

Landsat 5, LDCM, NPOESS

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¹NASA/GSFC, ²USGS, ³CONABIO

1. MODIS/NPOESS Direct Readout and Direct Readout Web Portal
2. Landsat Data Continuity Mission(LDCM) status



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Welcome to Direct Readout

International EOS/NPP Direct Readout Meeting
March 31 - April 4, 2008
Bangkok, Thailand

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DRL News

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- Simulcast V4.0 Released...
- IMAPP_SPA V2.0 Released
- RT-STPS V4.0 Released...
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- MODISL1DB_SPA V1.4...
- MODIS Product Gallery...
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- MOD14_SPA V5.0.0...
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- DRL on the Road to NPP...
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- Simulcast V3.0 Released...
- GSAD V2.5 Released... Earth
- Observer Article...

This Portal provides the Direct Readout (DR) community with easy access to Earth remote sensing data and technologies through shared information resources.

We achieve this by:

1. Providing mission-specific information and free technologies to acquire and process Direct Broadcast Data.
2. Introducing the user community to Direct Readout Systems Technologies.
3. Providing users with a design template to receive, process and analyze their own Direct Readout Data.

NASA BREAKING NEWS

Mon, 21 Apr 2008 NASA Offers Educational Online Gaming Opportunity to Developers

Educators soon may be able take the "learning can be fun" adage to another level using computer-simulation games with new technologies created by NASA and a yet-to-be-selected game developer.

+ Read More

Sat, 19 Apr 2008 Expedition 16 Soyuz Lands Safely in Kazakhstan

Astronaut Peggy Whitson returns home from a record flight.

+ Read More

Fri, 18 Apr 2008 NASA Deputy Administrator and Florida Governor Discuss Benefits of Space Exploration at Miami Future Forum

NASA Deputy Administrator Shana Dale and Florida Gov. Charlie Crist discussed Friday how space exploration gives Floridians a more competitive economy and better quality of life during a NASA Future Forum at the University of Miami.

+ Read More

ABOUT US

What is Direct Broadcast (DB)?

Direct Broadcast (DB) is the real-time transmission of satellite data to the ground. As the Earth is being observed by satellite instruments the data is formatted and transmitted to any user below in real-time. Users who have compatible ground receiving equipment and are in direct line of sight to the satellite may receive these transmissions.

What is Direct Readout (DR)?

Direct Readout (DR) is the process of acquiring freely transmitted live satellite data. As Direct Readout technologies have become more affordable and accessible (such as with the onset of the Internet), tools have been developed by the remote sensing community to make satellite data easier to acquire, process, and utilize. As a member of this community, NASA supplies many of these tools to foster global data exchange and scientific collaboration. Live local and regional environmental data, in turn, benefits environmental, commercial, and public interest decision making.

<http://directreadout.sci.gsfc.nasa.gov>





DIRECT READOUT PROGRAM ROADMAP

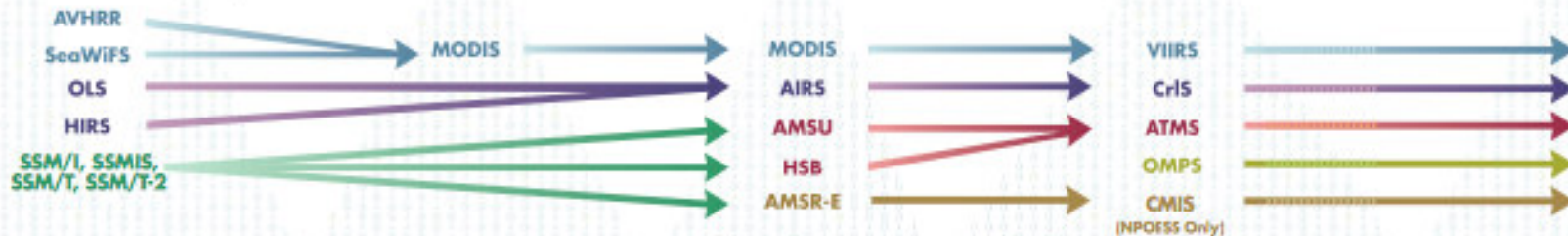
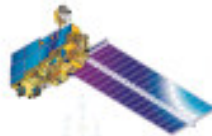
POES • DMSP • SeaStar

