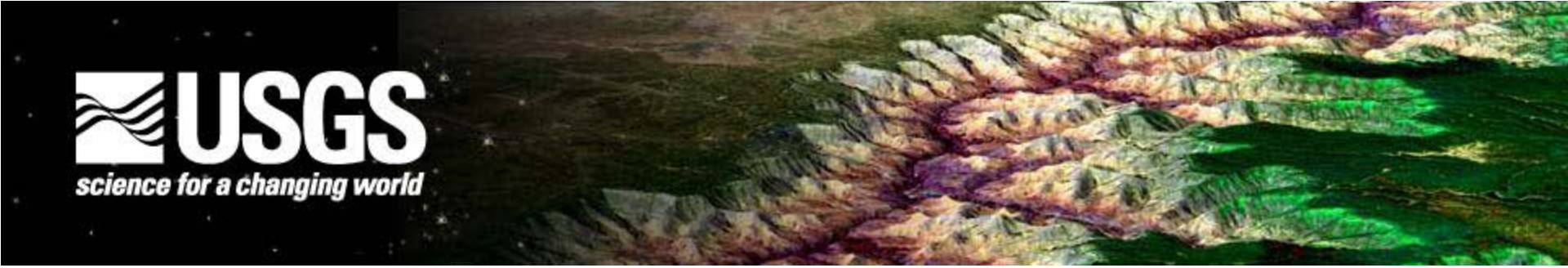

Landsat Project Status
Landsat Science Team Meeting

August 2011

Kristi Kline, PMP

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U.S. Department of the Interior

U.S. Geological Survey

Landsat 5 and 7 Status

Spacecraft Status

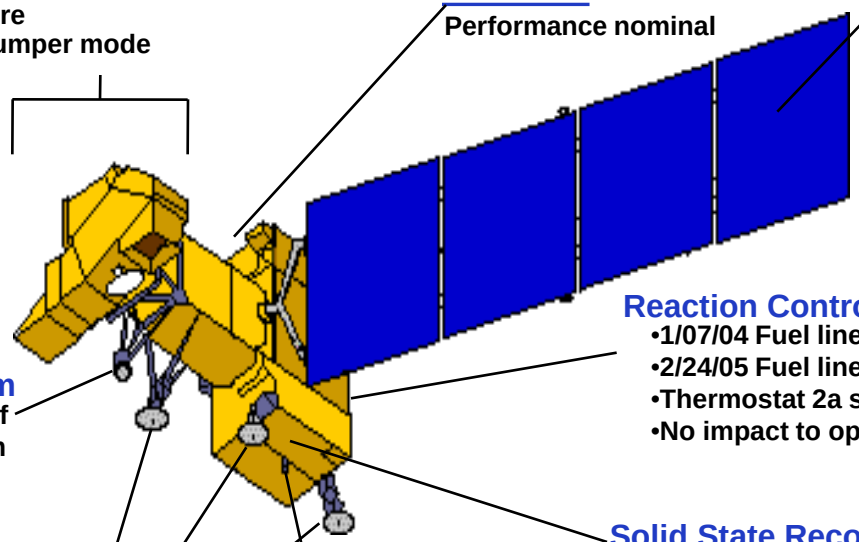
≈ 12 years of on-orbit operations

Enhanced Thematic Mapper +
- 5/31/2003 SLC Failure
- 4/01/2007 SAM -> Bumper mode

Electrical Power System

Batteries:
Performance nominal

Solar array:
- 5/14/2002 Circuit #14 Failure
- 5/16/2005 Circuit # 6 Failure
- 8/13/2008 Circuit #14 partial recovery
- 14 circuits remain operating
- no impact to ops



Reaction Control System
- 1/07/04 Fuel line #4 thermostat #1a failure
- 2/24/05 Fuel line #4 thermostat #1b failure
- Thermostat 2a shows signs of failure
- No impact to ops; extended plan in place

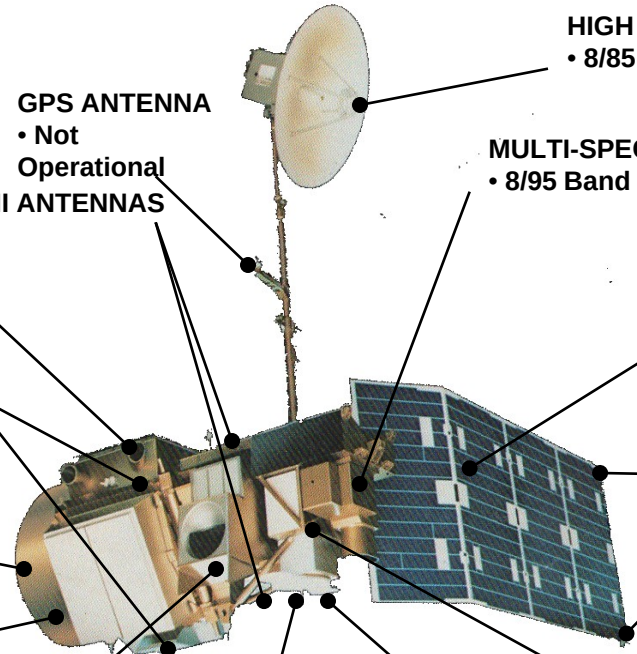
Attitude Control System
- 05/05/2004 Gyro 3 Shut Off
- Singe gyro control system in development

