



Dawn



Delta Launch Vehicle Programs



Dawn

United Launch Alliance is proud to launch the Dawn mission. Dawn will be launched aboard a Delta II 7925H launch vehicle from Cape Canaveral Air Force Station (CCAFS), Florida. The launch vehicle will deliver the Dawn spacecraft into an Earth-escape trajectory, where it will commence its journey to the solar system's main asteroid belt to gather comparative data from dwarf planet Ceres and asteroid Vesta.

United Launch Alliance provides the Delta II launch service under the NASA Launch Services (NLS) contract with the NASA Kennedy Space Center Expendable Launch Services Program. We are delighted that NASA has chosen the Delta II for this Discovery Mission. I congratulate the entire Delta team for their significant efforts that resulted in achieving this milestone and look forward to continued launches of scientific space missions aboard the Delta launch vehicle.



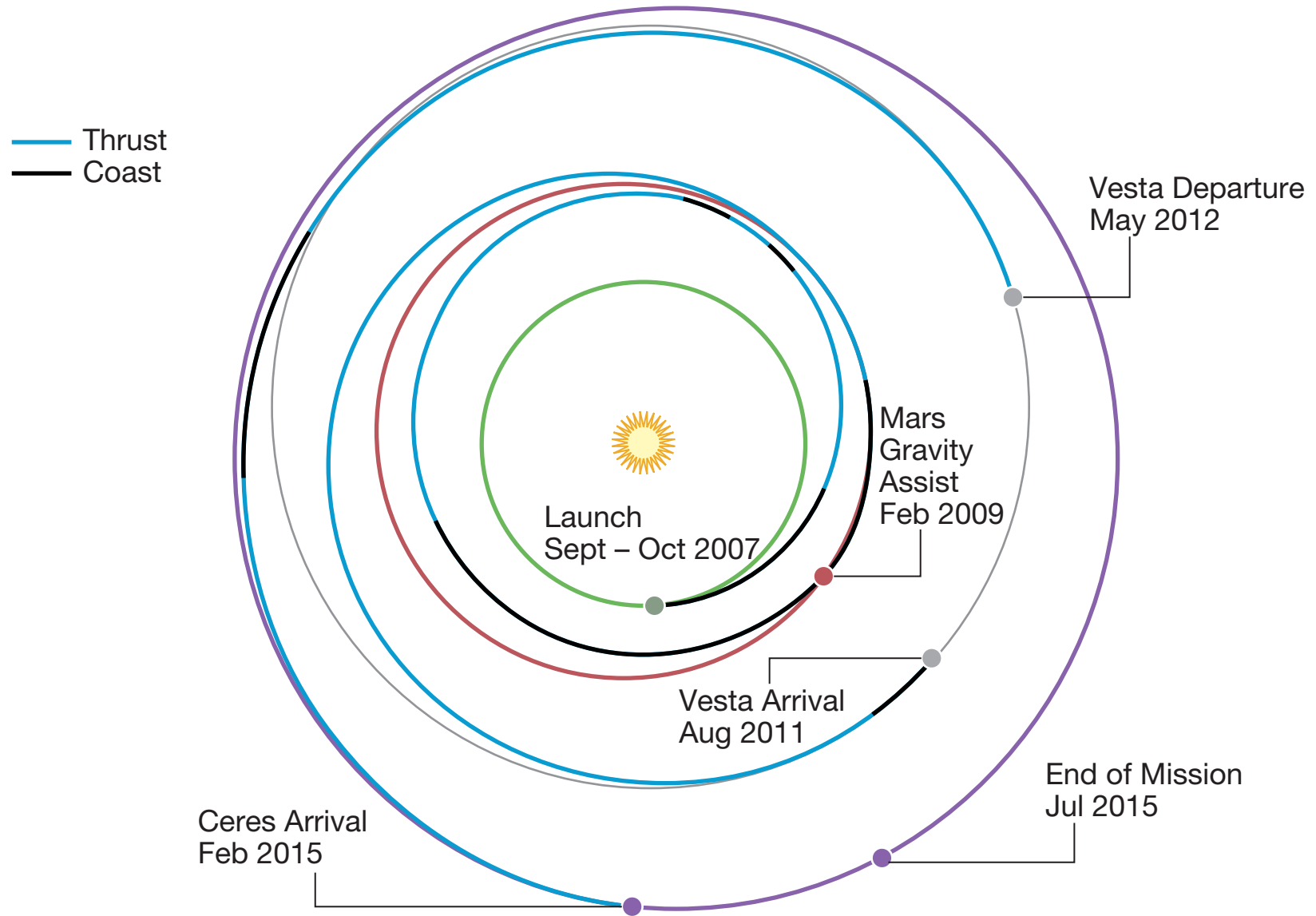
Kristen T. Walsh
Director, NASA Programs
Delta Launch Vehicles

