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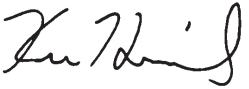
United Launch Alliance

WorldView-2

Boeing Launch Services and United Launch Alliance are honored to launch WorldView-2, the second of the DigitalGlobe next-generation class of imaging satellites. WorldView-2 will be launched aboard a Delta II launch vehicle from Vandenberg Air Force Base (VAFB). The launch vehicle will deliver the satellite into a sun-synchronous orbit where the satellite will begin its mission of collecting and recording high-resolution, commercial, digital Earth imagery from space.

United Launch Alliance provides the Delta II launch vehicle and mission services under a commercial launch service contract administered by Boeing Launch Services for DigitalGlobe, located in Longmont, Colorado. The first of the DigitalGlobe next-generation class of imaging satellites, WorldView-1, was launched by a Delta II in September 2007. We are pleased that DigitalGlobe once again has selected Delta II to launch their newest satellite. Our congratulations to the entire Delta team for their continued efforts in achieving this milestone.



Kenneth A. Heinly
President, Boeing Launch Services
The Boeing Company

Michael C. Gass
President and Chief Executive Officer
United Launch Alliance

WorldView-2 System Overview

WorldView-2 is the first high-resolution 8-band multispectral satellite commercially available. Along with the four typical multispectral bands, blue, green, red and near infrared, WorldView-2 is introducing the following new color bands for enhanced multispectral analysis: red edge, coastal, yellow and near infrared 2. Operating at an altitude of 770 kilometers, WorldView-2 will provide half-meter panchromatic resolution and 1.8-meter multispectral resolution. WorldView-2 will have an average revisit time of 1.1 days and will be capable of collection up to 975,000 square kilometers (376,000 square miles) per day, doubling the DigitalGlobe collection capacity.

The system utilizes control moment gyros (CMGs) for rapid retargeting and offers bi-directional scanning, 2199 gigabits of on-board storage and 800 Mbps X-band data downlink. The satellite will also be equipped with industry-leading geo-location accuracy capabilities. The predicted performance is in the range of 4.6 to 10.7 meters (15 to 35 feet) CE90 (Circular Error 90%).

