



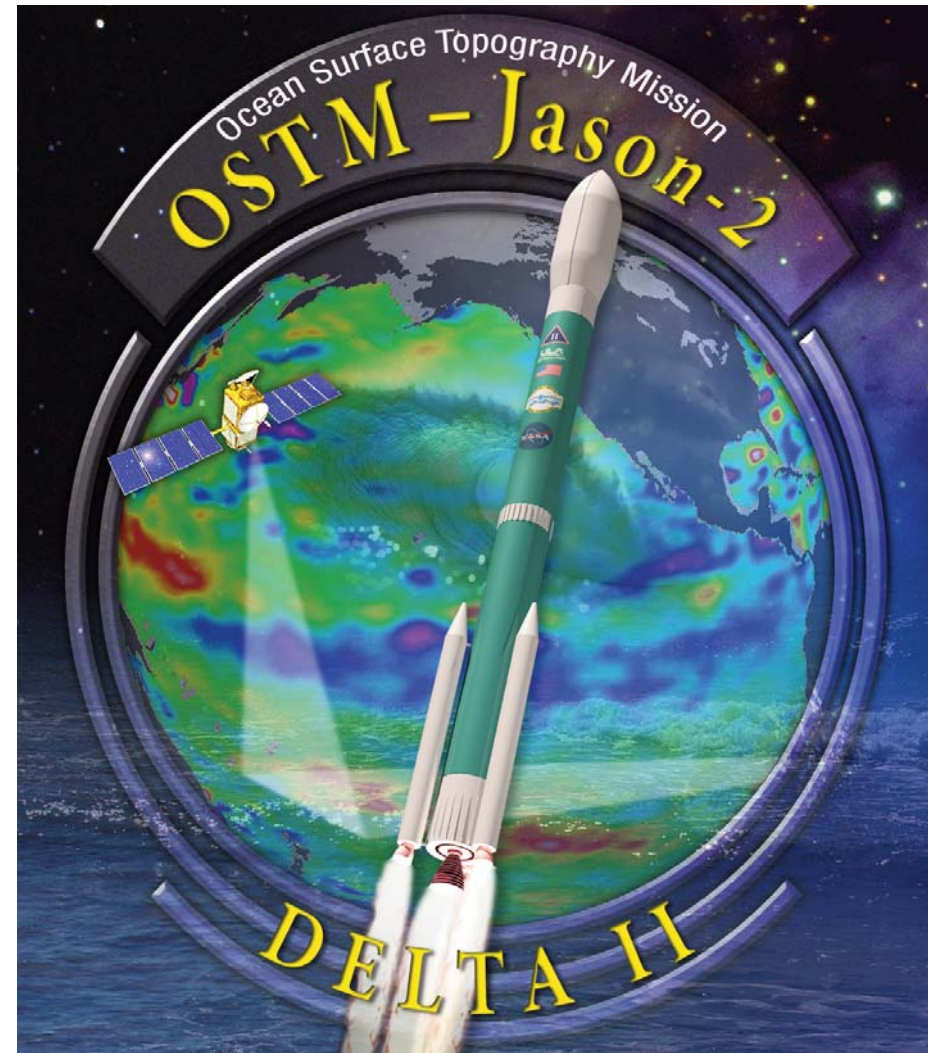
Ocean Surface Topography Mission (OSTM/Jason-2)

Mission Overview

Delta II 7320

Vandenberg Air Force Base, CA

Space Launch Complex-2 West





OSTM



United Launch Alliance (ULA) is proud to launch the OSTM/Jason-2 mission. Jason-2 will be launched aboard a Delta II 7320 launch vehicle from Vandenberg Air Force Base (VAFB), California. The launch vehicle will deliver the Jason-2 spacecraft into a low-Earth orbit, where it will begin its mission to acquire topographical measurements of ninety-five percent of the Earth's ice-free oceans.

ULA provides the Delta II launch service under the NASA Launch Services (NLS) contract with the NASA Kennedy Space Center Launch Services Program. We are delighted that NASA has chosen the Delta II for this international-partnered mission between the Jet Propulsion Laboratory (JPL) and the French Centre National d'Etudes Spatiales (CNES). I congratulate the entire team for their significant efforts that resulted in achieving this milestone. ULA looks forward to continued launches of scientific space missions.

A handwritten signature in black ink, appearing to read "Kristen T. Walsh".

Kristen T. Walsh
Director, NASA Programs
Delta Launch Vehicles



- Based on Alcatel's Proteus bus
- Total mass: 505.9 kg (1115.3 lbs)
- Power: 500W
- Reaction wheels and magnetic torque rods maintain three-axis stabilization and nadir-pointing
- Hydrazine propellant system provides orbital maintenance

- Extend the time series of ocean surface topography measurements beyond TOPEX/Poseidon (T/P) and Jason-1 to accomplish two decades of observation
- Provide a minimum of three years measurement of global ocean surface topography
- Determine the variability of ocean circulation at decadal time scales from combined data record with T/P and Jason
- Improve the measure of time-averaged ocean circulation
- Improve the measure of global sea-level change
- Improve open ocean tide models



OSTM/Jason-2 Orbit Description



- Altitude: 1336 km
- Orbit: circular, non-sun-synchronous, 66° nominal inclination
- Global data coverage between 66°N and 66°S latitude
- 10-day repeat of ground track (± 1 -km accuracy)
- Coverage of 95% of ice-free oceans every ten days