Solid State Recorder
- 11/15/1999 SSR PWA #23 Loss
- 02/11/2001 SSR PWA #12 Loss
- 12/07/2005 SSR PWA #02 Loss
- 08/02/2006 SSR PWA #13 Loss
- 03/28/2008 SSR PWA #22 Loss
- 09/03/2008 SSR PWA #23 Recovered
- Each PWA is 4% loss of launch capacity
- Boards are likely recoverable

X-band System
Performance nominal

S-band System
Performance nominal

Landsat 5 Flight Segment



HIGH GAIN ANTENNA
- 8/85 Transmitter A failure

GPS ANTENNA
- Not Operational

OMNI ANTENNAS

COMM & DATA HANDLING MODULE
- Located back side of s/c

ACS MODULE
- 07/03 FHST#1 Degradation
- Skew wheel tack anomaly 10/92
- 11/92 Earth Sensor 1 failure
- 02/02 Earth Sensor 2 failure
- Intermittent operations possible
- 08/09 Gyro-C anomaly
- 09/09 Gyro A&B Prime configuration

PROPULSION MODULE
- 3/84 Primary Thruster D failure

POWER MODULE
- 05/04 Battery-1 failure / Removed from power circuits
- 10/07 Battery-2: 1 of 22 Cells fails

THEMATIC MAPPER
- 10/94 Power Supply 1 stuck switch
- 06/02 TM switched to bumper mode

MULTI-SPECTRAL SCANNER
- 8/95 Band 4 failure

SOLAR ARRAY DRIVE / PANELS
- 01/05 Primary Solar Array Drive failure
- Nominal Solar array panel degradation (12/04)
- 11/05 Redundant Solar Array Drive Malfunction

COARSE SUN SENSORS

X-BAND ANTENNA

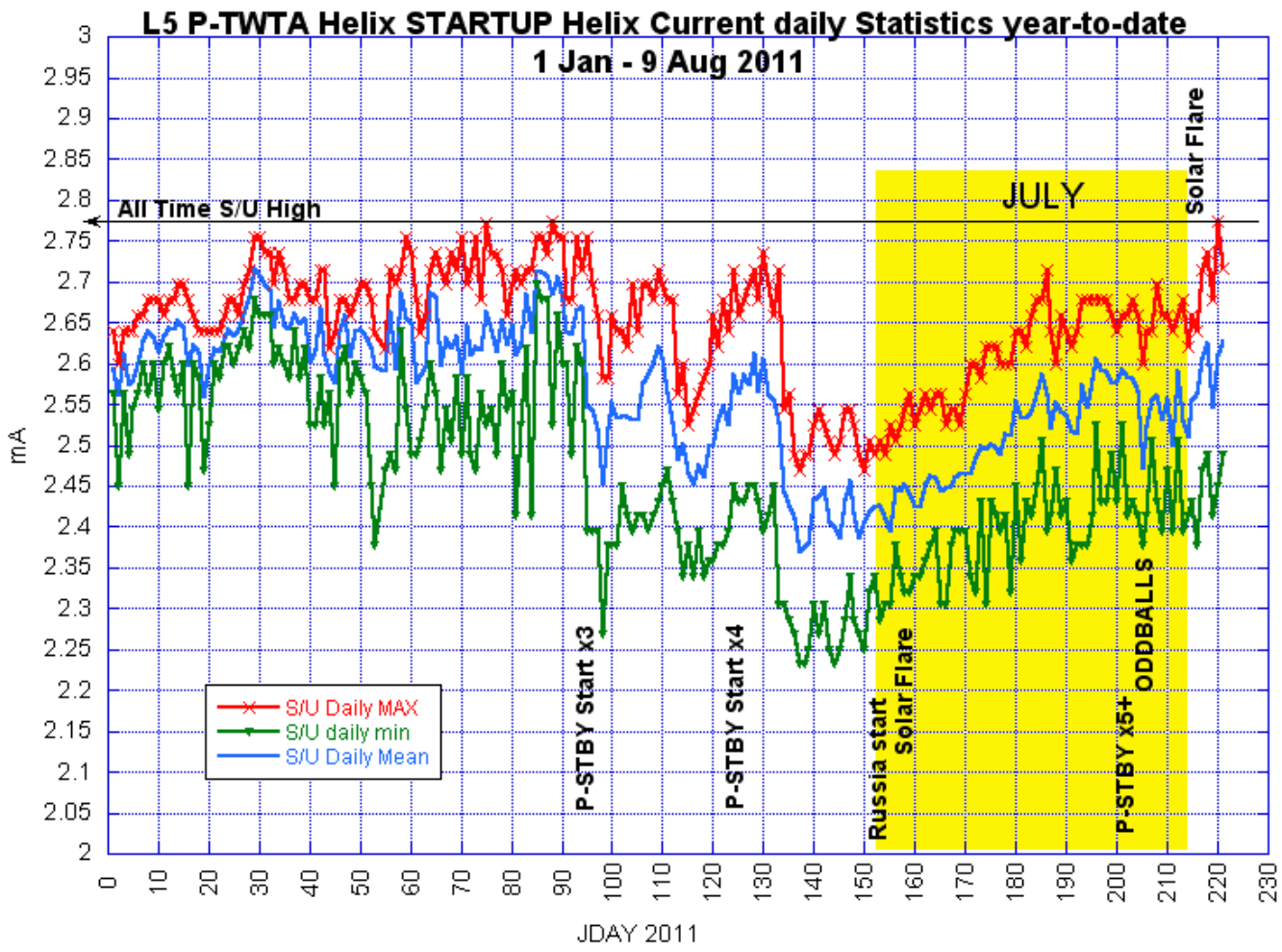
WIDEBAND COMM. MODULE
- 07/88 Ku-band TWTA Prime failure (OCP)
- 07/92 Ku-band TWTA Redundant failure (OCP)
- 08/87 X-band TWTA Prime failure (OCP)
- 03/06 X-band TWTA Redundant Anomaly
- 12/09 X-band TWTA Redundant Failure (OCP)
- 01/10 X-band TWTA Prime successfully Recovered