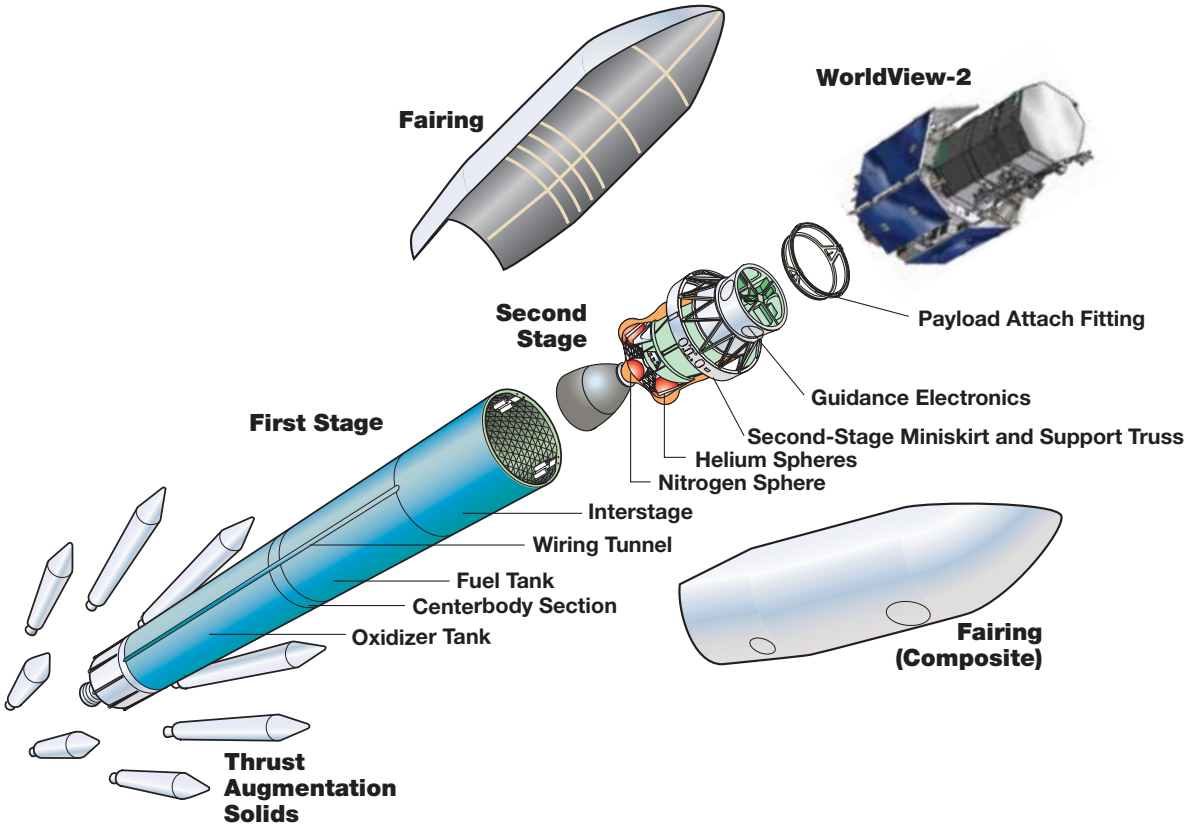
Mission Objectives

The WorldView-2 remote sensing satellite will return high-resolution, commercial, digital Earth imagery from space.

Highly detailed satellite imagery is currently used for a plethora of applications:

- Precise map creation
- In-depth image analysis
- Urban planning
- Internet portals and navigation technology
- Environmental monitoring/Disaster assessment and response
- Oil and gas exploration

Delta II 7920-10 Launch Vehicle



Mission Requirements

- Spacecraft Mass (lb/kg) — 5765.1 / 2615.0
- Launch Window — 11:38 – 11:52 am PDT (18:38 – 18:52 UTC)
- Orbit Requirements*
  - Local Mean Time at Descending Node — 10:15 am
  - Semi-Major Axis (nmi/km) — 3861.042/7150.655
  - Eccentricity — 0.001230
  - Inclination (deg) — 98.5694
  - Argument of Perigee (deg) — 113.500
- Free Molecular Heating Rate (FMHR) — ≤0.1 BTU/ft^2-sec (1135 Watts/m^2) at fairing jettison
- Spacecraft Contamination Level from Evasive Burn — <5 Angstroms
- Spacecraft Separation Orientation
  - Z_{SC} axis and sun vector angle between 30 and 38 deg (with additional allowance of 0.53 deg for solar photospheric disk diameter)
  - 9.0 ±0.5 deg/sec spin rate about $+Z_{SC}$ axis

*(Defined at First Descending Node after Spacecraft Separation)

Flight Mode Description – Boost-to-Orbit

- 7920-10 launch from Vandenberg Air Force Base (VAFB) SLC-2W
- Flight azimuth of 196 deg
- 6/3 GEM solid motors firing sequence
- Separation of ground-ignited GEMs at 1 min, 26 sec and 1 min, 27 sec to assure clearance of coastal oil platforms
- Air-ignited GEMs jettisoned at 2 min, 11.5 sec
- Dogleg maneuver (1 min, 30 sec to 2 min, 22 sec) performed to attain required orbital inclination
- Main Engine Cutoff (MECO) occurs approximately 4 min, 23.4 sec after liftoff
- Stage I-II separated 8 sec after MECO; Stage II ignited 5.5 sec later
- Payload fairing jettisoned when free molecular heating rate ≤0.1 BTU/ft^2-sec (1135 W/m^2)
- Command Receiver Decoders (CRDs) turned off at 6 min, 35.1 sec
- Stage II first burn cutoff (SECO-1) occurs at 10 min, 52.4 sec
  - Vehicle inserted in a 106 x 435 nmi (195 x 805 km) orbit with an inclination of 98.6 deg
- Mobile Telemetry (MT) required for coverage of last portion of second-stage burn

Sequence of Events – Boost-to-Orbit

Event	Time (hr:min:sec)
Liftoff	0:00:00.0
Mach 1	0:00:32.9
Maximum Dynamic Pressure	0:00:47.9
Solid Motor Burnout (6 ground-ignited)	0:01:04.0
Solid Motor Ignition (3 air-ignited)	0:01:05.5
Solid Motor Separation (3 ground-ignited)	0:01:26.0
Solid Motor Separation (3 ground-ignited)	0:01:27.0
Begin Dogleg Maneuver	0:01:30.0
Solid Motor Burnout (3 air-ignited)	0:02:09.7
Solid Motor Separation (3 air-ignited)	0:02:11.5
End Dogeg Maneuver	0:02:22.0
Main Engine Cutoff (MECO)	0:04:23.4
Stage I-II Separation	0:04:31.4
Stage II Ignition	0:04:36.9
Jettison Fairing	0:04:41.0
Turn Off CRDs	0:06:35.1
First Cutoff – Stage II (SECO-1)	0:10:52.4