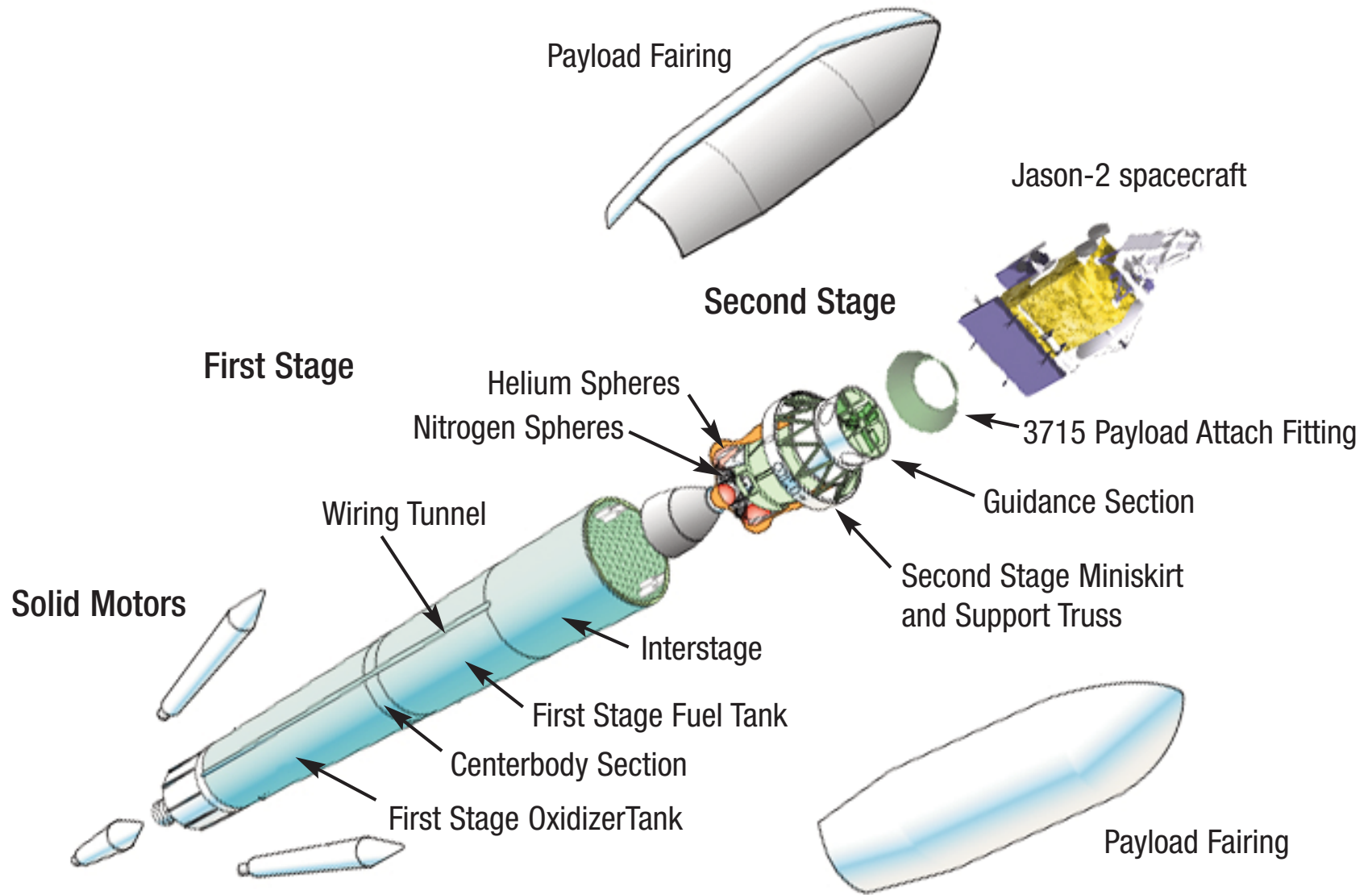
OSTM/Jason-2 Payload Sensors



- **CNES Poseidon-3 altimeter (C- and Ku-band) measures height above sea surface**
- **NASA Advanced Microwave Radiometer (AMR) three-frequency radiometer measures total water vapor along altimeter path to correct for pulse delay**
- **CNES Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) Doppler tracking antenna receives ground signals for precise orbit determination, satellite tracking, and ionospheric correction data for CNES altimeter**
- **NASA Global Positioning System Payload (GPSP) receiver provides precise orbit ephemeris data**
- **NASA Laser Retroreflector Array (LRA) works with ground stations to track satellite and calibrate the other satellite location systems, and verify altimeter measurements**

OSTM/Jason-2 Mission Requirements

- Initial Launch Opportunity 15 June 2008
- Launch Window
 - Daily nine-minute window
 - Launch time ~ 1:47am PDT on 15 June 2008
 - Launch time moves about 12 minutes earlier each day
- Spacecraft Mass 505.9 kg (1115.3 lb)
- Orbit Requirements (defined at first ascending node after spacecraft separation)
 - Semi-Major Axis 7711.594 km (4163.928 nmi)
 - Eccentricity 0.000502
 - Inclination 66.0501 deg
 - Argument of Perigee 10.979 deg
 - Earth-Fixed Longitude (+West) -60.312 deg
- Coast Phase Thermal Conditioning
 - Rotation axis (+XLV) perpendicular to the orbit plane
 - Angle between sun direction and roll axis between 0 and 93 deg
- Spacecraft Separation Orientation and Time
 - +ZSC (+YLV) nadir
 - Pointing error less than 30 deg from the separation direction
 - Minimum seven minutes of visibility from Hartebeesthoek tracking station after separation



OSTM/Jason-2 Flight Mode Description

- Launch from VAFB SLC-2W down a flight azimuth of 196 deg
- Three solid motors ignited at liftoff, jettisoned at 1 min, 39 seconds
- Dog-leg maneuver (1 min, 40 sec to 2 min, 20 sec) performed to attain required orbital inclination
- Main engine cutoff (MECO) occurs approximately 4 min, 24 seconds after liftoff
- Stage II separated 8 seconds after MECO; ignited 5.5 seconds later
- Payload fairing jettisoned when free molecular heating rate ≤ 0.10 BTU/ft²-sec
- Command receiver decoders (CRDs) turned off at 7 min, 31 sec
- Second stage first burn places vehicle in a 100 x 763-nmi (185 x 1414-km) orbit at 66.47-deg inclination
- Following SECO-1, vehicle is reoriented to perform coast phase thermal maneuvers
 - Rotation axis (+X_{LV}) perpendicular to the orbit plane
 - 1 deg/sec nominal roll rate, with direction reversed halfway through the maneuver
 - Angle between sun direction and roll axis between 0 and 93 deg