DIRECT ACCESS S-BAND
- 03/94 Side A FWD Power Sensor failure

Spacecraft Activities Summary

- **Landsat 5**
  - TWTA (Traveling Wave Tube Amplifier)
    - Still trending upward (see next slide)
    - Flight Operations Team working on changes to operations concept to further stabilize the current
- **Landsat 7**
  - Increased data collections using high latitude stations (~350 scenes/day during Northern Hemisphere growing season)
  - Also collecting in Australia, Argentina, and South Africa (in work)

TWTA Operational Status



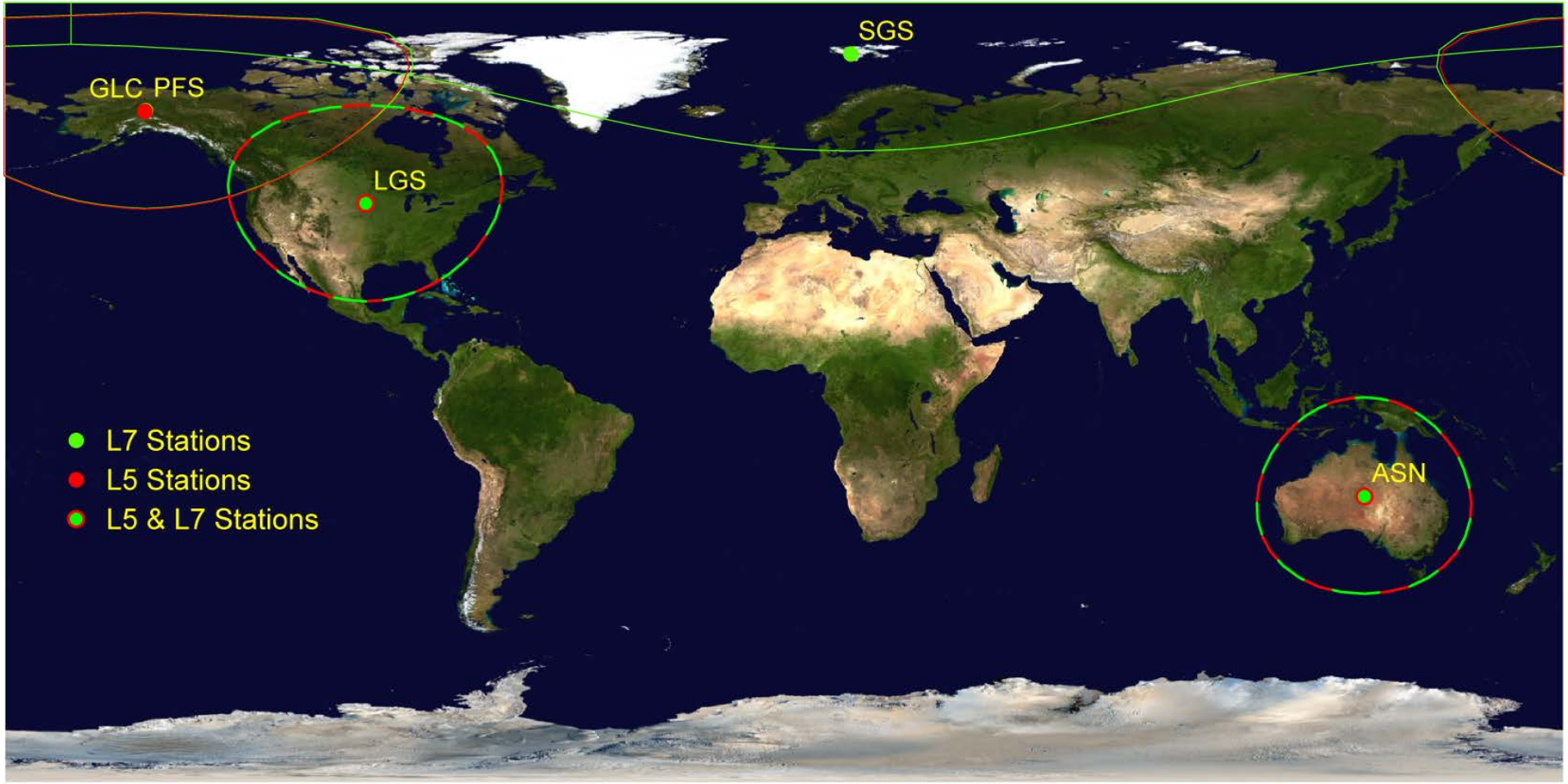
Landsat Ground Stations

				Current			Type	
Country	Organization	Location	GSID	LGN	IC	Historical	Full	Campaign
Argentina	CONAE	Córdoba	COA		X		X	
Australia	GA-NEO	Alice Springs	ASA		X		X	
Australia	GA-NEO	Alice Springs	ASN	X				
Australia	GA-NEO	Hobart	HOA		X		X	
Brazil	INPE	Cuíaba	CUB		X		X	
Canada	CCRS	Gatineau	GNC		X		X	
Canada	CCRS	Prince Albert	PAC		X		X	
China	CEODE	Beijing	BJC		X		X	
China	CEODE	KaShi	KHC		X		X	
Ecuador	CLIRSEN	Cotopaxi	CPE			X		
