



Status of the Landsat Data Continuity Mission

Bill Ochs

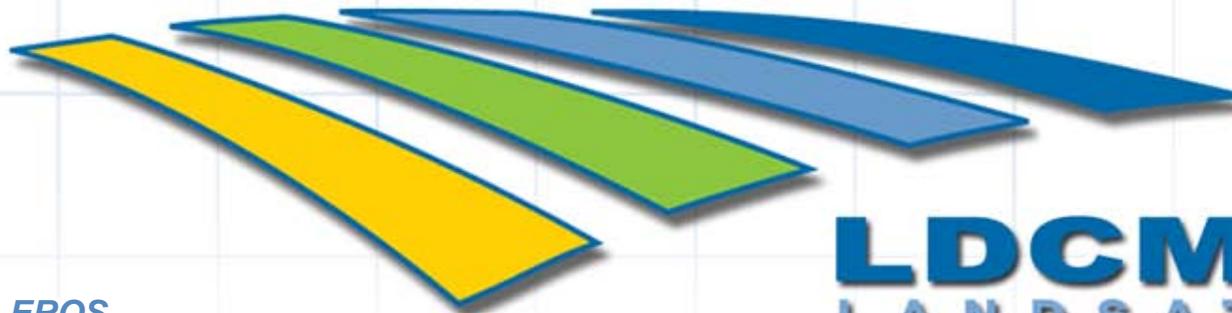
NASA LDCM Project Manager

NASA Goddard Space Flight Center

Landsat Science Team Meeting

Owyhee Plaza, Boise, Idaho

June 15-17, 2010

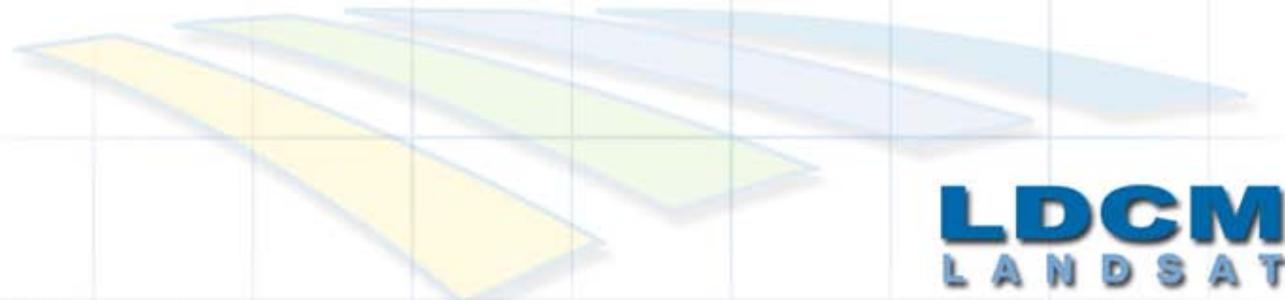


LDCM
LANDSAT

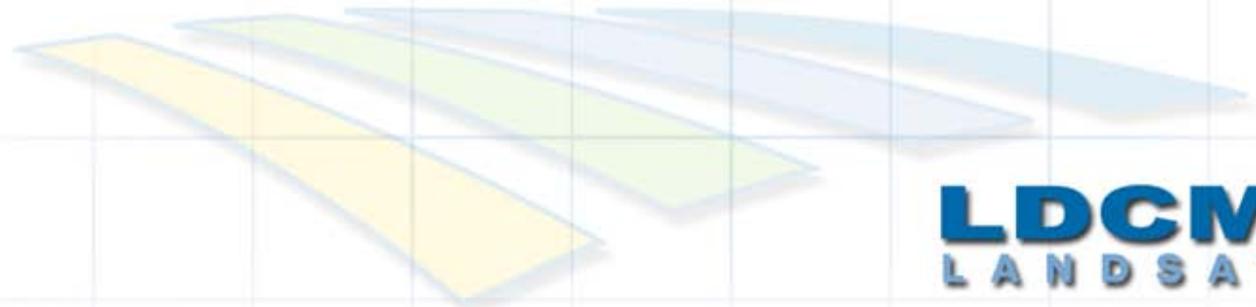
data continuity mission

Agenda

- Mission Status
 - OLI
 - S/C
 - Mission Operations Element & Operations
- Schedule
- Mission CDR
- Conclusion



Operational Land Imager



Accomplishments Since Jan. 2010

- Focal Plane Array

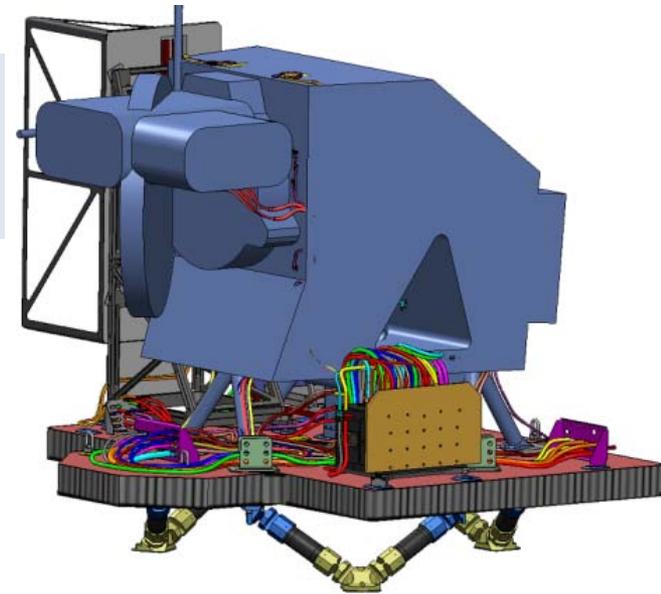
- Engineering Development Unit FPA completed
- Flight Focal Plane Modules
 - All issues resolved
 - First flight lot of FPMs delivered
 - Flight FPA completed
 - Flight Focal Plane System in build

