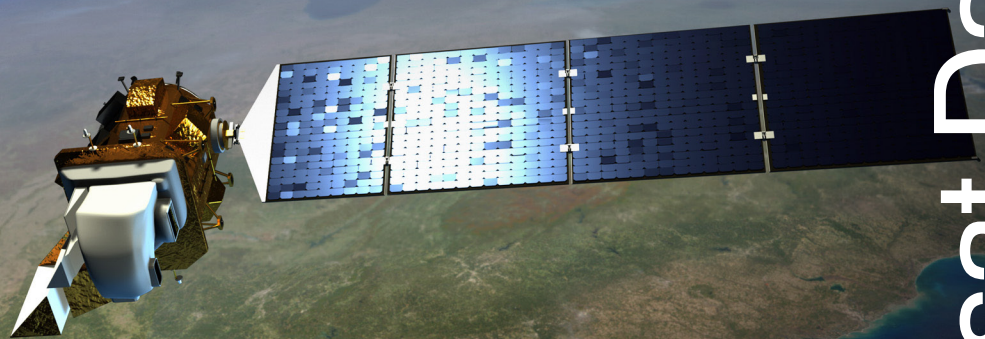
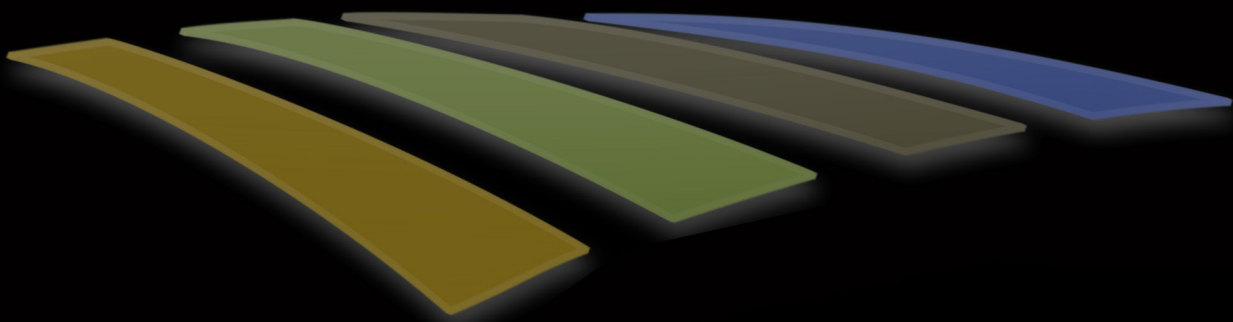




# LDCM

Press Kit



February 2013

Landsat Data Continuity Mission



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# Media Services

## News Center/ Status Reports

The NASA Newsroom in the NASA Resident Office at Vandenberg Air Force Base (VAFB) will be the center of public affairs and news media operations from L-5 days through launch until approximately five hours after a successful launch.

To speak with a NASA communications specialist, call 805-605-3051. A recorded launch status report also will be available starting at that time by dialing 805-734-2693 or 301-286-NEWS.

## Prelaunch Press Briefings

The L-3 prelaunch press briefing and science briefing are scheduled back-to-back for February 8 at noon PST at the NASA News Center at VAFB. Information presented will include the details about the Atlas V countdown, launch readiness of LDCM, background on the satellite and its mission, and the launch weather forecast. The briefing will be carried live on NASA TV. Audio of the conference will be carried on the NASA "V" circuits, which may be accessed by dialing 321/867-1220... 1240... 1260... 7135.

Both briefings will be televised live on NASA TV. Media advisories will be issued in advance, outlining details of these broadcasts.

## Postlaunch Press Briefing

A postlaunch press conference will be held approximately 2 hours after the spacecraft is safely in orbit. The postlaunch briefing will be held in the NASA News Center at VAFB.

## Launch Media Credentials

News media interested in attending the LDCM launch should contact 2nd Lt. Kaylee Ausbun, U.S. Air Force 30th Space Wing Public Affairs Office, Vandenberg Air Force Base, Calif., at (805) 606-3595 or [kaylee.ausbun@us.af.mil](mailto:kaylee.ausbun@us.af.mil)

## Web Coverage

Launch coverage of the Atlas V LDCM countdown activities will be available on the NASA website by going to the home page at: <http://www.nasa.gov>

Live countdown coverage on NASA's launch blog begins at 7:30 a.m. PST (10:30 a.m. EST). Coverage features real-time updates of countdown milestones, as well as streaming video clips highlighting launch preparations and liftoff.

To access these features, go to NASA's LDCM mission website at: <http://www.nasa.gov/landsat>

More information on the mission, including an electronic copy of this press kit, news releases, fact sheets, status reports and images, can be found at: <http://www.nasa.gov/landsat>

Broadcast quality video can be downloaded from: <http://svs.gsfc.nasa.gov/Gallery/Landsat.html>

# Media Services (continued)

## NASA Television

All NASA Television Channels (Public, Education, Media, occasional HD feed and the Live Interactive Media Outlet) are available on AMC 18 C, C-band Transponder 3 C, located at 105 degrees West. The downlink frequency is 3760 MHz with Vertical polarity. A Digital Video Broadcast (DVB) compliant Integrated Receiver Decoder (IRD) is needed for reception.