Egypt	NARSS	Aswan	AWE			X		
Germany	DLR	Neustrelitz	NSG			X	X	
India	NRSA	Shandnagar	SGI			X		
Indonesia	LAPAN	Parepare	DKI			X	X	
Italy	ESA	Matera	MTI		X		X	
Japan	JAXA/RESTEC	Hatoyama	HAJ		X		X	
Japan	JAXA/HIT/HEEIC	Hiroshima	HIJ		X		X	
Kenya	ESA	Malindi	MLK		X			X
Korea	MIC	Seoul	SEK			X		
Mexico	CONABIO	Chetumal	CHM		X			X
Norway	KSAT	Svalbard	SGS	X				
Pakistan	SUPARCO	Islamabad	ISP			X		
Russia	ScanEx	Irkutsk	IKR		X			X
Russia	ScanEx	Magadan	MGR		X			X
Russia	ScanEx	Moscow	MOR		X			X
Saudi Arabia	KACST, SCRS	Riyadh	RSA			X		
South Africa	CSIR-SAC	Hartebeesthoek	JSA		X		X	X
Spain	ESA-INTA	Maspalomas	MPS		X			X
Sweden	ESA-SSC	Kiruna	KIS		X			X
Thailand	GISTDA	Bangkok	BKT		X		X	
United States	NOAA	Gilmore Creek, AK	GLC	X				
United States	USGS	Sioux Falls, SD	LGS	X				
United States	U of Puerto Rico	Mayaguez	UPR			X		
24	24	32	33	4	20	9	15	8

Unique Full IC Organizations	12
Unique Campaign IC Organizations	4
Full IC Stations	15
Campaign IC Stations	8

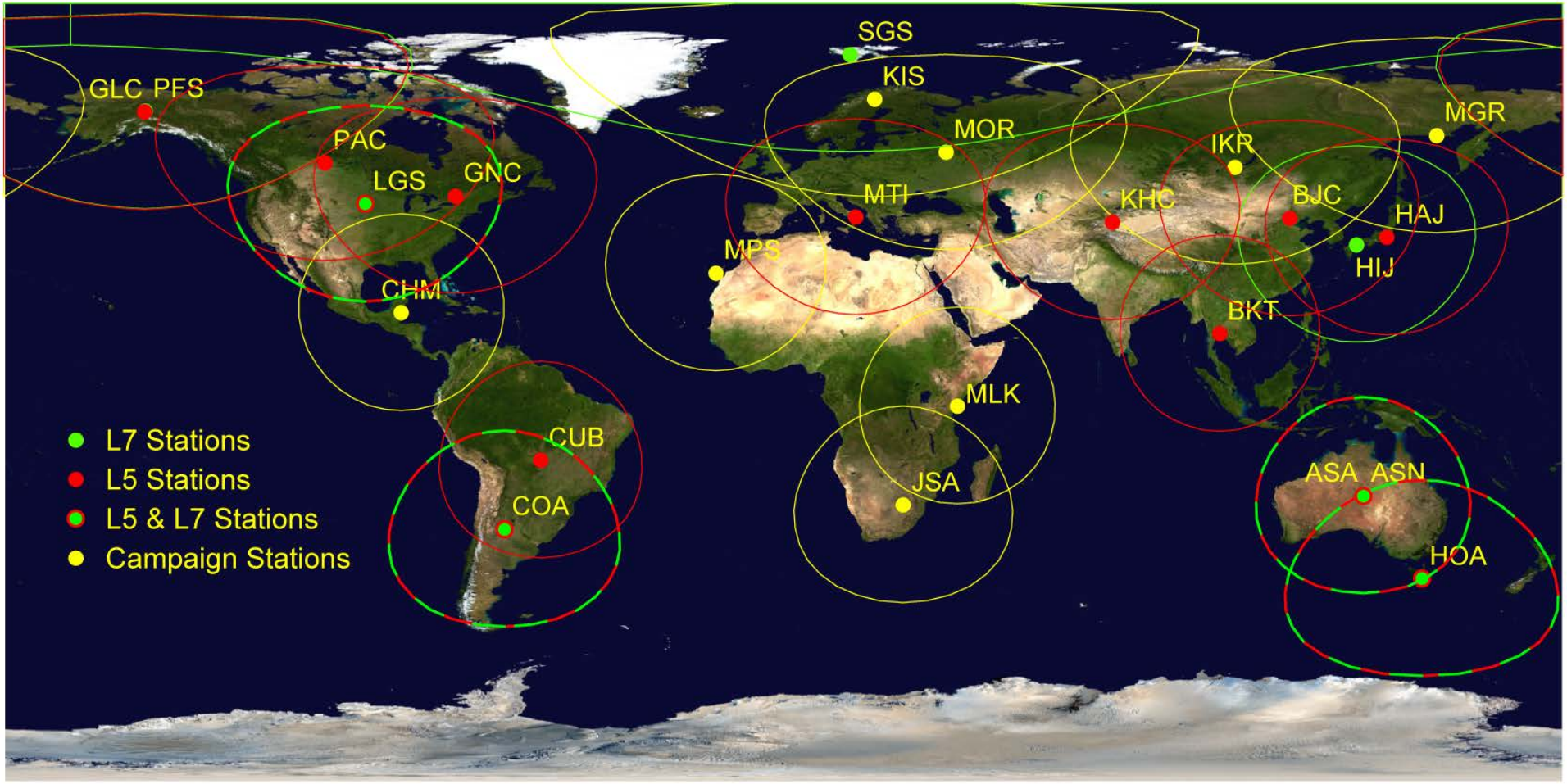
Current Landsat Ground Network (LGN)

