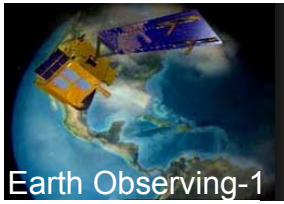
Section 6

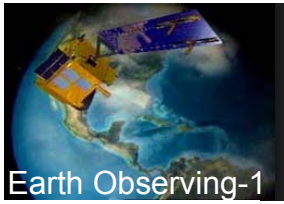
Technology Validation and Infusion Status



Technology Validation Scorecard

June 4, 2002

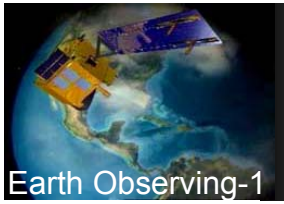
Technology	Tech Val completed?	Science Val Completed?	Primary Partner	Comment
ALI – MS/Pan	Yes – 6/01	Completed	Raytheon	Better than spec SNR's
ALI – WFOV	Yes – 6/01	Completed	MIT/LL	Validated pushbroom technology
ALI – SiC optics	Yes – 8/01	Completed	SSG	Parallel lab mirror finish program successful
Hyperion	Yes – 6/01	Completed	TRW	First hyperspectral benchmark
LEISA Atm Corrector (WIS)	Yes – 6/01	Completed	Rockwell	Minor problems but validated WIS concept
WARP	Yes – 2/01	N/A	GSFC/NG	Over 6000 cycles, 3x original rqt
LFSA	Yes – 7/01	N/A	Lockheed Martin – Phillips Lab	Problem with CIS/harness interconnects
EFF – GSFC	Yes – 7/01	N/A	GSFC/al solutions	Fully successful
EFF - JPL	Yes – 8/01	N/A	JPL/ai solutions	Successful
LAII Thermal Coating	Yes – 6/01	N/A		Validated
PPT	Mostly – 1/02	N/A	GRC-Primex	Excellent performance
CCR	Yes – 6/01	N/A	BF-Goodrich	Excellent conductivity
XPAA	Yes – 7/01	N/A	Boeing	Exceeds Requirements



Technology Transfer Approach

June 4, 2002

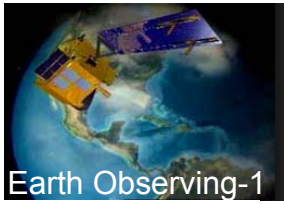
- ***Technology Transfer Forums***
  - ***Proceedings on CD-ROM provided including Tech Validation Reports***
- ***Eo-1 Website, EO-1 Library, Publications, Reports, Conferences and Journal Articles***
  - ***Most available on EO-1 Website/Library or via Technology Point of Contacts.***
- ***Proactive technology and knowledge transfer into relevant missions – i.e., Landsat Data Continuity Mission***
- ***Scientific and Application based use of Imagery***
  - ***Science Validation Team***
  - ***Broader User Community via USGS***



Technology Transfer Forums

June 4, 2002

- ***Multiple EO-1 Technology Transfer Forums held over last 18 months***
  - ***LDCM Workshop, USGS in Reston, VA -- January 2001***
  - ***EO-1 Mission Technology Forum -- August 15-16, 2001***
  - ***EO-1 ALI Technology Workshop, MIT/LL -- October 16-17, 2001***
  - ***EO-1 ALI / Hyperion Data Users Workshop -- November 28-29, 2001***
  - ***EO-1 Science Validation Team Results, IGARS Toronto -- June 25, 2002***
- ***The purpose of these Forums are to facilitate the transfer of EO-1 technologies into new applications and efficiently infuse them into future missions***
- ***EO-1 developed as pathfinder for future Landsat missions, these technology forums are tightly coordinated with the LDCM Formulation Efforts and formulation activities***

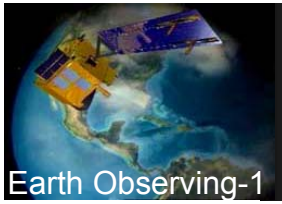


EO-1 Technology Documentation

June 4, 2002

EO-1 Papers Generated or to expected be generated (estimated as of 5/31/02):