Terra

Aqua

NPP • NPOESS

FUTURE MISSIONS



Spacecraft and Instrument Evolution

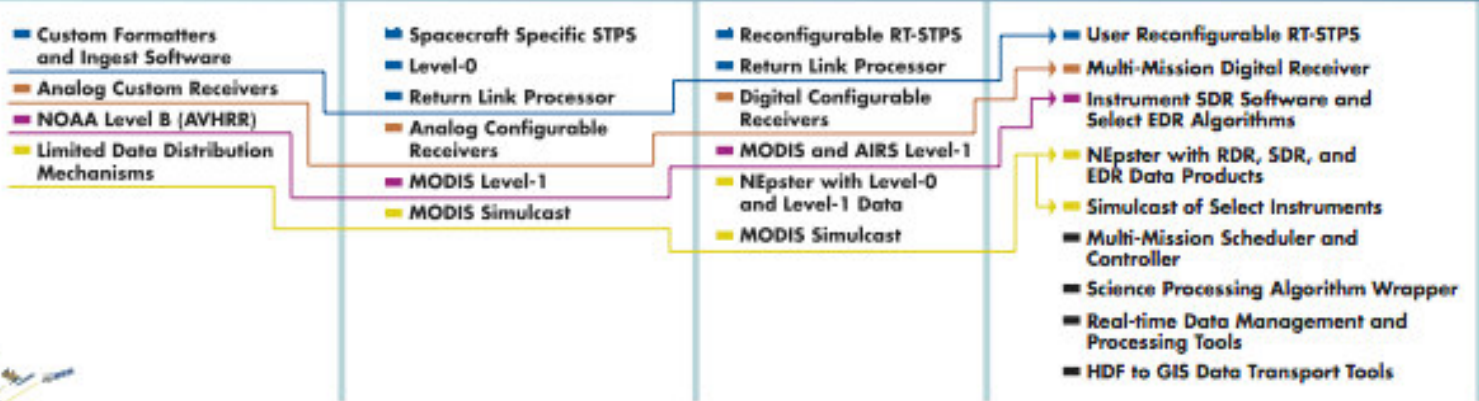
L-Band, S-Band
665 - 2 Mbps
BPSK

X-Band
13.1 Mbps
Convolutional UOQPSK
NRZ-M

X-Band
15 Mbps
OQPSK
NRZ-M

X-Band • X-Band, L-Band
15 Mbps • 20, 3.8 Mbps
Convolutional QPSK • OQPSK
NRZ-M
Compression