Sequence of Events Boost to Orbit

Event	Time (HR:MIN:SEC)
Liftoff	0:00:00.0
Maximum dynamic pressure	0:00:48.3
3 Solid motors burnout	0:01:04.0
Jettison 3 solid motors	0:01:39.0
Begin dog-leg maneuver	0:01:40.0
End dog-leg maneuver	0:02:20.0
MECO	0:04:24.2
Stage I/II separation	0:04:32.2
Stage II ignition	0:04:37.7
Jettison fairing	0:04:54.0
Turn off command receiver decoders (CRDs)	0:07:31.0
First cutoff - Second Stage (SECO 1)	0:10:27.4
Begin maneuver to coast attitude	0:12:20.0
End maneuver to coast attitude	0:17:20.0
Begin coast phase thermal roll	0:17:30.0
End coast phase thermal roll	0:37:40.0

- First second stage restart begins at 48 min, 50.5 sec
 - Occurs in view of Hartebeesthoek tracking station
 - Burn duration of 24.2 sec
 - At end of restart burn, vehicle in an orbit of 711 x 718 nmi (1317 x 1329 km) with an inclination of 66.03 deg
- Following SECO-2, second stage is reoriented for Jason-2 separation in view of Hartebeesthoek tracking station
 - Spacecraft is separated 55 min after liftoff
 - Separation velocity provided by spring separation system
 - +ZSC (+YLV) nadir nominally
 - Spacecraft reaches first ascending node approximately 1 hr, 6 min after liftoff, at which point the orbit requirements are met



Sequence of Events

Restart to Spacecraft Orbit Injection

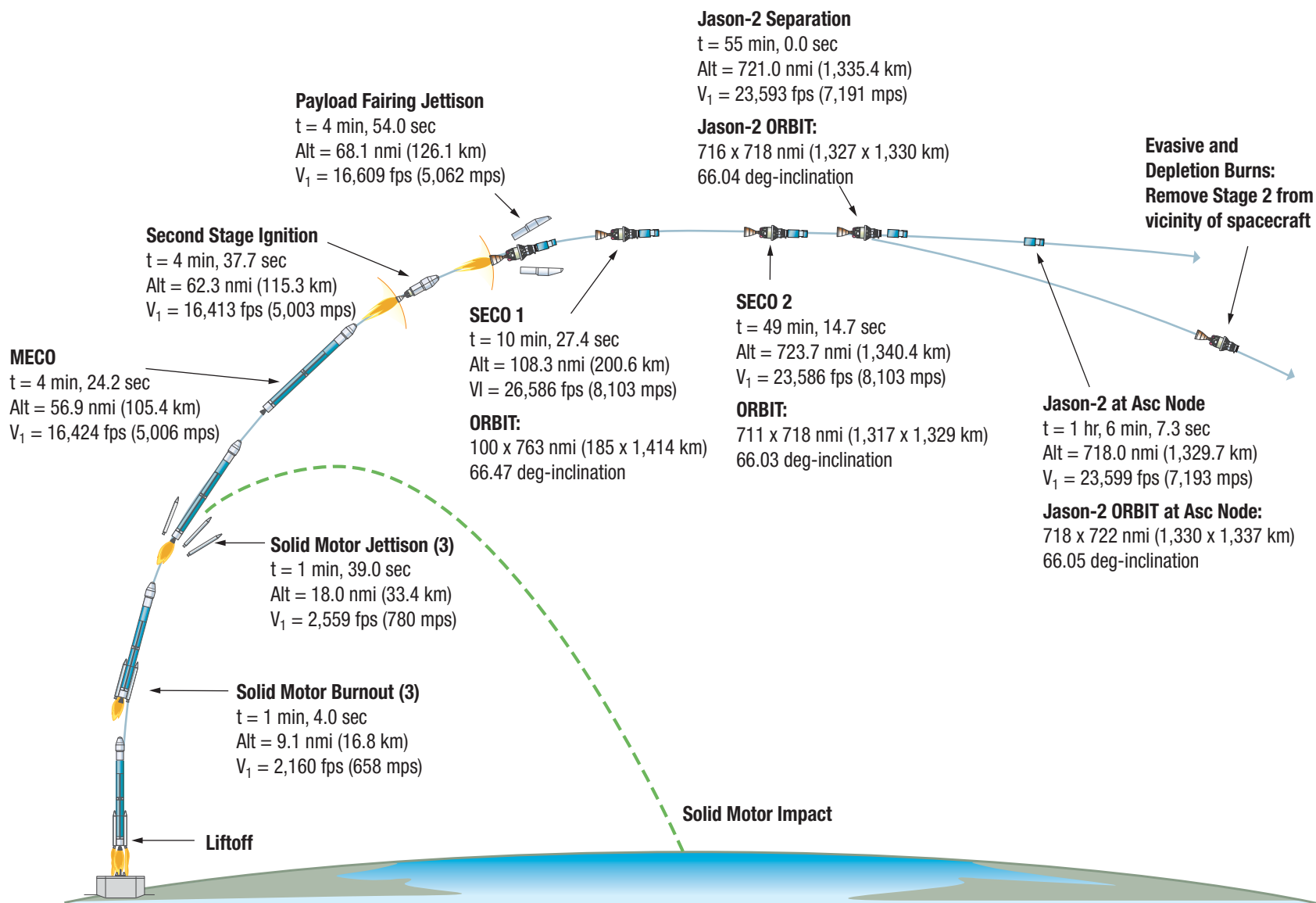


Event	Time (HR:MIN:SEC)
Begin maneuver to restart attitude	0:38:20.0
End maneuver to restart attitude	0:46:40.0
Restart Second Stage	0:48:50.5
Second Cutoff - Second Stage (SECO 2)	0:49:14.7
Begin maneuver to separation attitude	0:50:30.0
End maneuver to separation attitude	0:53:00.0
Separate Jason-2 spacecraft	0:55:00.0
Jason-2 reaches ascending node	1:06:07.3