Landsat Ground Network



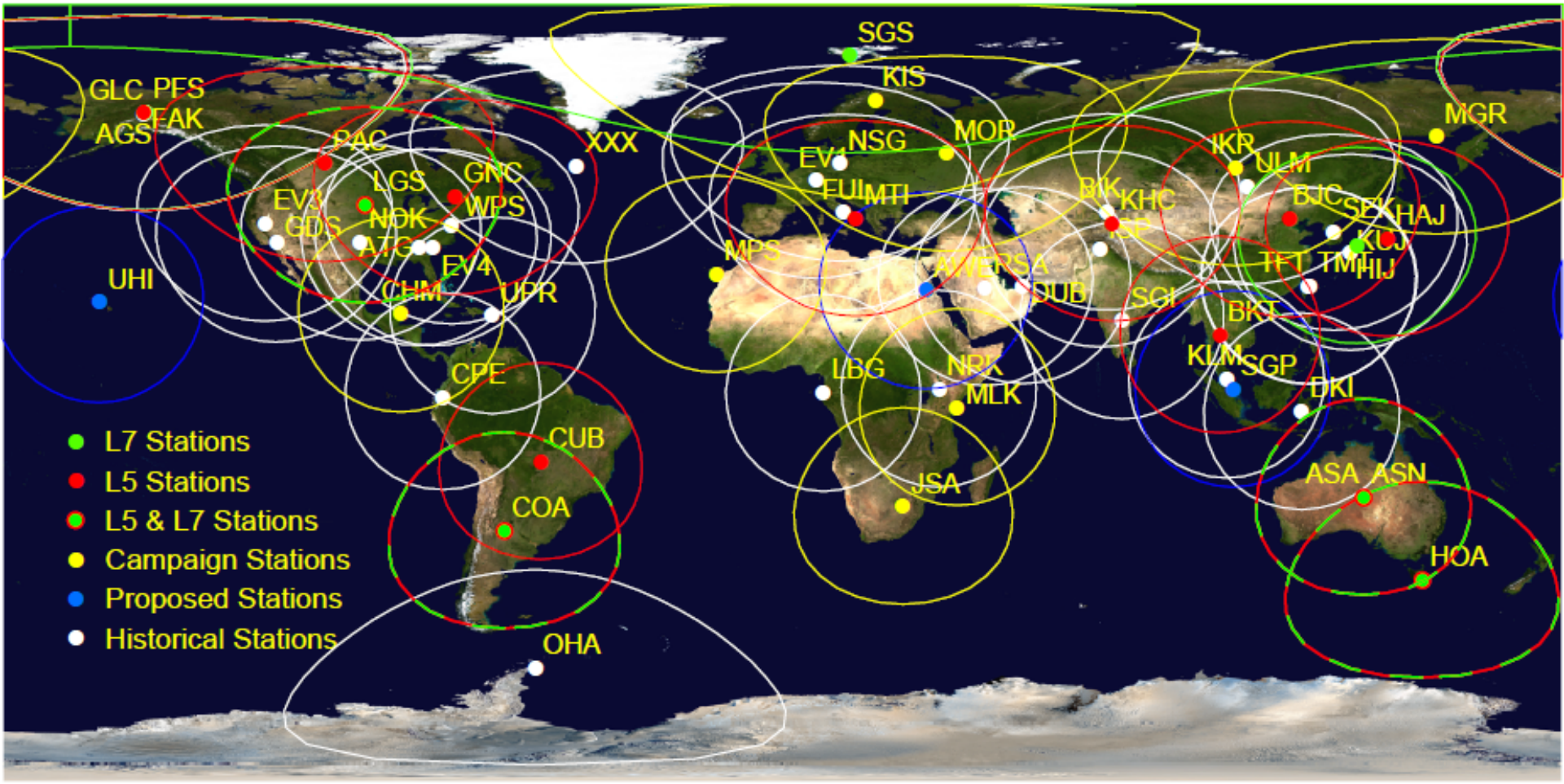
Current Landsat Ground Stations

Active Landsat Ground Stations



Historical Landsat Ground Stations

Landsat Ground Stations



Landsat Archive and Processing Topics

U.S. Landsat Archive Overview

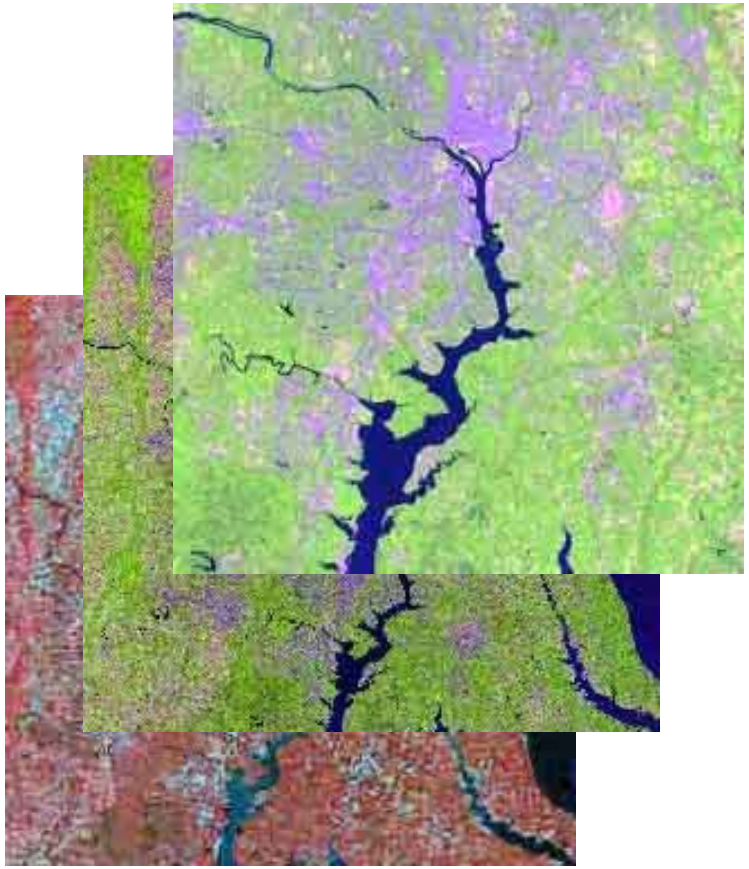
(August 1, 2011)

- **ETM+: Landsat 7**
  - **1,153,059** scenes
    - ~1,071 TB Raw and L0Ra Data