Standardization and Increasing RF, Modulation, and Bandwidth Requirements

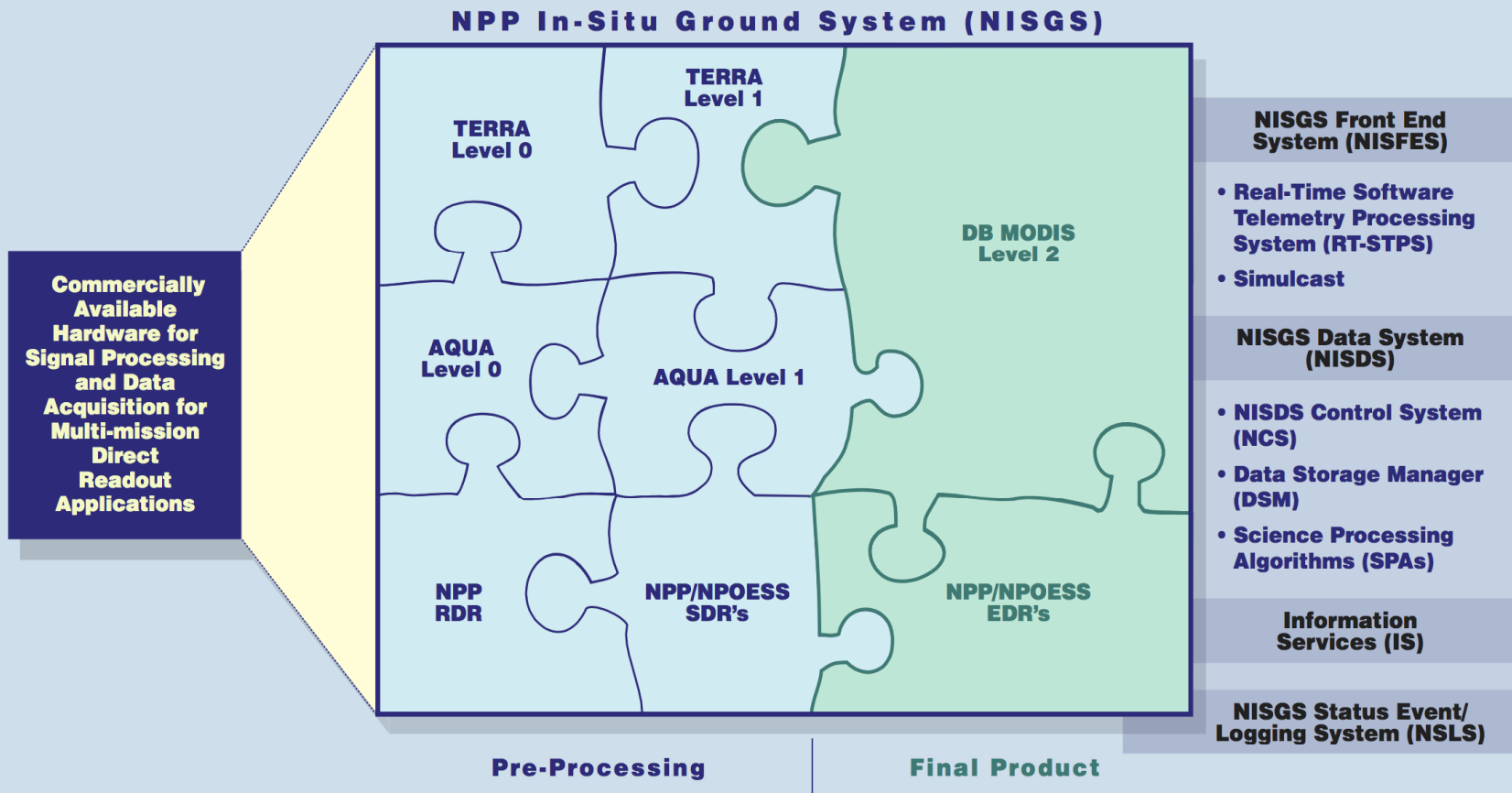


Evolution of Concurrent Ground Systems Supporting Technologies and Algorithm Development



