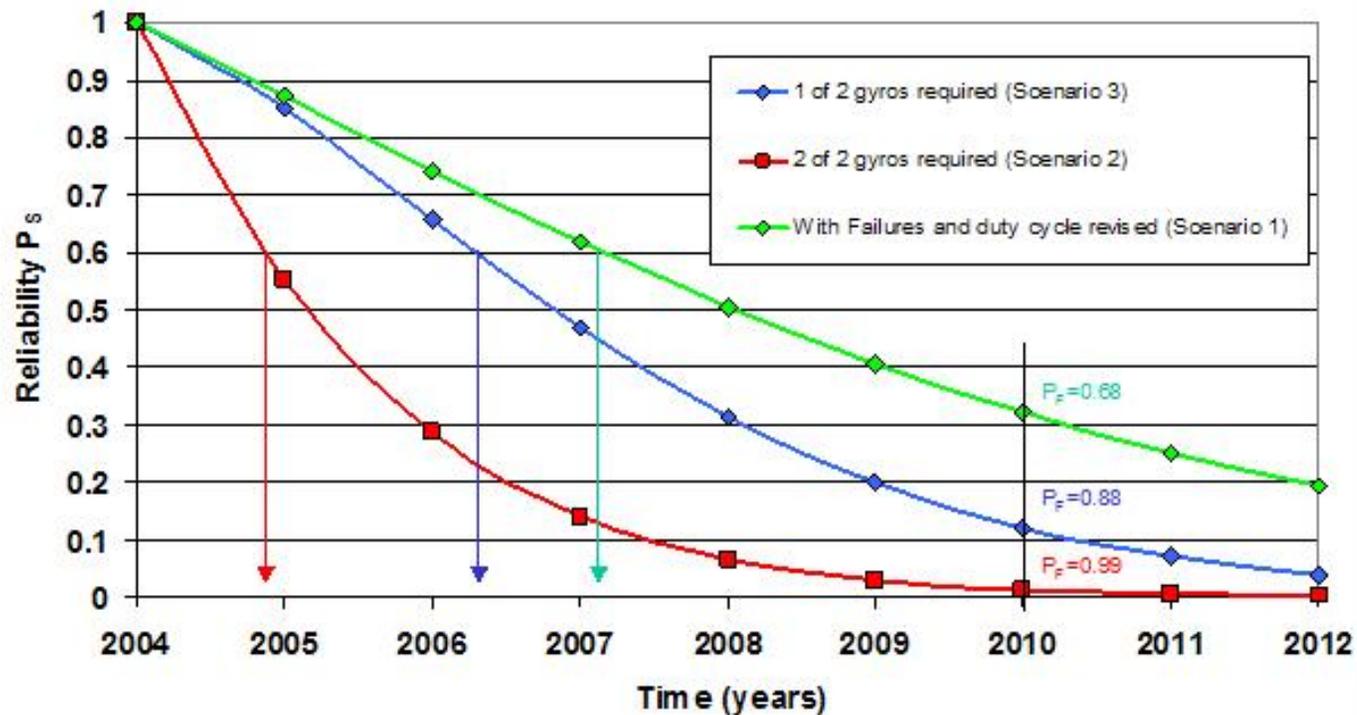
- ◆ Step 1: Re-power PWA #23 (1st PWA Lost) – **Tentative July**
  - Backplane power was recycled 1 time since shut down
  - Analysis of results prior to Step 2
- ◆ Step 2: Re-power PWA #12, 2, 13, 22
  - Analysis of results prior to Step3
- ◆ Step 3: Recycle backplane power (Optional)
  - Would only be necessary if step 2 is unsuccessful
  - Not recommended at this time.

- **Risks**

- ◆ Repowering individual PWA will not cause increased risk
  - PWA will shut down autonomously again if “hard failure” (E.g., circuit short) is problem
- ◆ Backplane power recycling – small chance failure of entire backplane (**WILL ONLY DO THIS IF NECESSARY** – should additional failures lead to unacceptable loss of ops capability)

# NASA Risk Assessment

- Risk assessment in 2005 concluded that the probability for Landsat 7 failure prior to 2010 is 99% primarily due to gyroscope issues (with launch requirement of 2 gyros)
- NASA and USGS intend to update the report this year



---

# Ground Segment Activities

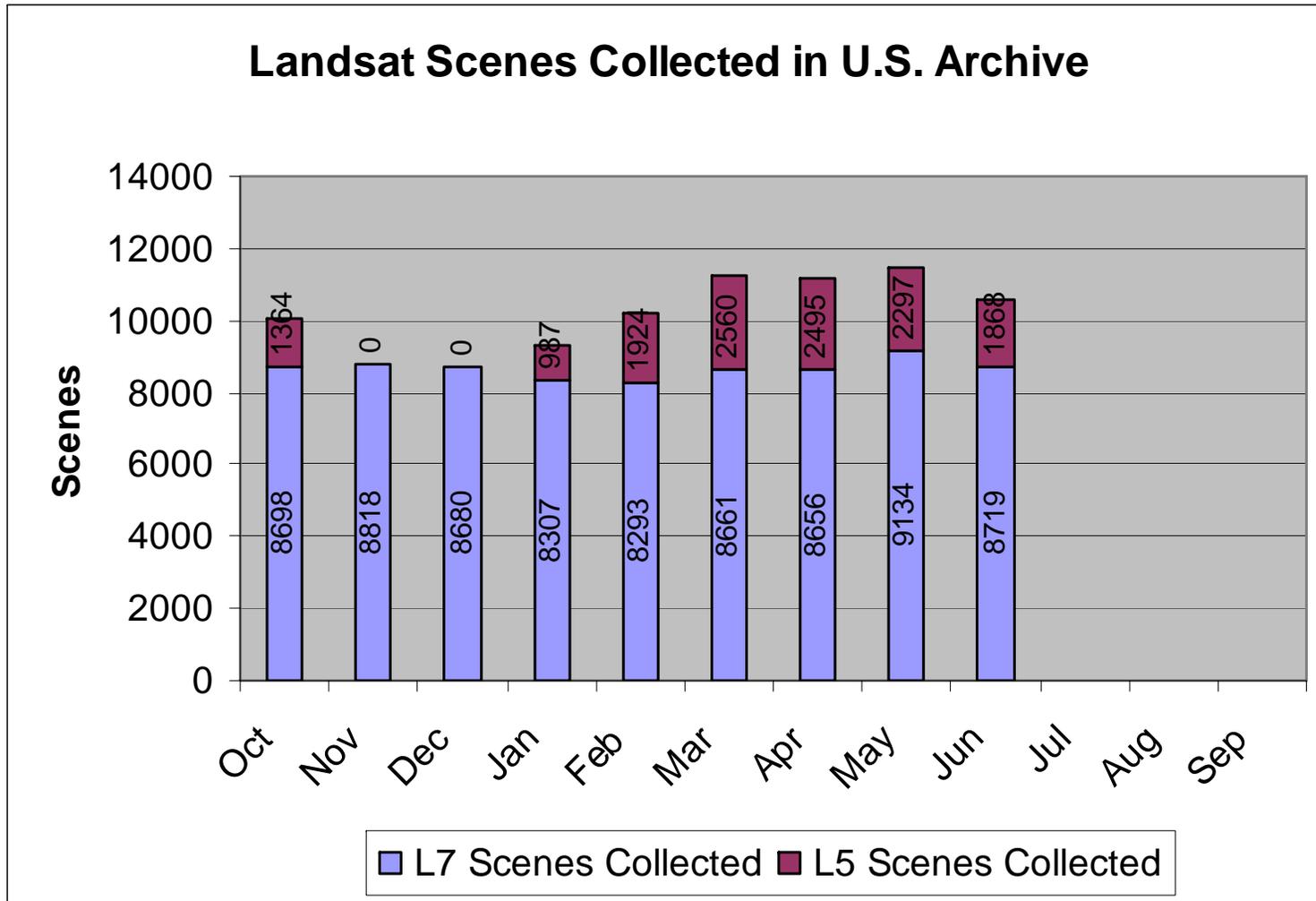
# Ground Segment Activities

---

- **Archive**

- ◆ Off-site archive
  - Continued work on off-site archive tape copies
    - ◆ 3404/3683 (92.42%) completed
- ◆ Six box tape shipment (432 tapes) to NARA managed limestone cave near Kansas City; total tapes shipped now 46 boxes (3312 tapes)