*“News networks, their reporters, and other broadcast media organizations must tune their satellite receivers to the Media Channel to ensure reception of clean feeds for all mission coverage, news conferences and other agency distributed news and information. News and other media organizations will no longer be able to rely on content from the Public Channel for clean feeds of mission and other agency activities.”*

For complete downlink information for Satellite AMC 18C, please see “Important Information” at: [www.nasa.gov/ntv](http://www.nasa.gov/ntv).

In continental North America, Alaska and Hawaii, NASA Television’s Public, Education, Media and HD channels are MPEG-2 digital C-band signals carried by QPSK/ DVB-S modulation on satellite AMC-3, transponder 15C, at 87 degrees west longitude. Downlink frequency is 4000 MHz, horizontal polarization, with a data rate of 38.86 MHz, symbol rate of 28.1115 ms/s, and 3/4 FEC. A Digital Video Broadcast (DVB)-compliant Integrated Receiver Decoder (IRD) is needed for reception.

NASA TV Multichannel Broadcast includes: Public Services Channel (Channel 101); the Education Channel (Channel 102) and the Media Services Channel (Channel 103).

For digital downlink information for each NASA TV channel, schedule information for LDCM activities and access to NASA TV’s public channel on the Web, visit <http://www.nasa.gov/ntv>.

## Audio

Audio of the pre-launch news conference on launch minus two days and of the NASA TV launch coverage will be available on “V-circuits” that may be reached by dialing 321-867-1220, -1240, -1260 or -7135.

(321) 867-1220    (321) 867-1240  
(321) 867-1260    (321) 867-7135

# LDCM Press Release

## NASA Prepares for Launch of Next Earth Observation Satellite

01.10.13 - NASA's Landsat Data Continuity Mission (LDCM) is scheduled to launch Feb. 11 from Vandenberg Air Force Base in California. A joint NASA and U.S. Geological Survey (USGS) mission, LDCM will add to the longest continuous data record of Earth's surface as viewed from space.

LDCM is the eighth satellite in the Landsat series, which began in 1972. The mission will extend more than 40 years of global land observations that are critical in many areas, such as energy and water management, forest monitoring, human and environmental health, urban planning, disaster recovery and agriculture. NASA and the USGS jointly manage the Landsat Program.

"For decades, Landsat has played an important part in NASA's mission to advance Earth system science. LDCM promises to extend and expand that capability," said Michael Freilich, director of the Earth Science Division in the Science Mission Directorate at NASA Headquarters in Washington. "USGS's policy of offering free and open access to the phenomenal 40-year Landsat data record will continue to give the United States and global research community a better understanding of the changes occurring on our planet."

After launch, LDCM will enter a polar orbit, circling Earth about 14 times daily from an altitude of 438 miles (705 kilometers), returning over each location on Earth every 16 days. After launch and the initial checkout phase, the USGS will take operational control of the satellite, and LDCM will be renamed Landsat 8. Data will be downlinked to three ground stations in Gilmore Creek, Alaska; Svalbard, Norway; and Sioux Falls, South Dakota. The data will be archived and distributed at no cost to users from the USGS's Earth Resources Observation and Science Center in Sioux Falls.

"The Landsat program provides the nation with crucial, impartial data about its natural resources," said Matthew Larsen, USGS associate director for climate and land use change in Reston, Va. "Forest managers, for instance, use Landsat's recurring imagery to monitor the status of woodlands in near real-time. Landsat-based approaches also now are being used in most western states for cost-effective allocation of water for irrigation. This mission will continue that vital role."

LDCM carries two instruments, the Operational Land Imager (OLI), built by Ball Aerospace & Technologies Corp. in Boulder, Colo., and the Thermal Infrared Sensor (TIRS), built by NASA's Goddard Space Flight Center in Greenbelt, Md. These instruments are designed to improve performance and reliability over previous Landsat sensors.

"LDCM will be the best Landsat satellite yet launched in terms of the quality and quantity of the data collected by the LDCM sensors," said Jim Irons, LDCM project scientist at Goddard. "OLI and TIRS both employ technological advances that will make the observations more sensitive to the variation across the landscape and to changes in the land surface over time."

OLI will continue observations currently made by Landsat 7 in the visible, near infrared and shortwave infrared portions of the electromagnetic spectrum. It also will take measurements in two new bands, one to observe high altitude cirrus clouds and one to observe water quality in lakes and shallow waters near the coasts, as well as aerosols. OLI's new design has fewer moving parts than previous versions.

TIRS will collect data on heat emitted from Earth's surface in two thermal bands, as opposed to the single thermal band on previous Landsat satellites. Observations in the thermal bands are vital to monitoring water consumption, especially in the arid western United States.

The LDCM spacecraft, built by Orbital Sciences Corp. in Gilbert, Ariz., will launch from Vandenberg's Space Complex 3 aboard an Atlas V rocket provided by United Launch Alliance. NASA's Launch Services Program at Kennedy Space Center is responsible for launch management.

# Quick Facts

## **Landsat Data Continuity Mission Observatory**

Built by Orbital Science Corporation  
Dimensions: 10 x 10 x 16 ft tall (3 x 3 x 4.8 m); plus a 32 x 8.5 ft (9.75 x 2.6 m) solar array  
Total Launch Weight: 6,133 lbs (2,782 kg)  
About the size of a large SUV  
Power: 1351 W (orbit average)  
Image Data Downlink: 384 Mbps

## **Science Instruments:**

Operational Land Imager (OLI) built by Ball Aerospace & Technologies, Inc., Boulder, Colo.  
Thermal Infrared Sensor (TIRS) built by NASA Goddard Space Flight Center, Greenbelt, Md.