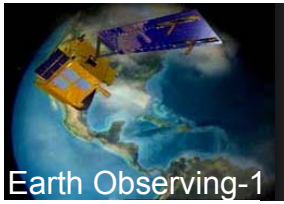
Science Validation Team	*~100*
Hyperion (TRW)	*34*
ALI (MIT/LL)	*37*
LEISA AC (GSFC)	*5*
Technologies:	
- PPT	*5*
- EFF	*12*
- CCR	*5*
- XPAA	*4*
- WARP	*3*
- S/C Bus	*10*
- LFSA	*3*
Others	*15*
Total	*233*



MIT/LL Pubs,Reports

ALI Publications:

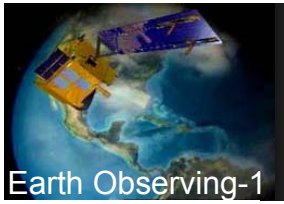
- ***D. E. Lencioni and D. R. Hearn, "New Millennium EO-1 Advanced Land Imager," International Symposium on Spectral Sensing Research, San Diego, Dec. 13-19, 1997.***
- ***C. J. Digenis, D. E. Lencioni6/2/026/2/02 and W. E. Bicknell, "New Millennium EO-1 Advanced Land Imager," SPIE Conference on Earth Observing Systems III, San Diego, California, Proc. SPIE, Vol. 3439, pp. 49-55, July 1998.***
- ***J. A. Mendenhall, D. E. Lencioni, D. R. Hearn and A. C. Parker, "EO-1 Advanced Land Imager preflight calibration," Proc. SPIE, Vol. 3439, pp. 390-399, July 1998.***
- ***D. R. Hearn, "Characterization of instrument spectral resolution by the spectral modulation transfer function," Proc. SPIE, Vol. 3439, pp. 400-407, July 1998.***
- ***J. A. Mendenhall, D. E. Lencioni, D. R. Hearn and A. C. Parker, "EO-1 Advanced Land Imager in-flight calibration," Proc. SPIE, Vol. 3439, pp. 416-422, July 1998.***
- ***W. E. Bicknell, C. J. Digenis, S. E. Forman and D. E. Lencioni, "EO-1 Advanced Land Imager," SPIE Conference on Earth Observing Systems IV, Denver, Colorado, Proc. SPIE, Vol. 3750, pp. 80-88, July 1999.***
- ***D. E. Lencioni, D. R. Hearn, J. A. Mendenhall and W. E. Bicknell, "EO-1 Advanced Land Imager calibration and performance," SPIE Conference on Earth Observing Systems IV, Denver, Colorado, Proc. SPIE, Vol. 3750, pp. 89-96, July 1999.***
- ***D. R. Hearn, J. A. Mendenhall and B. C. Willard, "Spatial calibration of the EO-1 Advanced Land Imager," SPIE Conference on Earth Observing Systems IV, Denver, Colorado, Proc. SPIE, Vol. 3750, pp. 97-108, July 1999.***
- ***J. A. Mendenhall and A. C. Parker, "Spectral calibration of the EO-1 Advanced Land Imager," SPIE Conference on Earth Observing Systems IV, Denver, Colorado, Proc. SPIE, Vol. 3750, pp. 109-116, July 1999…***



Landsat Mission Background

June 4, 2002

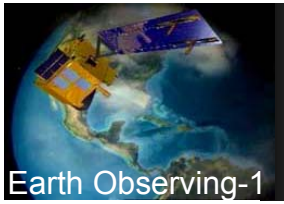
- ***Landsat program has continually acquired synoptic images of the Earth's land surfaces for almost 30 years.***
  - ***At least one Landsat satellite has been acquiring data since the 1972 launch of Landsat 1***
  - ***Landsats 5 & 7 are extending a 30 year record of the land surface***
- ***Landsat has evolved to a global survey mission***
  - ***Affording synoptic coverage of the Earth's land mass on a seasonal basis***
  - ***Providing multispectral digital image data with a moderate spatial resolution (~ 30 meters) for:***
    - *Assessment of land cover and land use change over time*
    - *Characterization of land ecosystem processes*
    - *Management of land resources*
  - ***Serving Government (Federal, state, local, and foreign) as the largest customer, directly or indirectly, of Landsat data***