# Landsat Data Acquired by Month



# Global Land Survey

---

## MDA Federal Task Order

- **GLS2000 processing**

- ◆ Completed initial deliveries of all areas of the globe
- ◆ 9 areas have been identified as not meeting 30m spec.
  - Rework in progress (6-700 scenes to be replaced)
  - Africa & India scenes resent and being analyzed
  - Expecting NZ and South America early next week

- **GLS1975, GLS1990**

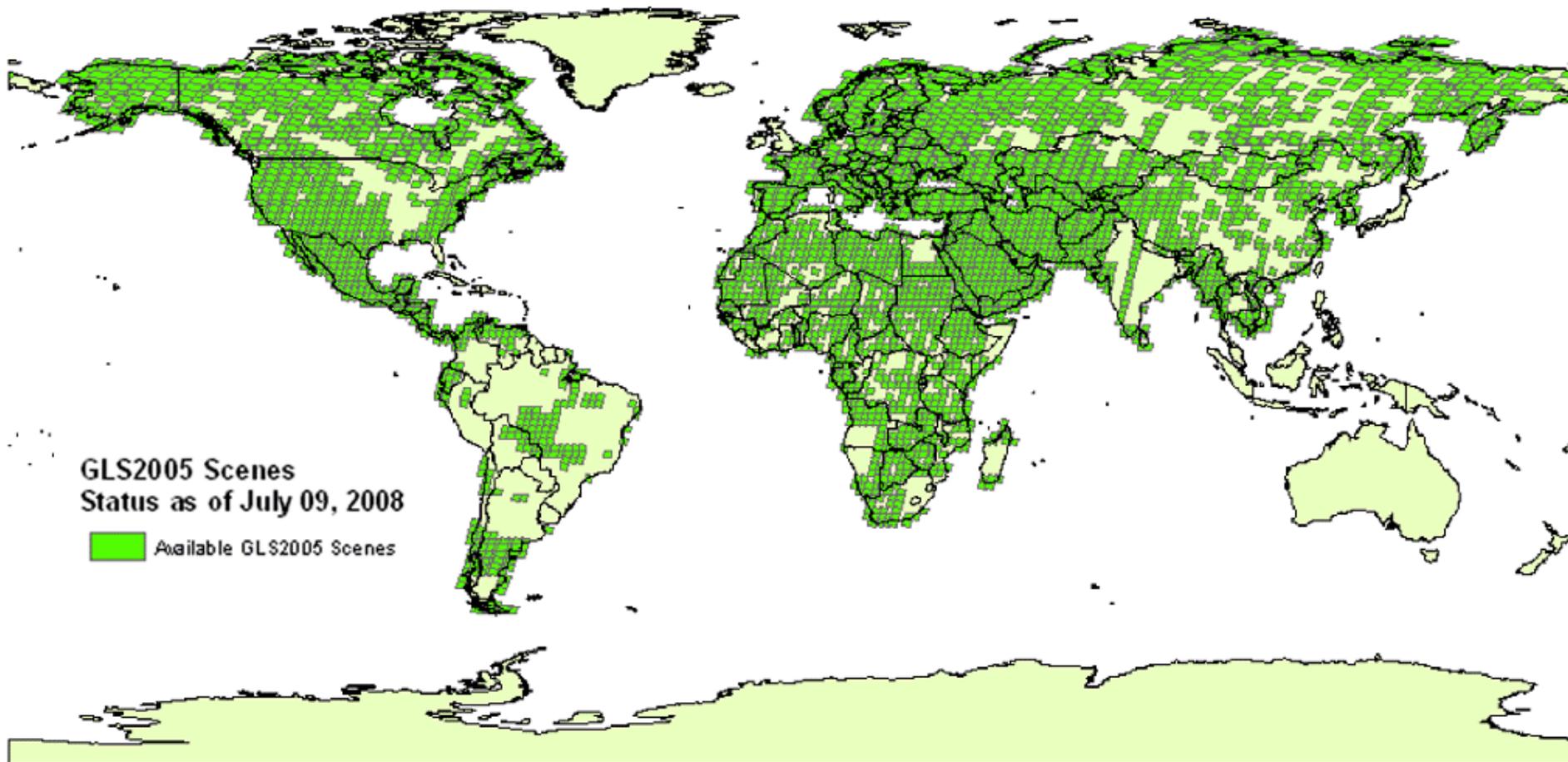
- ◆ Metadata issues in work
- ◆ Should have delivery by end of 4<sup>th</sup> quarter

- **GLS2005**

- ◆ L7 processing
  - North America, Africa, Eurasia, S. America complete
  - Waiting on scene lists for Rest of World
- ◆ L5 processing
  - Start planned for late July

# GLS2005 Status

---



# Web-Enabling Activities

---

- **Created Ground Control Points (GCPs) from GLS2000 data received**
- **Web-enabled Landsat Archive (current L7 newly acquired) for all areas with GCPs**
  - ◆ **Global data currently processed and distributed**
- **Landsat System Upgrades**
  - ◆ Submitted procurements for SAN and processing system upgrades for Web-Enabling
  - ◆ Throughput tests
    - Can currently process approximately 600 scenes per day
    - Working toward throughput of 1500-2000 per day
    - Tests helping to identify system bottlenecks

