USGS Agency Report

Tom Cecere

Land Remote Sensing Program

703-648-5551

tcecere@usgs.gov

ICCAGRA

Palmdale, CA

October 21, 2008

U.S. Department of the Interior
U.S. Geological Survey

Landsat Web-enabled Data

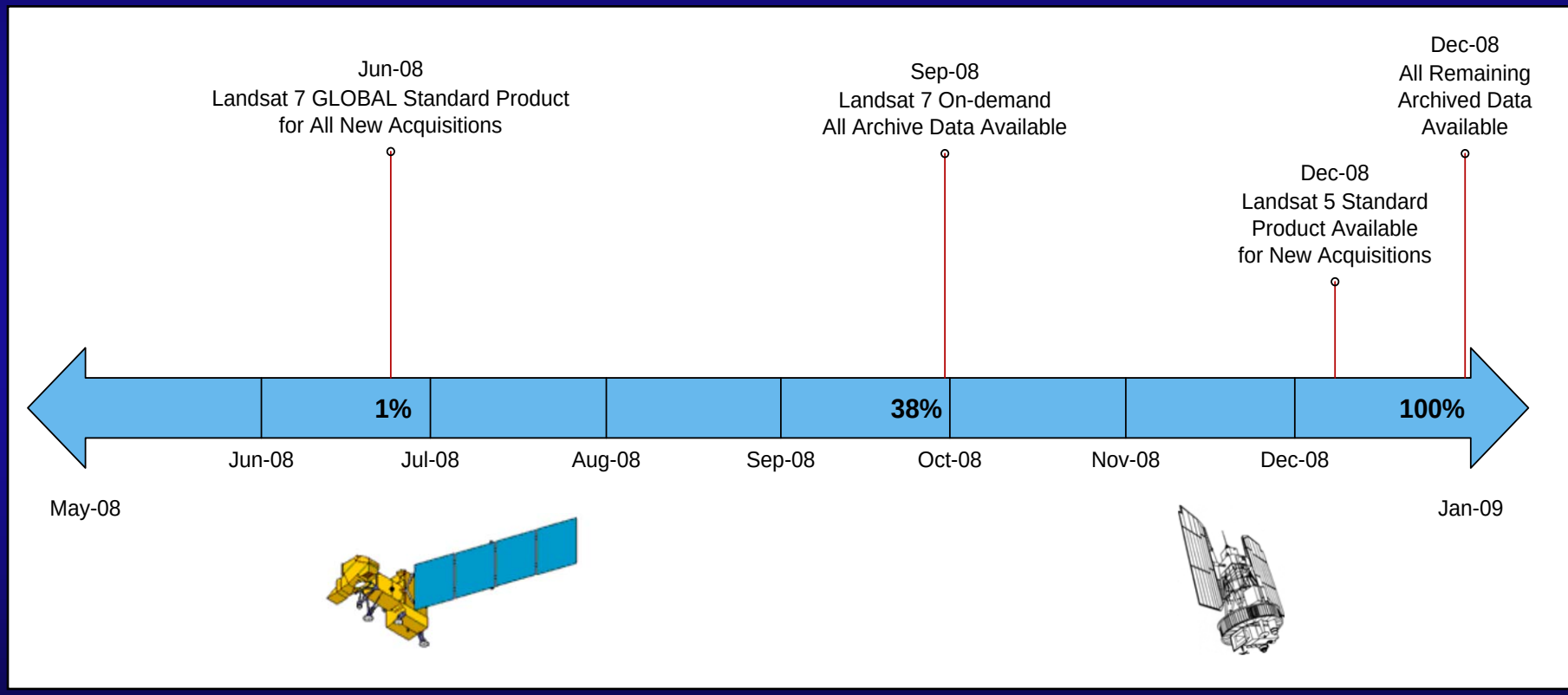
Landsat Standard L1T

- **Newly acquired data that will be automatically processed**
  - **≤ 20% cloud cover, 9 quality**