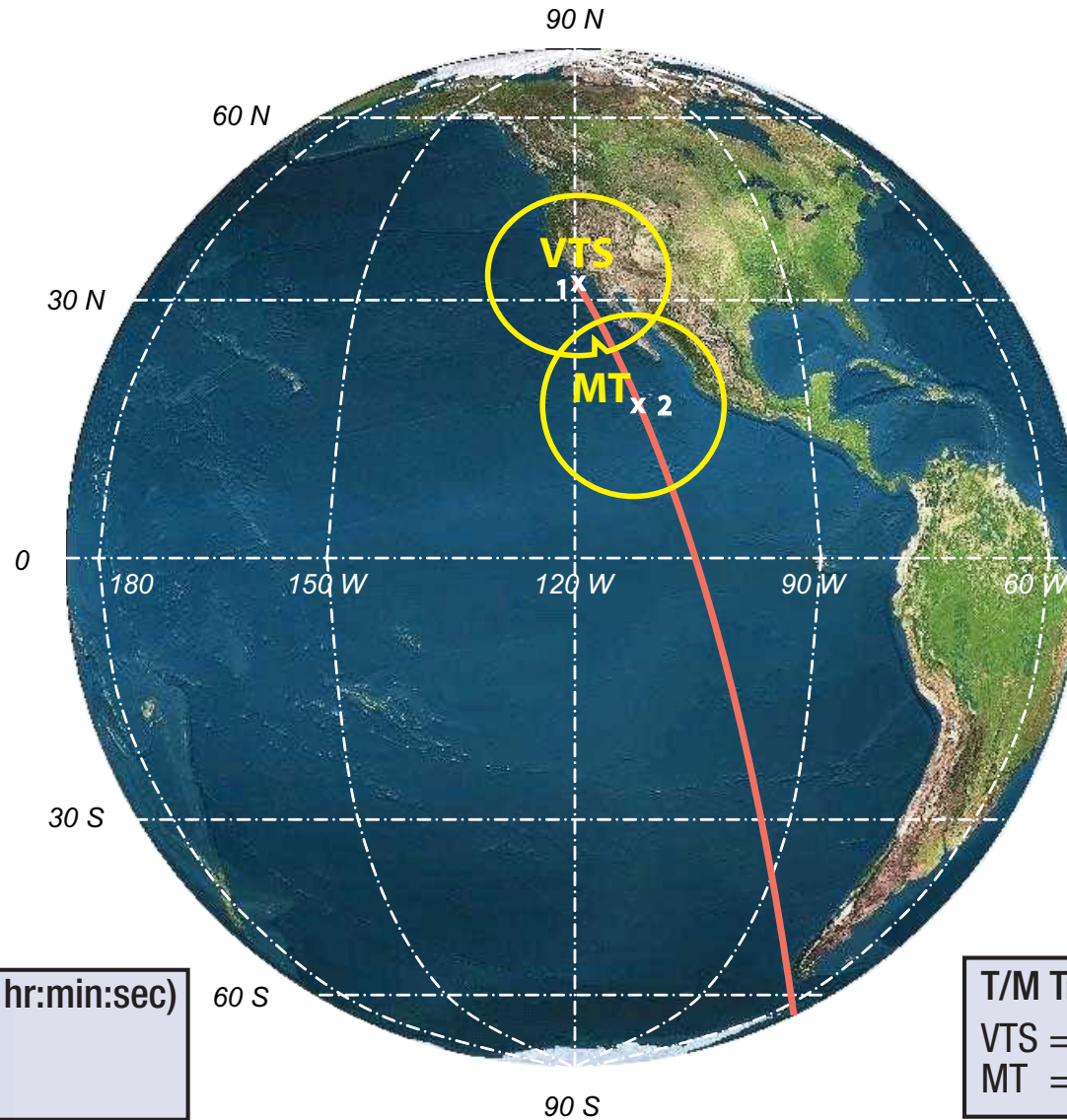
- Following Jason-2 separation, second stage is reoriented for cold gas evasive maneuver (CGEM)
 - CGEM is 25 seconds long, beginning at 1 hr, 10 min, 50 sec after liftoff
 - Increases separation distance between spacecraft and second stage in preparation for evasive burn
 - Velocity of 1.1 fps imparted to second stage
- Restart burn to raise apogee begins at 1 hr, 35 min in view of Poker Flats tracking station
 - Burn duration of 31 seconds
 - At end of restart burn, vehicle in an orbit of 715 x 2295 nmi (1324 x 4250 km) with an inclination of 65.84 deg
- Following restart burn, second stage is reoriented for depletion burn to raise perigee
 - Depletion burn begins 2 hr, 4 min, 10 sec after liftoff, in view of VAFB tracking station
 - Nominal burn time is 41.4 seconds
 - At end of nominal depletion burn, second stage in a 1332 x 2605-nmi (2468 x 4824-km) orbit at 64.91-deg inclination

Sequence of Events Post Separation

Event	Time (HR:MIN:SEC)
Begin maneuver to cold gas evasive attitude	1:01:40.0
End maneuver to cold gas evasive attitude	1:10:40.0
Begin CGEM	1:10:50.0
End CGEM	1:11:15.0
Begin maneuver to evasive burn attitude	1:23:20.0
End maneuver to evasive burn attitude	1:32:30.0
Restart Second Stage - evasive burn	1:35:00.0
Third Cutoff - Second Stage (SECO 3)	1:35:31.0
Begin maneuver to depletion burn attitude	1:38:20.0
End maneuver to depletion burn attitude	1:48:20.0
Restart Second Stage - depletion burn	2:04:10.0
Depletion Cutoff - Second Stage (SECO 4)	2:04:51.4