# Web-Enabling Activities

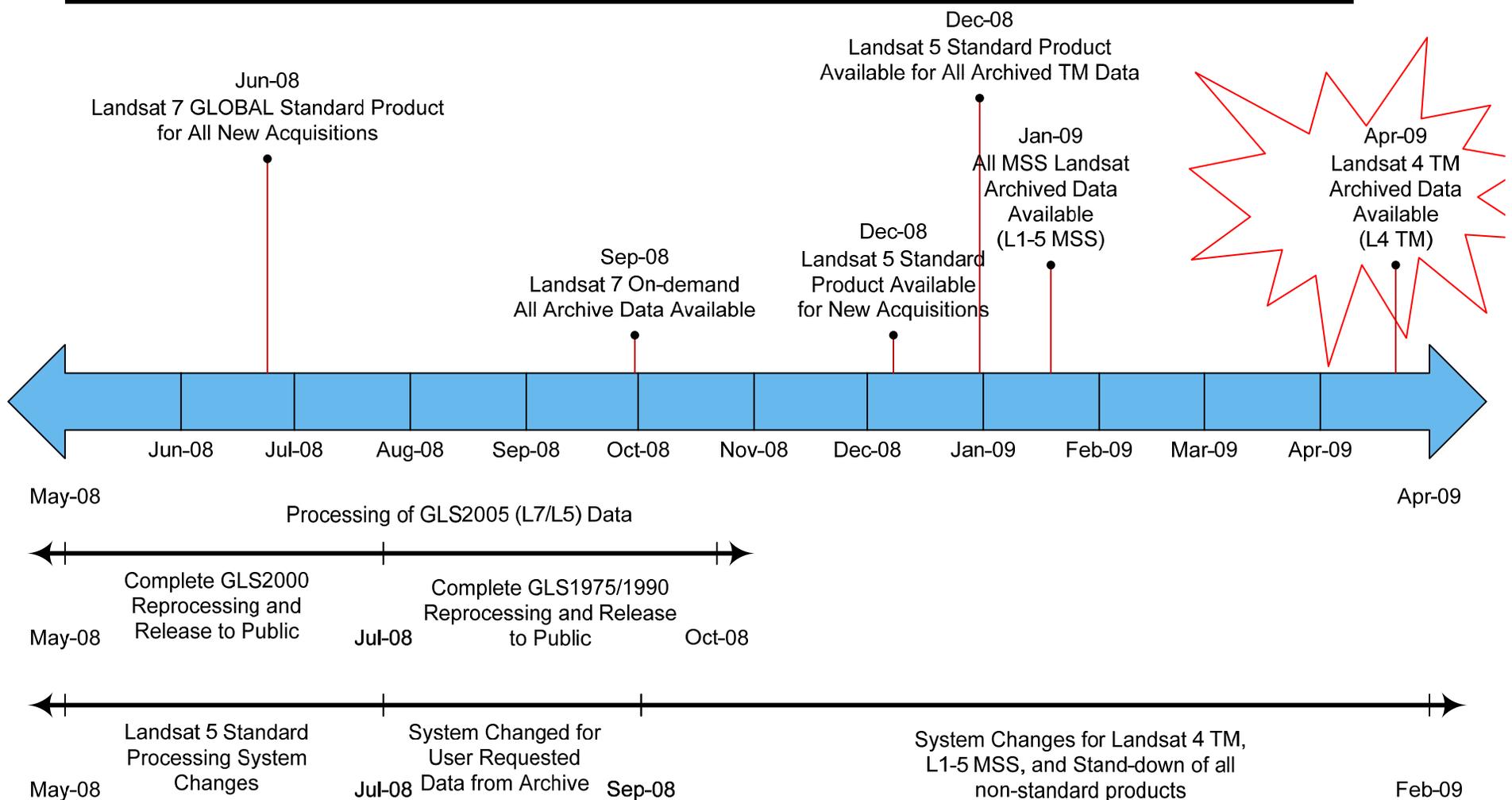
---

- **Landsat System Upgrades (Cont.)**

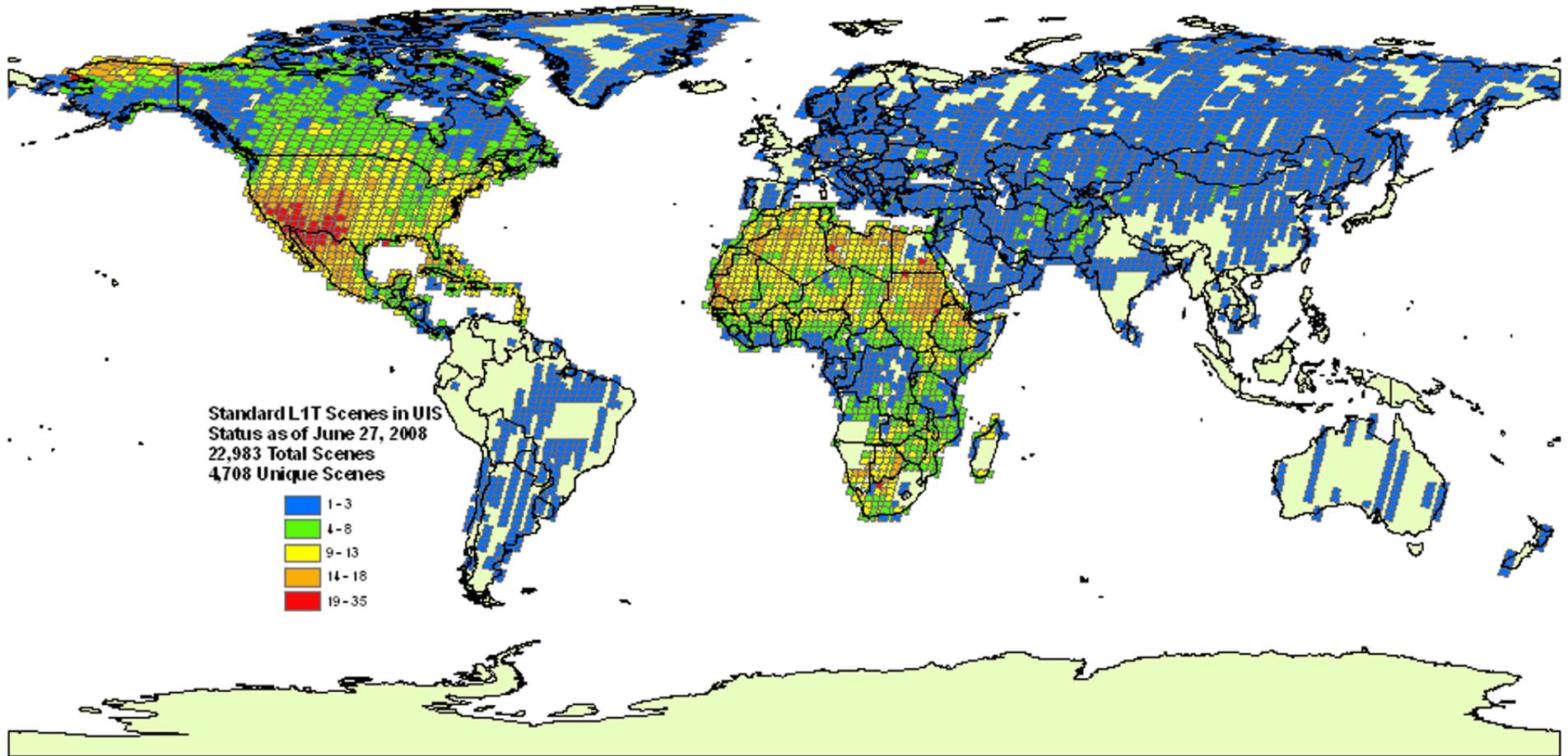
- ◆ Upcoming Web-enabling Activities

- System Releases (LPGS, LAM, UIS, NLAPS)
- Installation of new hardware
- Cache mgmt & cross-cut system changes
- L4 TM processing in LPGS – **DELAYED**
- Stand down all recipes, options, priorities, etc - **DELAYED**

# Web-enabled Schedule



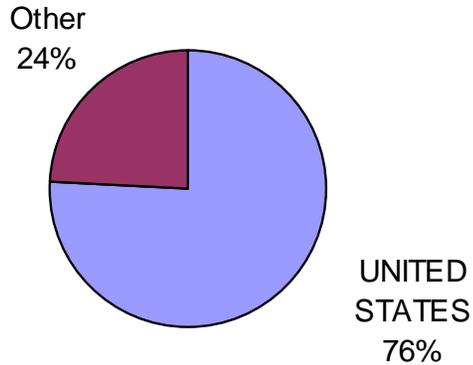
# Web-enabled Scenes Available



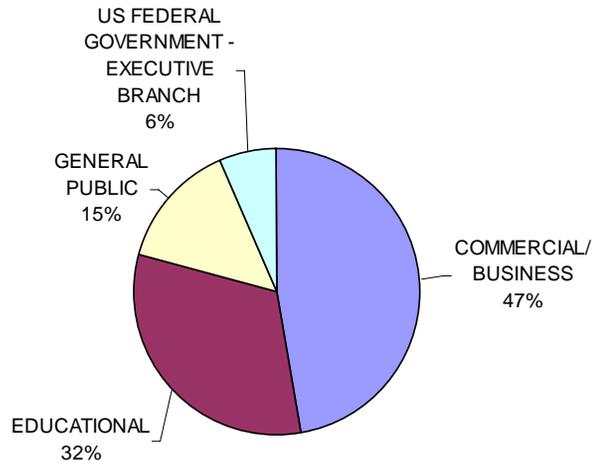
# Web-enabled Customer Demographics

(\*Does NOT Include Bulk FTP Downloads)