- Telescope

- Flight telescope complete and successfully tested

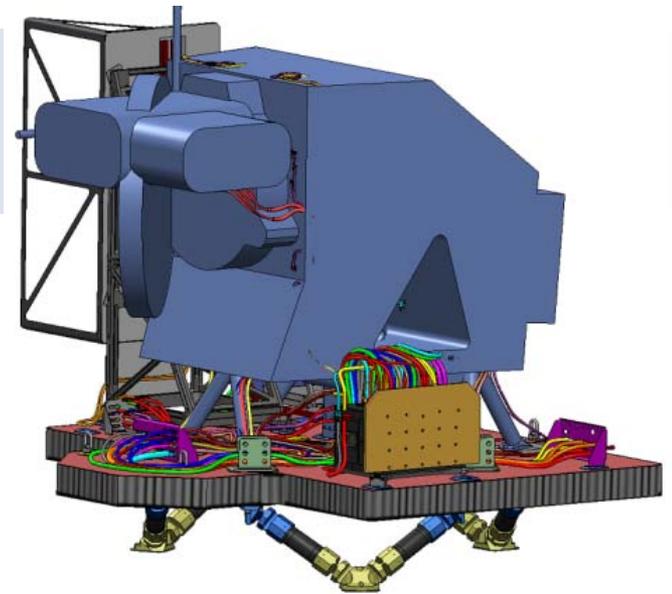
- Electronics

- EDU Focal Plane Electronics and Instrument Support Electronics complete
- Flight FPE and ISE complete and in test



Accomplishments Since June 10

- Solar Calibration Assembly
 - Black chrome plating issue resolved on solar/nadir baffles and transition housing
 - Entire flight solar calibration assembly rebuilt to mitigate schedule risk
- Flight Thermal Control Subsystem thermal balance test completed
- EDU configured OLI
 - EDU FPE, ISE, and FPA integrated with Flight Telescope
 - Functional testing complete
 - Spatial testing scheduled to be completed this week
 - Data analysis still on-going, but through-focus, angular sample distance, and edge response all look good

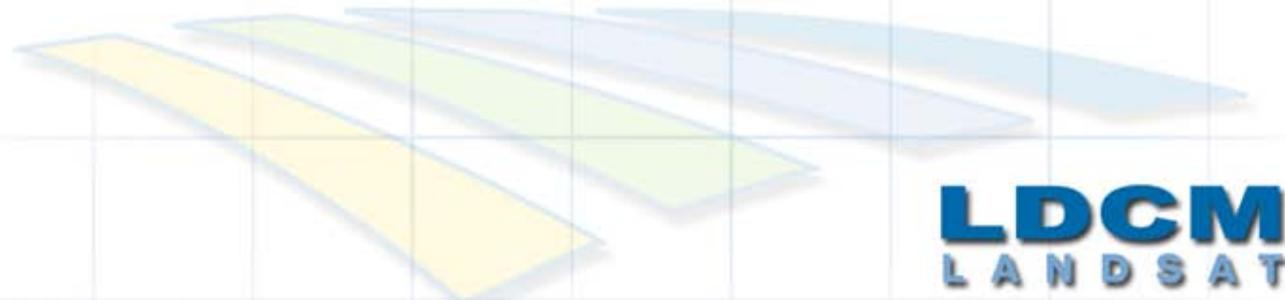


OLI Issues

- Focus Mechanism Motors
 - Unexpected mechanism movement during vibrate
 - Failed functional test after vibrate
 - Work-around
 - Complete EDU Instrument Test without focus mechanism
 - Investigation concluded
 - Root cause determined (there were 6 issues uncovered)
 - New motors in work
- Black Chrome Plating Degradation on Solar Calibration Subsystem
 - Probable root causes determined and validated
 - Replacement parts completed
 - Issues closed
- All detector issues resolved

OLI Issues

- Aeroflex SRAM (memory devices) Reliability
 - Existing SRAM parts used on the embedded controller card of the OLI Instrument Support Electronics have defects posing an unacceptable risk to on-orbit reliability
 - New parts received from Aeroflex
 - Defects corrected
 - Parts being replaced



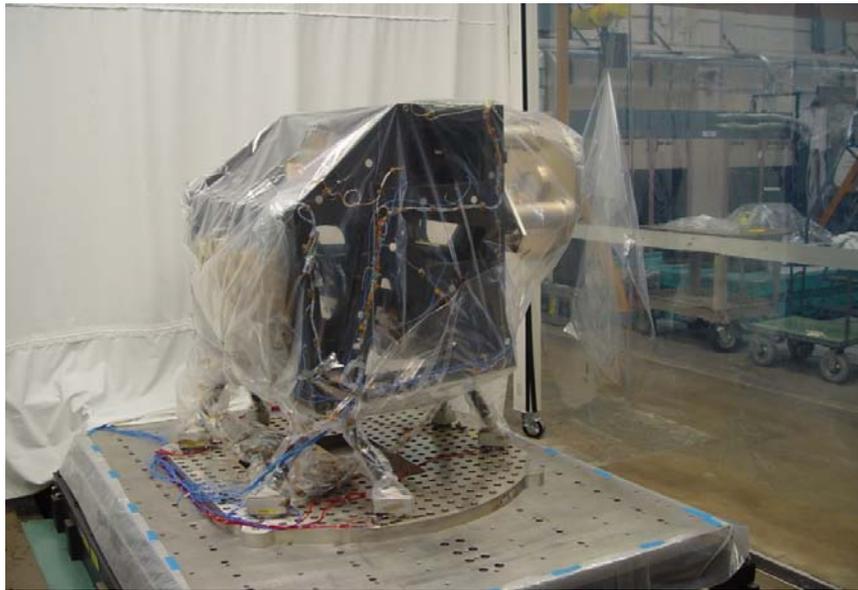
OLI Risks

| Rank | RID | Risk Title |
|------|--------|--|
| 1 | PM-86 | SIRU Delivery Delay |
| 2 | PM-71 | TIRS Schedule |
| 3 | PM-87 | OLI TV Chamber Conflict with NPP |
| 4 | PM-83 | S/C MOSFET Availability |
| 5 | PM-85 | SEAKR Water Soluble Flux |
| 6 | PM-55 | Observatory Jitter |
| 7 | PM-88 | TIRS Simulator Delay |
| 8 | SC-41 | Payload/Spacecraft Interface Changes |
| 9 | TIR-61 | Functional Performance Model Focus |
| 10 | PM-80 | OLI ROIC Latch-up |
| 11 | PM-89 | Solar Array Deployment Rate Check |
| 12 | LS-05 | Launch Vehicle Readiness |
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| 19 | OLI-18 | Late Results from Observatory Level STOP Modeling |
| 20 | SC-40 | S/C EM compatibility problems with instruments |
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OLI Schedule Reserves Expenditures and What's Left