## **Operational Land Imager (OLI):**

Dimensions: 72 x 86 x 70 in tall (1.8 x 2.2 x 1.8 m)  
Weight: 950 lbs (432 Kg)  
Power: 139 W average  
Data Rate: 261 Mbps

## **Thermal Infrared Sensor (TIRS)**

Dimensions: 79 x 30 x 76 in tall (2 x 0.76 x 1.9 m)  
Weight: 495 lbs (225 kg)  
Power: 180 W average  
Data Rate: 26 Mbps

**Mission Lifetime:** The spacecraft has a design life of 5 years and enough fuel for ten years. OLI also has a design life of five years in order to carry out LDCM's mission. TIRS has a design life of three years, due to its late addition to the mission

**Spacecraft Operations Center:** NASA Goddard Space Flight Center

**Spacecraft Provider and Observatory Integrator:** Orbital Sciences Corporation, Gilbert, Ariz.

**Mission Management:** NASA Goddard manages development of the LDCM mission on behalf of the Earth Science Division at NASA Headquarters, Washington, DC, which includes acquiring the spacecraft the instruments, launch vehicle, a portion of the ground system, and overall mission systems engineering and early orbit operations. NASA works in coordination with the U.S. Department of the Interior through the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center, Sioux Falls, SD, which leads the development of the ground system and will take responsibility for LDCM mission operations after completion of the on-orbit checkout period.

**Mission Operations:** The U.S. Department of the Interior through the U.S. Geological Survey (USGS) is responsible for the ground system, mission operations, and the Data Processing and Archive System for LDCM after on-orbit commissioning of the observatory.

**NASA Investment:** \$855 million for design, development, launch and on-orbit checkout phase.

**Launch Date/Window:** February 11, 2013 with a 48-minute launch window 1:02 - 1:50 pm EST (10:02:00 - 10:50:00 a.m. PST). The time and the window will remain the same in the event of a launch slip.

**Launch Period:** Feb. 11 – Feb. 15, 2013

**Launch Vehicle:** Atlas V 401

## **Spacecraft Separation and Events:**

L + 79 min – spacecraft separation  
L + 96 min – solar array deployment and power positive

**First Satellite Signal Acquisition:** L + 79 min via Svalbard Station

**Spacecraft Orbit:** LDCM has a near-polar, sun-synchronous orbit, at an altitude of 438 miles (705 kilometers) with a descending node over the equator at mean local time of 10:11 a.m. (+/- 1 min.). It orbits Earth once every 98 minutes and repeats the same ground track every 16 days or about every 224 revolutions.

**Orbital Inclination:** 98.2° ± 15°

**Spacecraft Speed:** 16,760 mi/hr (26,972 km/hr), which is 4.7 mi/sec (7.5 km/sec)

**Launch Operations:** United Launch Alliance

# LDCM Mission Overview

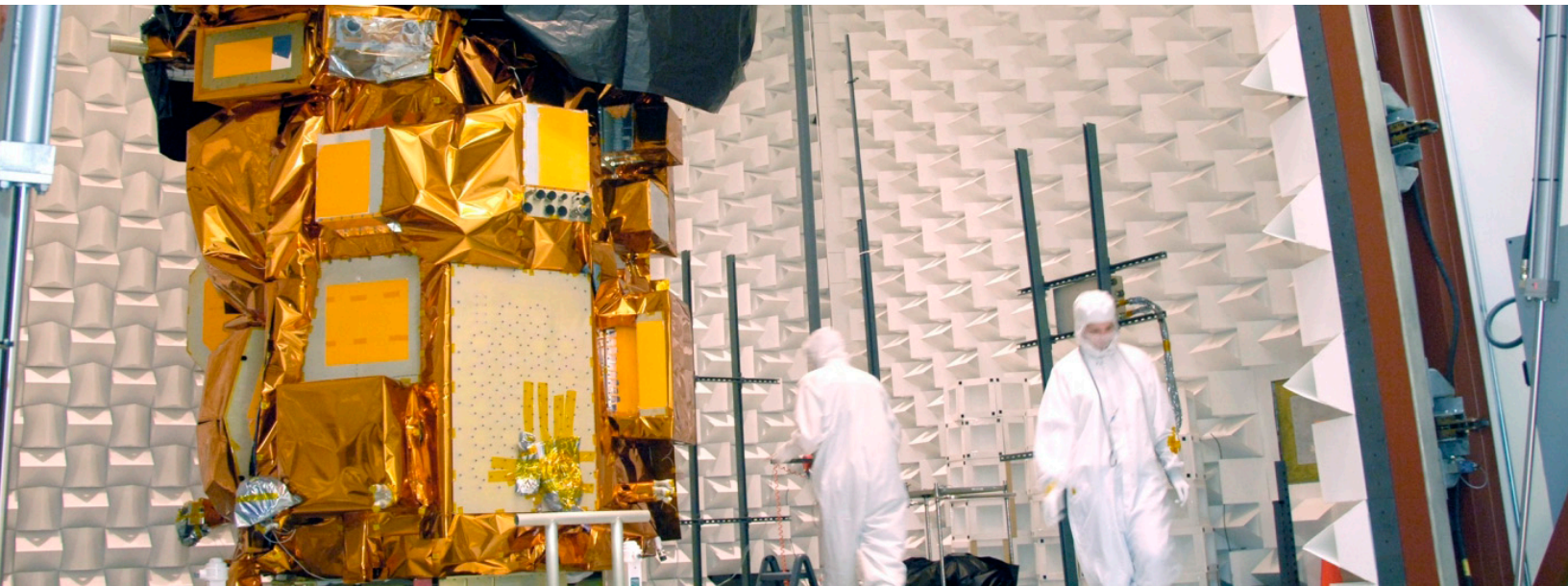
The Landsat Data Continuity Mission (LDCM), a collaboration between NASA and the United States Geological Survey (USGS), is the eighth satellite in the Landsat series and is the future of Landsat satellites. It is poised to expand, improve, and advance the unique and highly beneficial long-term record of Earth's landscapes, while maintaining the high-value heritage of its seven Landsat predecessors.