Dawn Mission Overview

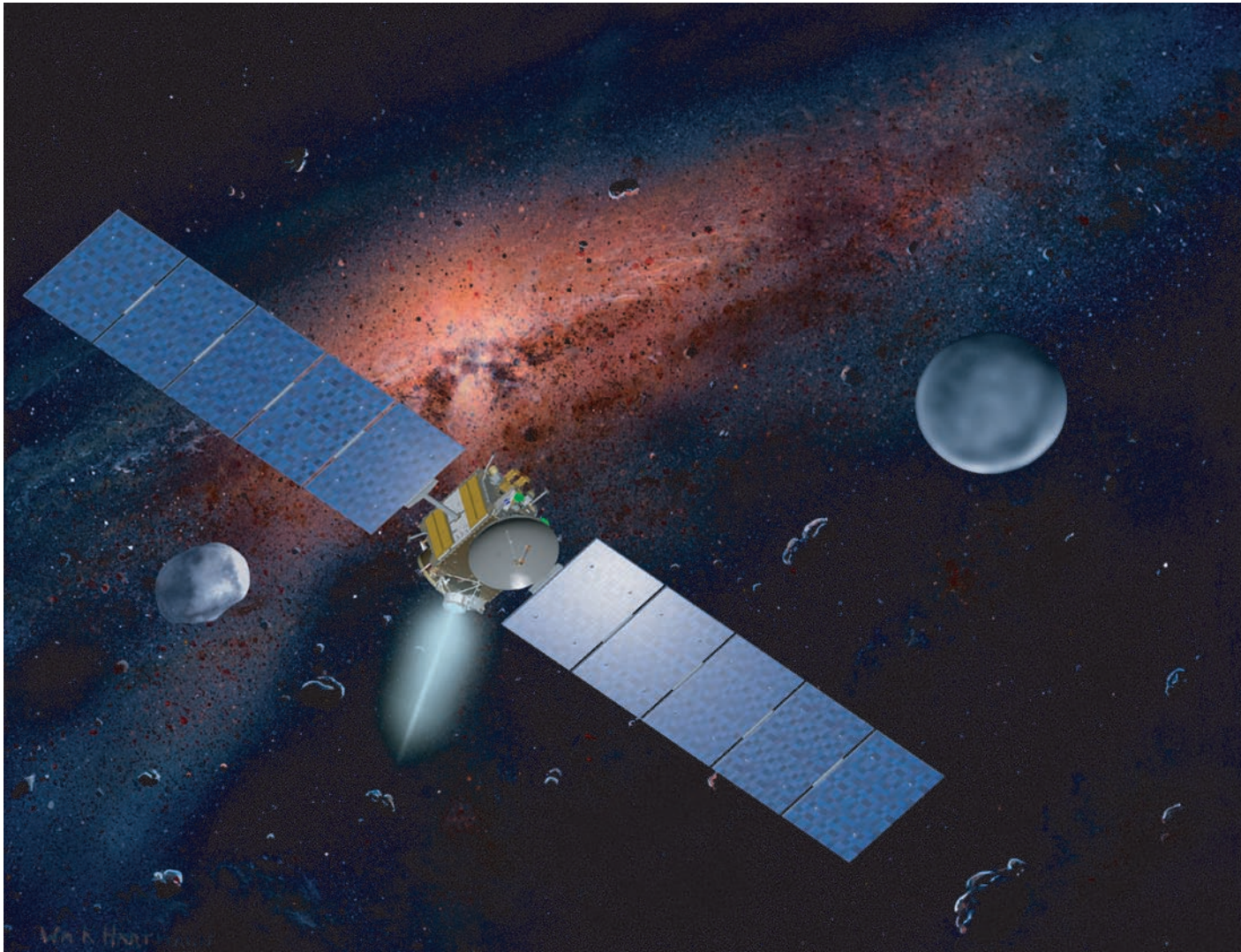
The Dawn spacecraft will make an eight-year journey to the main asteroid belt between Mars and Jupiter in an effort to significantly increase our understanding of the conditions and processes acting at the solar system's earliest epoch by examining the geophysical properties of the asteroid Vesta and dwarf planet Ceres.

Evidence shows that Vesta and Ceres have distinct characteristics and, therefore, must have followed different evolutionary paths. By observing both, with the same set of instruments, scientists hope to develop an understanding of the transition from the rocky inner regions, of which Vesta is characteristic, to the icy outer regions, of which Ceres is representative.