- Mission PDR
 - Project Held Reserves to OLI Delivery → 5.25 mos.
- Solar Calibration Assembly Black Chrome Anomaly
 - Drove BATC reserves to delivery to → -20 days
- Directed change to BATC to rebuild entire Solar Cal Assembly instead of only damaged pieces and not interrupt EDU configured OLI test flow
 - Recovered 20 days of reserve
- Project released 40 days (2 mos.) of Project held reserve to OLI delivery
- Current total (Project + BATC) reserve to delivery to Observatory
 - 3.25 mos. (Project) + 0.75 (BATC) = 4.0 mos.

Hardware

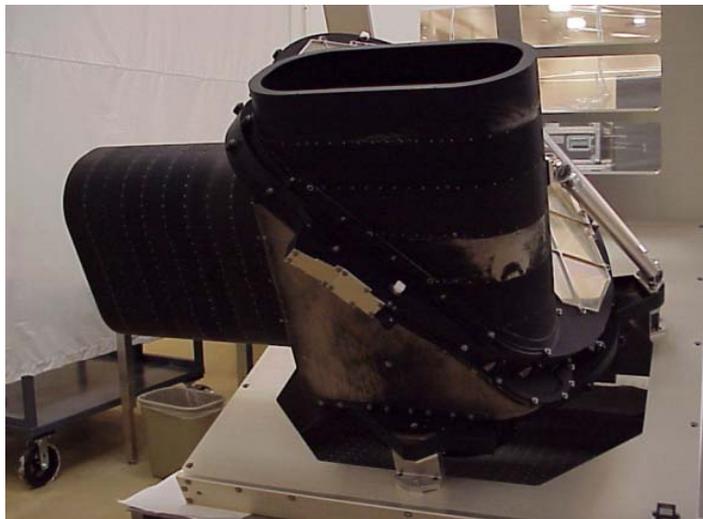


OLI Telescope Vibe

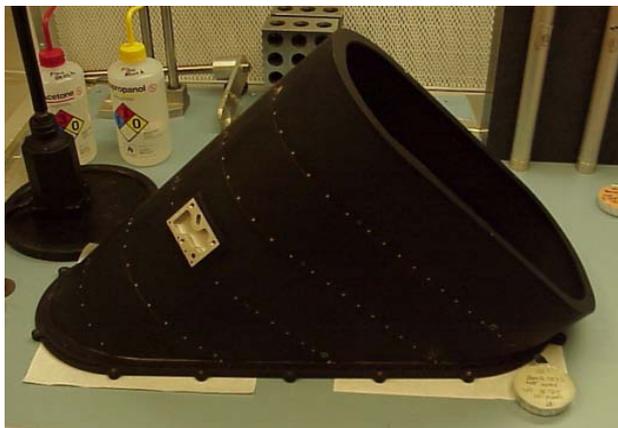


Preps for Stray Light Testing

Hardware - Solar Calibration Subsystem



Black Chrome Plating Issue

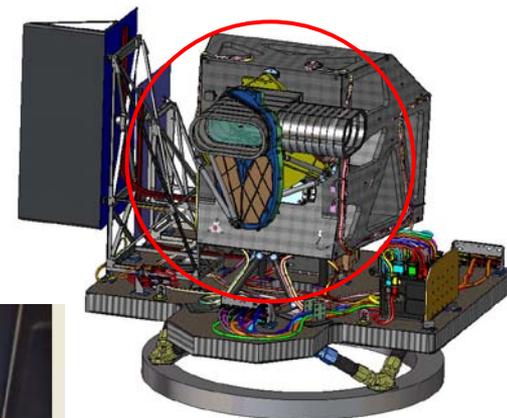


New Entrance Light Shade

NASA GSFC / USGS EROS



New Solar Light Shade

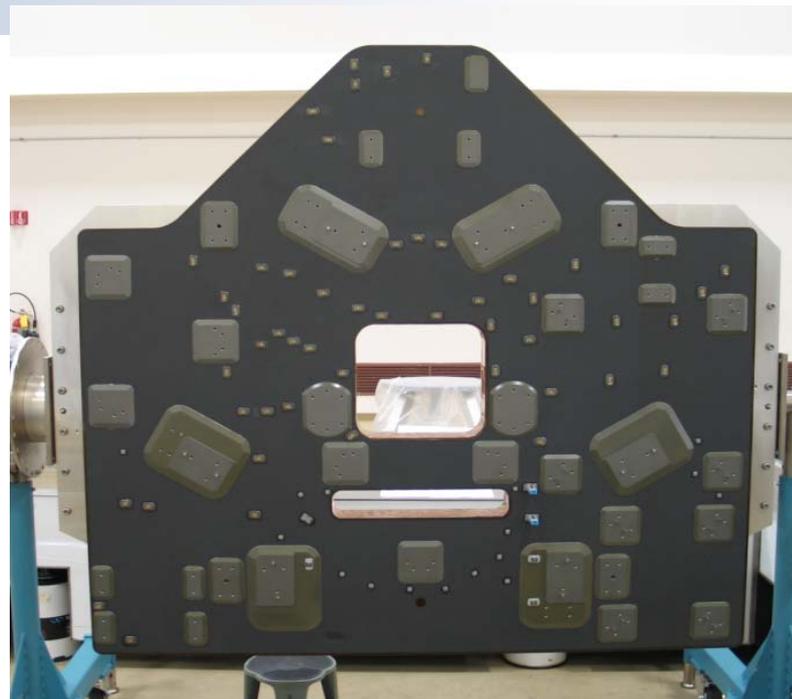


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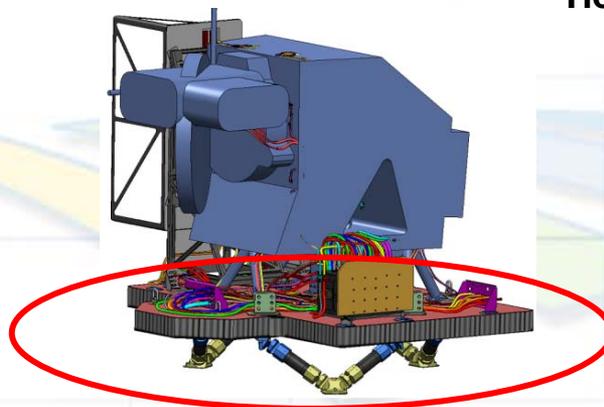
Hardware - Baseplate



Bipods attached to Handling Frame and Vibe Plate



Tie bases bonded on baseplate



Hardware – Spatial Testing



EDU FPA/Flight Telescope
Integrated with
EDU FPE and ISE Box



Horizontal Collimator
Assembly



OLI being lowered into Brutus T/V
Chamber



OLI being installed in Horizontal
Collimator Assembly

Hardware



OLI In Times Square

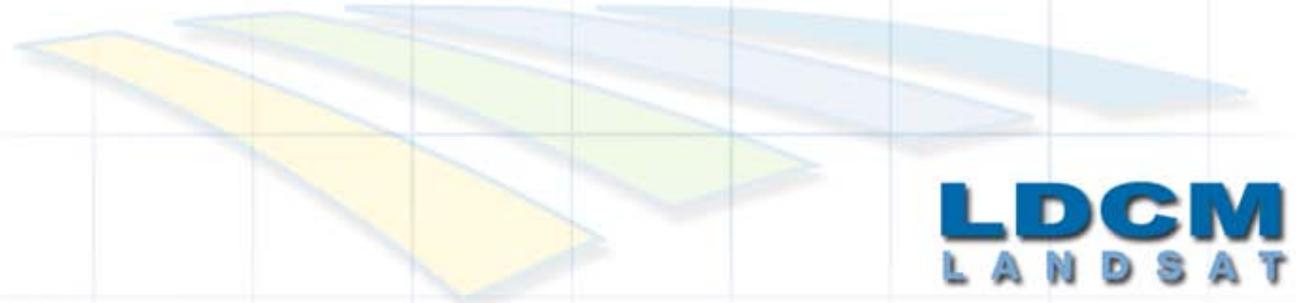


OLI In Vegas

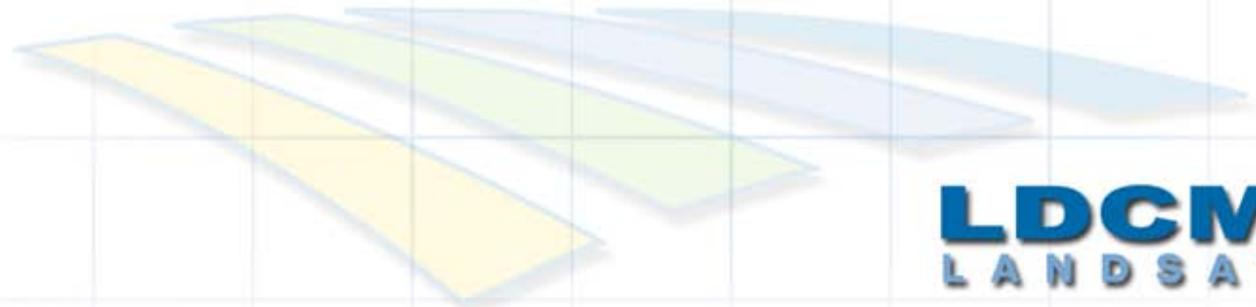


Near-Term Plans

- Complete integration of OLI
- Begin integrated Flight OLI testing
- OLI Pre-Environmental Review schedule for September



Spacecraft



ACCOMPLISHMENTS Since Jan. 2010

- GDAIS became Orbital on 4/2 at midnight
- All Engineering Model (EM) avionics boxes complete and tested
- Flight avionics boxes in test