Ground Trace Boost to Orbit



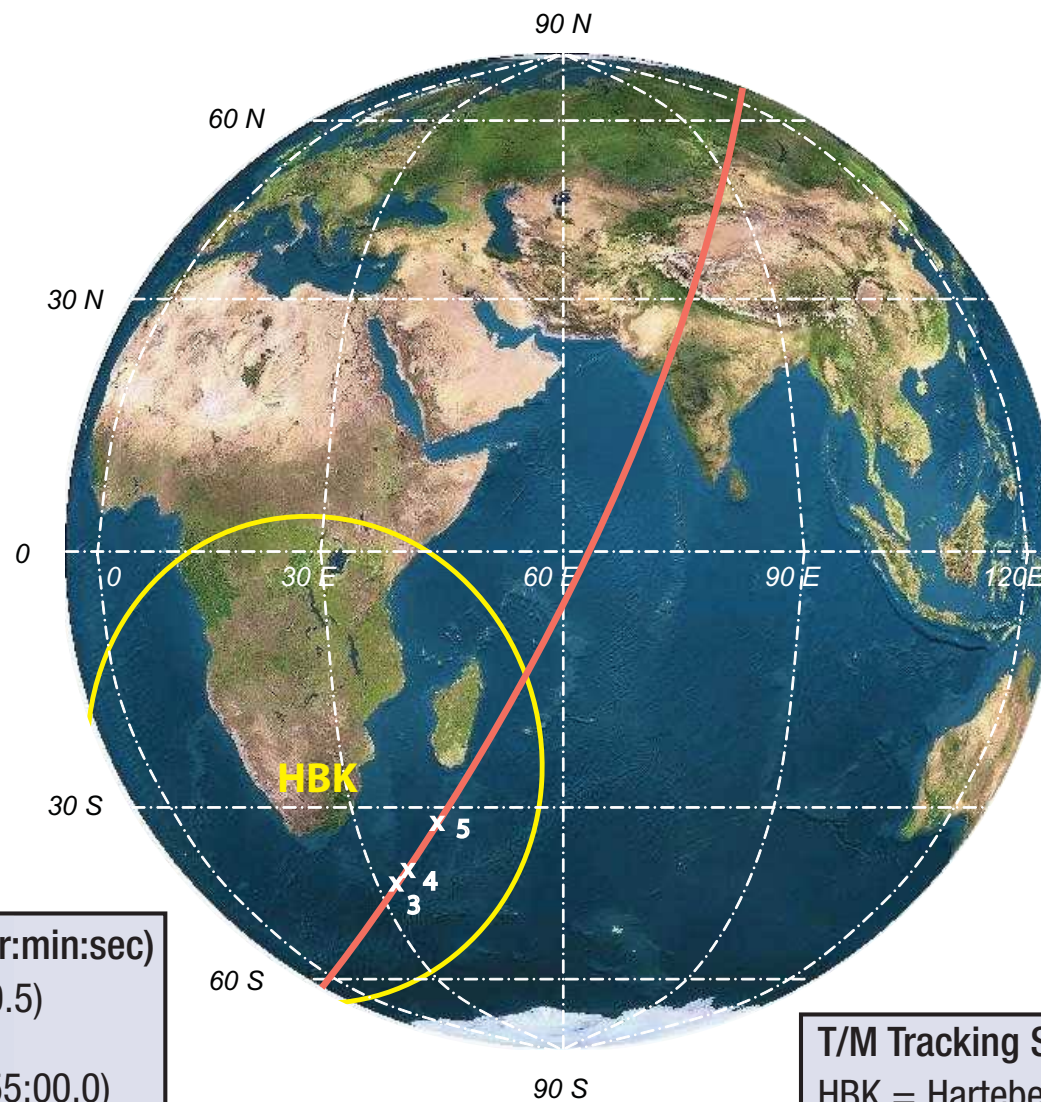
Events (Time After Liftoff, hr:min:sec)

- 1 = MECO (0:04:24.2)
- 2 = SECO 1 (0:10:27.4)

T/M Tracking Stations

- VTS = Vandenberg AFB
- MT = Mobile Telemetry

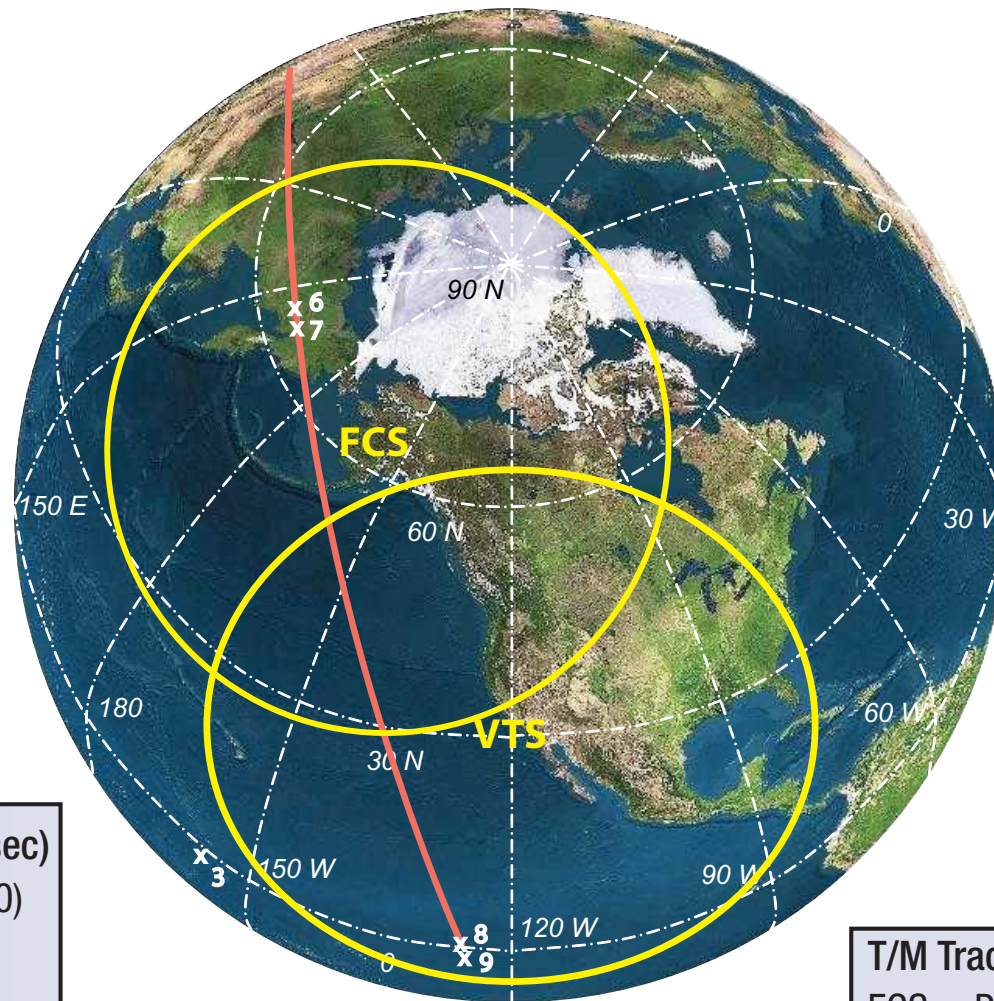
Ground Trace Restart to Spacecraft Separation