Dawn Trajectory



Dawn On-Orbit



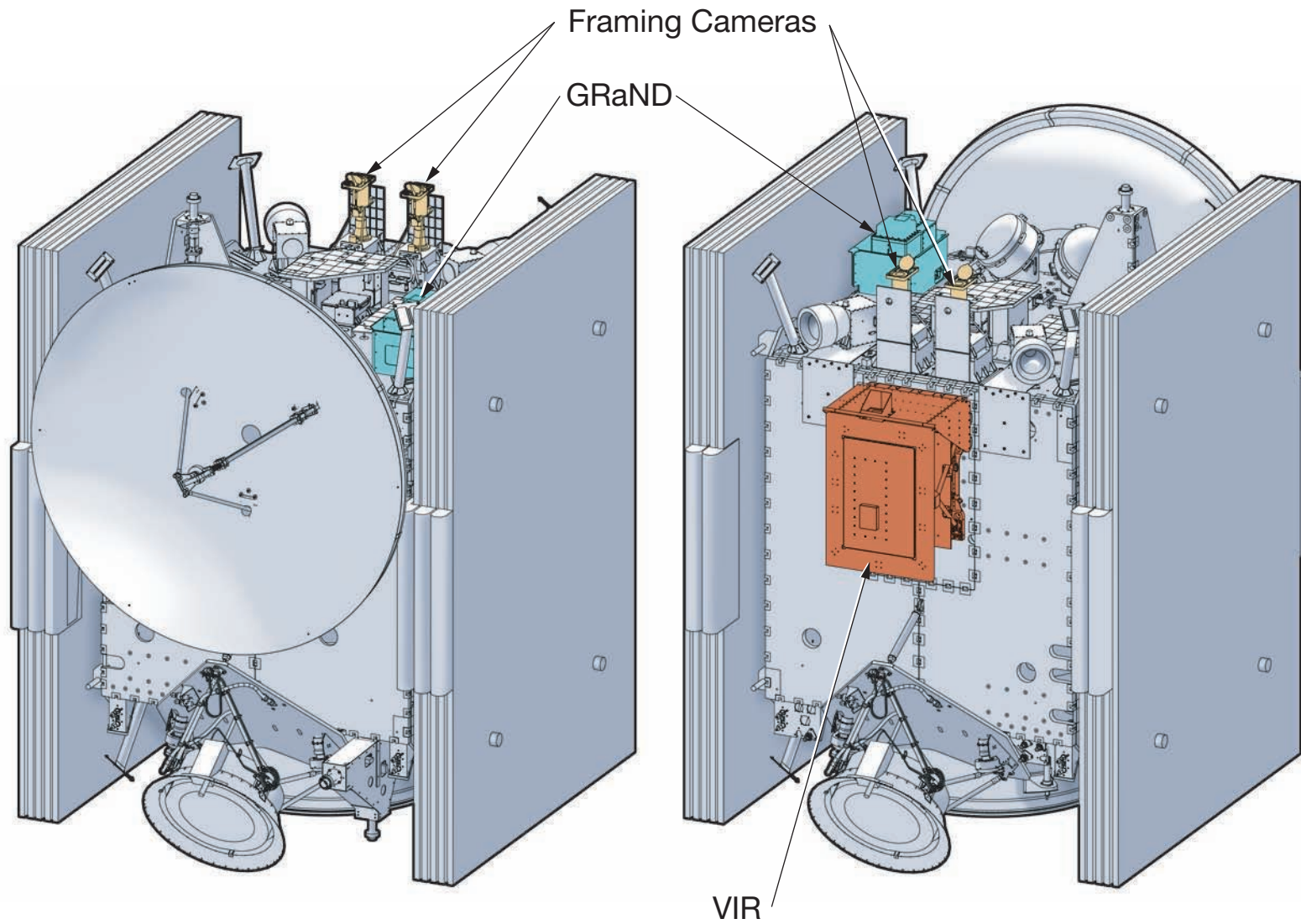
Dawn Science Objectives

- Define the internal structure, density, and heterogeneity of Vesta and Ceres, two of the most massive asteroids in the solar system
- Determine the thermal history and geochemistry of Vesta and Ceres
- Investigate surficial processes, cratering, and tectonics of the asteroids
- Determine meteoric source locations and production mechanisms
- Investigate the role of water in controlling asteroid evolution