- Flight harness fabrication in full swing
- EM solar array deployed
- Spacecraft primary structure assembly complete
 - Structural testing on-going
- OLI Interface Simulator tested with S/C Interface Simulator
- Successful testing of communication system with ground demodulator

Spacecraft Issues

- Solid State Recorder (SSR) Memory Error
 - Occurring on stacked memory modules
 - Problem with stacking process
 - Pursuing two paths to resolution
 - New 4Gb device (other device 2Gb) – no stacking required
 - Device in qualification now
 - Non-stacked device dual sided board design
 - Decision will be made on which final path to use by the end of June.
 - Will use EM SSR during early stages of I&T
- S/C Solar Array Substrate Delamination
 - Delaminations around titanium fittings on the solar array
 - Build-up of excess adhesive that was used on the titanium fittings forming a pillar of adhesive along the side of the fitting extending from both face sheets
 - Expansion and contraction of this pillar is believed to have initiated and propagated de-bonding between the facesheet and fitting
 - Continuing down the path of both repairing the existing set of solar array panels and rebuilding a new set of panels

Spacecraft Issues

- S/C Instrument Deck Delamination
 - De-laminations were found on the instrument deck the gyro and TIRS titanium fittings
 - Design error in tension of face sheet
 - Repair options were identified and the deck is due to be delivered in July
- GPS EEE Parts
 - Destructive Parts Analysis (DPA) report indicates GPS ASIC had failed the analysis
 - GSFC parts folks are currently investigating
 - GSFC and Orbital looking at replacement GPS units
- RWA contaminated lubricant
 - Significant amounts of silicone found in lube
 - Affects multiple projects at GSFC
 - Under investigation