Following launch, the LDCM satellite will be renamed Landsat 8. The system will consist of two major segments: the observatory and the ground system. The observatory consists of the spacecraft bus and its payload of two Earth-observing sensors, the Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS). OLI and TIRS will collect data jointly to provide coincident images of the global land surface including coastal regions, polar ice, islands, and the continental areas. The OLI instrument was built by Ball Aerospace & Technologies Corporation in Boulder, Colo. and the TIRS instrument was built by the NASA Goddard Space Flight Center in Greenbelt, Md. In addition,

LDCM will follow the same sequence of fixed ground tracks (also known as paths) as the Landsat 4, Landsat 5 and Landsat 7 satellites. This will allow all of the science data from LDCM to be referenced to the same coordinate system, continuing the decades-long data record.

The spacecraft bus will store the OLI and TIRS data on an onboard solid-state recorder and transmit the data to ground receiving stations. The ground system will also provide the capabilities necessary for planning and scheduling the operations of the LDCM observatory and the capabilities necessary to manage and distribute the science data.

The LDCM spacecraft, built by Orbital Sciences Corporation in Gilbert, Ariz., has a design life of 5 years, but carries sufficient fuel for 10 years of operations. The spacecraft will orbit from north to south during the day, crossing the equator at about 10:00 a.m. local time, and will fly 438 miles (705 kilometers) above Earth.



*Above : Electromagnetic Interference/Electromagnetic Compatibility testing  
August 2012, Orbital Sciences Corporation*



A satellite image of a river delta, likely the Amazon, showing a complex network of channels and floodplains. The water is a deep blue, and the surrounding land is a mix of green and brown. A dark grey banner is positioned at the top of the image, containing the title.

# The Landsat Program

## What it is and why we have LDCM

Prior to 1972, the idea of using satellite data for land monitoring, mapping, or exploration was a visionary concept. The Landsat Program—a series of Earth-observing satellite missions jointly managed by NASA and the United States Geological Survey (USGS)—has revolutionized the way humans view and study our planet. The data series, which began in 1972, is the longest continuous record of changes in Earth’s surface as seen from space. Landsat has been the only satellite system designed and operated to repeatedly observe the global land surface at moderate resolution, about the size of a baseball field. The Landsat Data Continuity Mission (LDCM) will continue the legacy of Landsat’s global, medium-resolution archive.

After launch and the NASA’s initial check out phase during its first three months in orbit, USGS will take operational control of LDCM and distribute the data from OLI and TIRS. At this time, LDCM will be renamed Landsat 8.

The LDCM Satellite will orbit 438 miles (705 kilometers) above our homes and follow the same ground track as the earlier Landsats to ensure continuity of the Landsat 40-year data record.

## Why study Earth’s land surface?

Landsat data have helped to improve our understanding of Earth. Because of Landsat, today we have a better understanding of surface features as diverse as coral reefs, glaciers, and tropical forests. Landsat imagery fills an important scientific niche. Landsat’s near-polar orbit allows nearly the entire Earth to fall within view once every 16 days. Its 115-mile (185-kilometers) wide orbital swaths are broad enough for global coverage every season of the year. With a spatial resolution of 98-feet (30-meters) images acquired by Landsat are detailed enough to characterize human-scale processes such as urban growth, agricultural irrigation, and deforestation.

By establishing baseline knowledge of Earth’s land areas over the last half century, Landsat enables scientists to evaluate environmental change over time. Through 40 years of continuous coverage, the Landsat series of Earth-observation satellites has become a fundamental global reference for scientific issues related to land use and natural resources. For example, Landsat holds the distinction of being the only satellite record that is both long and consistent enough to track landcover changes related to climate change at the scale of cities and farms.

Landsat is valued all over the world as the gold standard of land observation. No other civilian satellite program, in our nation or in any other country, comes close to having the historical length and breadth, the continuity, and the coverage of the Landsat archive.



## In summary: What will LDCM do?

LDCM continues the decades-long Landsat record of Earth's land surface at a scale where the impacts of humans and nature can be detected and monitored over time. The global society requires the continuation of Landsat observations to manage food, water, forests and other land resources to our collective benefit.

### LDCM has three key science objectives:

- + Collect and archive multispectral and thermal data of every land surface on Earth, every season of every year at a resolution that can distinguish an area the size of a baseball field.
- + Ensure that LDCM data are consistent with the data from the earlier Landsat missions, in terms of acquisition geometry, calibration, coverage characteristics, spectral and spatial characteristics, output product quality, and data availability to permit studies of land cover and land use change over multi-decadal periods.
- + Distribute standard LDCM data products to users on a nondiscriminatory basis and at no cost to the users.