Flight Mode Description – Coast to Spacecraft Injection Orbit

- Following SECO-1, vehicle reoriented to desired coast attitude
- At end of reorientation maneuver, thermal conditioning roll of ~2 deg/sec initiated
  - Direction reversed halfway through maneuver
- Following termination of roll maneuver, vehicle reoriented to second-stage restart burn attitude
- Second-stage restart occurs at 53 min, 34 sec over the Malindi (MAL) tracking station in Kenya
  - Restart burn duration of 22.4 sec
  - At end of restart burn, vehicle in an orbit of 413 x 419 nmi (764 x 776 km) with an inclination of 98.6 deg
- Following second-stage restart, vehicle reoriented to desired attitude for spacecraft separation
- 9 deg/sec roll initiated 70 sec prior to separation
- Spacecraft separation will occur at 1 hr, 1 min, 40 sec over MAL tracking station
  - Spacecraft reaches first descending node approximately 1 hr, 50 min after liftoff, at which point orbit requirements are satisfied

Sequence of Events – Coast to Spacecraft Orbit Injection

Event	Time (hr:min:sec)
Maneuver to Thermal Conditioning Attitude	0:13:00.0 – 0:18:00.0
Thermal Conditioning Roll	0:18:10.0 – 0:45:00.0
Maneuver to Restart Attitude	0:45:20.0 – 0:51:10.0
Stage II Restart Ignition	0:53:34.0
Second Cutoff – Stage II (SECO-2)	0:53:56.4
Maneuver to Separation Attitude	0:55:10.0 – 0:59:30.0
Initiate Spin	1:00:30.0
Spacecraft Separation	1:01:40.0
Spacecraft at Descending Node (Orbit Injection)	1:49:53.5

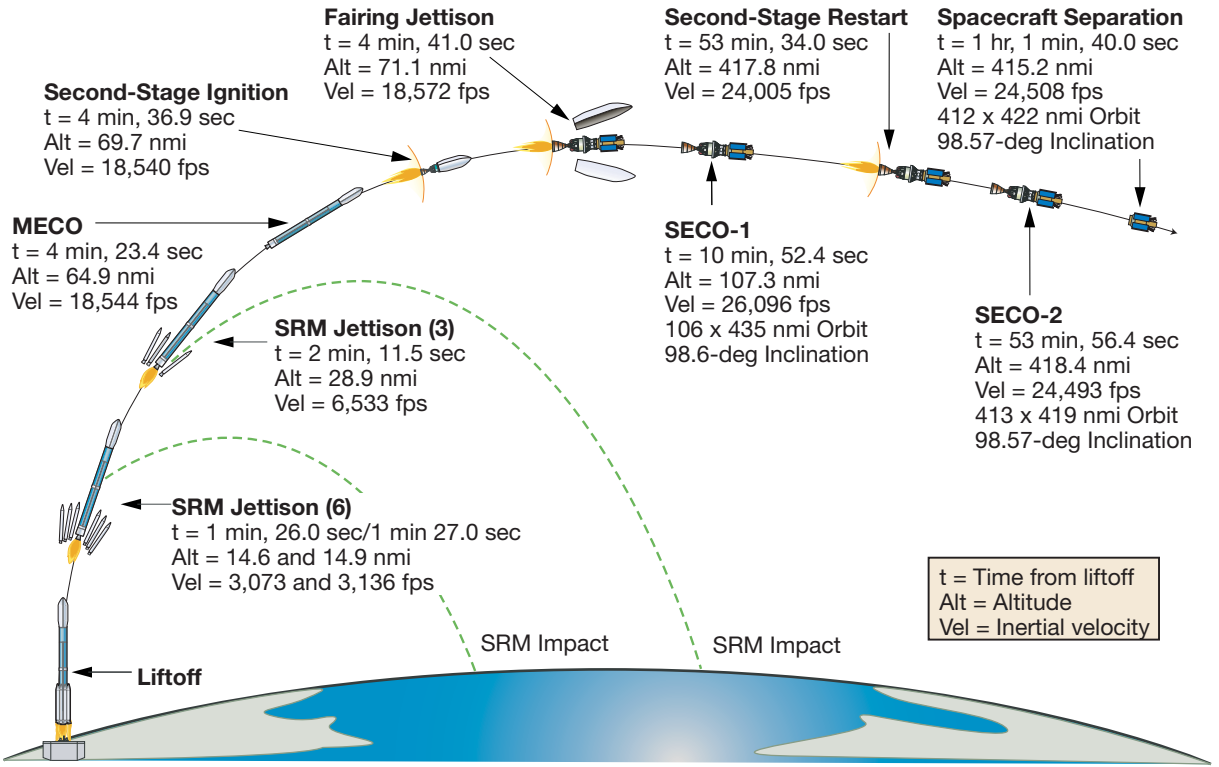
Flight Mode Description – Post-Separation