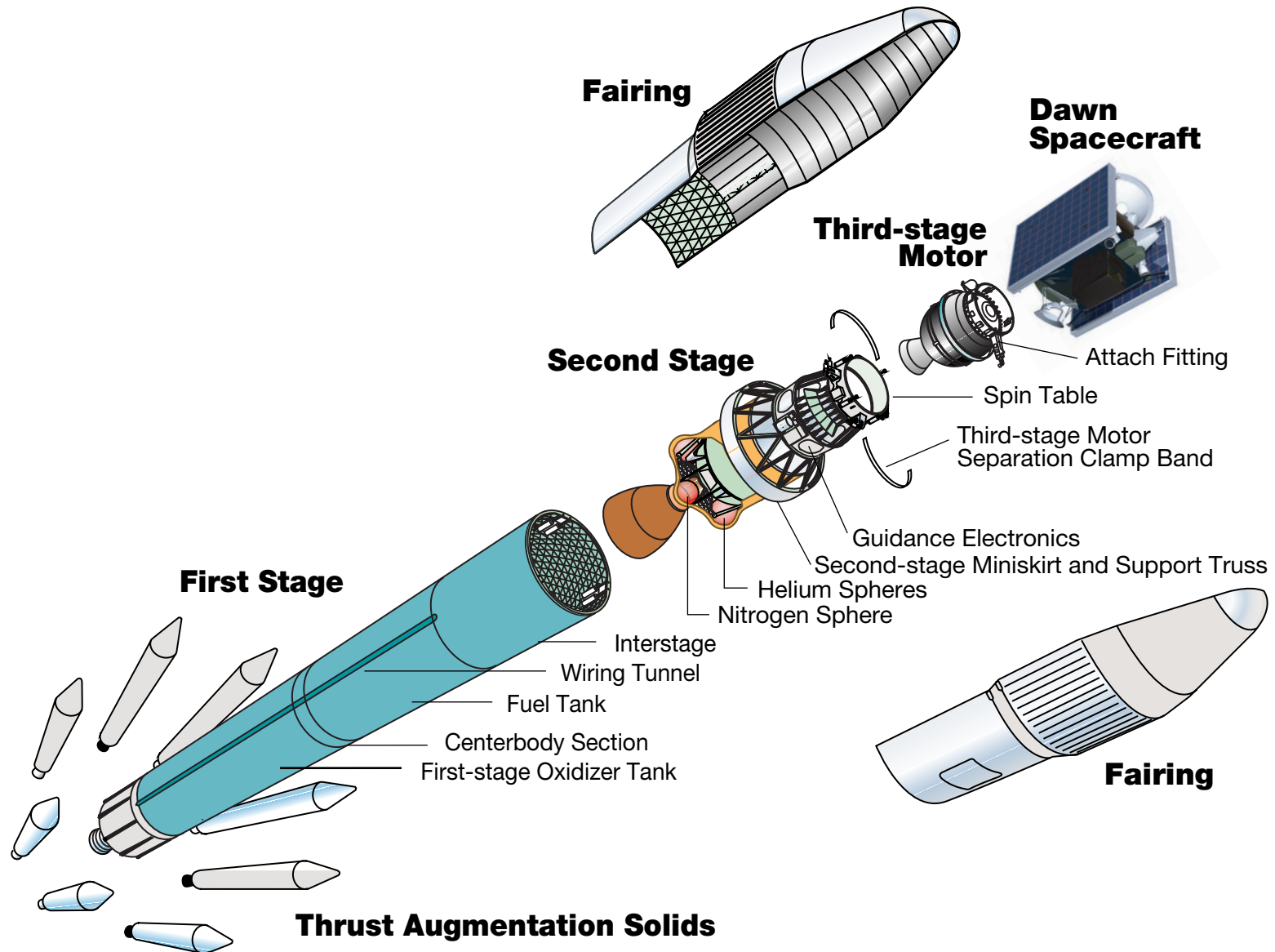
Dawn Science Instruments

- Two Framing Cameras comprise the scientific imaging system of the Dawn mission. The cameras will be used to study the surfaces of Vesta and Ceres to understand the geological processes that shaped them.
- The Gamma Ray and Neutron Detector (GRaND) will measure elemental abundances on the surface and near surface of Vesta and Ceres.
- The Visible and Infrared Mapping Spectrometer (VIR) will measure the mineralogical composition of the surfaces.
- Dawn will also carry a system to measure the gravity fields of Vesta and Ceres, which will enable scientists to infer the internal structure of each body.

Dawn Instruments



Delta II 7925H Launch Vehicle



Dawn Mission Description

- Launch Site CCAFS SLC-17B
- Launch Period 26 Sept – 15 Oct 2007
- Spacecraft Mass 1217.67 kg (2684.5 lb)
- Launch Time (26 Sept 2007) 7:25 AM EDT
- Launch Window (26 Sept 2007) 29 min
- Launch Azimuth 93 deg
- Target Orbit (26 Sept 2007) C3 = 11.4 km²/sec
DLA = 28.5 deg

Dawn Flight Mode Description

Boost Phase

- Flight azimuth of 93 deg
- Direct flight azimuth mode employed for initial boost phase (combined pitch/yaw)
- Six GEM solid motors ignite at liftoff, three ignite in flight after burnout of the first six
- Boost trajectory designed to meet controllability, structural, and environmental constraints while maximizing vehicle performance
- Main engine cutoff (MECO) occurs at depletion of first-stage propellants, approximately 263 sec after liftoff
- Stage I-II separation occurs 8 sec after MECO
- Stage II ignition 5.5 sec after separation
- Payload fairing jettisoned when free molecular heating rate ≤ 0.1 Btu/ft²-sec
- At Stage II first cutoff (SECO-1), vehicle is in 100-nmi transfer orbit

Dawn Flight Mode Description

Stages II and III

- Following second-stage engine cutoff (SECO-1), a thermal roll will be initiated, ending approximately 34 min later
- Second-stage restart follows
- Spin-up and Stage II-III separation occur following SECO-2
- Third-stage burn injects payload into desired orbit
- Nutation control system (NCS) is disabled and yo-yo despin initiated
- Spacecraft is separated
- A second-stage depletion burn sequence follows the primary mission to safe the stage

Sequence of Events

Event	Time (hr:min:sec)
Liftoff	00:00:00.0
Mach 1	00:00:30.3
Maximum Dynamic Pressure	00:00:39.2
Six Ground-Lit Solid Motors Burnout	00:01:17.1
Three Air-Lit Solid Motors Ignition	00:01:19.0
Jettison Three Ground-Lit Solid Motors	00:01:20.5
Jettison Three Ground-Lit Solid Motors	00:01:21.5
Three Air-Lit Solid Motors Burnout	00:02:35.8
Jettison Three Air-Lit Solid Motors	00:02:39.5
Main Engine Cutoff (MECO)	00:04:22.5
Stage I-II Separation	00:04:31.0
Stage II Ignition	00:04:36.5
Jettison Fairing	00:04:41.0
First Cutoff – Stage II (SECO-1)	00:08:58.3