Spacecraft Risks

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Schedule Reserves Expenditures and What's Left

- Project held reserves against spacecraft delivery remain unchanged
 - 4 mos.
- Orbital is currently maintaining 59 days of margin to spacecraft delivery
 - Dropped from 72 days in January 2010
 - Delays in PIB-T procurement
 - Dropped to 19 days due to multiple hardware issues and rework of S/C I&T
 - Solar Arrays
 - Instrument Deck
 - Star Trackers
 - SIRUs
 - Propulsion System
 - Structural Qual Test (crane failed inspection)
- Current total (Project + Orbital) reserve to delivery to Observatory I&T
 - 4 mos. (Project) + 1 mos. (Orbital) = 5.0 mos.

HARDWARE



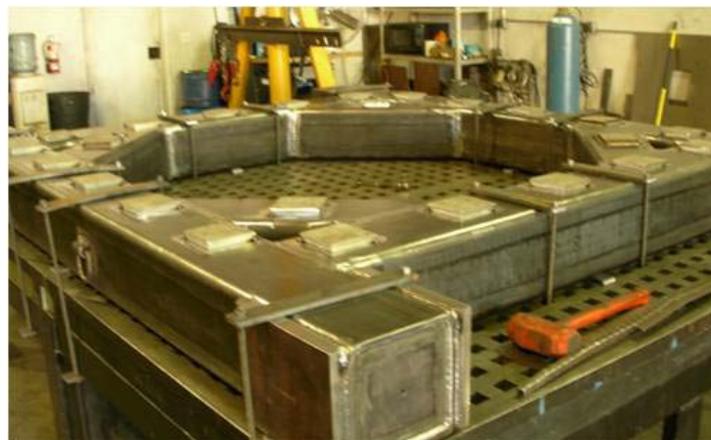
EM Solar Array Deployed



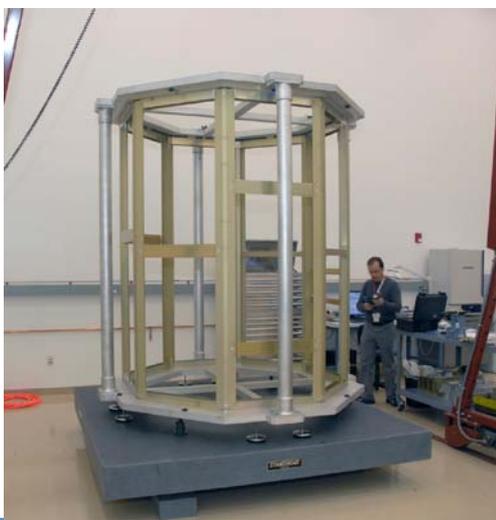
HARDWARE



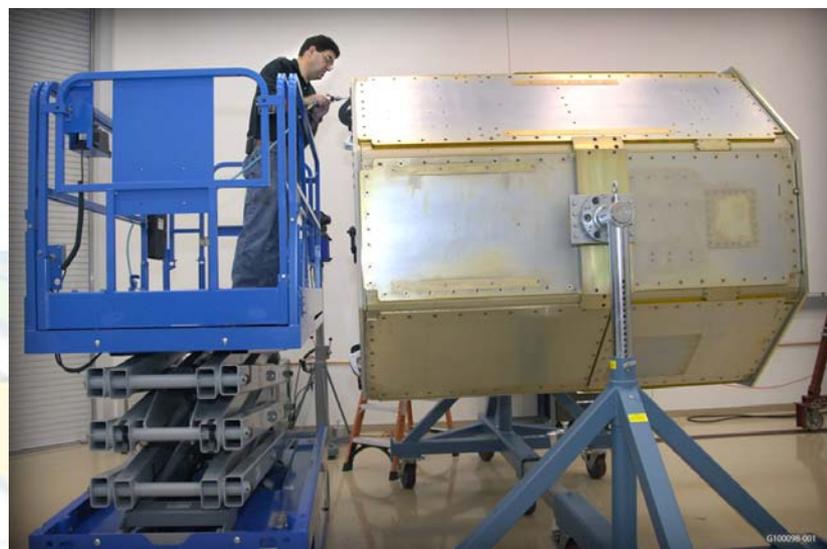
Shipping Propulsion Tank



I&T Stand



Spacecraft
Structure
Assembly



NASA GSFC / USGS EROS

Hardware



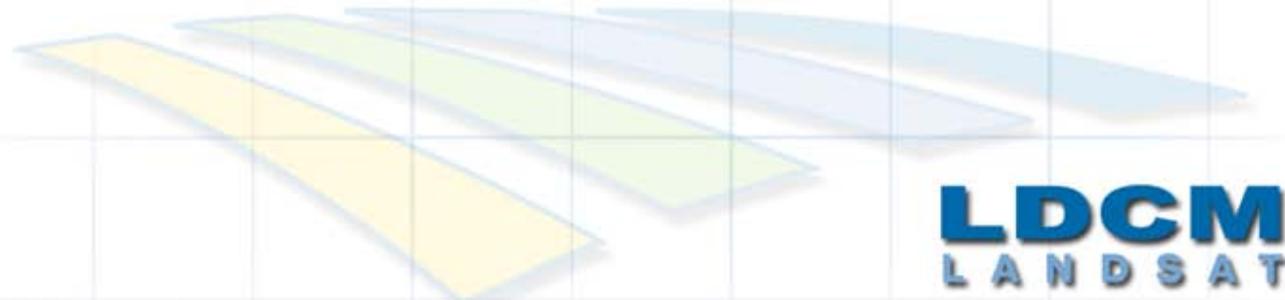
Five guys and a S/C Structure



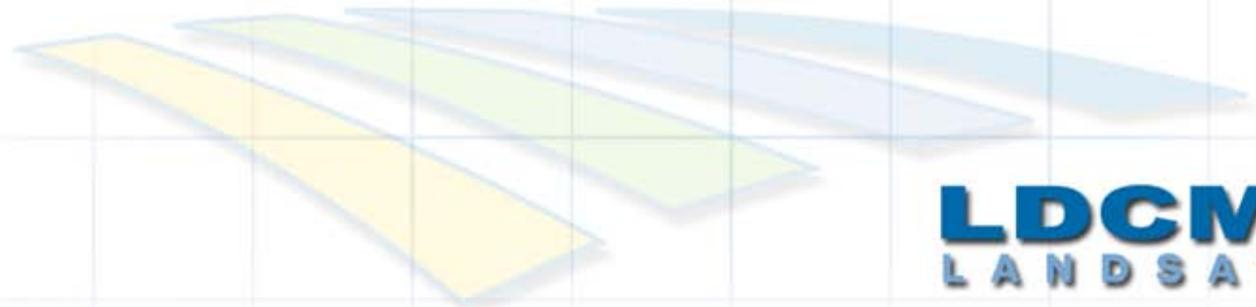
Cable Mock-Up with beginnings of flight harness

Near Term Plans

- Spacecraft Integration Readiness review in Aug.
- Spacecraft I&T

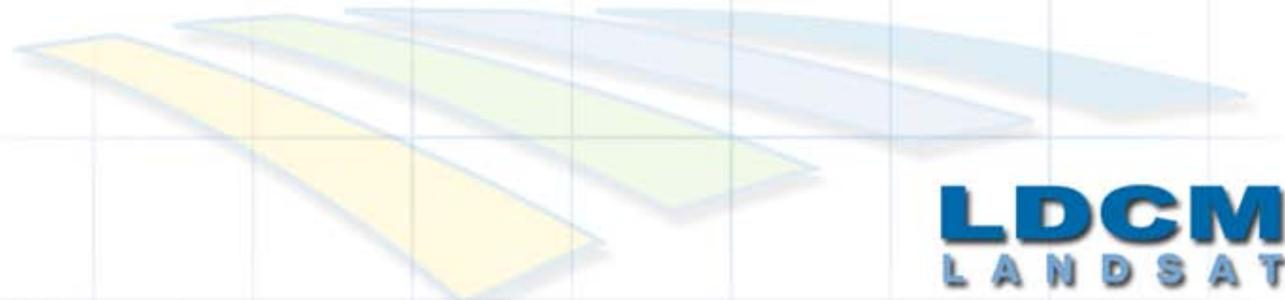


Mission Operations Element & Operations



Accomplishments Since Jan. 2010

- MOC Ribbon Cutting held on November 20
- Delivered MOE Software Build 3 to MOC
- Delivered Mini-MOE to Orbital
 - Successful Mini-MOE interface test with Spacecraft Observatory Simulator (SOS) softbench at Orbital
- Completed CAPE release 1.1 hardware and software installation in MOC
- 6.5 full-time FOT on staff
- Establishing Svalbard as an additional ground station for On-Orbit Verification
 - Options will be in contract for USGS to pick up for normal operations



Risks

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Schedule Reserves Expenditures and What's Left

- Project does not hold reserves directly against the MOE, but against the overall Ground System Development
 - Mission PDR
 - Project Held Reserves to delivery → 4 mos.
 - Mission CDR
 - Reserves still 4 mos.
- Ground System is directly tied to the execution of GRTs which is tied to S/C and Observatory I&T
 - I&T environment is highly dynamic
 - As a result, Ground System testing with “hot bench”, “soft bench”, and eventually S/C must be flexible
 - At any given moment, Ground System development schedule could have positive or negative slack
 - Ground System personnel work very closely with Orbital I&T folks to develop work arounds, etc. when negative slack occurs
- Project Management is driving the Ground System hard to exhaust all work around options before releasing any project reserves at this point
 - Want to maintain as much reserve as possible for when in the midst of I&T