- Following spacecraft separation, vehicle reoriented to cold-gas evasive maneuver (CGEM) attitude
- CGEM provides additional separation velocity
  - Duration of 25 sec, beginning at 1 hr, 11 min, 40 sec after liftoff
  - ~1.3 fps ΔV imparted to second stage
- Following CGEM, the second stage is reoriented for an evasive burn in view of the Air Force Satellite Control Network (AFSCN) station at Thule, Greenland (TTS)
  - Burn duration of 5 sec, beginning at 1 hr, 30 min after liftoff
  - At end of evasive burn, second stage is in a 180 x 410 nmi (333 x 759 km) orbit at 98.66-deg inclination
- Following evasive burn maneuver, vehicle reoriented for second-stage depletion burn in view of Hawaii tracking station (HTS)
  - Nominal burn duration of 51.2 sec, beginning at 1 hr, 38 min, 20 sec after liftoff
  - At end of nominal depletion burn, second stage is in a 117 x 406 nmi (217 x 752 km) orbit with an inclination of 92.41 deg
- Sequence and burn attitudes designed to minimize contamination potential and meet contamination requirement of <5 Angstroms

Sequence of Events – Post-Separation

Event	Time (hr:min:sec)
Maneuver to Cold-Gas Evasive Attitude	1:05:00.0 – 1:11:30.0
Begin Cold-Gas Evasive Maneuver	1:11:40.0
End Cold-Gas Evasive Maneuver	1:12:05.0
Maneuver to Evasive Burn Attitude	1:16:40.0 – 1:25:00.0
Stage II Evasive Burn Ignition	1:30:00.0
Second Cutoff – Stage II (SECO-3)	1:30:05.0
Maneuver to Depletion Burn Attitude	1:31:40.00 – 1:36:20.0
Stage II Restart Ignition (Depletion Burn)	1:38:20.0
Depletion Cutoff – Stage II (SECO-4)	1:39:11.2

Flight Profile



Orbit Trace – Boost-to-Orbit

Legend (time, sec)

1 – Main Engine Cutoff (263.4)

2 – SECO-1 (652.4)

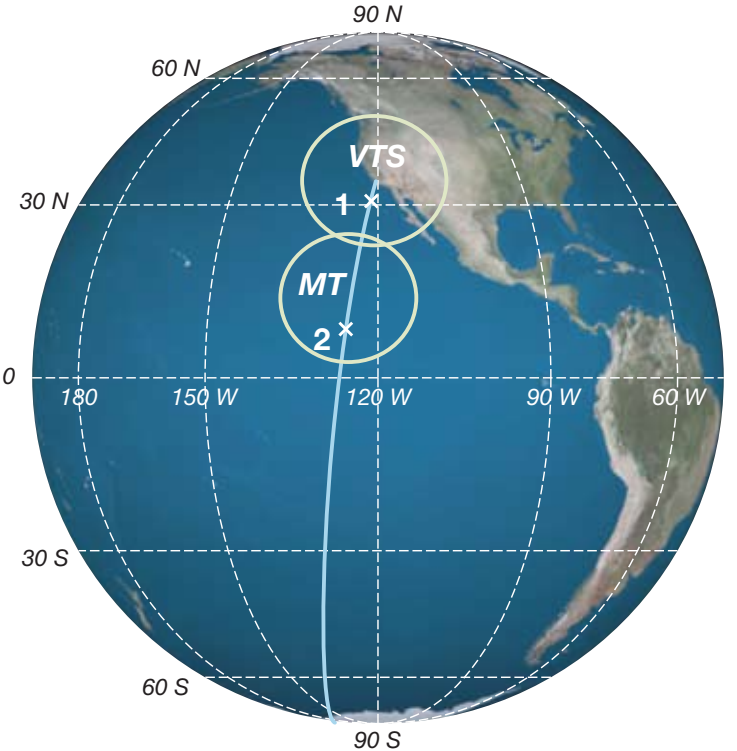
WR Tracking Sites

VTS – AFSCN Vandenberg

TRS – VAFB TM Telemetry Receiving Station

SNI – NAWC San Nicolas Island

MT – Mobile Telemetry



Orbit Trace – Coast to Spacecraft Separation

Legend (time, sec)