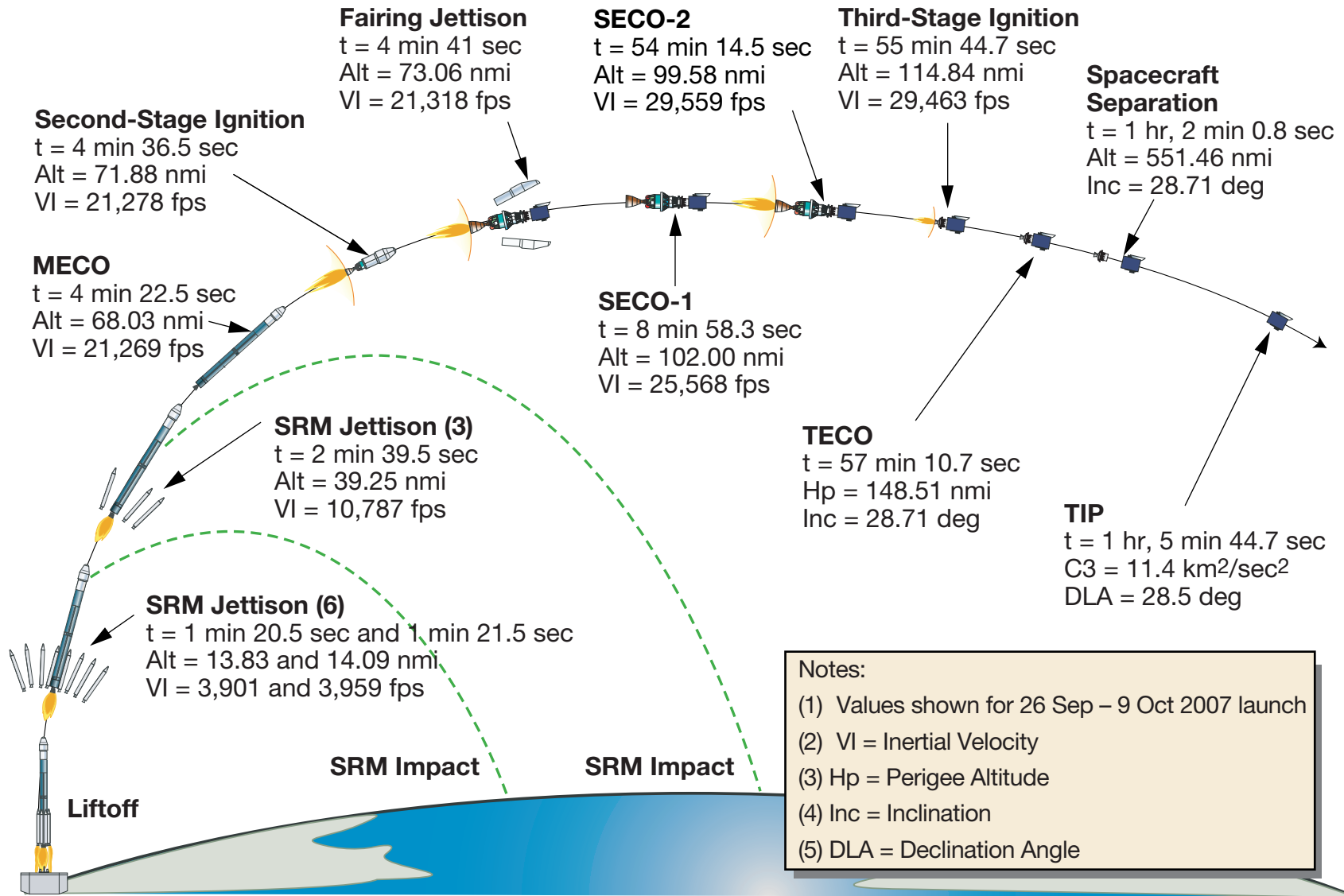
Sequence of Events

Continued

For 26 Sep – 9 Oct 2007 Launch

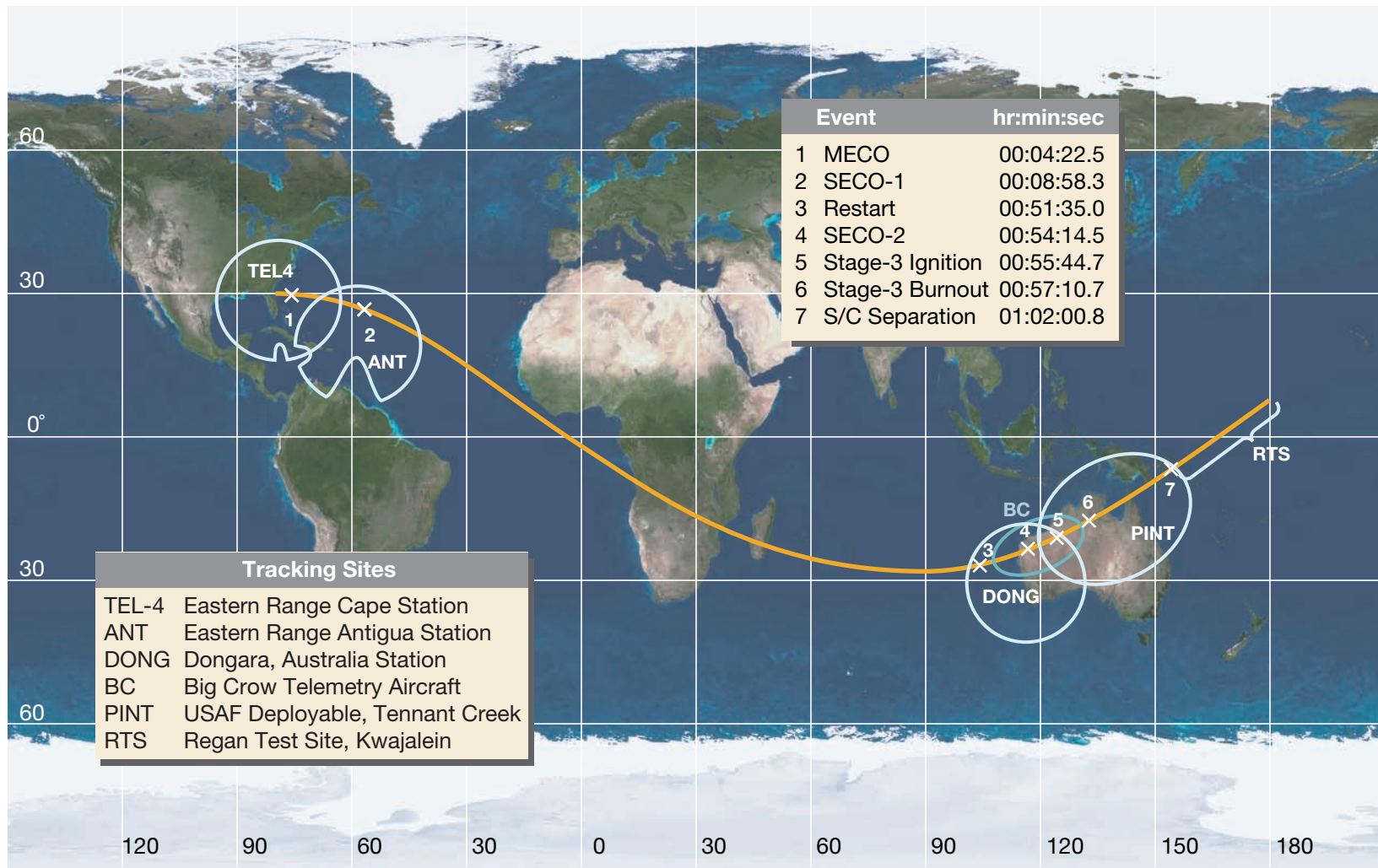
Event	Time (hr:min:sec)
Begin Coast Phase Roll Program	00:15:10.5
End Coast Phase Roll Program	00:48:50.5
First Restart Ignition	00:51:35.0
Second Cutoff – Stage II (SECO-2)	00:54:14.5
Fire Spin Rockets	00:55:04.5
Stage II – III Separation	00:55:07.7
Stage III Ignition	00:55:44.7
Stage III Burnout (TECO)	00:57:10.7
Separate Spacecraft	01:02:00.8
Target Interface Point (TIP)	01:05:44.7
Depletion Ignition	01:16:40.5
Third Cutoff – Stage II (SECO-3)	01:17:03.9