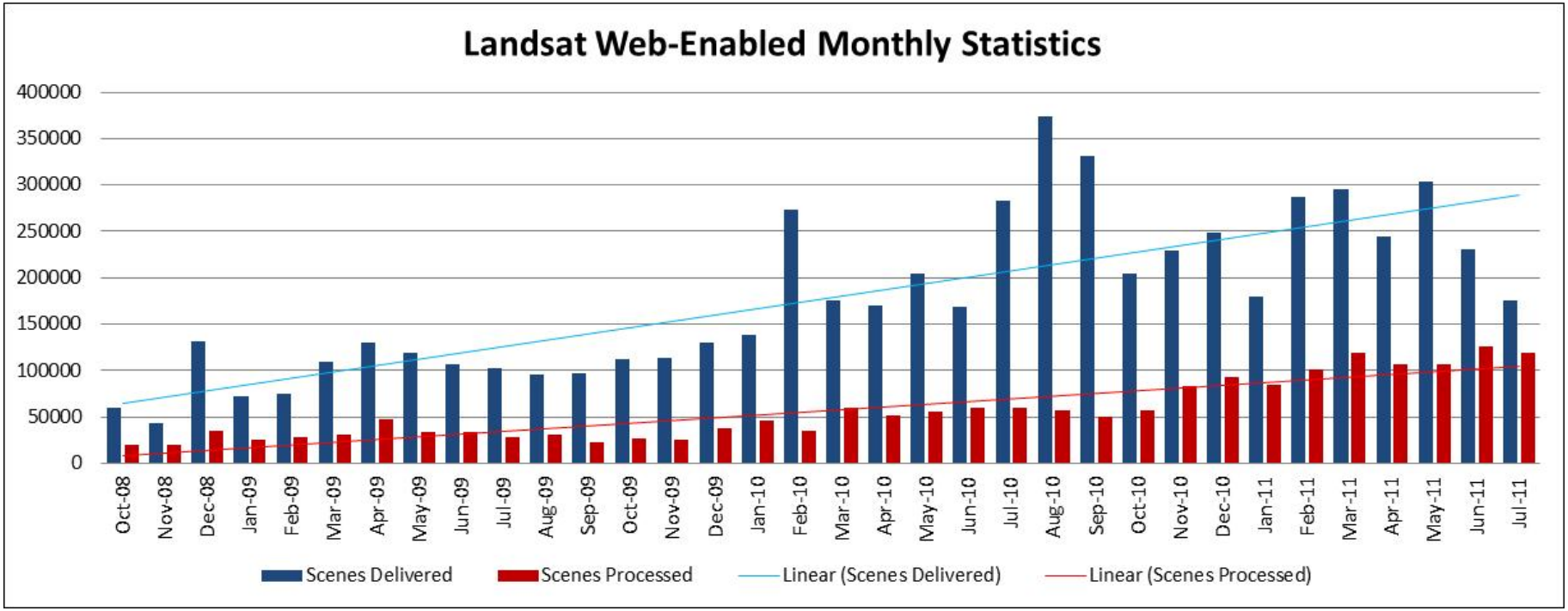
      average scene size 487 MB
- **TM: Landsat 4 & Landsat 5**
  - **1,150,074** scenes
    - ~576 TB Raw and L0Ra Data

      average scene size 263 MB
- **MSS: Landsat 1 through 5**
  - **610,210** scenes
    - ~18 TB Raw and L0Ra Data

      average scene size 32 MB
- **Total:**
  - **2,913,343** scenes
    - ~1,665 TB Raw and L0Ra Data