Above : The growth and change in irrigation practices is visible in these Landsat images from August 16, 1972 (left), and August 14, 2011 (right). The 1972 image was taken by Landsat 1, which had only been launched three weeks prior; the 2011 image was captured by Landsat 5. Both use false-color such that healthy vegetation appears bright red, while sparse grasslands and fallow fields appear in shades of green. Images were collected over the Nebraska Sandhills.

# The Instruments

Landsat sensors enable us to see beyond what our human eyes alone can see, not only because the satellite's perspective on Earth comes from an orbit of 438 miles (705 kilometers), but also because the sensors record light reflected and emitted from Earth's surface in specific infrared wavelengths as well as visible ones.

The two science instruments aboard LDCM—the Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS)—represent evolutionary advances in sensor technology and performance. OLI and TIRS will measure Earth's surface in the visible, near infrared, shortwave-infrared, and thermal infrared with a moderate resolution between 49 and 328 feet (15 and 100 meters)—depending on spectral wavelength. The distribution of observed energy across these spectral wavelengths reveals information about the reflecting and emitting surfaces.

To make it possible for scientists to compare new Landsat images to Landsat images taken in the past, engineers had to design the next Landsat satellite to measure roughly the same spectral bands as previous Landsat satellites. In addition, the OLI provides two new spectral bands—one tailored especially for detecting cirrus clouds and the other for coastal zone observations. TIRS will collect data for two additional narrow spectral bands in the thermal region, formerly covered by only one wide spectral band on Landsats 4–7 to measure Earth's thermal energy (i.e., heat).

LDCM is also required to return 400 scenes per day (150 more scenes per day than required of Landsat 7) to the USGS data archive, increasing the probability of capturing cloud-free scenes for the global landmass.





The Operational Land Imager (OLI) advances Landsat sensor technology using an approach demonstrated by the Advanced Land Imager sensor flown on NASA's experimental Earth Observing-1 (EO-1) satellite. Earlier Landsat satellites carried "whiskbroom" sensors that employed scan mirrors to sweep the instrument's field of view across the surface swath width and transmit light to a few detectors. The OLI, in contrast, is a "pushbroom" sensor that will use long detector arrays, with over 7000 detectors per spectral band, aligned across its focal plane to view across the swath. This "pushbroom" design results in a more sensitive instrument providing improved land surface information with fewer moving parts. Its images will have 49 feet (15 meters) panchromatic and 98 feet (30 meters) multi-spectral spatial resolutions (including visible, near infrared, and shortwave-infrared) along a 115 miles (185 kilometers) wide swath, covering wide areas of Earth's landscape while providing sufficient resolution to distinguish features like urban centers, farms, forests, and other land cover.

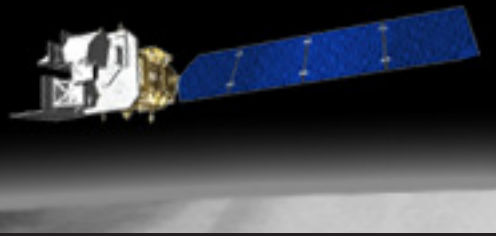
The OLI was designed to have a five-year lifespan and will detect the same spectral bands as earlier Landsat instruments (that is, the Thematic Mapper and Enhanced Thematic Mapper-Plus sensors) with the exception of a thermal infrared band. In addition to seven heritage Landsat multispectral bands (six of which have been refined) OLI will add two new spectral bands—a blue "coastal" band (band 1) and a shortwave-infrared "cirrus" band (band 9). These new bands will, respectively, help scientists measure water quality and help detect high, thin clouds that have previously been difficult to see in Landsat images.



*Above : Ball Aerospace built the OLI Instrument for LDCM. Ball Aerospace & Technologies Corp. develops and manufactures spacecraft, advanced instruments and sensors, components, data exploitation systems and RF solutions for strategic, tactical and scientific applications.*

# TIRS

Thermal Infrared Sensor



Everything on Earth emits thermal infrared radiation, or heat. Physics tells us that the amount of emitted radiation is proportional to the object's temperature. The Thermal Infrared Sensor (TIRS) was added to the LDCM payload when it became clear that state water resource managers rely on the highly accurate measurements of Earth's thermal energy obtained by LDCM's predecessors — the Thematic Mapper on Landsat 5 and Enhanced Thematic Mapper — Plus on Landsat 7 — to track how land and water are being used. The decision to add TIRS was made after the mission design had been started. Engineers had less than four years to design and build TIRS so they turned to a new technology called Quantum Well Infrared Photodetectors (QWIPs) that NASA Goddard helped develop.

QWIPs are made from material that is compatible with silicon processing, meaning that the same tools that facilities use to make computer chips can be used to build QWIPs. QWIPs are very reliable, uniform, and well suited to TIRS requirements. The engineers at GSFC knew how to work with QWIPs and willingly took up the challenge to build TIRS in the short time available.

The QWIPs design operates on the complex principles of quantum mechanics. Gallium arsenide semiconductor chips trap electrons in an energy state "well" until the electrons are elevated to a higher state by thermal infrared light of a certain wavelength. The elevated electrons create an electrical signal that can be measured and recorded to create a digital image.