Procurement Approach

June 4, 2002

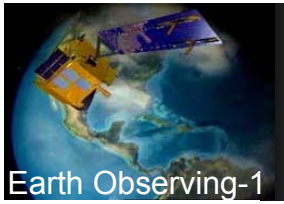
- ***In an effort to move towards a private sector supplier of Landsat-like data, LDCM has been framed around a <u>data specification</u> with data delivery starting March 2006.***
  - ***Gov't specifies spectral, spatial and radiometric qualities of data.***
  - ***Maximizing Industry's flexibility in systems for data acquisition***
  - ***Defining the data as the <u>principal</u> deliverable,***
  - ***Desiring to share cost, risk, and rewards, and***
  - ***Making available relevant new technologies, such as EO-1 sensor(s), to data providers.***
- ***Step 1 is Formulation (Phase A/B) with multiple contractors.***
  - ***Step 1 RFP released November, Awarded late March 2002***
  - ***DigitalGlobe and Resource21 selected as Formulation Phase Contractors.***
    - *Trade studies results by Aug 02'*
    - *System PDR in Nov 02'*
- ***Step 2 is Implementation with a single contractor (Phase C/D/E).***
  - ***Step 2 RFP release expected circa December, 2002, Award in May/June 03'***
  - ***Data Delivery begins March 2006***
- ***The data provider may use <u>any reasonable means</u> of producing the data, but the Government must validate:***
  - ***The approach, (business case included)***
  - ***The implementation, and***
  - ***The data.***
- ***The Government may provide milestone payments during system development for demonstrated progress.***



LDCM-EO1 Technology Infusion

June 4, 2002

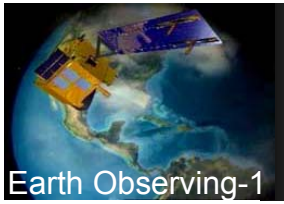
- ***Candidate EO-1 Technology and "experiences" being infused into LDCM***
  - ***Advanced Land Imager (ALI)***
    - *WFOV, pushbroom scanner,*
    - *Focal plane (large number of detectors)*
    - *Pre and Post validate calibration/characterization and validation*
    - *On-board calibration (lunar, solar, stellar)*
    - *Data Processing (L0,L1R)*
  - ***WARP***
    - *High rate data recording, data management, error correction, high rate downlink capabilities.*
  - ***RF (XPAA)***
    - *Ability to work with diverse ground station.*
    - *High data rates*



Intangible Benefits to LDCM from EO-1

June 4, 2002

- ***EO-1 In-tangible payoff***
  - ***Science Validation Team – expert and broader user community have gained extensive experience in utilizing EO-1 data, understand processing and data product generation algorithms***
  - ***Smart Buyer Staff – Transition of both L7 and EO-1 teams onto LDCM project.***
  - ***Major Risks Retired – ALI has retired significant development and potential "data product " problems.***
  - ***LDCM able to better judge proposed technology***



Mission Technologist Operations Lessons Learned

June 4, 2002

- ***Do not wage a two front war***
- ***Make sure its working in the lab before you commit to flight validating it (TRL 6 minimum)***
- ***Avoid nested technologies***
- ***Test as though you will have a launch failure***
  - ***Good experience (ALI – excellent pre-launch characterization)***
  - ***Bad experience (PPT - not fully testing EMI/EMC almost postponed validation indefinitely)***
- ***Keep an eye on the easy stuff***
- ***Validate as you will operate the target mission***
- ***Do not bypass Engineering Test Units***
- ***More proactive risk management and mitigation***

Summary

- ***EO-1 technology results are well publicized and are being infused into future mission proposals and architectures***
- ***EO-1 Hyperion and LAC data are first benchmark for non-DoD hyperspectral data***
- ***EO-1 (and L7) experience and lessons learned enables LDCM mission to proceed as a data buy mission with improved confidence***
  - ***Retired major risks in moving from ETM+ to pushbroom technology***