Events (Time After Liftoff, hr:min:sec)
3 = Restart Ignition (0:48:50.5)
4 = SECO 2 (0:49:14.7)
5 = Jason-2 Separation (0:55:00.0)

T/M Tracking Stations
HBK = Hartebeesthoek, South Africa

Ground Trace Post-Separation



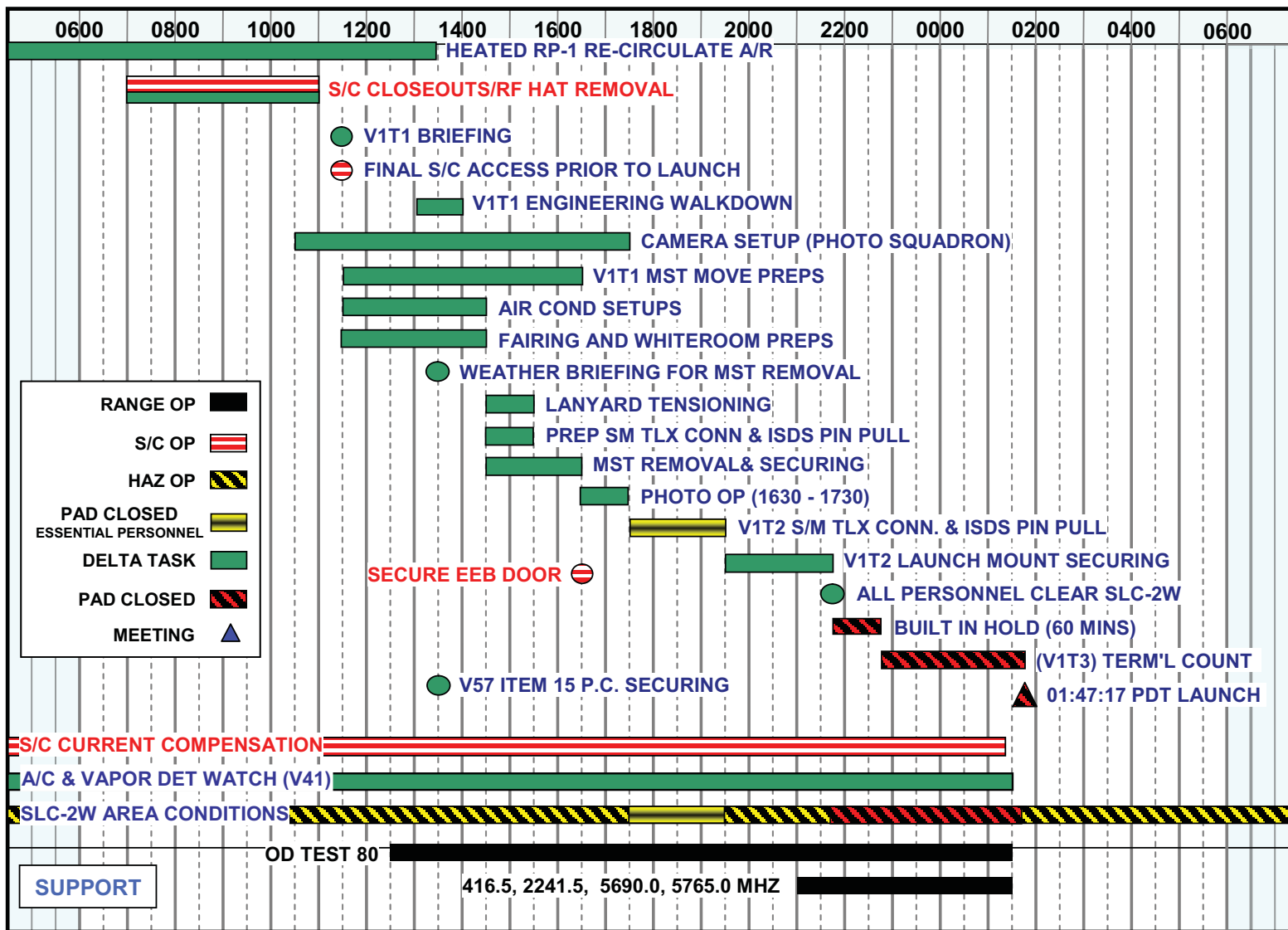
Events (Time After Liftoff, hr:min:sec)

- 6 = Evasive Burn Restart (1:35:00.0)
- 7 = SECO 3 (1:35:31.0)
- 8 = Depletion Restart (2:04:10.0)
- 9 = Depletion Cutoff (2:04:51.4)