Downloads by Country

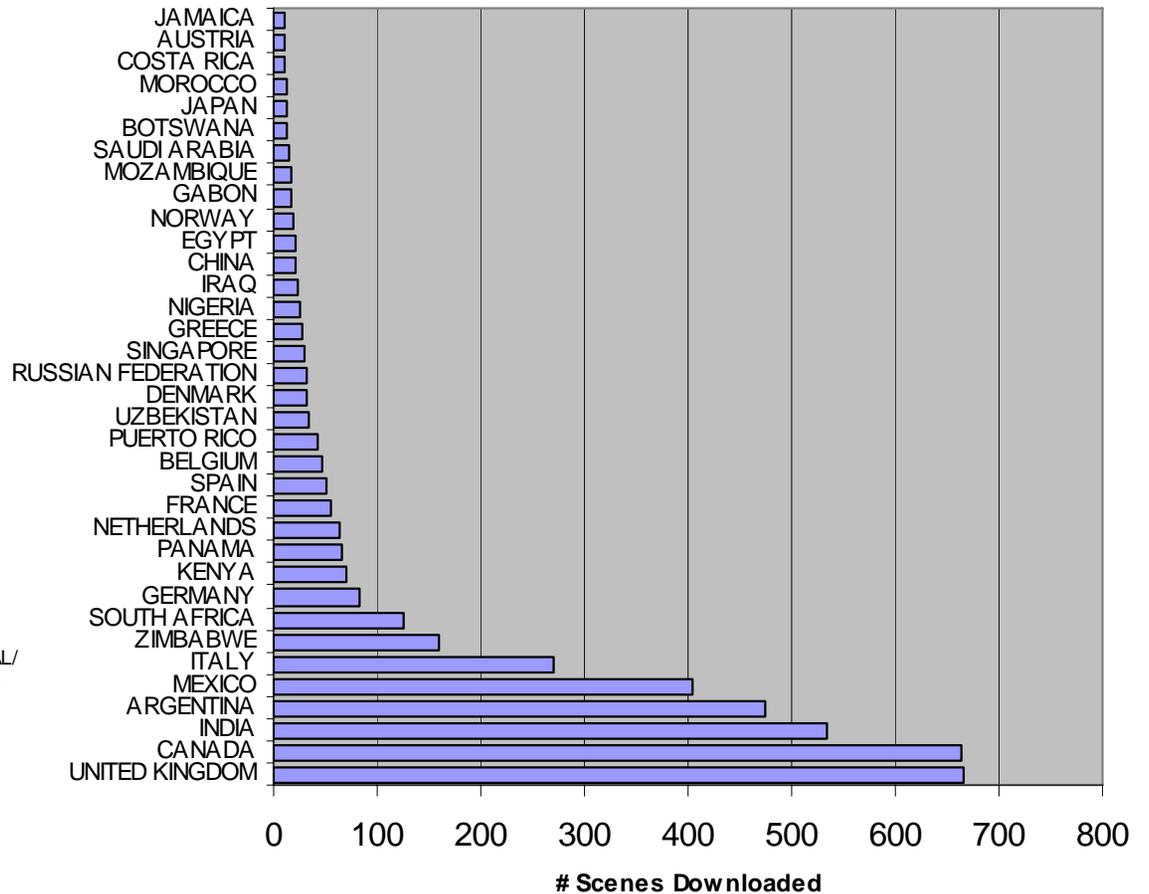


Downloads by Affiliation



Access by Countries (Other than U.S.)

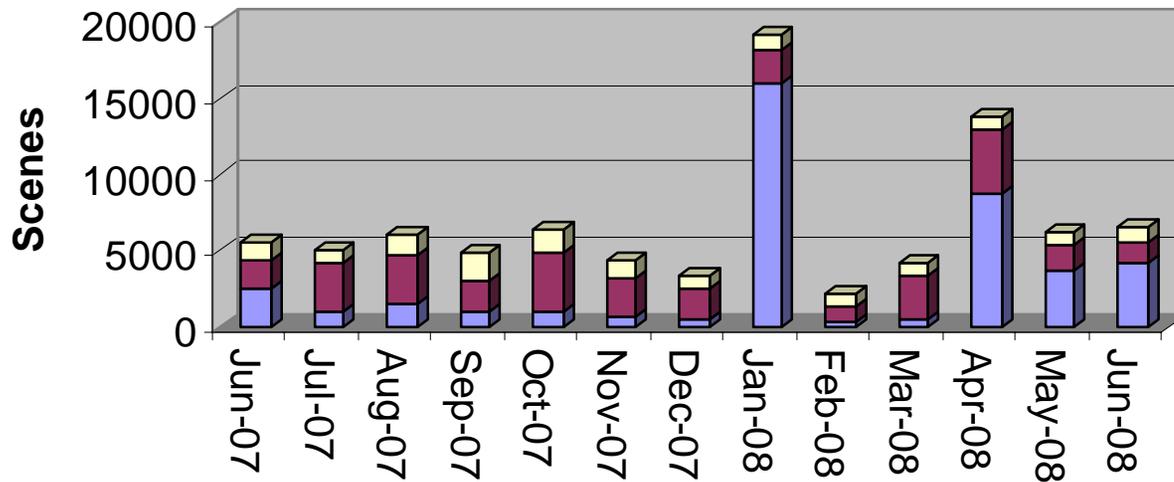
\*Only Countries with >10 Scenes Downloaded



# Total Landsat Data Distribution

- Over 41,000 Standard L1T products downloaded since June 2007

### Landsat Data Distribution

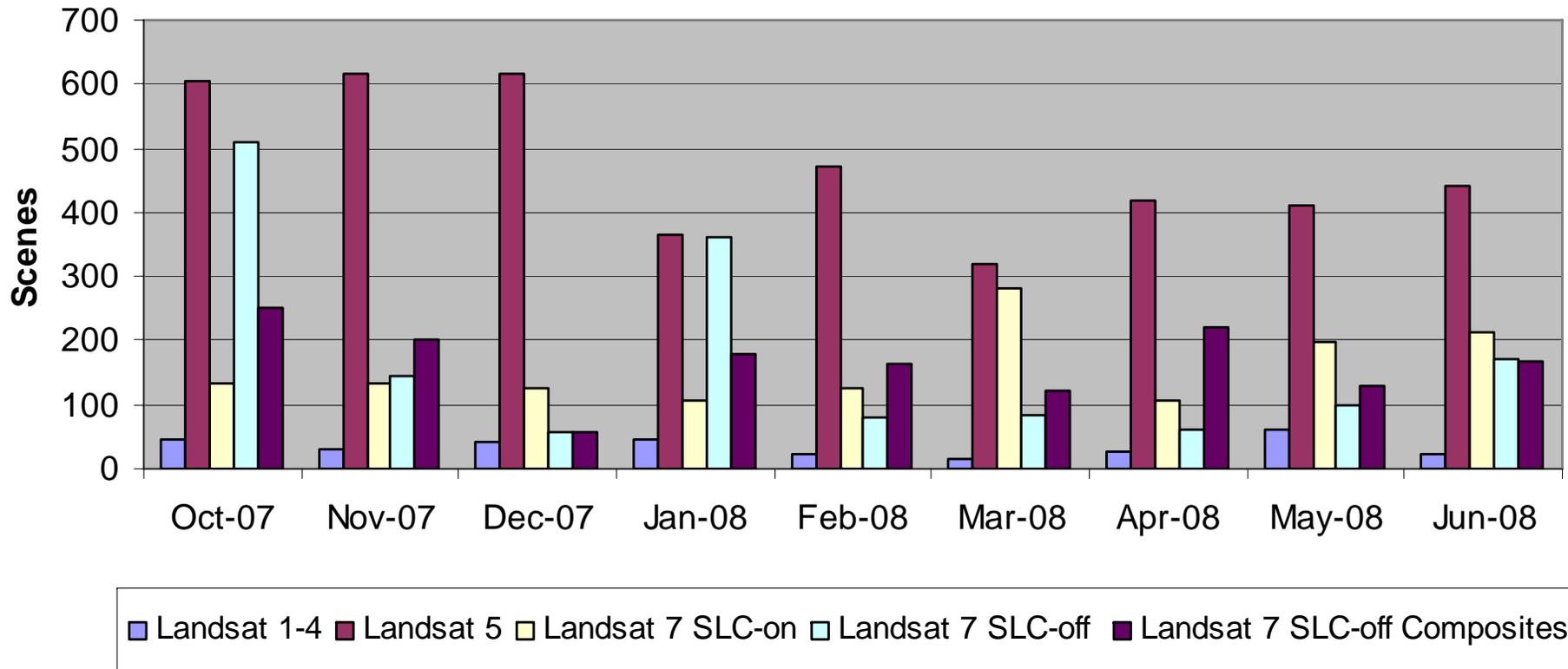


■ L1T Pilot Downloads ■ Other Landsat Web-enabled Downloads □ Landsat Products Sold