Dawn Flight Profile



Dawn Ground Trace

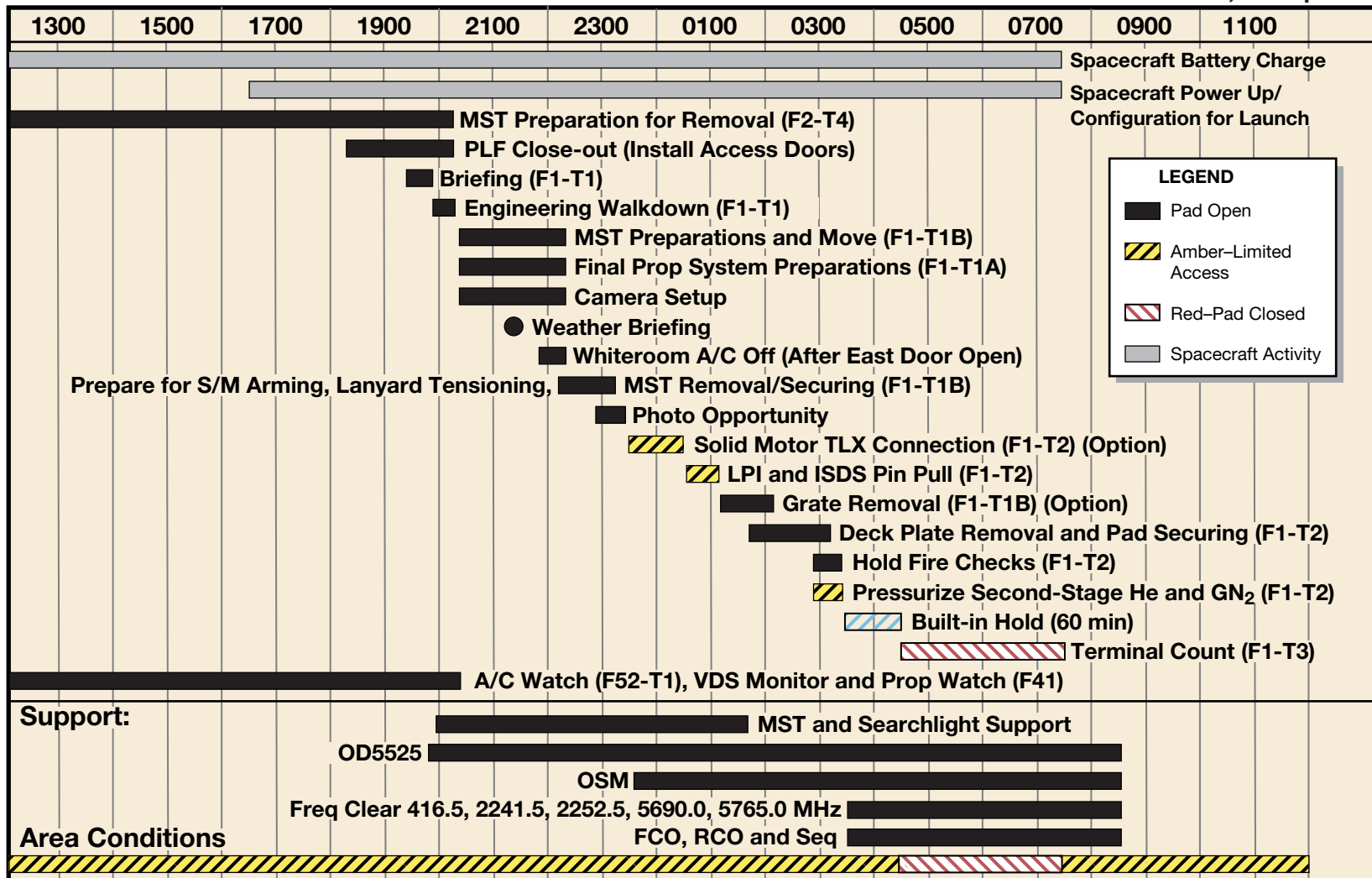
26 Sep – 9 Oct 2007



Delta Countdown

T-0 Day