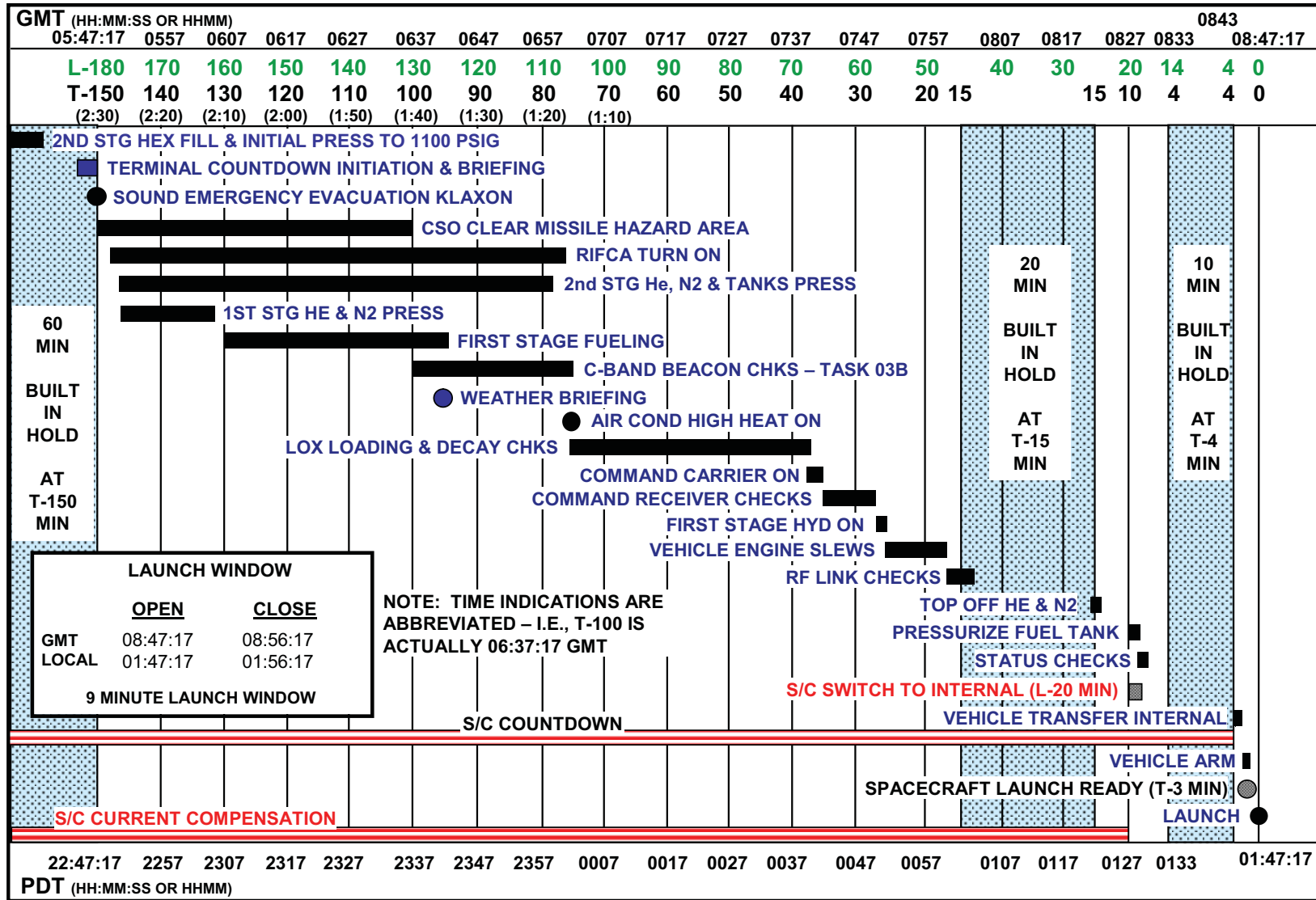
T/M Tracking Stations

- FGS = Poker Flats, Alaska
- VTS = Vandenberg AFB

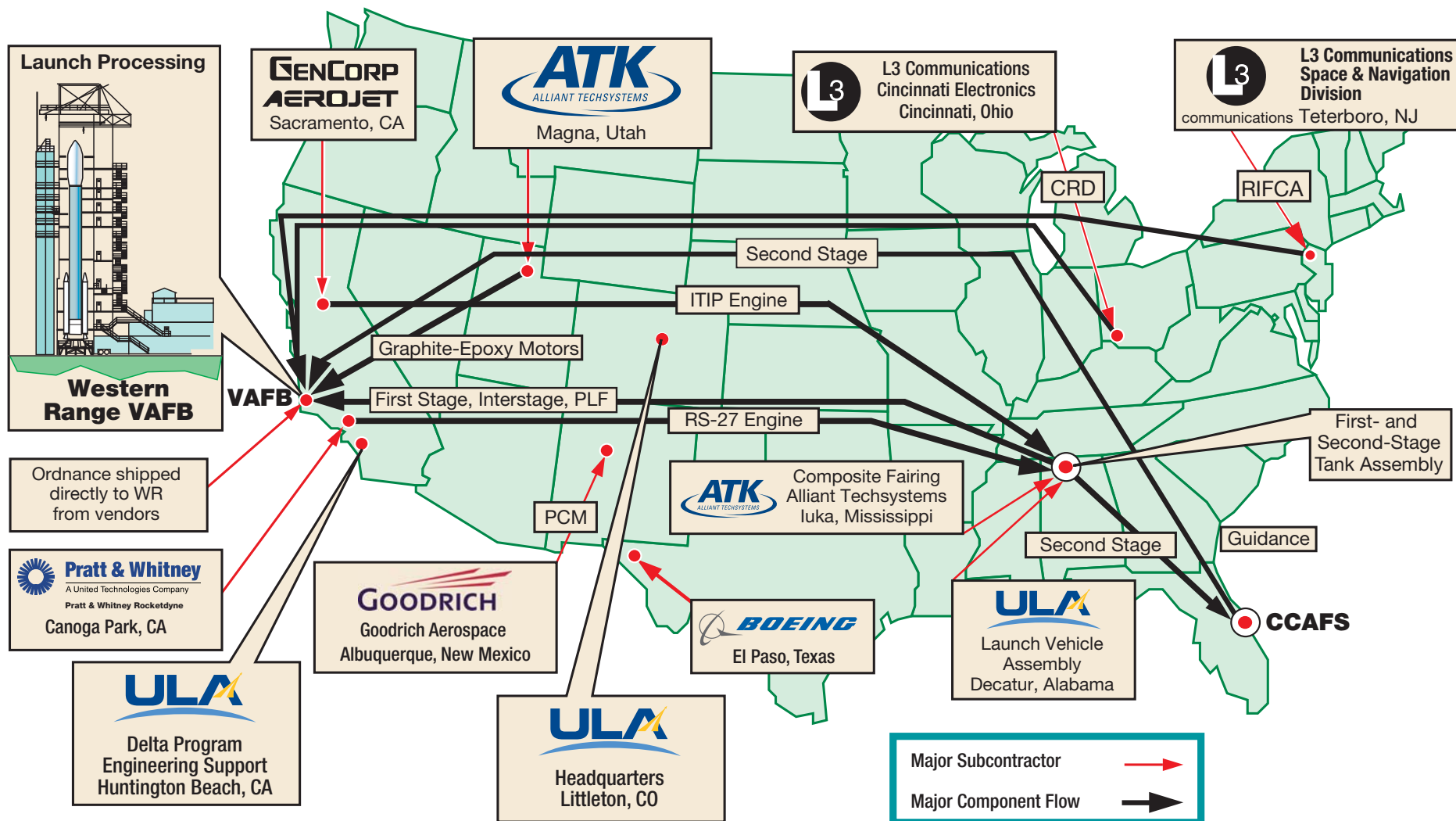
Delta II Countdown (T-0 Day)