# Landsat Sales by Month

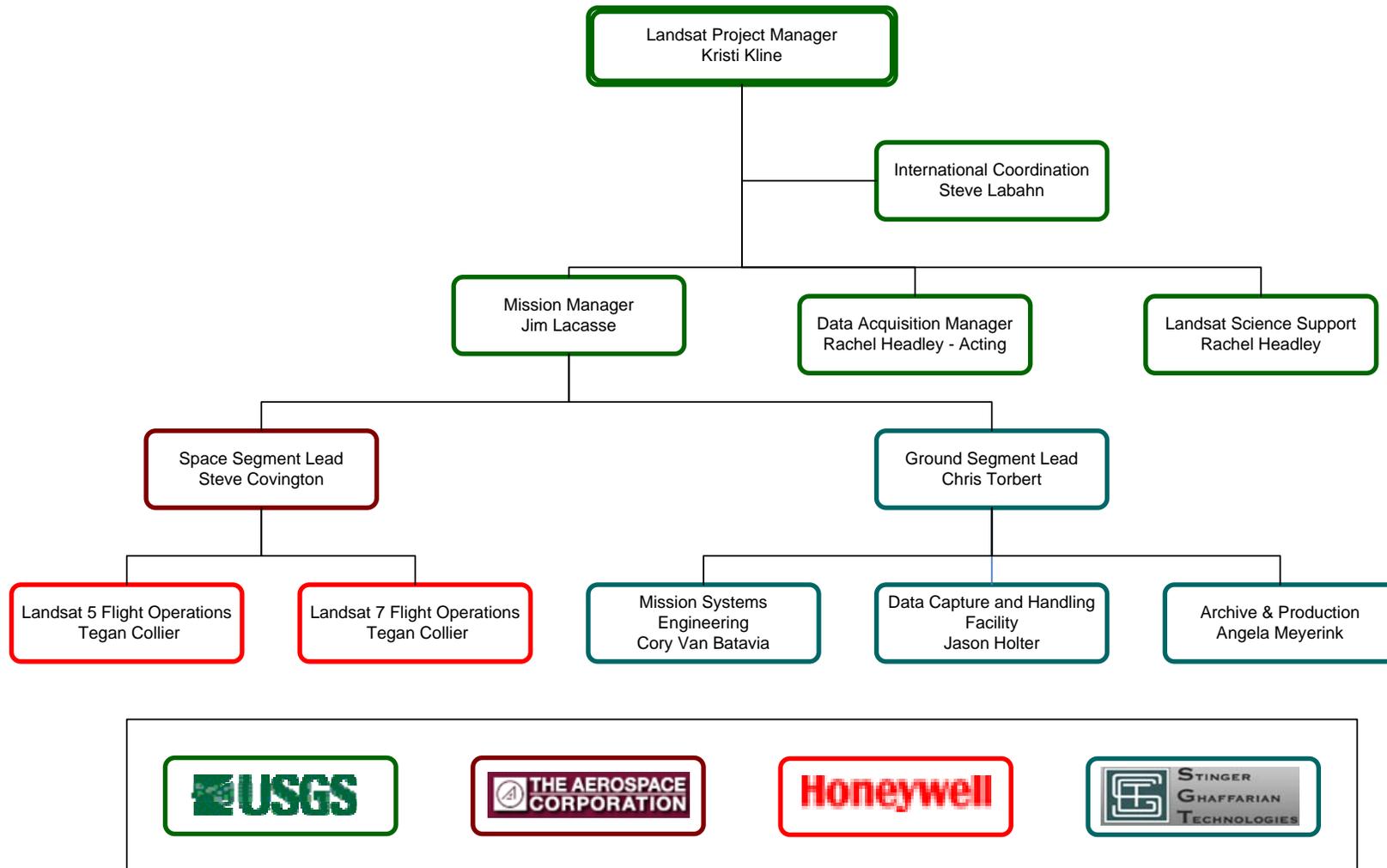
Monthly Landsat Sales (FY08)