3 – First Restart (3214.0)

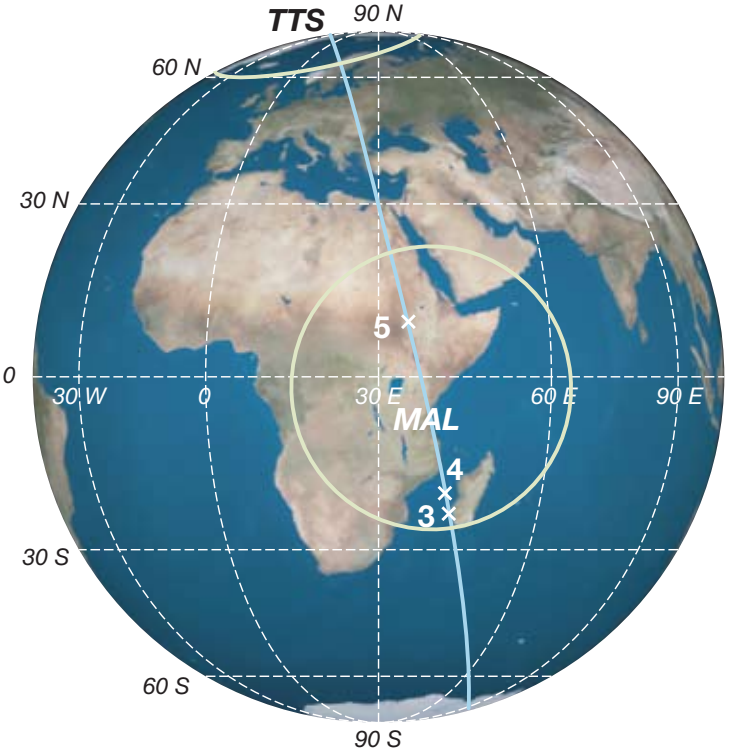
4 – SECO-2 (3236.4)

5 – Spacecraft Separation (3700.0)

Downrange Tracking Site(s)

MAL – Malindi, Kenya

TTS – AFSCN Thule Tracking Station



Orbit Trace – Post-Separation

Legend (time, sec)

6 – Evasive Burn (5400.0–5405.0)

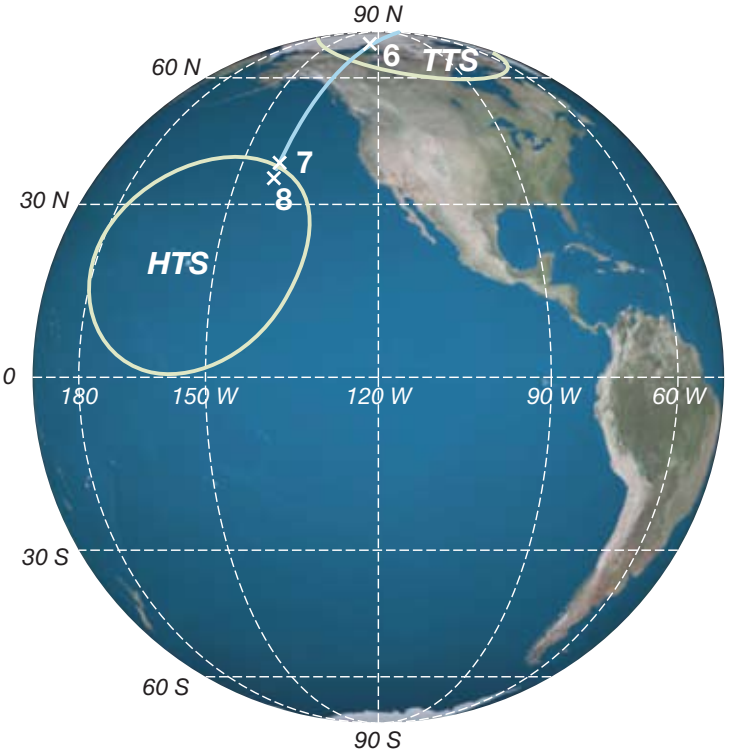
7 – Depletion Restart (5900.0)

8 – Depletion Cutoff (5951.2)

Downrange Tracking Site(s)