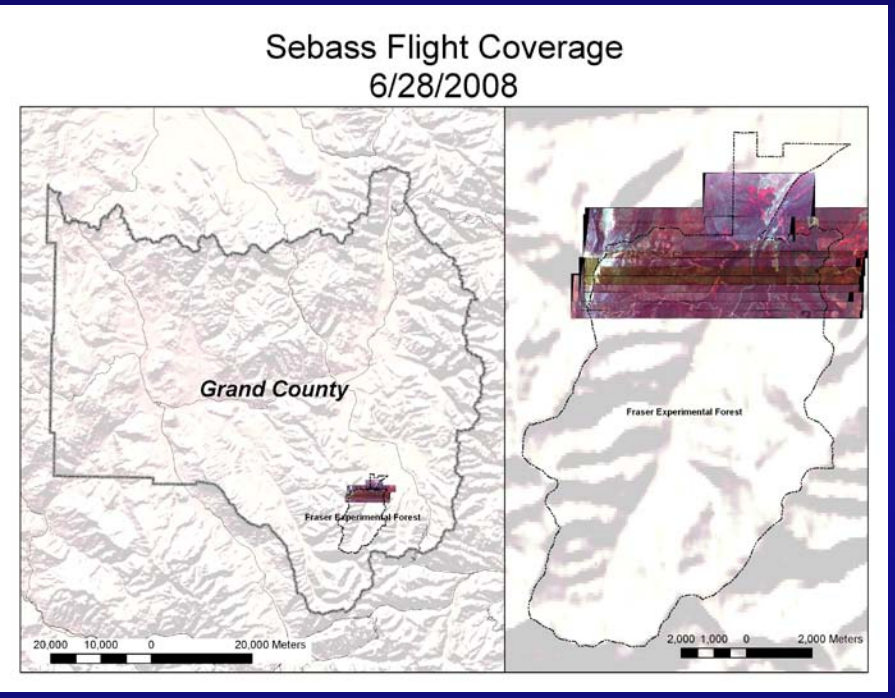
- **All other data (and archive data) can be ordered at no-charge**
  - **L7: Sep 30, 2008**
  - **L5 TM, L4 TM, L1-5 MSS: Dec 31, 2008**

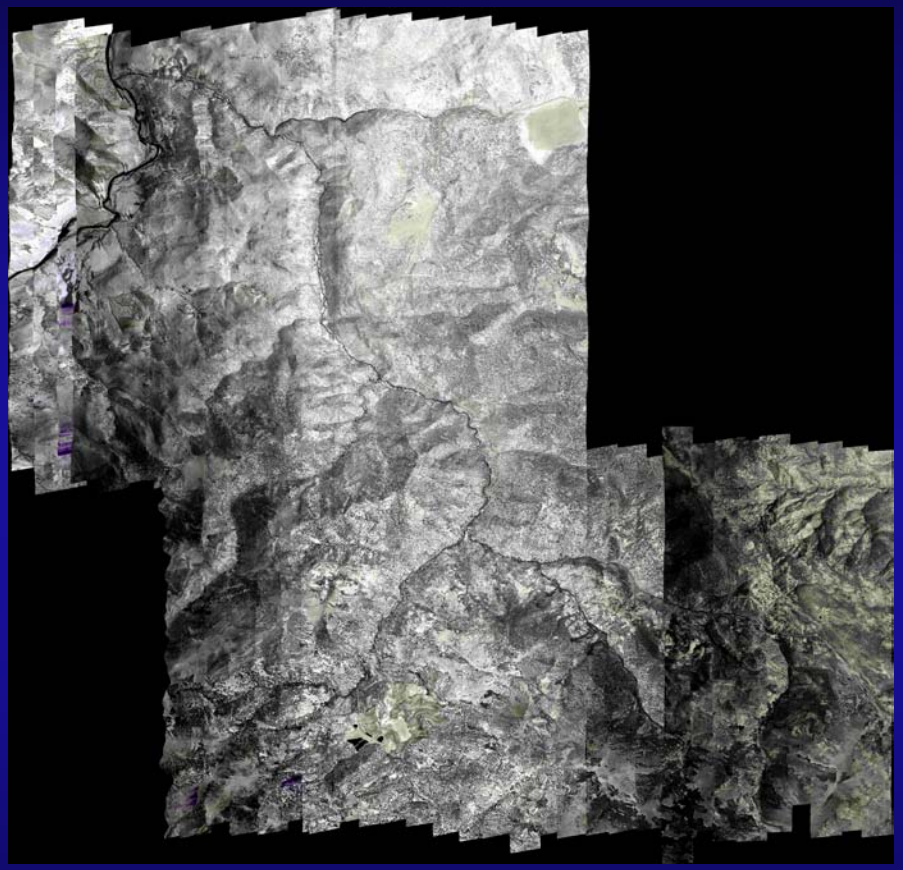
- Pixel size: 15m/30m/30m
- Media type: Download (web-enabled)
- Product type: L1T (terrain-corrected)
- Output format: GeoTIFF
- Map projection: UTM
- Orientation: North up
- Resampling: Cubic convolution
- DEM: GLS DEM (SRTM, NED, CDAD, DTED, GTOPO 30)