Previous Landsat satellites measured land surface temperature using a single thermal band to detect long wavelengths of light emitted by Earth. The QWIPs on TIRS, however, detect two segments of the thermal infrared spectrum, both falling within an atmospheric transmission window, to produce better estimates of surface temperature than can be retrieved from a single thermal band. These wavelengths, called thermal infrared, are well beyond the range of human vision.

Like OLI, TIRS is also a pushbroom sensor with a 115-mile (185-kilometers) cross-track field of view. With a spatial resolution of 328 feet (100 meters) across, the TIRS spatial resolution is deemed sufficient for water consumption measurements over fields that use center-pivot irrigation — particularly across the U.S. Great Plains.

A major difference between OLI and TIRS specifications is that TIRS has only a three-year design life. This relaxation was specified to help expedite the TIRS development. The designers were able to save schedule through more selective redundancy in subsystem components rather than the more robust redundancy required for a five-year design life.



*Above : TIRS was built on an accelerated schedule at NASA's Goddard Space Flight Center, Greenbelt, Md.*

# Ground System

The LDCM ground system includes all of the ground-based assets needed to operate the LDCM observatory. In simple terms, the LDCM ground system will perform two main functions: the first will be to command and control the LDCM observatory in orbit and the second will be to manage and distribute the data transmitted from the observatory.

The observatory is controlled by software commands that originate within the LDCM Mission Operations Center, or MOC, at NASA Goddard. A flight operations team at the MOC will operate two computer systems: the Collection Activity Planning Element (CAPE) and the Mission Operations Element (MOE). The CAPE will plan science data collection by building activity requests for the LDCM imaging sensors each day, while the MOE will translate the activity requests into software commands transmitted to the observatory. The Hammers Company, Inc. developed the MOE.

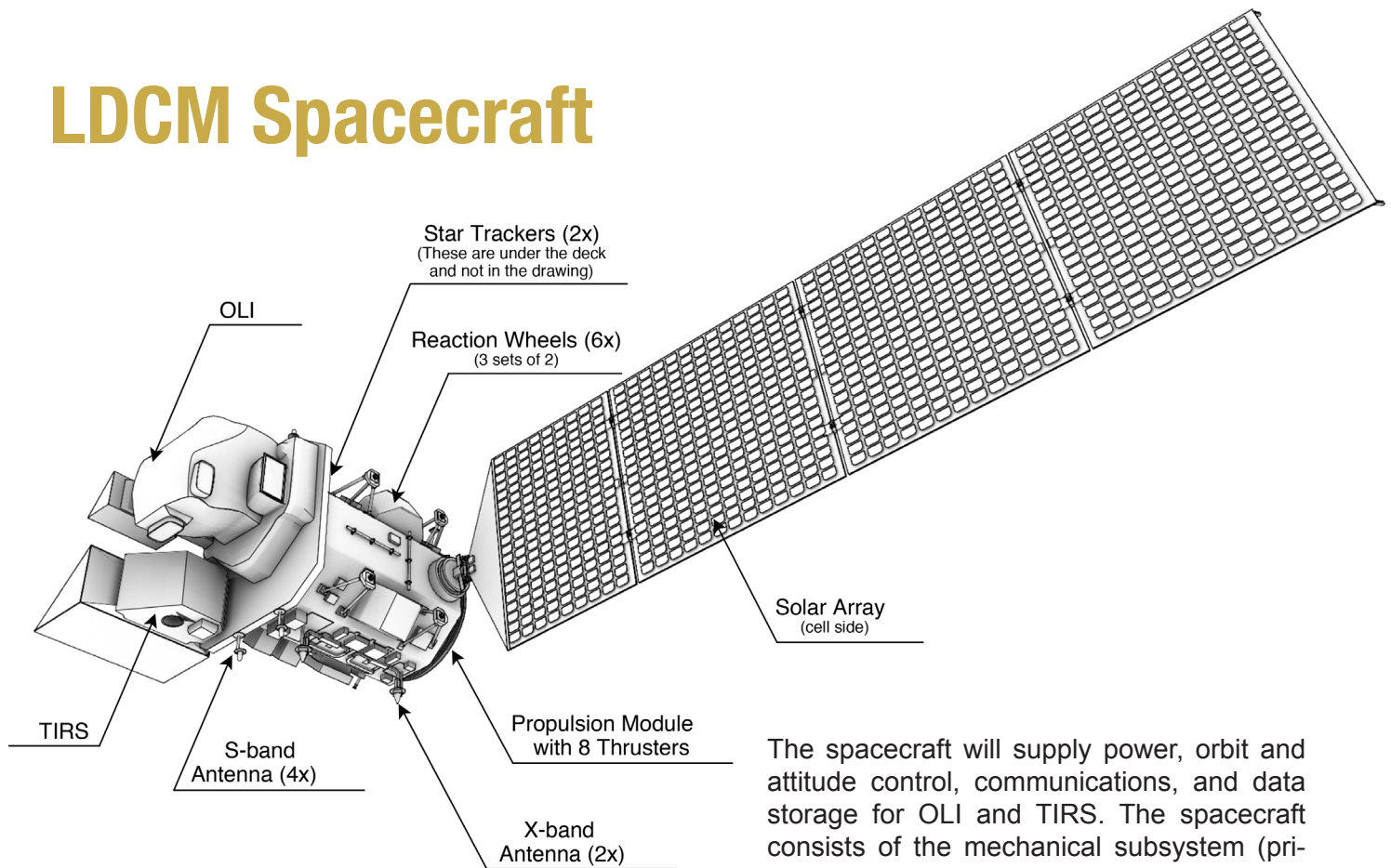
The software commands are transmitted to the observatory from the antennae of the LDCM Ground Network Element (GNE). In return, the observatory transmits data back to the GNE. The GNE is composed of three nodes, one located at Gilmore Creek, Alaska, another at Svalbard, Norway, and the third at Sioux Falls, South Dakota. Each node in the GNE includes a ground station that will be capable of receiving LDCM science X-band data. Additionally, each station provides complete S-band uplink and downlink capabilities for command and control of the observatory.

