Landsat 9 Mission Overview

Mission Objectives
- Provide continuity in the multi-decadal Landsat land surface observations to study, predict, and understand the consequences of land surface dynamics
  - Core Component of Sustainable Land Imaging Program

Mission Parameters
- Single Satellite, Mission Category 1, Risk Class B
  - 5-year design life after on-orbit checkout
  - At least 10 years of consumables
- Sun-synchronous orbit, 705 km at equator, 98° inclination
- 16-day global land revisit
- Partnership: NASA & United States Geological Survey (USGS)
  - NASA: Flight segment & checkout
  - USGS: Ground system and operations
- Launch: FY2021 (Targeting December 15, 2020), Category 3 Vehicle

Mission Team
- NASA Goddard Space Flight Center (GSFC)
- USGS Earth Resources Observation & Science (EROS) Center
- NASA Kennedy Space Center (KSC)

Instruments
- Operational Land Imager 2 (Ball Aerospace)
  - Reflective-band push-broom imager (15-30m res)
  - 9 spectral bands at 15 - 30m resolution
  - Retrieves data on surface properties, land cover, and vegetation condition
- Thermal Infrared Sensor 2 (NASA GSFC)
  - Thermal infrared (TIR) push-broom imager
  - 2 TIR bands at 100m resolution
  - Retrieves surface temperature, supporting agricultural and climate applications, including monitoring evapotranspiration

Spacecraft & Observatory I&T
- Orbital ATK (same spacecraft vendor as Landsat 8)

Launch Services
- Competitively Procured: TBD

Increase in pivot irrigation in Saudi Arabia from 1987 to 2012 as recorded by Landsat. The increase in irrigated land correlates with declining groundwater levels measured from GRACE (courtesy M. Rodell, GSFC)
Operational Land Imager 2 (OLI-2)

- Contract with Ball Aerospace in Boulder CO established in December 2015
- OLI-2 successfully completed Critical Design Review in August 2016
- Instrument in fabrication at Ball Aerospace
- On target for mid-2019 delivery to spacecraft

OLI-2 will, to the extent possible, be a copy of OLI for Landsat 9 to maintain data continuity with Landsat 8 and to minimize cost and risk
OLI-2 Is Coming Together Quickly!!

OLI-2 Flight Focal Plane Assembly (FPA) and Ball Aerospace FPA Assembly Team

Installing the Tertiary Mirror into the OLI-2 Optical Bench at Ball Aerospace

OLI-2 Optical Bench

OLI-2 Baseplate
Thermal Infrared Sensor 2 (TIRS-2)

TIRS-2 will be a rebuild of Landsat 8 TIRS except TIRS-2 will be upgraded from Risk Class C to Class B for Landsat 9

- NASA GSFC TIRS-2 team formed in 2015
- TIRS-2 successfully completed Critical Design Review in February 2017
- Instrument in fabrication at NASA GSFC
- On target for mid-2019 delivery to spacecraft

**TIRS-2 Improvements**

- Increased redundancy to satisfy Class B reliability standards
- Improved stray light performance through improved telescope baffling
- Improved position encoder for scene select mirror to address problematic encoder on Landsat 8 TIRS
TIRS-2 Is Moving Just As Quickly!!

Fully Assembled TIRS-2 Flight Structure

Flight TIRS-2 FPA

Integrated Main Electronics Box (MEB) Testbed

Flight Telescope
Landsat 9 spacecraft will be similar to that of Landsat 8, and it will also draw on component heritage from ICESat-2 and JPSS-2 missions.

- Contract competitively awarded to Orbital ATK in Gilbert, AZ in October 2016
- Spacecraft successfully completed System Requirements Review in February 2017
- Preliminary Design Review planned for July 18-20, 2017
- Targeting readiness to integrate OLI-2 and TIRS-2 in mid-2019
• Flight Operations Team performs mission planning and scheduling, command and control, health and status monitoring, orbit and attitude maintenance, mission data management

• Landsat Mission Operations (LMO) contract supports Landsat 8 and 9
  - LMO contract awarded to General Dynamics Mission Systems (GDMS) on June 22, 2017 (same development contractors as LDCM/L8)
  - Planning to consolidate mission operations and external interfaces across missions

• Landsat Multi-Satellite Operations Center (LMOC) facility will be at GSFC in space currently occupied by the Landsat 7 MOC
  - Landsat 7 MOC relocation efforts underway

• System Requirements Review planned for August 2017
Ground Network Element (GNE)

• Ground Network Element provides space to ground communications with the Landsat 9 observatory
• All Landsat 9 Ground Stations currently used operationally on Landsat 8
  - Launch and Early Orbit stations and Operations Readiness stations
• Status:
  - System Requirements Review completed in April 2017
  - Subsystem Requirements Engineering Peer Reviews completed in May/June 2017
  - On track for Preliminary Design Review in Nov 2017

GLC – Gilmore Creek, AK
LGS – EROS, Sioux Falls, SD
SGS – Svalbard, Norway
ASN – Alice Springs, Australia (Ops Readiness)
NSN – Neustrelitz, Germany (Ops Readiness)

Note: Working to obtain L9 downlink licensing early in the L9 development lifecycle by collecting necessary ground station information from the ICs
• Provides science data ingest, storage and archive, image assessment, product generation, and data access and distribution

• Landsat 9 building upon system developed for Landsat 8
  ➢ Multi-mission DPAS development Phase 1 nearing completion; Phase 2 on track for early 2018 delivery

• Status:
  ➢ System Requirements Review completed in April 2017
  ➢ Subsystem Requirements Engineering Peer Reviews completed in May 2017
  ➢ On track for Preliminary Design Review in Dec 2017
### Landsat 9 Ground System & Operations Master Schedule

Current as of 6/30/2017

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**Notes:**
- **Launch:** 12/20
- **LRR:** 9/20/2017
- **Reserve:** 10d
- **Reserve:** 20d

**Start Dates:**
- USGS ASM: 10/15
- GSRR: 12/16
- GPDR: 2/18
- GCDR: 8/18
- MOR: 6/19
- FOR: 3/20
- LMO: 4/17
- GNE: 4/17
- DPAS: 4/17
- GRT 1: 4/19
- GRT 2: 7/19
- GRT 3: 10/19
- GRT 4: 12/19
- GRT 5: 2/20

**End Dates:**
- MOSs: 8/19
- MOSs: 4/20
- MOSs: 7/20
- MOSs: 12/20
Summary

• Instrument development is proceeding rapidly!!!
  ➢ On-orbit performance should be excellent!!!

• Spacecraft development is on-plan for instrument integration in 2019

• Ground System is making excellent progress
  ➢ Landsat Mission Operations contract awarded and moving quickly

• Strong NASA-USGS relationship is well defined and operating effectively

• Landsat 9 has been making excellent progress against an aggressive plan
  ➢ Mission on target for launch in December 2020