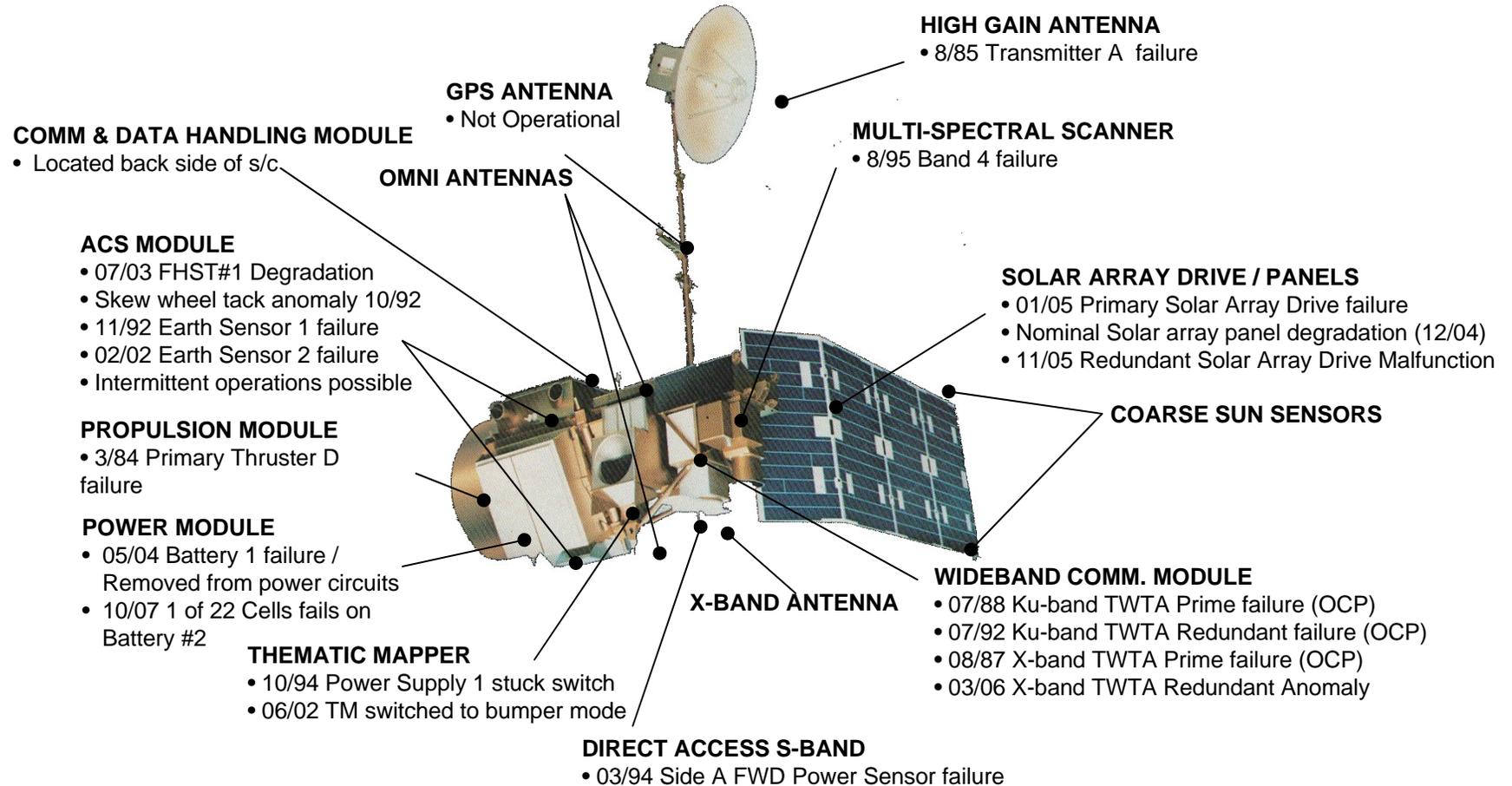
---

# GENERAL BACKUP SLIDES

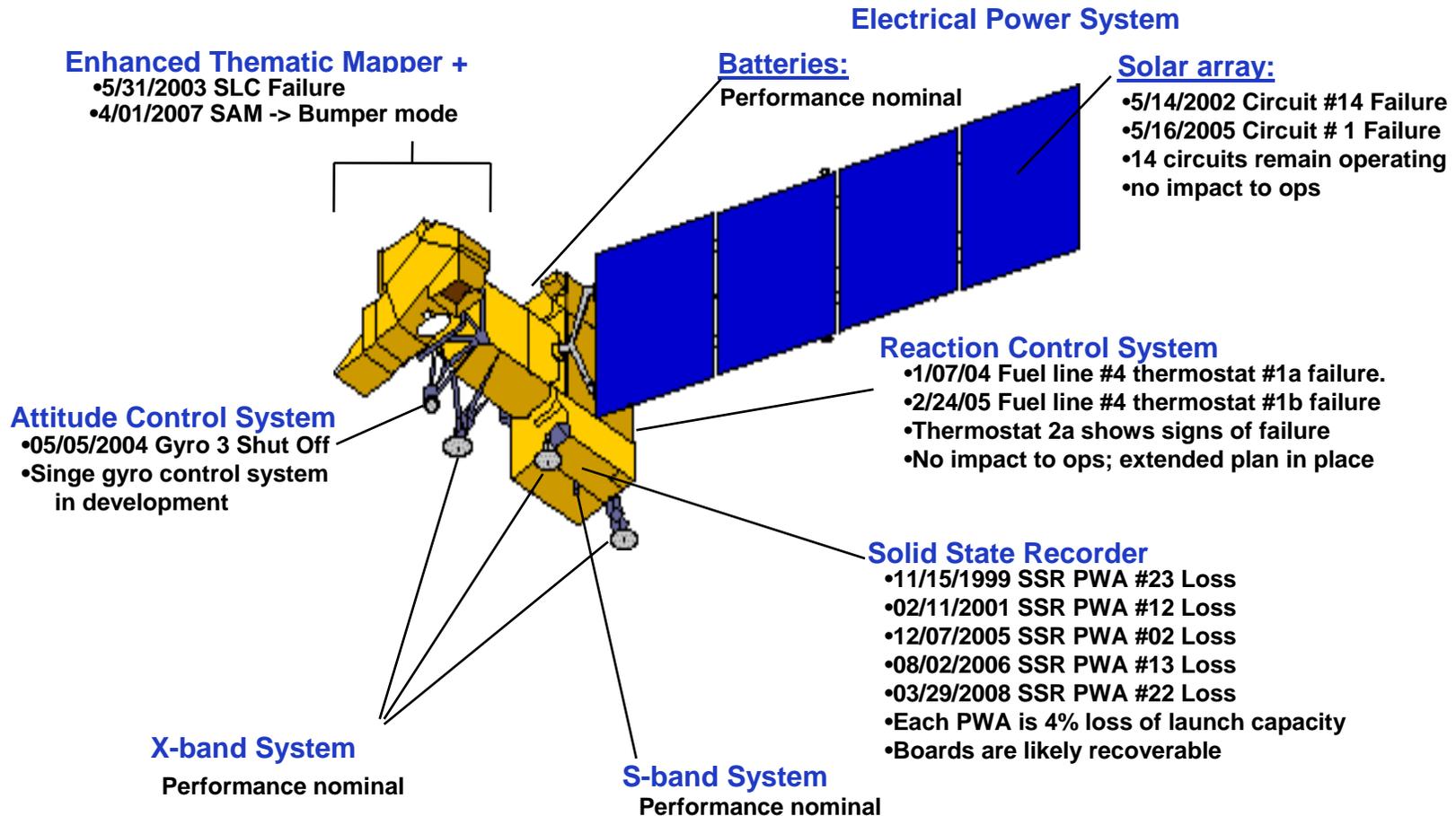
# Project Management Structure



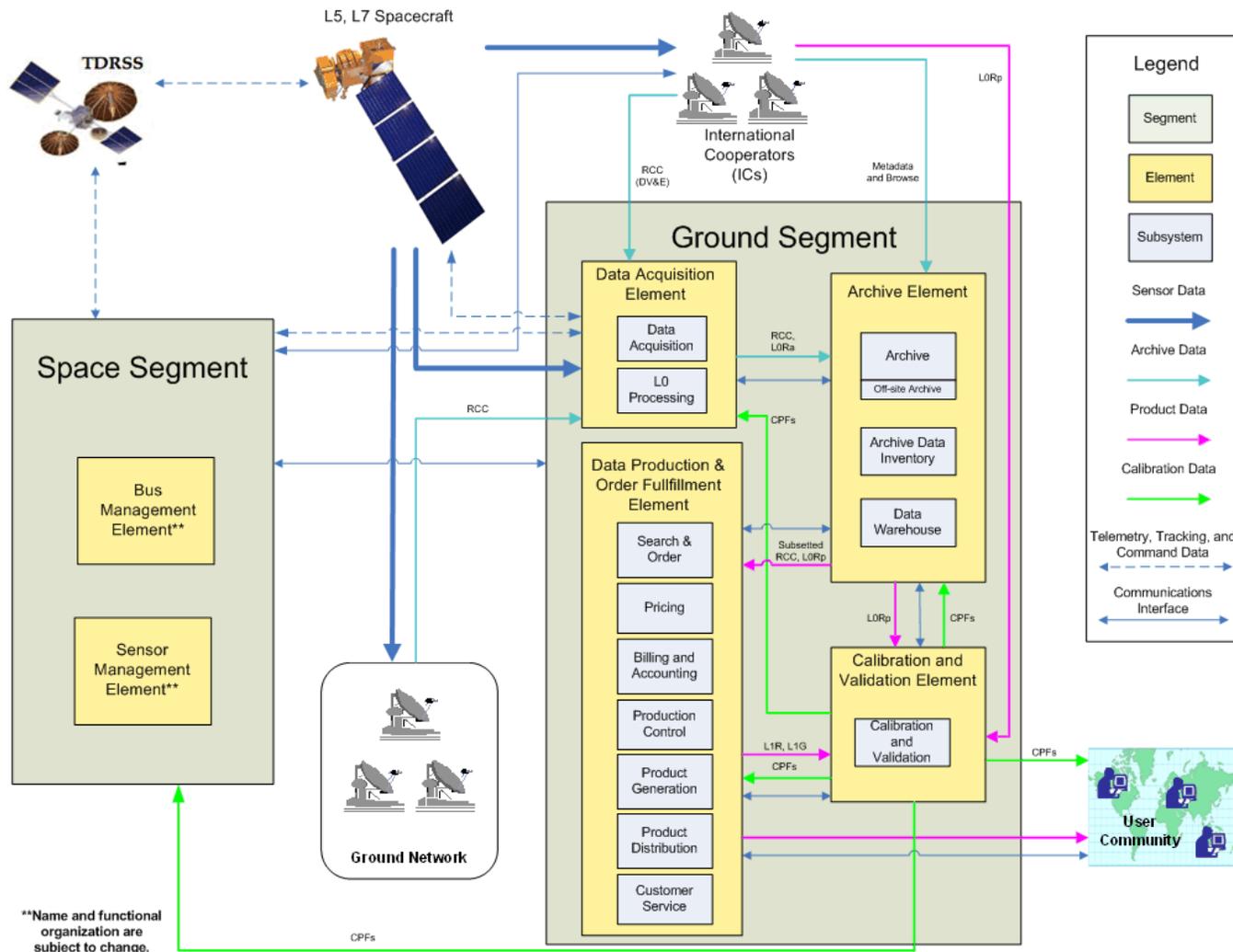
# Landsat 5 Flight Segment



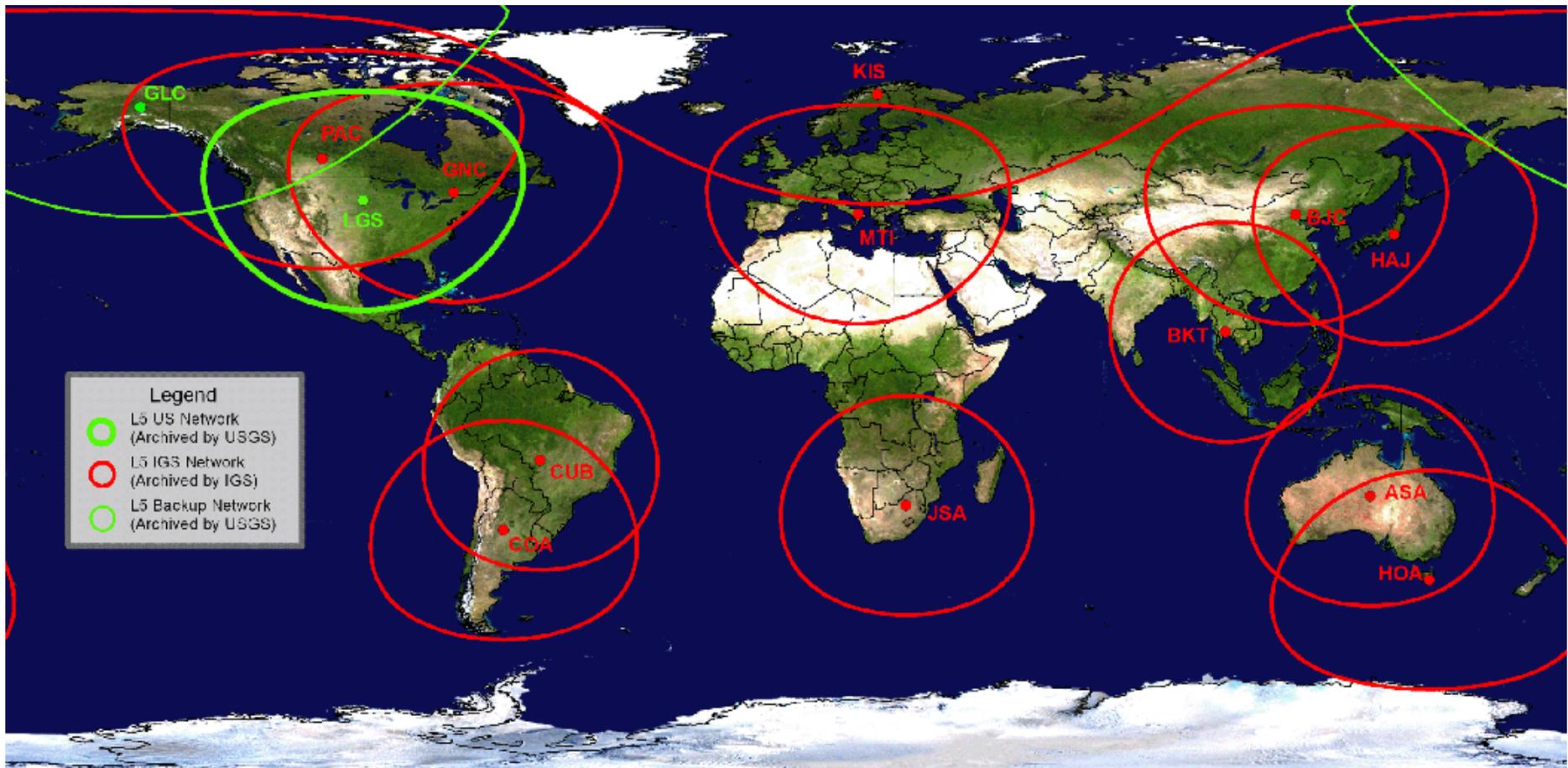
# Spacecraft Status



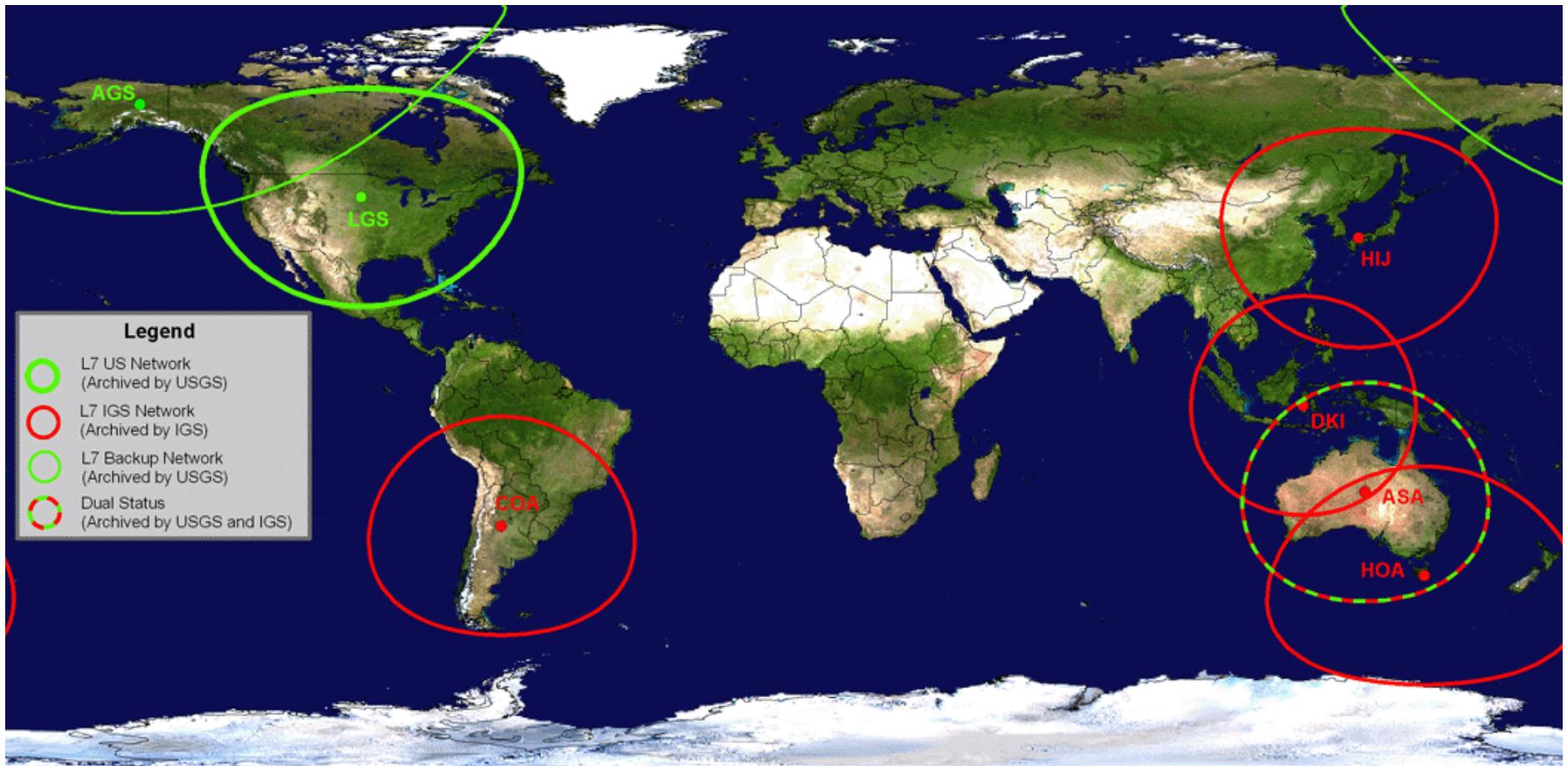
# Landsat Ground System Architecture



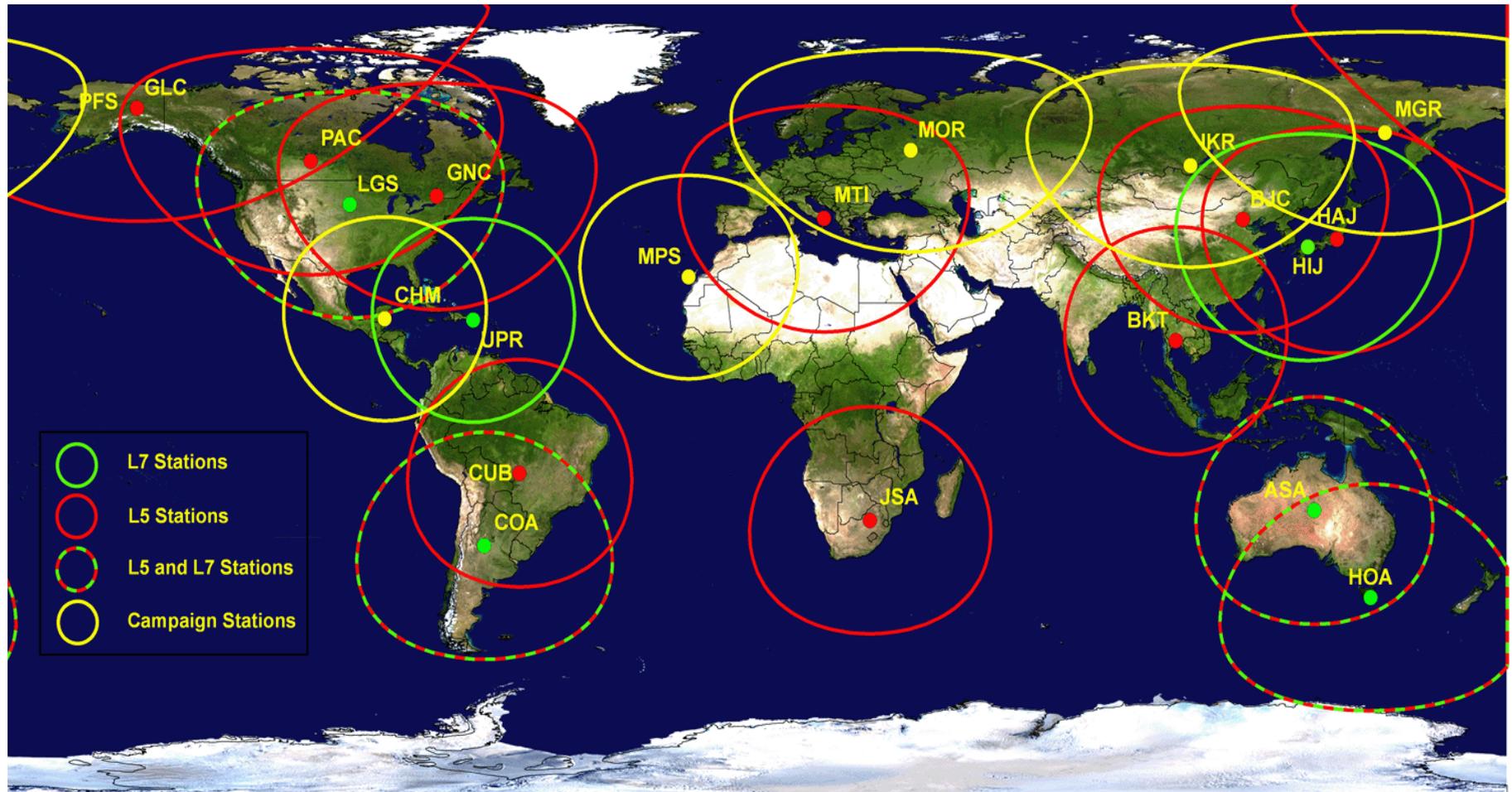
# Landsat 5 Ground Station Network



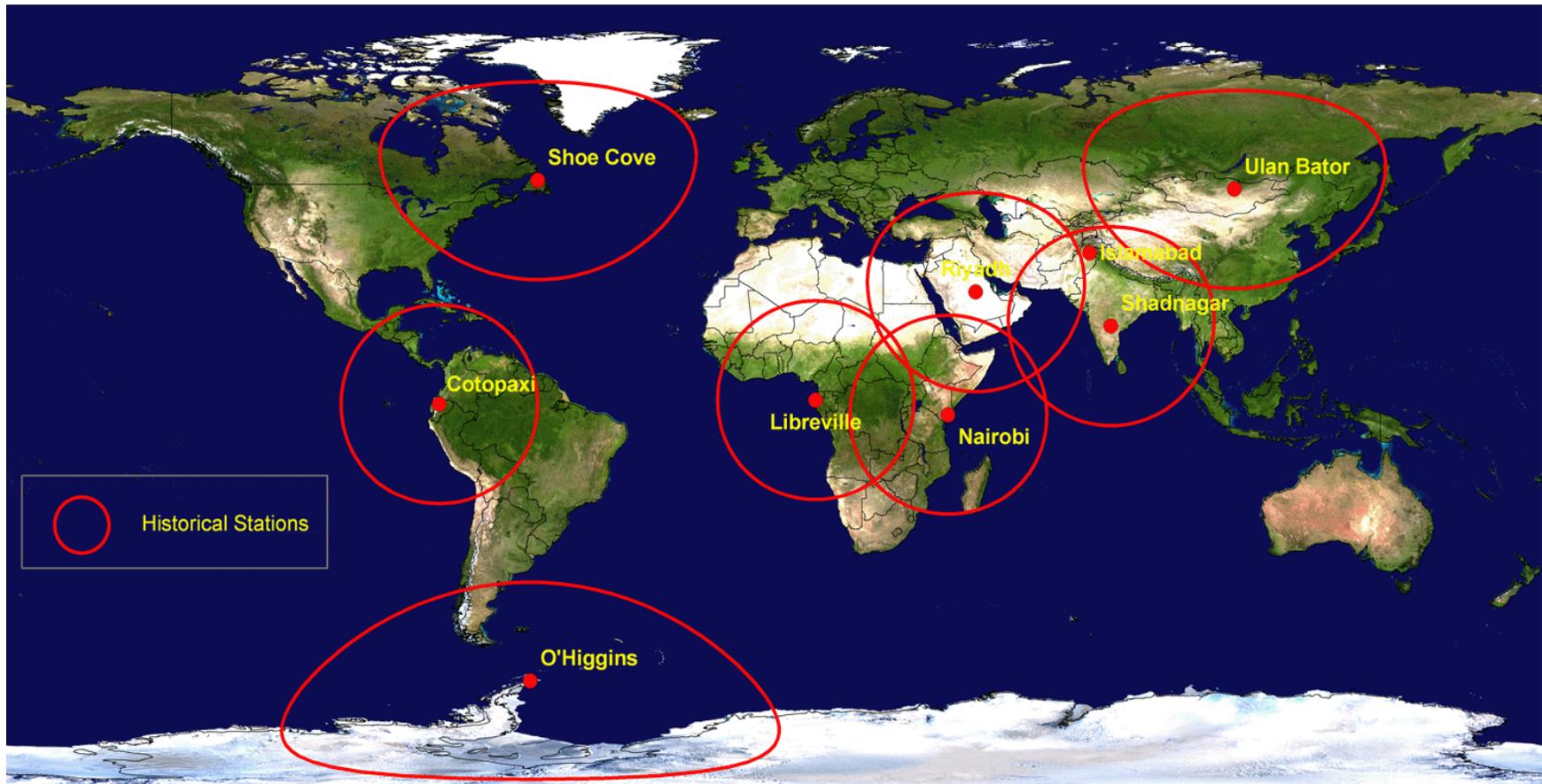
# Landsat 7 Ground Station Network



# Combined Ground Station Network



# Historical Stations



# Ground Station Identifiers

Country	Location	Identifier	Satellite Rcvd
Argentina	Córdoba	COA	L5, L7
Australia	Alice Springs	ASA, ASN	L5, L7
Australia	Hobart	HOA	L5, L7
Brazil	Cuíaba	CUB	L5
Canada	Gatineau	GNC	L5
Canada	Prince Albert	PAC	L5