Landsat Web-Enabling Timeline



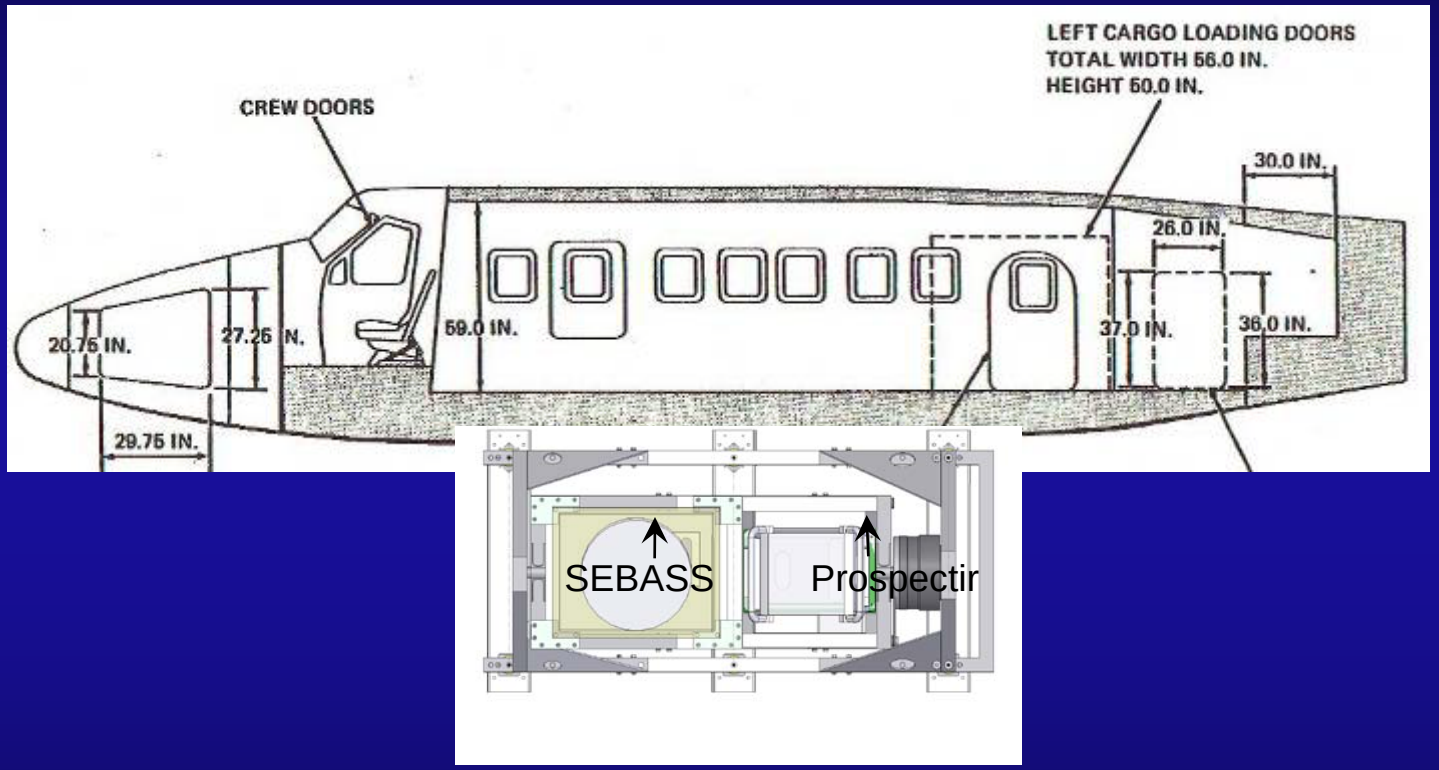
Contract Activity - SEBASS





USGS

Upcoming IR&D “Full Spectrum” Collection Capability



Aerospace Full-Spectrum Sensors

- ProspecTIR
  - VNIR
    - 0.4-0.99 µm
    - 64 – 238 channels (2.2 – 19.5 nm)
  - SWIR
    - 0.97-2.45 µm
    - 64 – 238 channels (6.2 – 25 nm)
  - 0.52 / 1.31 mrad IFOV (0.25 – 5.0 m GSD)
  - GPS/INS
- SEBASS
  - MWIR
    - 2.5 – 5.3 µm
    - 128 channels (~25 nm)
  - LWIR
    - 7.6 – 13.5 µm
    - 128 channels (~50 nm)
  - 1.1 mrad IFOV (0.5 – 5.0 m GSD)
  - GPS/INS

USGS

“Full Spectrum” Collect Locations
Sponsors Pay Only for Their Flight Days (~$25K/day)

USGS

EAARL Update

- Recent Activities
  - Support for Hurricanes Gustav and Ike
- Upcoming Missions
  - Survey S. Atchafalaya Basin in November
  - Mountain Stream Mapping - TBD
  - Possible AK North Slope collect Summer 2009
- Replacement Laser funded
  - Scanning configuration change leading to improved capabilities

UAS Issues

- **FAA COA and associated regulations**
- **Operator Training**
- **Defining UAS classes**
- **Procurement Vehicle Establishment**
  - Purchase or lease?
  - Contract for data?
- **Sensor Development**
  - Currently available: SAR, IR, FMV, LIDAR, MS, HyperSpectral
  - Sensor vs. Platform
- **Dissemination/Archiving of Data**
- **Analysis of Data**
  - **Right Tools?**
  - **FMV**

- **USGS UAS Roadmap to be developed this FY**

Data Management and Digital Delivery of Analog Data

Douglas R. Binnie
Information Solution Branch Chief

USGS Center for Earth Resources Observation and Science (EROS)
Sioux Falls, South Dakota

U.S. Department of the Interior
U.S. Geological Survey

The USGS Film Archive

- 59,500 rolls of film
  - 8.6 million images

- Over 70,000 photo indexes

Background

- After 30 years of operation, the decision was made in 2004 to close the photo lab and only provide digital access to the more than 9-million frames of imagery in the archive