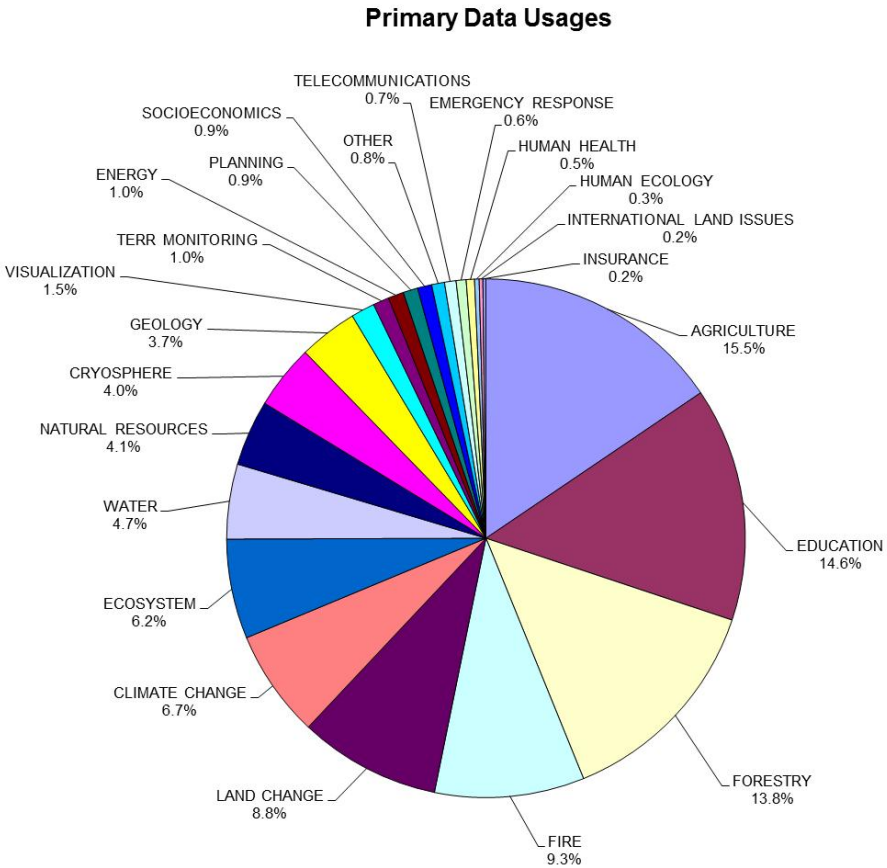


Monthly Downloads / Processed



- **FY09 (Oct 2008 – Sep 2009)**
  - Delivered: 1.14M
  - Processed: 358K
- **FY10 (Oct 2009 – Sep 2010)**
  - Delivered: 2.48M
  - Processed: 567K
- **FY11 (Oct 2010 – Jul 2011)**
  - Delivered: 2.4M
  - Processed: 998K

FY2011 Landsat Data Use



Project Activities and Status

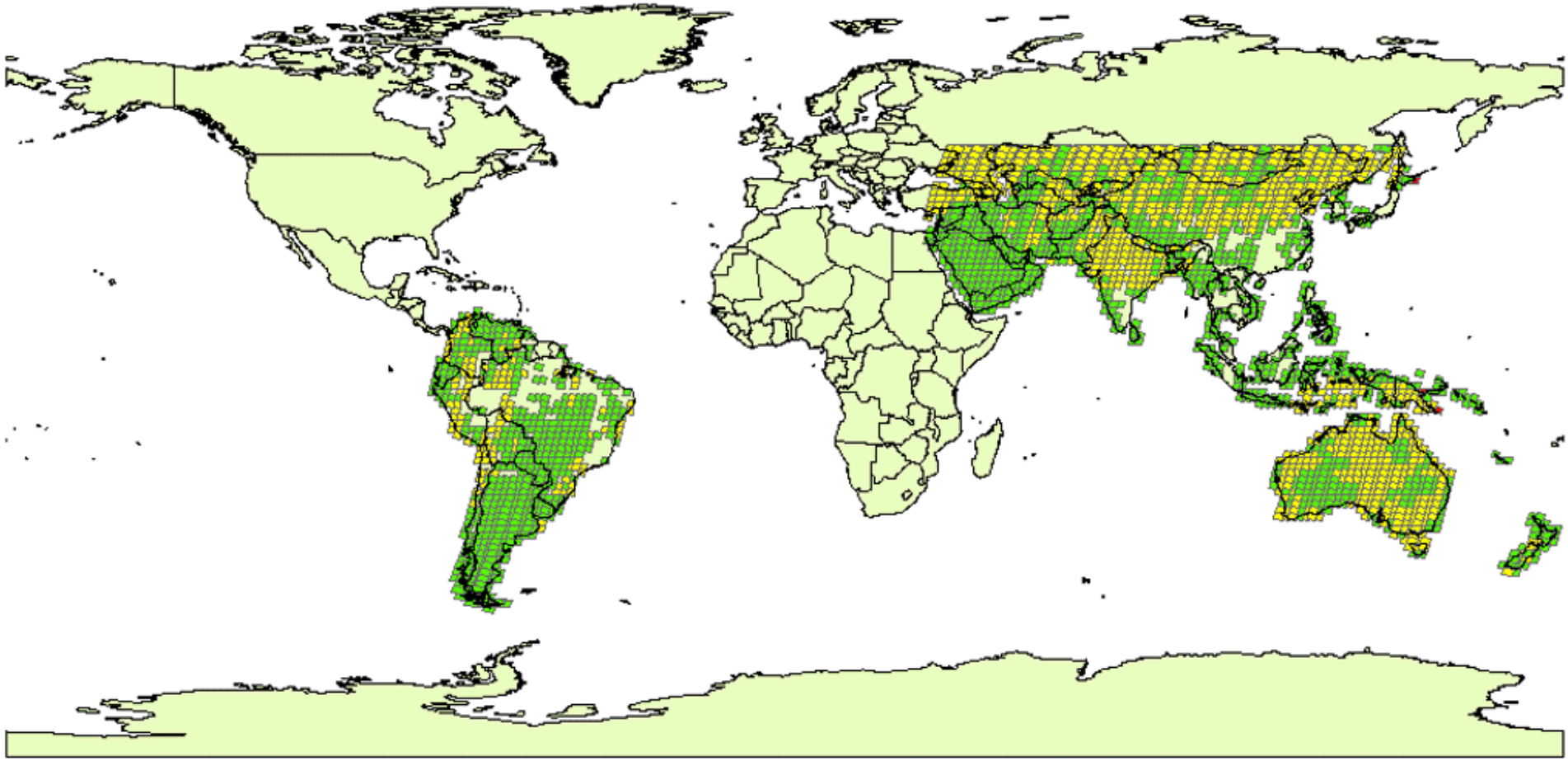
- **Archive migration**
  - Migrating all Landsat data to new tape archive unit and copy to on-line disk storage
  - Old tape archive obsolete technology
  - On-line storage will help increase processing throughput