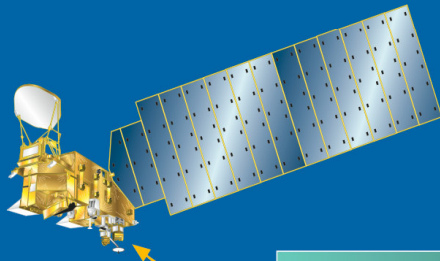


Modular Components Approach for *Real-Time* Data System Implementation

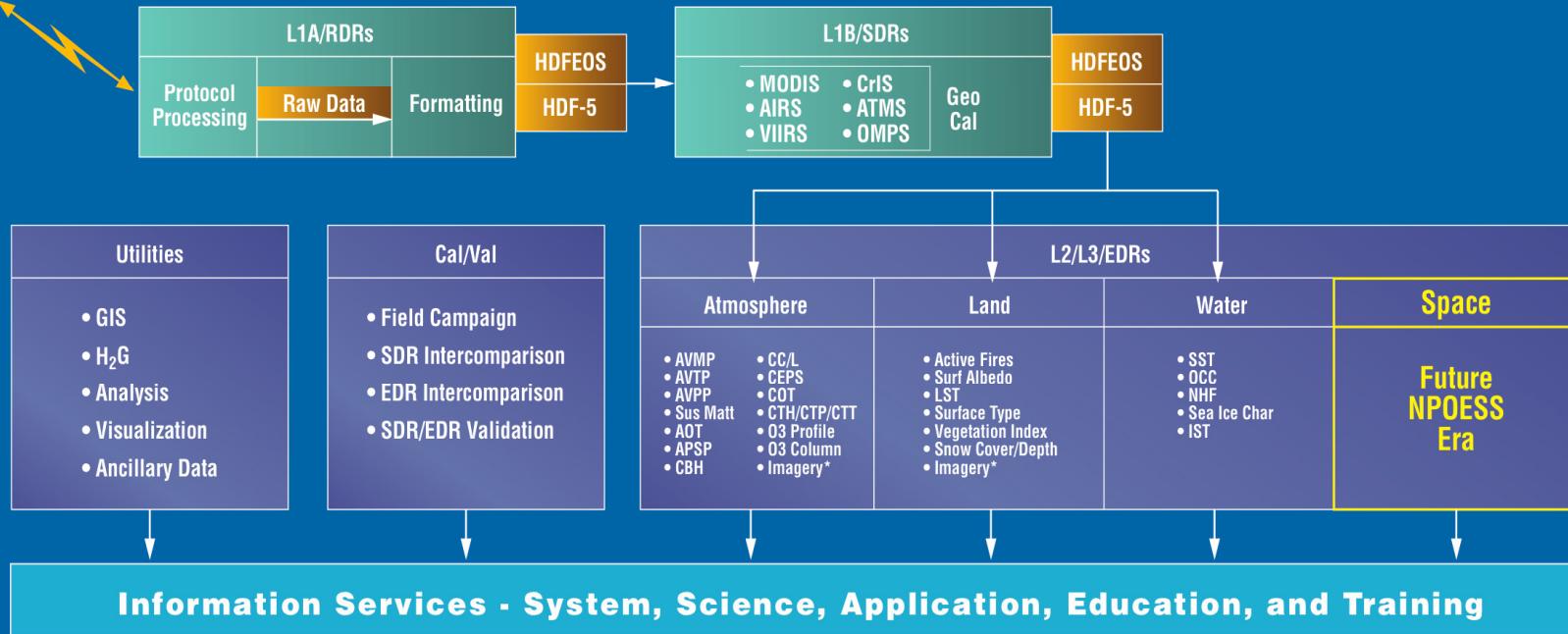




International Polar Orbiter Processing Package (IPOPP) Elements for Terra, Aqua, and NPP