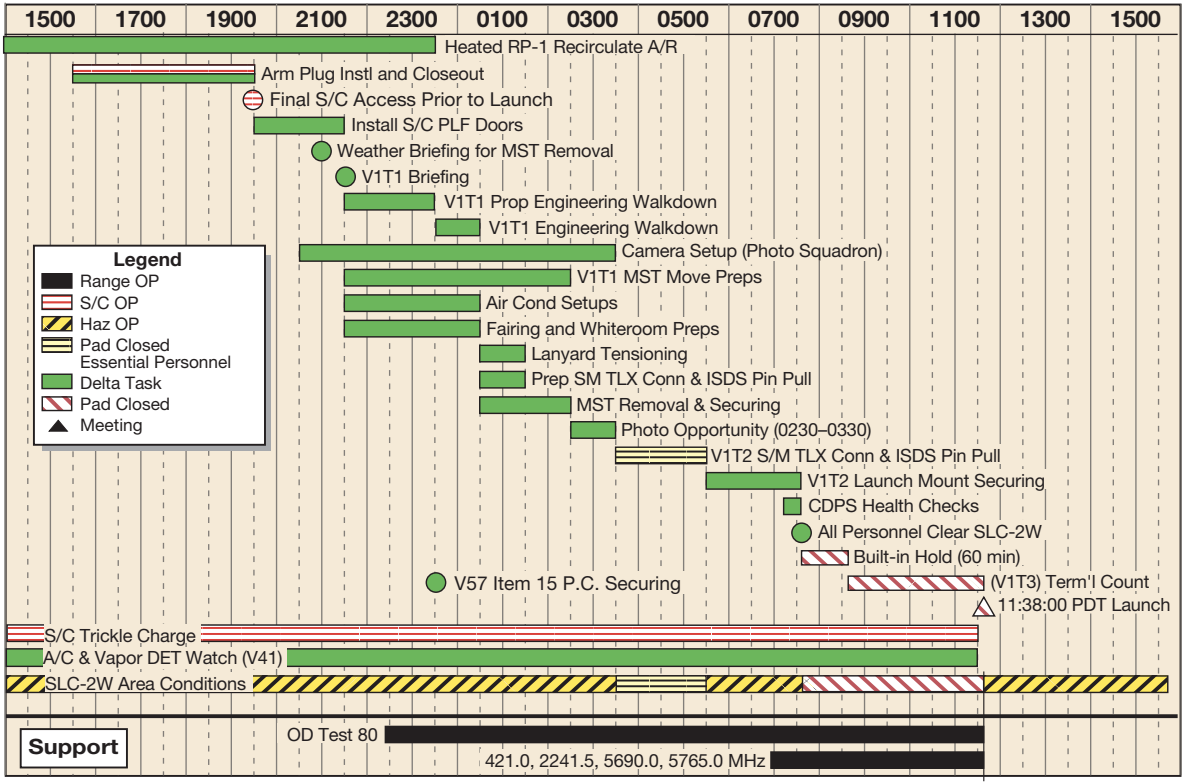
TTS – AFSCN Thule Tracking Station

HTS – AFSCN Hawaii Tracking Station



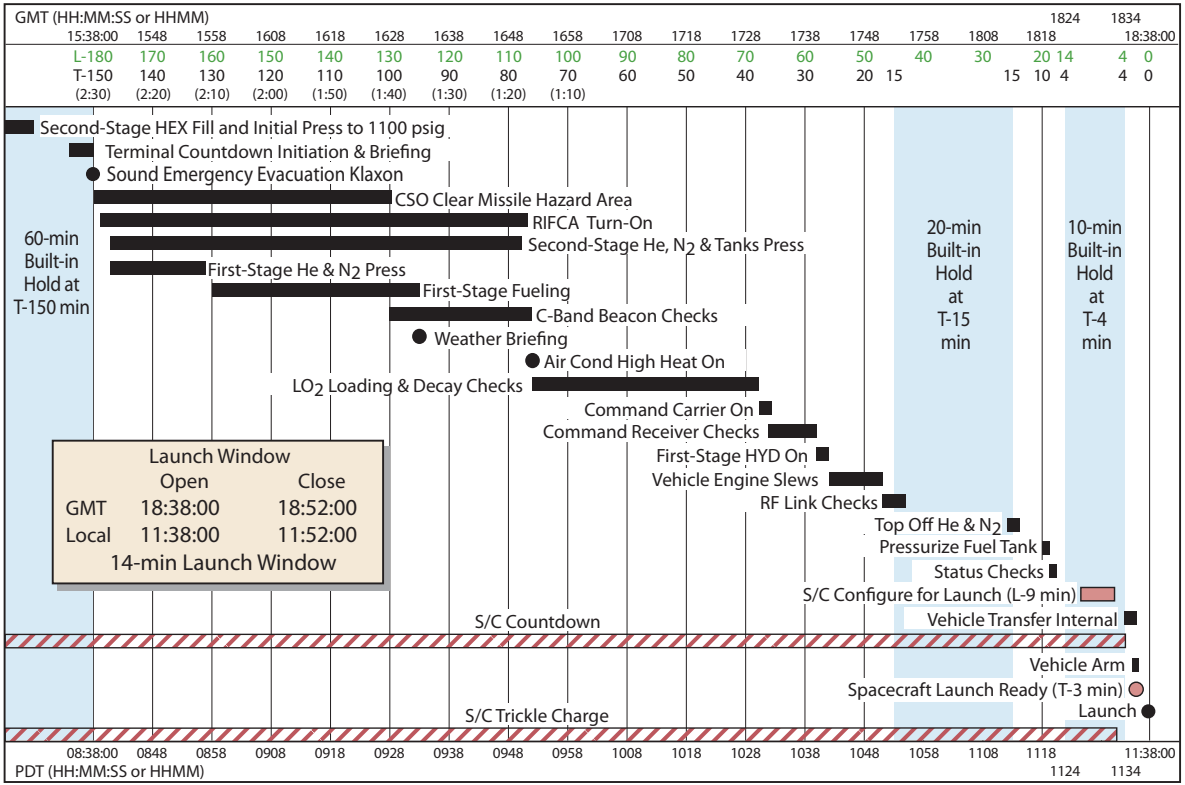
Delta Countdown

L-1/L-0 Day