Sensor	Migration to New Tape Media	Migration to On-line Disk
MSS	100%	100%
TM	100%	56%
ETM+	100%	79%

Project Activities and Status

- **Processing Enhancements**
  - Released enhancements for TM geometric processing
    - Using Gaussian Pyramid approach developed for MSS
  - Plans to add more servers
  - Hit new high of over 10,000 scenes process in one day!
    - About 70% MSS data
- **Now processing 100% of new data acquisitions**
  - Includes any data collected at EROS or at other sites within the last month
  - LGAC historical archive additions are not process automatically

Global Land Survey 2010



GLS2010 Scenes
Status as of July 29, 2011

Available GLS2010 L7 Scenes | Available GLS2010 L5 Scenes | Available GLS2010 L7/L5 Scenes

The Woodcock Metric

500,185

Landsat Global Archive Consolidation (LGAC)

- **Goal is to consolidate the entire Landsat archive**
  - 5 million scenes held internationally vs. 2 million in the USGS archive
  - From current stations as well as historical stations
  - Each station has data that will enhance the USGS archive
- **Enables scientific analysis of most complete time-series of images for global land change**
- **Facilitates large scale scene selection and data mining capability**
- **Recover data not currently available to users**
  - Some data at risk due to aging media and drive obsolescence
- **Provides data to global user community as standard product like current Landsat data from US archive**
- **Electronic hi-speed data exchanges are being implemented where possible to obtain near real-time data acquisitions**

LGAC International Data Holdings

ICs	Scenes (in 1,000s)	Unique to IC	% Unique
Europe (ESA)	2,089	1,883	90%
Australia (GA-NEO)	629	463	74%
Canada (CCRS)	532	242	45%
China (CEODE)	449	409	91%
Japan (RESTEC)	275	261	95%
Brazil (INPE)	234	210	90%
Thailand (GISTDA)	90	77	86%
Germany (DLR)	87	61	70%
India (NRSC)	51	50	98%
Ecuador (CLIRSEN)	40	30	75%
Pakistan (SUPARCO)	24	20	84%
Japan (HIT)	21	7	35%
Indonesia (LAPAN)	8	3	63%
Argentina (CONAE)	253	162	64%
South Africa (CSIR-SAC)	137	122	89%
Subtotal	4919	3704	75%
Saudi Arabia (KACST)	69		
Puerto Rico (UPR)	42		
Grand Total (in 1,000s)	**5030**		

LGAC Progress

Station	Cooperation Requested	Metadata Received	Test Data Received	Agreement Reached	Data Transferred
Active Stations					
Argentina (CONAE)					
Australia (GA-NEO)					
Brazil (INPE)					
Canada (CCRS)					
China (CEODE)					
Europe (ESA)					
Indonesia (LAPAN)					
Japan (HIT)					
Japan (RESTEC)					
South Africa (SANSA)					
Thailand (GISTDA)					
Historical Stations					
Ecuador (IGM-CLIRSEN)					
India (NRSA)					
Pakistan (SUPARCO)					
Saudi Arabia (KACST MAW)					
Taiwan (CSRSR-NCU)					
US (US Air Force)					
US (University of Puerto Rico)					

LGAC Progress

- **“Bent Pipe” Operation**
  - Collection of newly acquired data in near real-time
    - Canada
    - Brazil
    - Argentina
    - China (KaShi station only)
    - South Africa (coming soon)
    - Australia (coming soon)
- **Coming Soon**
  - Historical Archive Transfer
    - Argentina
    - South Africa
    - Australia
    - Ecuador