Once data are transmitted from the observatory to the GNE, the GNE sends it to the Data Processing and Archive System (DPAS), which is located at the EROS Center in Sioux Falls, South Dakota, via the internet. The DPAS will archive the data and produce the LDCM data products for science and applications, as well as provide a data portal to the user community.



*EROS Center in Sioux Falls, SD*

# LDCM Spacecraft



**Launch Mass:** 6,133 lbs (2,782 kg)

**Solar Arrays:** Triple-junction Gallium Arsenide (GaAs) cells, 3750 W EOL

**Orbit:** 705 km circular @ 98.2°

**Stabilization:** 3-axis, zero momentum bias, nadir pointing

**Pointing Stability:** 6.02 microradians

**Data Storage:** 3.14-terabit solid state recorder

**Data Downlink:** X-band, 384 Mbps (over two channels)

**Propulsion:** 870 lb. (395 kg) of blowdown mono-propellant hydrazine with eight (8) 22 Newton (N) thrusters

**Design Life:** 5 years

The spacecraft will supply power, orbit and attitude control, communications, and data storage for OLI and TIRS. The spacecraft consists of the mechanical subsystem (primary structure and deployable mechanisms), command and data handling subsystem, attitude control subsystem, electrical power subsystem, radio frequency (RF) communications subsystem, the hydrazine propulsion subsystem, and thermal control subsystem.

All the components, except for the propulsion module, will be mounted on the exterior of the primary structure. A ~32 x 8.5 ft (9.75 x 2.6 m) deployable solar array will generate power for the spacecraft components and will charge the spacecraft's 125 amp-hour nickel-hydrogen (Ni-H<sub>2</sub>) battery. A 3.14-terabit solid-state data recorder will provide data storage aboard the spacecraft and a X-band antenna will transmit OLI and TIRS data either in real time or played back from the data recorder. The OLI and TIRS are mounted on an optical bench at the forward end of the spacecraft.

Orbital Science Corporation is responsible for the design and manufacture of the LDCM spacecraft bus, a LEOStar-3 standard bus, and the integration of the instruments, as well as full observatory testing.

# NASA Launch Services Program

NASA turns to the engineers and analysts in its Launch Services Program to send robotic spacecraft on their way for some of the most exciting and notable missions in the agency's history.

The Launch Services Program, known as LSP, is based at NASA's Kennedy Space Center in Florida and boasts a roster of engineers and technicians who specialize in all aspects of rocketry and spacecraft integration. LSP selects the appropriate launcher for a mission's spacecraft, in this case the United Launch Alliance Atlas V for the Landsat Data Continuity Mission, known as LDCM. Sometimes, this selection process takes place years before the first launch opportunity. The program then provides oversight as the designs of the rocket and mission are integrated with each other.

As liftoff nears, teams oversee the launch vehicle's engineering and manufacture and its integration with the spacecraft. LSP conducts the countdowns for NASA's scientific missions and provides additional quality assurance along with other controls to ensure a successful mission.

Working with commercial rocket builders, planners have a number of rocket models to choose from, ranging from the small, air-launched Orbital Sciences Pegasus to the workhorse Delta II rocket from the United Launch Alliance, or ULA, to the powerhouse Atlas V, also from ULA. The catalog is growing, too, with the addition of the SpaceX Falcon 9 and Orbital Sciences Antares rockets.

LSP moved its operations to Kennedy in 1998, becoming the first program based at the nation's premiere launch site. The 14 years since then have seen orbiters, landers and rovers to Mars, huge observation spacecraft to Jupiter and the New Horizons mission launched to Pluto and the Kuiper Belt, two astronomical locations that have never been seen up-close before.

Because some spacecraft need to fly in a different kind of orbit, LSP operates several launch centers around the world. Cape Canaveral Air Force Station in Florida is adjacent to Kennedy Space Center and hosts launches to place spacecraft in orbits that remain close to the equator. The LSP launch team goes to Vandenberg AFB in California to run launches that require spacecraft to fly around the world in a north-to-south orbit, known as a polar orbit. The LDCM spacecraft will operate in a roughly polar orbit, so the launch will take place at Vandenberg. LSP also conducts launches from Kwajalein in the Marshall Islands, Kodiak Island, Alaska, and NASA's Wallops Flight Facility on Virginia's eastern Shore.