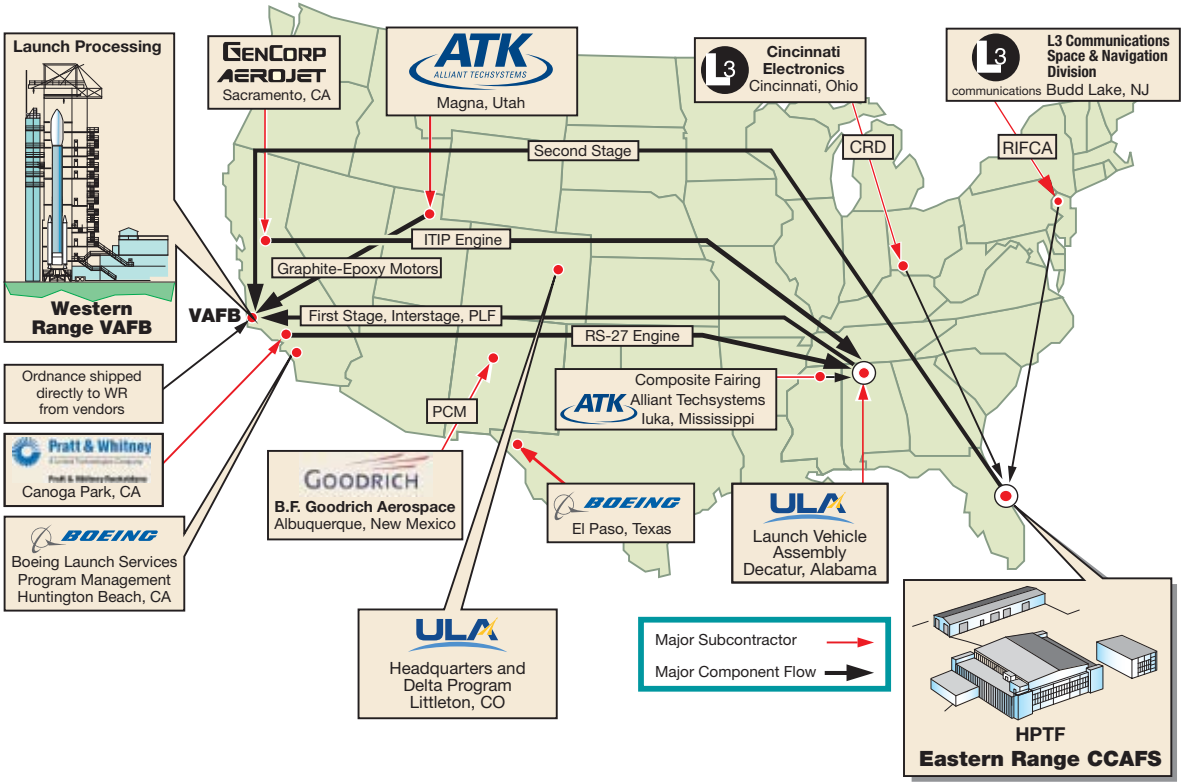


WorldView-2 Terminal Count

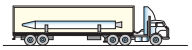
L-0 Day



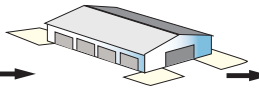
Delta II Operational Flow at Western Range