China	Beijing	BJC	L5
China	KaShi	KHC	L5
Italy (ESA)	Matera	MTI	L5
Indonesia	Parepare	DKI	L7
Japan	Hatoyama	HAJ	L5
Japan	Hiroshima	HIJ	L7
Kenya (ESA)	Malindi	MLK	L5*
Mexico	Chetumal	CHM	L5*

\* Campaign Station

# Ground Station Identifiers

Country	Location	Identifier	Satellite Rcvd
Norway	Svalbard	SGS	L5, L7
Russia	Irkutsk	IKR	L5*
Russia	Magadan	MGR	L5*
Russia	Moscos	MOR	L5*
South Africa	Hartebeesthoek	JSA	L5
Spain (ESA)	Maspalomas	MPS	L5*
Sweden (ESA)	Kiruna	KIS	L5
Thailand	Bangkok	BKT	L5
U.S.	Gilmore Creek, AK	GLC	L5*
U.S.	Poker Flats, AK	AGS	L5, L7
U.S.	Poker Flats, AK	PFS (PF1, PF2)	L5, L7
U.S.	Sioux Falls, SD	LGS	L5, L7
U.S.	Univ. of Puerto Rico	UPR	L7

\* Campaign Station

# U.S. Landsat Archive Overview

(Marketable Scenes through May 31, 2008)

---

- **ETM+: Landsat 7**
  - ◆ 830,440 scenes
  - ◆ 771 TB RCC and L0Ra Data