Why Change was Necessary

- Customer demand for film based products was declining
- Cost to produce film/paper products was increasing
- Some raw stock used at EROS was no longer being manufactured
- Demand for digital products was increasing

Decision

- Provide on-demand scanning at 7, 14, or 21 micron spot size
- Digitize USGS aerial collections using automated high performance cameras and generate a searchable browse
- Create single frame metadata from photo indexes to improve user access to historical photos
- Provide internet access and electronic data delivery at no charge to the user

Scanning

- Use High Resolution photogrammetric quality scanners
- Standard output spot size is 21 micron (1200 dpi) with options to 7 micron spot size (3600 dpi)
- Output format = TIFF
- File size = 120 MB for B/W and 360 MB for Color
- All scanned products are currently generated on-demand and not archived

Phoenix IV Digitizing System

- Phoenix IV was built in house using a Logetronic photographic printer base
- Outfitted with a frame edge detection system for film advancement and a light source consisting of 144 LEDs
- Utilizes a Kodak 13.9 mega-pixel digital camera to capture each frame
- Streams data into a PC to generate an on-line browse and a medium resolution (400 dpi) digital file

USGS

Digitizing Output Specifications

- Browse files
  - Format = JPG
  - Black and White size = 148 KB
  - Color size = 400 KB
  - Resolution = 72 dpi
- Medium-resolution files
  - Format = TIFF
  - Black and White size = 13 MB
  - Color size = 38 MB
  - Resolution = 400 dpi
  - Non-photogrammetric quality
  - Minimal data editing (format, adjust polarity, add USGS Visual Identification

Digitizing Process

- Digitize photo indexes and provide on-line access
- Digitize each roll of film to generate a full frame browse including orphans and provide on-line access
- Archive the medium-resolution products in a mass storage system and provide on-demand electronic access to the data