LDCM Mission Ops Center

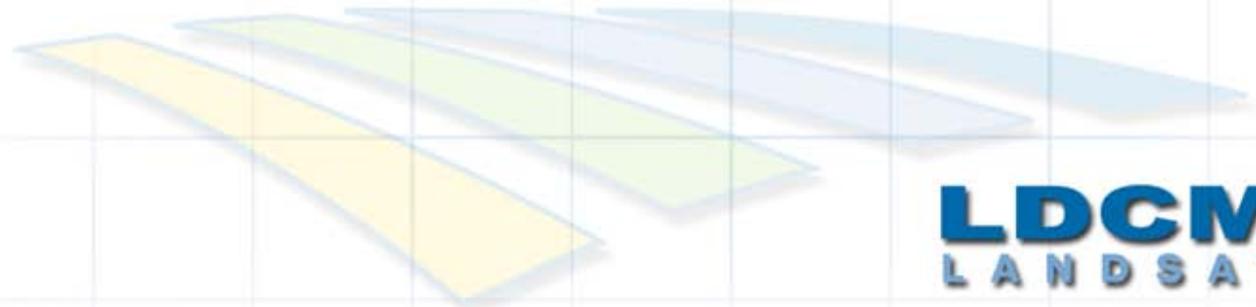


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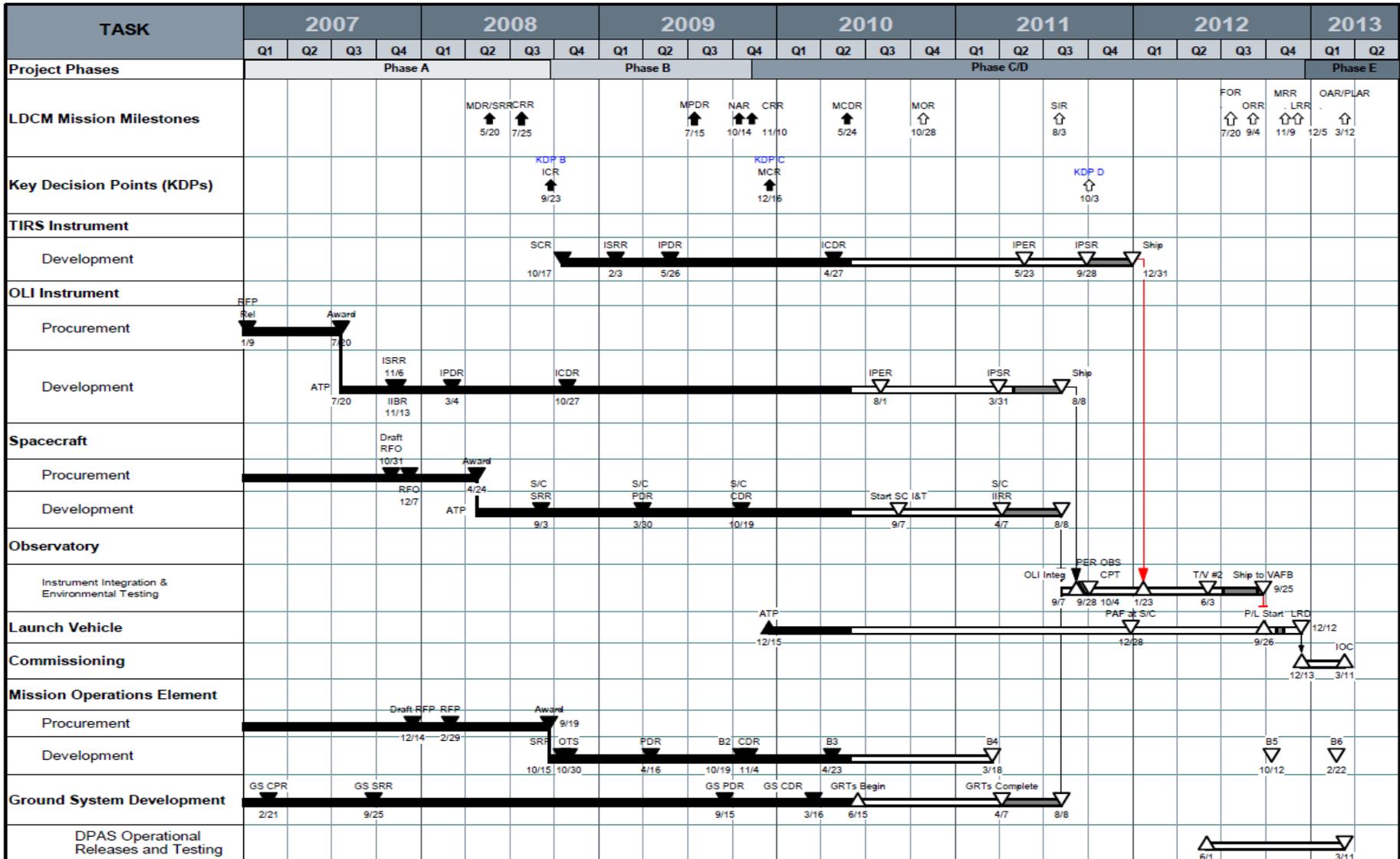