  - ◆ Archive grows by 260 GB Daily
- **TM: Landsat 4 & Landsat 5**
  - ◆ 745,235 scenes
  - ◆ 373 TB of RCC and L0Ra Data
  - ◆ Archive Grows by 40 GB Daily
- **MSS: Landsat 1 through 5**
  - ◆ 652,174 scenes
  - ◆ 20 TB of Data



# Define the content of the archives

## USGS Archive Content (Sept 2007)

Satellite	Sensor	Date Range	Data Format	Scenes	Volume	Media
L1 - 3	MSS	Jul 23, 1972 – Sep 7, 1983	MSS-X, WBV	199,319	6.01 TB	DLT 7000
L2 - 3	MSS	Jan 22, 1975 – Sep 7, 1983	MSS-P, RCC	61,601	1.82 TB	9940B
L2 - 5	MSS	Jan 22, 1975 – Oct 15, 1992	MSS-A, RCC	261,046	7.88 TB	9940B
L4	TM	Aug 17, 1982 – Nov 18, 1993	TM-A, TM-R, RCC	58,457	29 TB	9940B
L5	TM	Mar 1, 1984 – Current	TM-A, TM-R, RCC	668,296	335 TB	9940B
L7	ETM+	Apr 15, 1999 – Current	L0Ra, RCC	755,401	701 TB	9940B
				<b>2,004,120</b>	<b>1,081 TB</b>	