Medium-resolution Digitization System

Digitized Map Index

Digitized Aerial Image

USGS

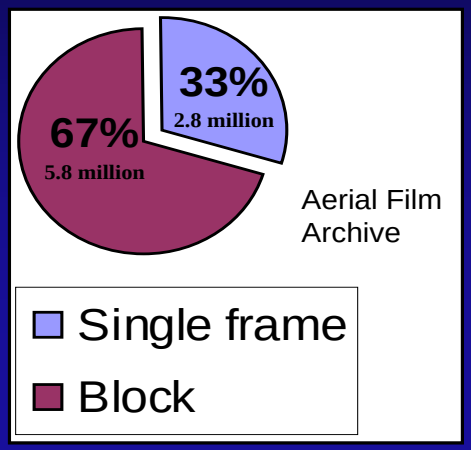
Phoenix V Prototype

- Phoenix V was built using the same Logetronic printer base and automated frame edge detection system as the Phoenix IV
- Uses an enhanced light source consisting of 675 LED's to improve scanning efficiency
- Utilizes a Better Light 416 mega-pixel scanning back
- Outputs a 25 micron spot size (1000 dpi) digital image

USGS

Creating Single Frame Metadata

8.6 Millon Frames



- Implemented processes and software
- Working USGS historical collection
  - 68,000 indexes
  - 2,600,000 frames
- 350,000 frames annually

Photo Index

Single Frame

USGS

Preservation and Access

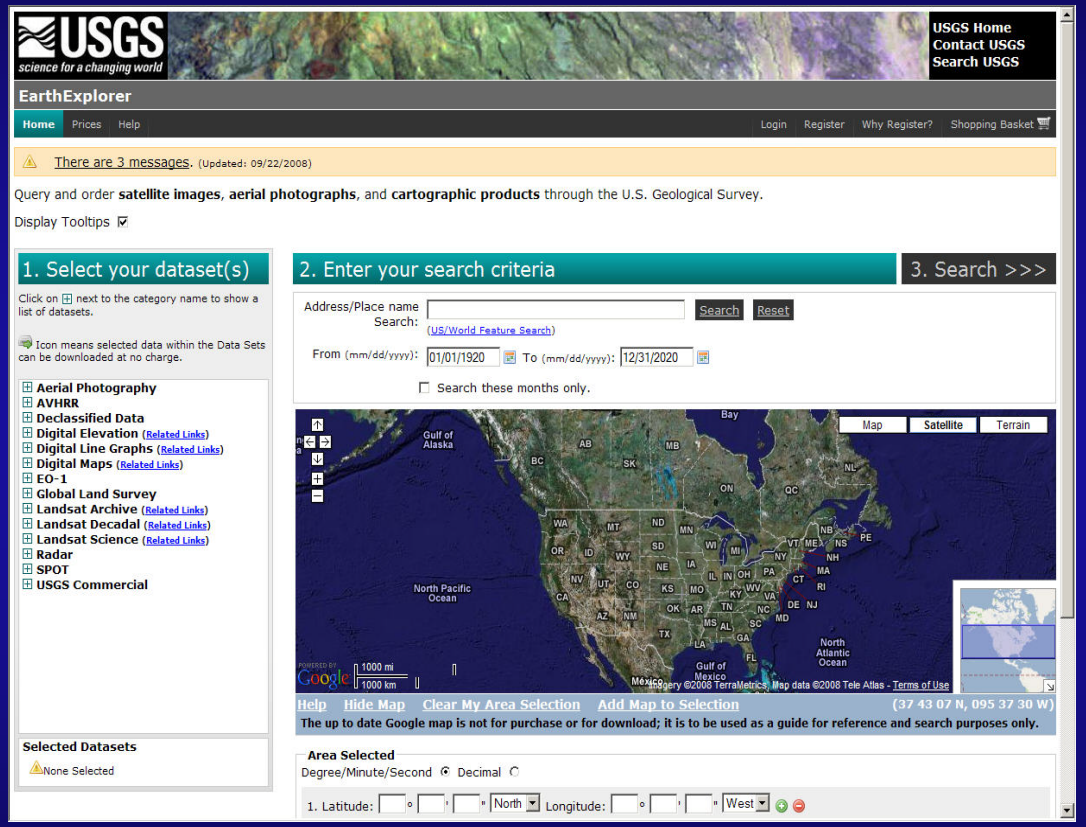
- Manage all on-line, near-line and off-site data locations using a mass storage system architecture
  - Robotic tape storage
  - Data migration to newer media
  - Creation of backup copies for off-site storage
  - Supports electronic data distribution