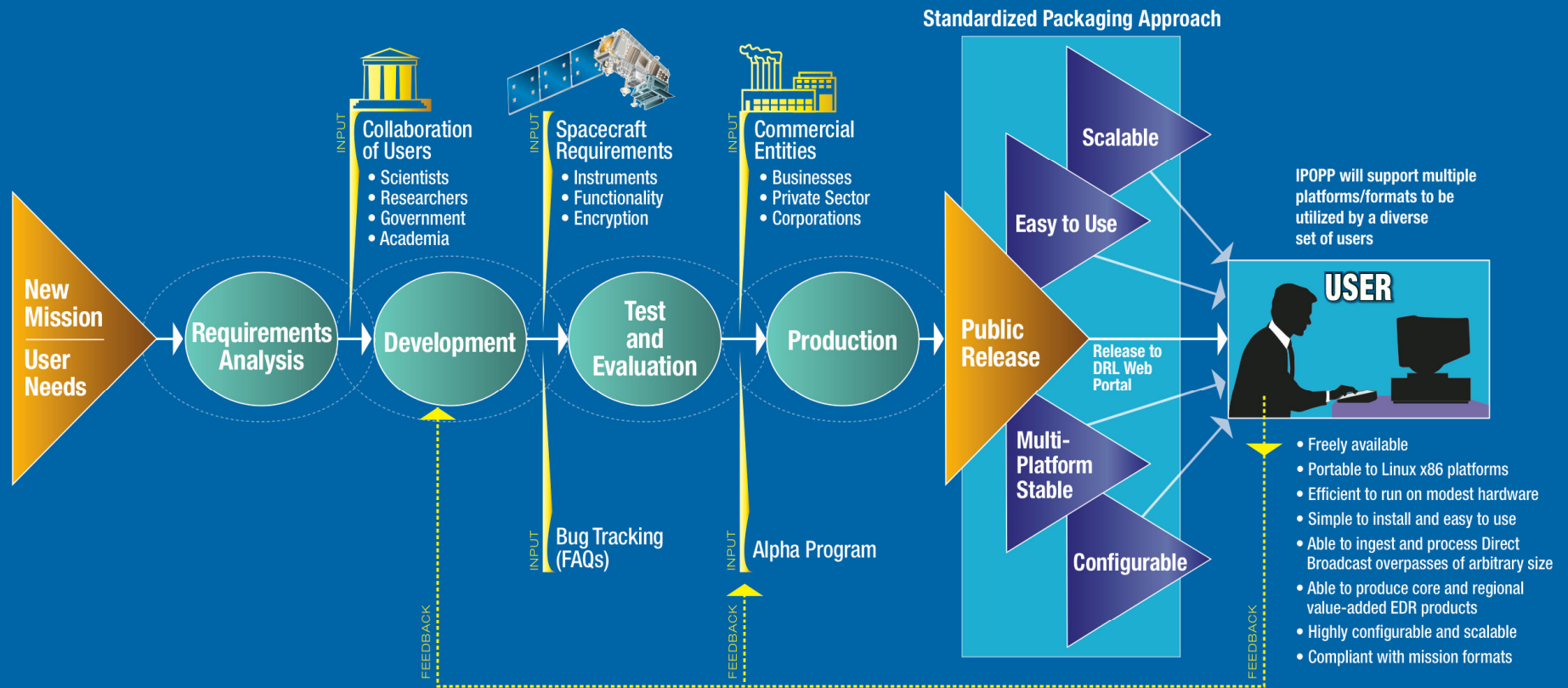


IPOPP is the primary processing package that will enable the Direct Broadcast (DB) community to process, visualize, and evaluate NPP Sensor and Environmental Data Records—which is a necessity for the DB community during the transition from the Earth Observing System Era to the NPOESS Era.





International Polar Orbiter Processing Package (IPOPP) Development Process: An Approach Driven By User Needs





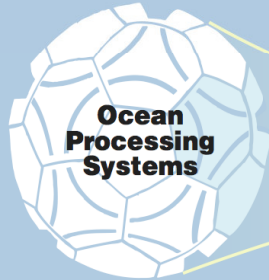
Science Processing Algorithm (SPA) Wrapper

SPA Wrapper Process

1. Varied Requirements
2. Assimilation
3. Standardization



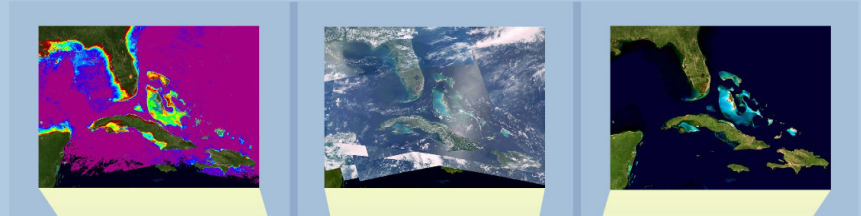
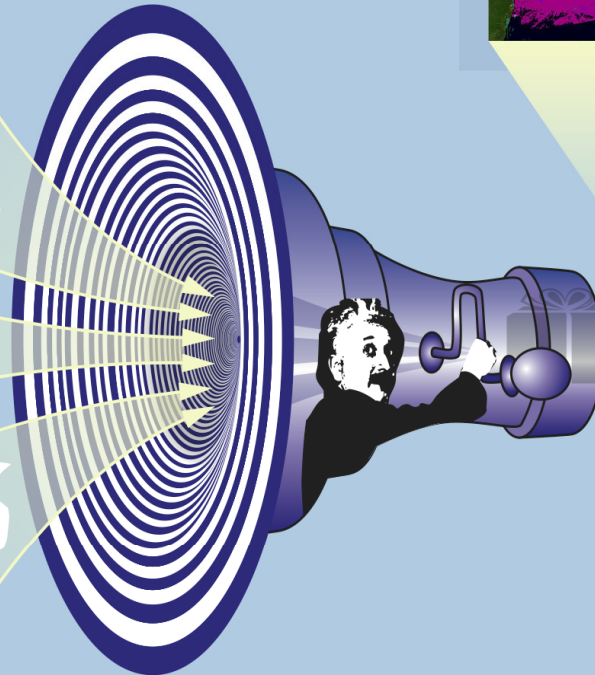
Land
Processing
Systems