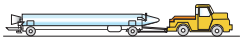
Delta II Hardware Flow at VAFB



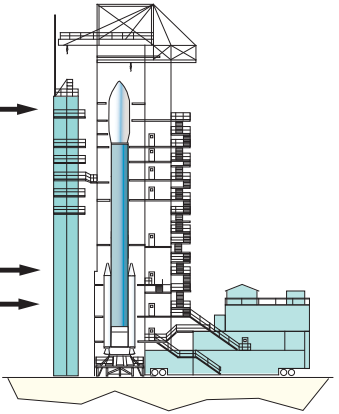
• Solid motors from Alliant



Solid Motor Building 1670
- Receive and inspect
- Leak-check motor
- Inspect grain
- Solid motor buildup
- Install nose cone



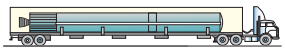
Solid Motors
- Transport to SLC-2



Vehicle Processing
- Erect and mate
  - First stage
  - Interstage
  - Solid motors
  - Second stage
- Erect and store fairing
- Align solid motors
- Vehicle checkout
- Interface checkout
- Simulated flight test
- Countdown preparation

SV Mate and Integrated Testing
- Mate SV assembly
- Flight program verification
- Ordnance installations
- Mate fairing
- Second-stage propellant loading
- RIFCA, beacon, and RS checks

Terminal Countdown and Launch

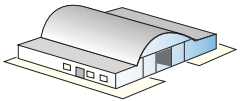


• First stage from Decatur

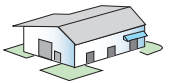
• Second stage from CCAFS

• Interstage from Decatur

• Fairing from Decatur



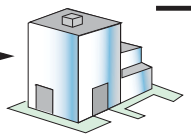
Building 836 South VAFB
- Offload stages
- Receiving inspection/storage
- Transport first stage and second stage to HPF
- Transport interstage to SLC-2
- Offload fairing, install LEA, and transport to SLC-2



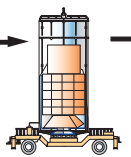
Hazardous Processing Facility (HPF)
First-Stage Processing
- Receiving inspection
- Destruct installation
- Transport to SLC-2

Second-Stage Processing
- Receiving inspection
- Nozzle installation
- Destruct installation
- Transport to SLC-2

• Space vehicle (SV)

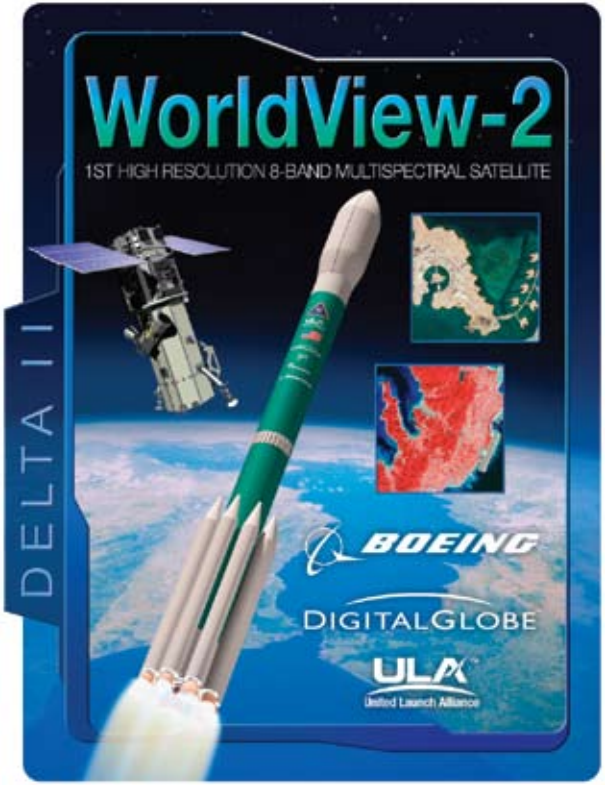


SV Processing Facility
- SV receiving inspection
- SV checkout activities
- Mate SV to PAF
- Encapsulate SV assembly



• Transport SV assembly to SLC-2

Notes:


WorldView-2
1ST HIGH RESOLUTION 8-BAND MULTISPECTRAL SATELLITE
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