SL8500 Mass Storage System

USGS

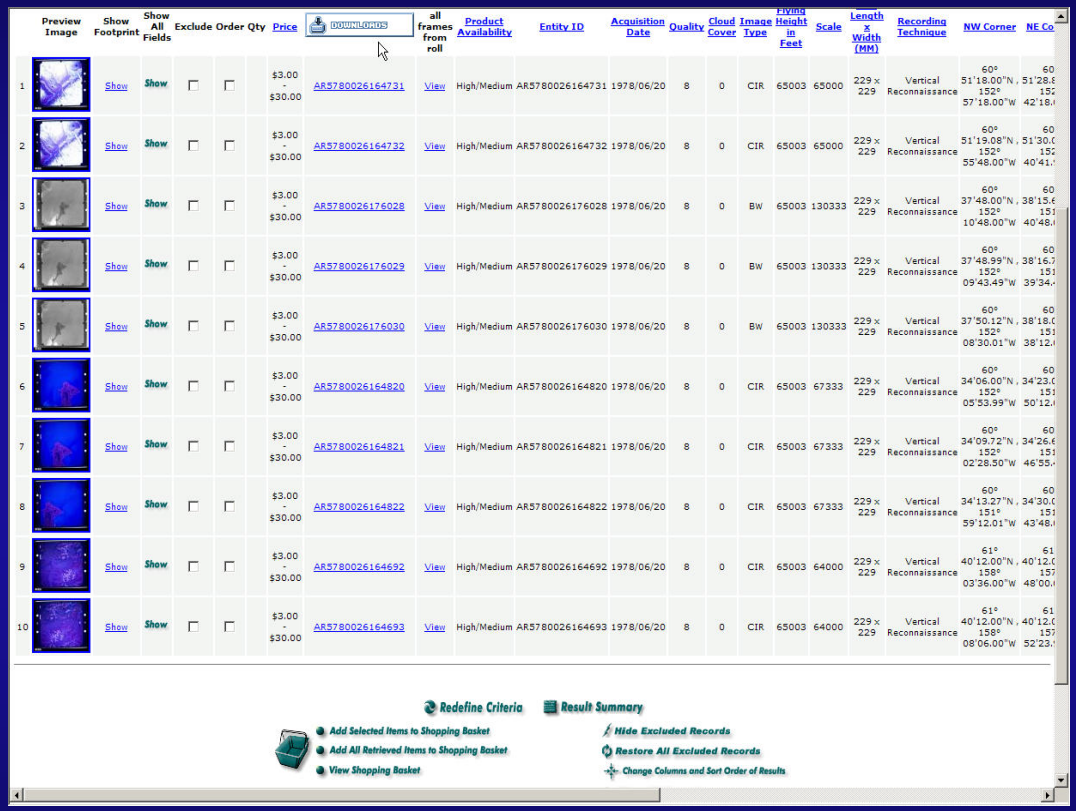
Data Discovery

- Combines “Point and Click” ease with textual query capabilities to form an easy to use search and order interface
- Allows users to search spatially over multiple datasets



Data Search Results

- Search results grouped by dataset
- Displays browse imagery and footprints by scene
- Allows users to export results into a KML file viewable in Google Earth