Ocean
Processing
Systems



Atmosphere
Processing
Systems

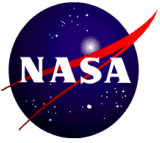


Standalone Wrapped Algorithms



End User Options
- Freedom of Choice -

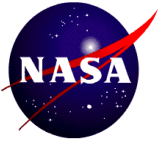
<http://directreadout.sci.gsfc.nasa.gov>



ALPHA PROGRAM -SCIENCE PROCESSING ALGORITHMS (SPAs) (overview)

The DRL supplies Alpha testers with the following SPAs:

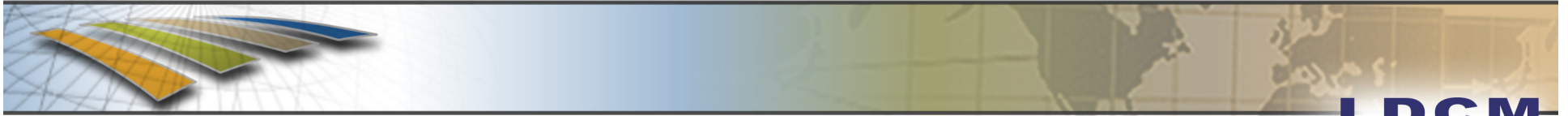
1. MODISL1DB (Ocean Biology Processing Group)
2. Aqua Ground Based Ephemeris and Attitude Data (GBAD) Converter (DRL)
3. Fire Mask (MODIS Land Rapid Response Team)
4. Vegetation Index (Normalized Vegetation Index [NDVI] and Enhanced Vegetation Index [EVI]) (MODIS Land Rapid Response Team)
5. Sea Surface Temperature (SST) (SeaDAS)
6. Chlorophyll-a Concentration (SeaDAS)
7. Cloud mask (IMAPP)
8. Aerosol (IMAPP)
9. Cloud top Properties and Cloud Phase (IMAPP)
10. Atmospheric Profiles (IMAPP)
11. Land Surface Temperature (LST) (MODIS Land Rapid Response Team)
12. Corrected Reflectance (CREFL) (MODIS Land Rapid Response Team)



ALPHA PROGRAM - TECHNOLOGIES (overview)

The DRL supplies Alpha testers following NISGS technologies:

1. Real-time Software Telemetry Processing System (RT-STPS)
2. Simulcast
3. Hierarchical Data Format (HDF) to Georeferenced Tagged Image File Format (GEOTIFF) (H2G) Converter
4. Data Storage Manager (DSM)
5. NISGS Data System (NISDS) Control System (NCS)
6. NISGS Status/Event Logging System (NSLS)
7. Information Services (IS)



Landsat Data Continuity Mission Status

Status, March 31, 2008



NASA / USGS Interagency Partnership

LDCM

- **NASA Associate Administrator Alan Stern and the USGS Associate Director of Geography, Barbara Ryan, signed Final Implementation Agreement in April 2007**
- **NASA Shall**
 - **Lead, fund, and manage development of Space Segment and Launch Segment**
 - **Procure on a reimbursable basis the Mission Operations Element (MOE)**
 - **Lead the LDCM development as the system integrator for all mission segments throughout development, on-orbit checkout, and acceptance**
 - **Lead, fund, and manage the LDCM pre-launch calibration, validation, and characterization of LDCM data through on-orbit check out**
 - **Transfer the Space Segment and MOE contracts to USGS following on-orbit acceptance**
 - **Provide a co-chair for the Landsat Science Team**
- **USGS shall**
 - **Lead, fund, and manage development of the Ground System (excluding the MOE) including flight operations and ground data processing**
 - **Accept the LDCM Space Segment and MOE contracts following on-orbit acceptance**
 - **Lead, fund, and manage on-orbit performance evaluation of the LDCM system and calibration, validation, and characterization of the LDCM data following on-orbit acceptance**
 - **Lead, fund, and manage the Landsat Science Team**