Landsat Science Team Meeting June 15 - 17, 2010

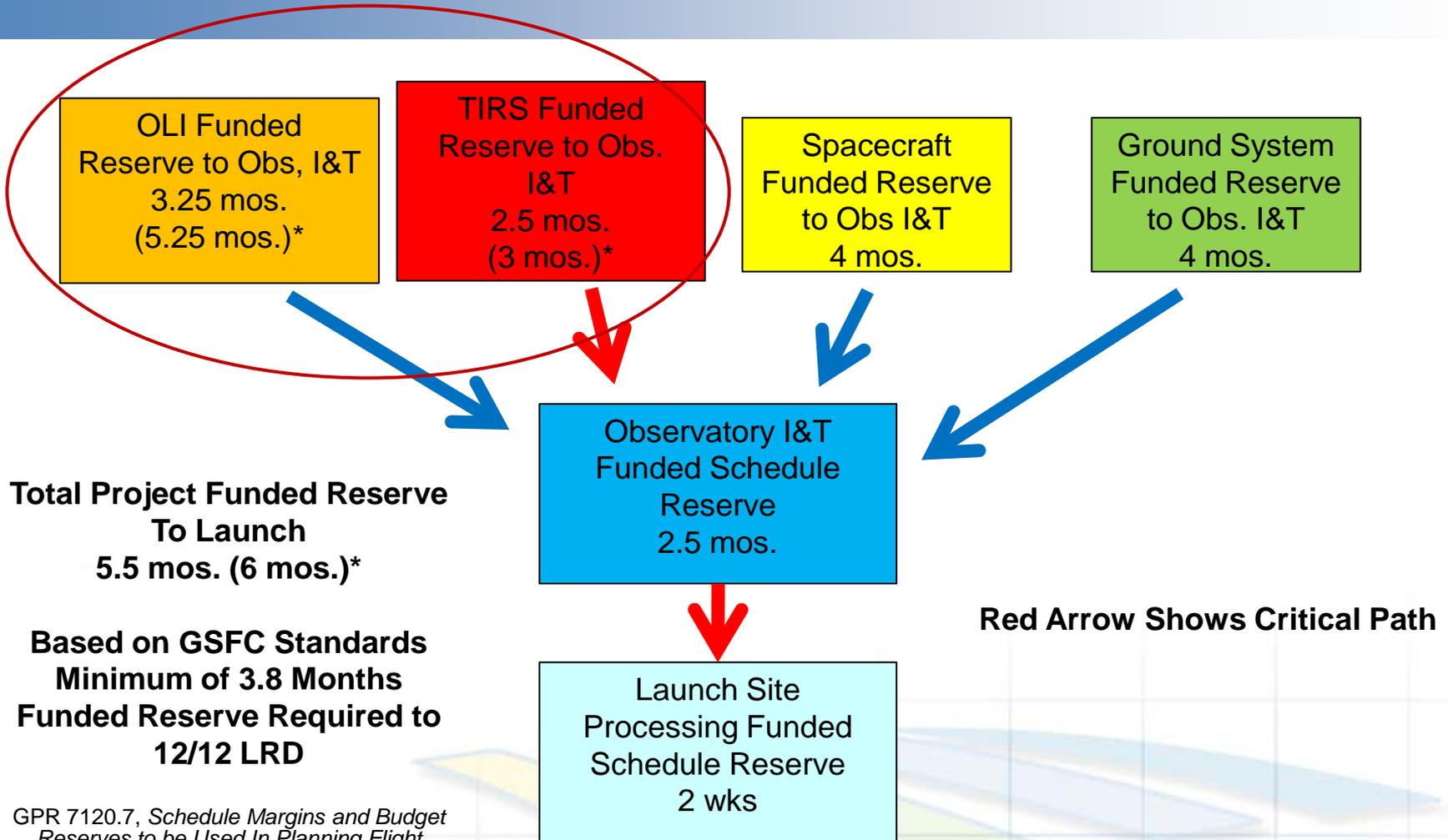
Schedule



LDCM Master Schedule



Funded Schedule Reserves



Total Project Funded Reserve To Launch
5.5 mos. (6 mos.)*

Based on GSFC Standards
Minimum of 3.8 Months
Funded Reserve Required to
12/12 LRD

GPR 7120.7, Schedule Margins and Budget Reserves to be Used In Planning Flight Projects and In Tracking Their Performance

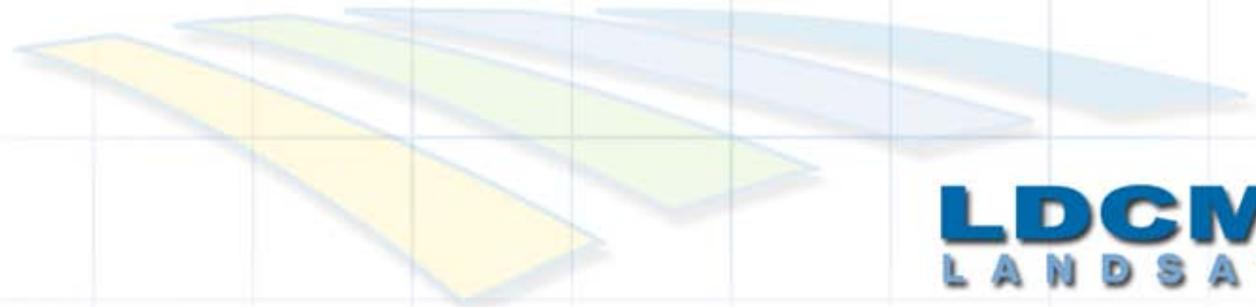
Red Arrow Shows Critical Path

* Reserves At KDP-C

Critical Path Management

- Team effort across the Project and various mission elements
- TIRS
 - TIRS project level reserves are jointly managed by the PM and TIRS IM
 - TIRS Team
 - Continually tracks schedules and any loss of slack results in work-arounds to maintain as much slack as possible
 - Actively implement backup options and parallel paths
 - » Plans generated and tracked as mitigation strategies as part of the schedule monitoring and Risk Management process
 - TIRS team, LDCM Project and AETD provides an environment to allow a management strategy which promotes as much schedule flexibility as possible
- Observatory
 - TIRS high fidelity mass model being built to facilitate Observatory I&T with OLI only
 - Orbital developed alternate Observatory I&T scenarios to allow for late arrival of TIRS
 - Scenarios were independently reviewed at Mission I&T EPR
 - Examining TIRS requirements (both performance and testing) to provide relief in the event of problems/issues while maintaining scientific integrity of instrument

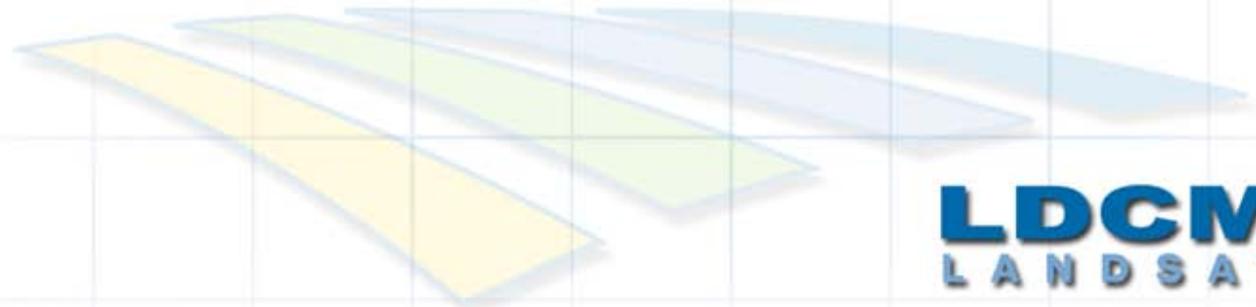
Mission Critical Design Review



MCDR

- Successful Mission CDR conducted on May 25-27
 - 3 RFAs
 - Transportation System
 - Cyro Cooler handling after delivery to GSFC
 - Provide full accounting of Failure Review Boards in progress
 - 2 issues identified
 - TIRS Schedule
 - Standing Review Board recommendation
 - » Continue to track/manage milestones and re-plan as appropriate
 - » Ensure very experienced designers are working critical path items
 - » Continue to mature options for late delivery to observatory I&T
 - Jitter Characterization
 - Standing Review Board recommendation
 - » Aggressively pursue component level disturbance data for inclusion in system jitter modeling
 - » Need to confirm model uncertainty factors are adequate
 - » Fully develop and implement observatory level jitter test plan

Conclusion



Conclusion

Project is and remains committed to the
Dec. 2012 Launch Date

Great Progress has been made to date,
but there are many challenges ahead