	Preview Image	Show Footprint	Show All Fields	Exclude	Order Qty	Price	DOWNLOADS	all frames from roll	Product Availability	Entity ID	Acquisition Date	Quality	Cloud Cover	Image Type	Flying Height in Feet	Scale	Length x Width (MM)	Recording Technique	NW Corner	NE Co
1		Show	Show			$3.00 - $30.00	AR5780026164731	View	High/Medium	AR5780026164731	1978/06/20	8	0	CIR	65003	65000	229 x 229	Vertical Reconnaissance	60° 51'18.00"N , 152° 57'18.00"W	60 51'28.8 152 42'18.4
2		Show	Show			$3.00 - $30.00	AR5780026164732	View	High/Medium	AR5780026164732	1978/06/20	8	0	CIR	65003	65000	229 x 229	Vertical Reconnaissance	60° 51'19.08"N , 152° 55'48.00"W	60 51'30.0 152 40'41.1
3		Show	Show			$3.00 - $30.00	AR5780026176028	View	High/Medium	AR5780026176028	1978/06/20	8	0	BW	65003	130333	229 x 229	Vertical Reconnaissance	60° 37'48.00"N , 152° 10'48.00"W	60 38'15.6 151 40'48.4
4		Show	Show			$3.00 - $30.00	AR5780026176029	View	High/Medium	AR5780026176029	1978/06/20	8	0	BW	65003	130333	229 x 229	Vertical Reconnaissance	60° 37'48.99"N , 152° 09'43.49"W	60 38'16.7 151 39'34.4
5		Show	Show			$3.00 - $30.00	AR5780026176030	View	High/Medium	AR5780026176030	1978/06/20	8	0	BW	65003	130333	229 x 229	Vertical Reconnaissance	60° 37'50.12"N , 152° 08'30.01"W	60 38'18.0 151 38'12.4
6		Show	Show			$3.00 - $30.00	AR5780026164820	View	High/Medium	AR5780026164820	1978/06/20	8	0	CIR	65003	67333	229 x 229	Vertical Reconnaissance	60° 34'06.00"N , 152° 05'53.99"W	60 34'23.0 151 50'12.4
7		Show	Show			$3.00 - $30.00	AR5780026164821	View	High/Medium	AR5780026164821	1978/06/20	8	0	CIR	65003	67333	229 x 229	Vertical Reconnaissance	60° 34'09.72"N , 152° 02'28.50"W	60 34'26.6 151 46'55.4
8		Show	Show			$3.00 - $30.00	AR5780026164822	View	High/Medium	AR5780026164822	1978/06/20	8	0	CIR	65003	67333	229 x 229	Vertical Reconnaissance	60° 34'13.27"N , 151° 59'12.01"W	60 34'30.0 151 43'48.4
9		Show	Show			$3.00 - $30.00	AR5780026164692	View	High/Medium	AR5780026164692	1978/06/20	8	0	CIR	65003	64000	229 x 229	Vertical Reconnaissance	61° 40'12.00"N , 158° 03'36.00"W	61 40'12.0 157 48'00.0
10		Show	Show			$3.00 - $30.00	AR5780026164693	View	High/Medium	AR5780026164693	1978/06/20	8	0	CIR	65003	64000	229 x 229	Vertical Reconnaissance	61° 40'12.00"N , 158° 08'06.00"W	61 40'12.0 157 52'23.1

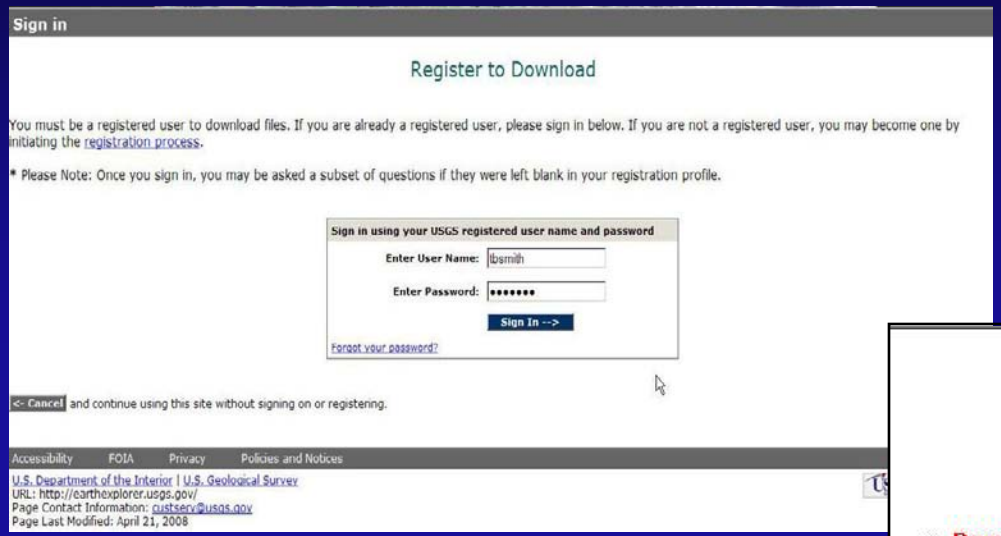
Redefine Criteria | Result Summary

Add Selected Items to Shopping Basket
Add All Retrieved Items to Shopping Basket
View Shopping Basket

Hide Excluded Records
Restore All Excluded Records
Change Columns and Sort Order of Results