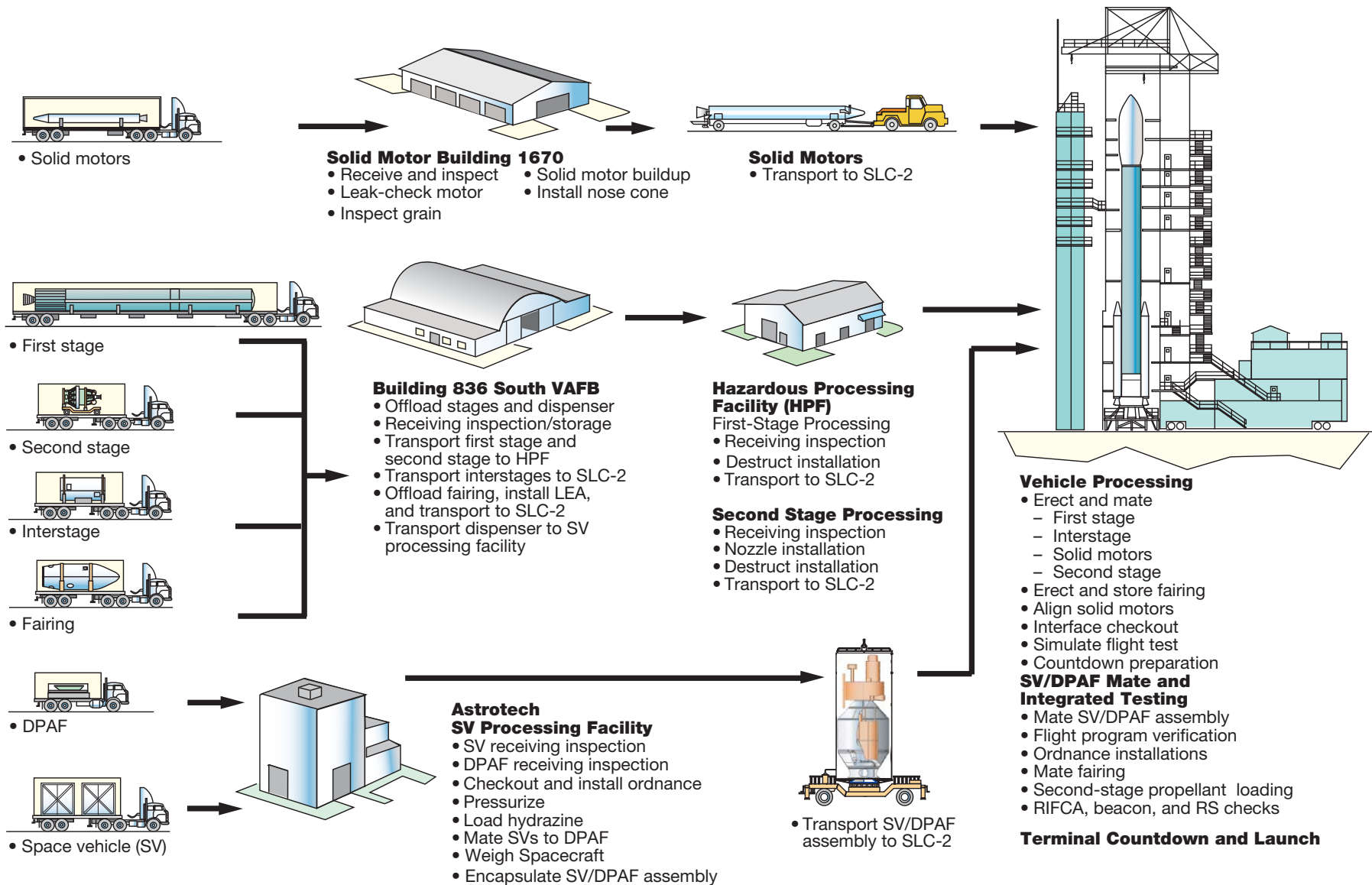
Delta II Terminal Count (T-0 Day)



Delta II Operational Flow at Western Range



Total Vehicle Integration & Checkout at the Launch Site



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