LDCM Milestones**LDCM**

- **Operational Land Imager (OLI) awarded to Ball Aerospace Technology Corporation (BATC), Boulder, CO on July 16, 2007**
 - RFP released Jan. 09, 2007
 - Cost-plus-award-fee contract, including all options, is for \$127.9million
 - OLI Instrument Preliminary Design Review held March 03-07 at BATC
- **Atlas V launch vehicle selected Oct. 03, 2007**
- **Ground System Requirements Review held at USGS EROS on Sept. 26 - 27**
- **Spacecraft Request for Offer (RFO) released Dec. 07, 2007 via RSDO**
 - Contract award expected by no later than May 01
- **Mission Operations Element (MOE) RFP released Feb. 28**
 - Contract award expected in June



OLI Specifications

LDCM

Table 1. Required Spectral Bands and Spatial Resolution

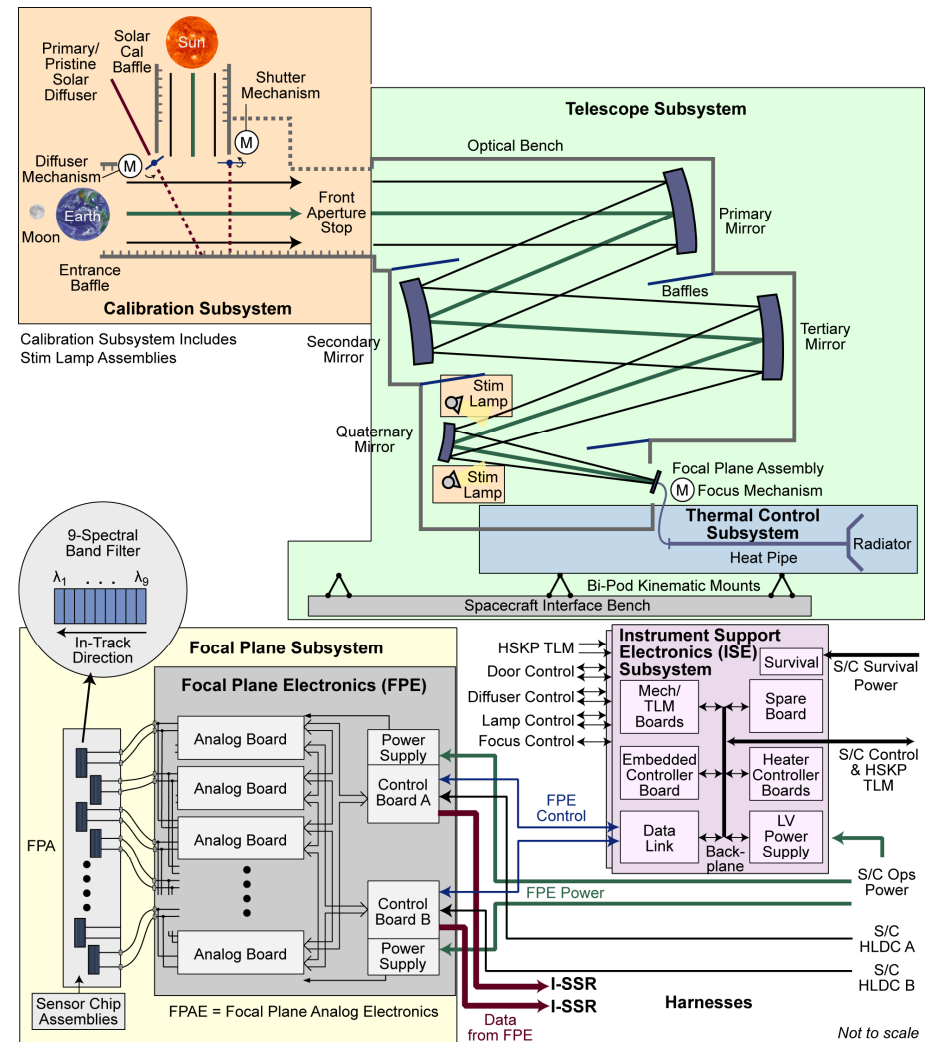
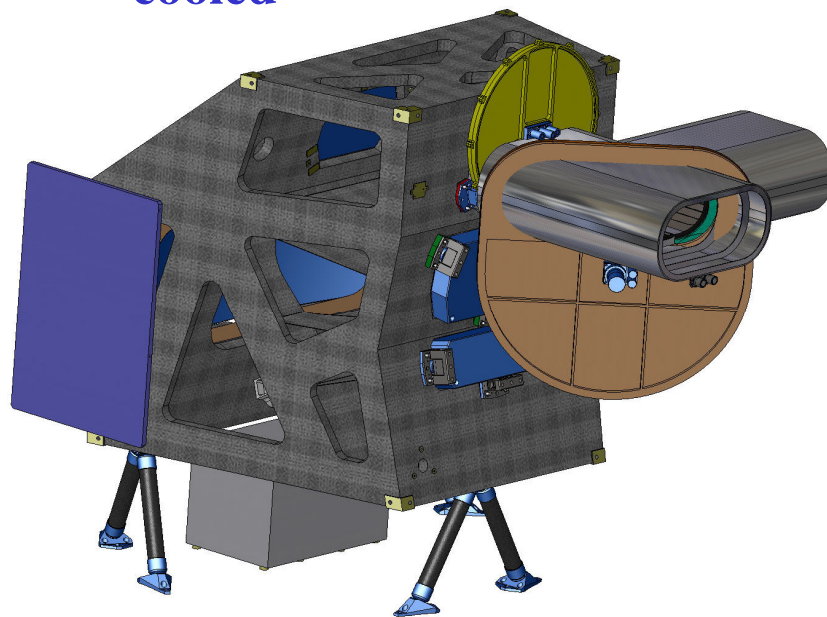
#	Band	Minimum Lower Band Edge (nm)	Maximum Upper Band Edge (nm)	Center Wavelength (nm)	Maximum Spatial Resolution At Nadir (m)
1*	Coastal /Aerosol	433	453	443	30
2	Blue	450	515	482	30
3	Green	525	600	562	30
4	Red	630	680	655	30
5	NIR	845	885	865	30
6	SWIR 1	1560	1660	1610	30
7	SWIR 2	2100	2300	2200	30
8	Panchromatic	500	680	590	15
9*	Cirrus	1360	1390	1375	30