USGS

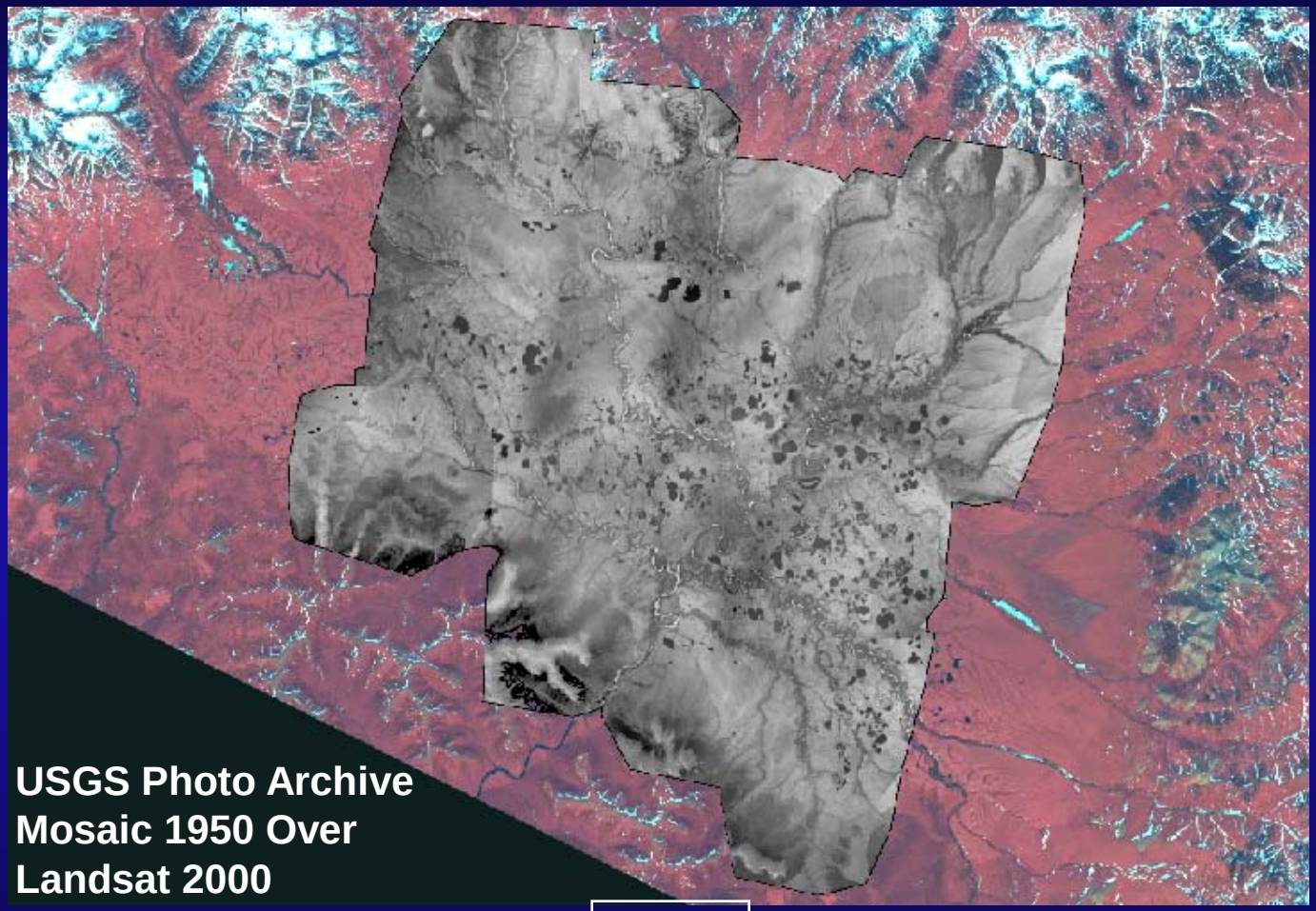
Data Download



- **Registered users can electronically download selected datasets at no cost to them**

USGS

Change Analysis



USGS

Summary

- Over 6 million frames have been digitized and over one million single frame metadata records have been generated since the program began
- On-line indexes and browse files simplifies archive access and promotes increased interest in the USGS/EROS film archive
- Digitizing effort uncovers images that were not previously accessible (orphan imagery)
- Once the data are in digital form it can be easily combined with other data sources to support change analysis
- This new approach enhances archive value and assures continued data access to support the ever changing needs of the science community