To learn more about LSP, rockets and NASA missions go to: <http://www.nasa.gov/centers/kennedy/launchingrockets>

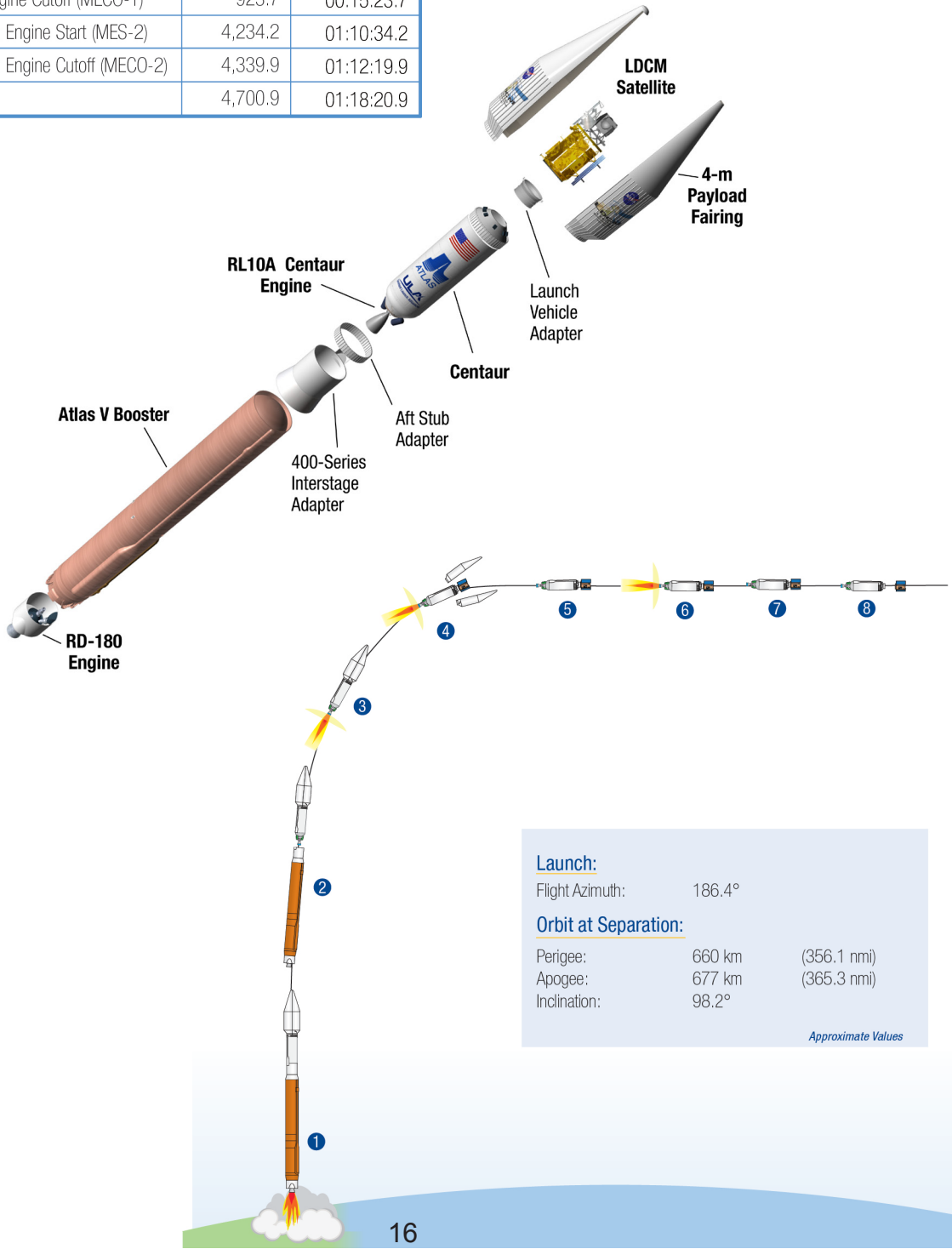


*(10/09/2012) --- VANDENBERG AFB, Calif. – A Centaur upper stage is lifted onto the first stage booster of a United Launch Alliance Atlas V at the launch pad at Space Launch Complex-3E at Vandenberg Air Force Base, Calif. in preparation for the launch of the Landsat Data Continuity Mission.*



# Launch Sequence

	Event	Time (seconds)	Time (hr:min:sec)
1	RD-180 Engine Ignition	-2.7	-00:00:02.7
	T=0 (Engine Ready)	0.0	00:00:00.0
	Liftoff (Thrust to Weight >1)	1.1	00:00:01.1
	Begin Pitch/Yaw/Roll Maneuver	17.3	00:00:17.3
	Maximum Dynamic Pressure	87.3	00:01:27.3
2	Atlas Booster Engine Cutoff (BECO)	242.2	00:04:02.2
	Atlas Booster/Centaur Separation	248.2	00:04:08.2
3	Centaur First Main Engine Start (MES-1)	258.2	00:04:18.2
4	Payload Fairing Jettison	266.2	00:04:26.2
5	Centaur First Main Engine Cutoff (MECO-1)	923.7	00:15:23.7
6	Centaur Second Main Engine Start (MES-2)	4,234.2	01:10:34.2
7	Centaur Second Main Engine Cutoff (MECO-2)	4,339.9	01:12:19.9
8	LDCM Separation	4,700.9	01:18:20.9



**Launch:**  
 Flight Azimuth: 186.4°

**Orbit at Separation:**  
 Perigee: 660 km (356.1 nmi)  
 Apogee: 677 km (365.3 nmi)  
 Inclination: 98.2°

*Approximate Values*