*New bands relative to TM and ETM+ sensors aboard Landsats 4, 5, & 7

Baseline Design and Descriptive Block Diagram

LDCM

- Pushbroom VIS/SWIR sensor
- Four mirror telescope with front aperture stop
- FPA consisting of 14 sensor chip assemblies, passively cooled



The logo features a stylized satellite or sensor array with four colored segments (orange, green, blue, and grey) pointing towards the right, set against a background of a grid pattern.

Landsat Science Team

LDCM

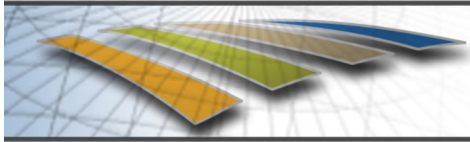
- **USGS convened the first meeting of the USGS-sponsored science team for Jan. 09 - 11, 2007 at USGS EROS in Sioux Falls, SD**
 - **Co-chaired by the USGS Landsat Project Scientist, Tom Loveland, and the NASA LDCM Project Scientist, Jim Irons**
 - **USGS selected 17 science team members in Oct.**
 - 8 PI's from academia and private industry
 - 6 civil servant PI's and 3 international PI's
 - **Team selected Curtis Woodcock, Boston U., as Team Leader**
- **Second meeting held June 12 - 14, 2007 in Corvallis, OR**
- **Third meeting held Jan. 08 - 10, 2008 at USGS EROS**

Future Planning

LDCM

- **National Science and Technology Council (NSTC) Future of Land Imaging - Interagency Working Group (FLI-IWG) have proposed a National Land Imaging Program (NLIP) within Dept. of Interior**
 - **\$2M FY09 funding in President's budget**
- **International Group on Earth Observations (GEO) and the Global Earth Observing System of Systems (GEOSS)**
 - **Committee on Earth Observation Satellites (CEOS) and the Land Surface Imaging Constellation**
- **National Research Council Decadal Survey: Earth Science and Applications from Space: A Community Assessment and Strategy for the Future.**

The LDCM needs to serve as a foundation upon which future land imaging systems can be built



Target Launch Date

LDCM

LDCM

Launch - July, 2011

Operational - March, 2012