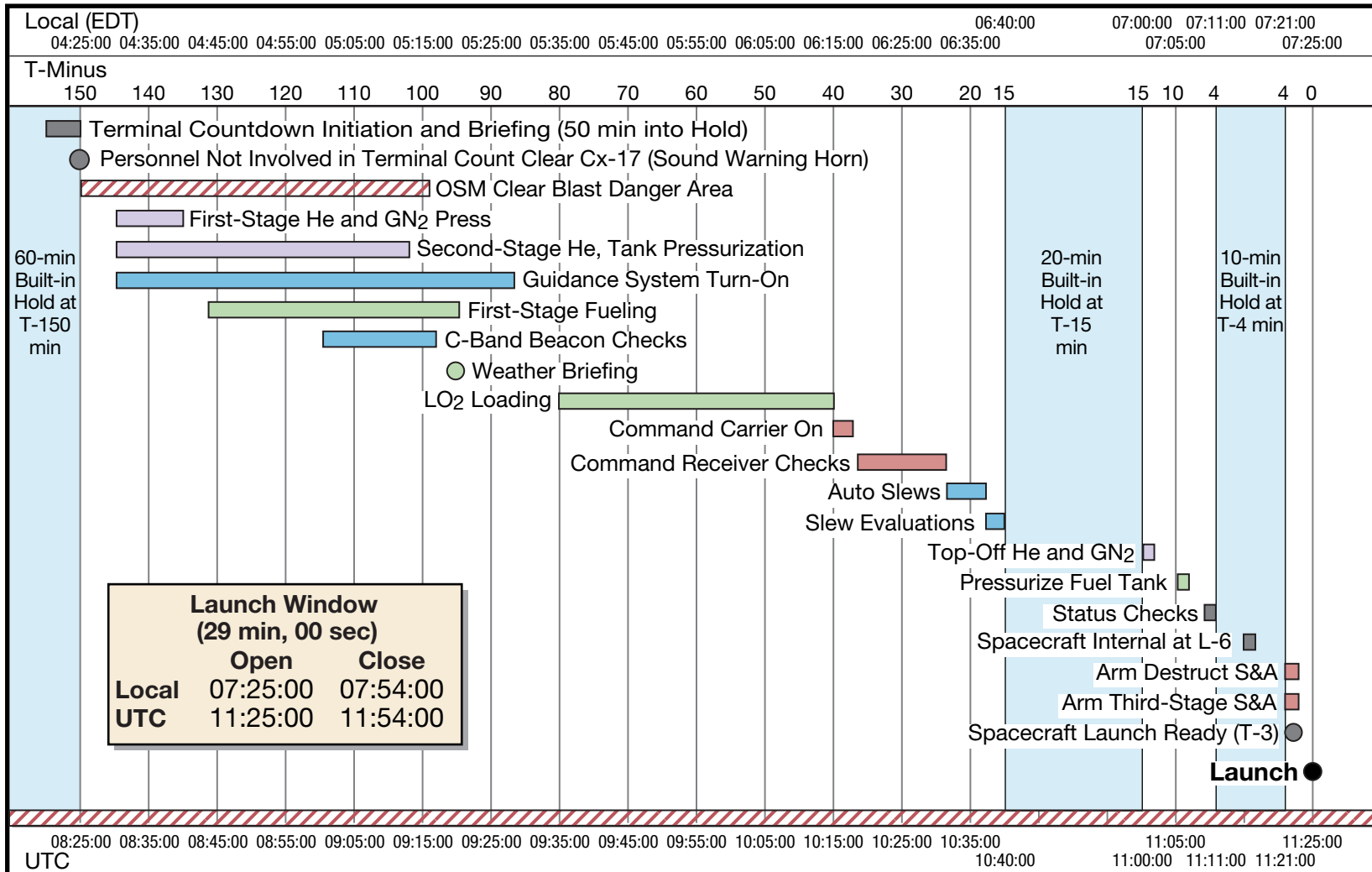
Wed, 26 Sep 2007



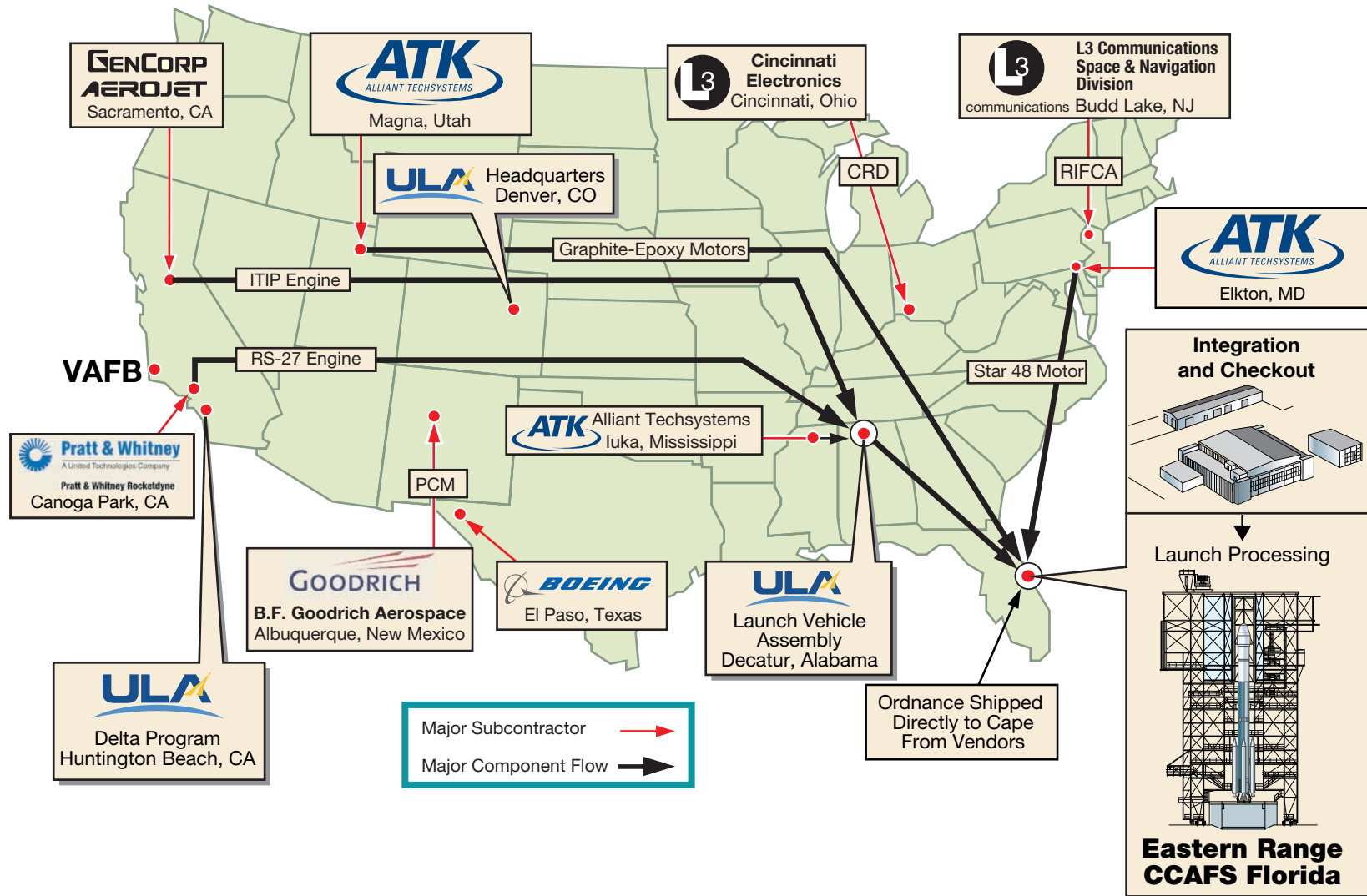
Terminal Count

T-0 Day

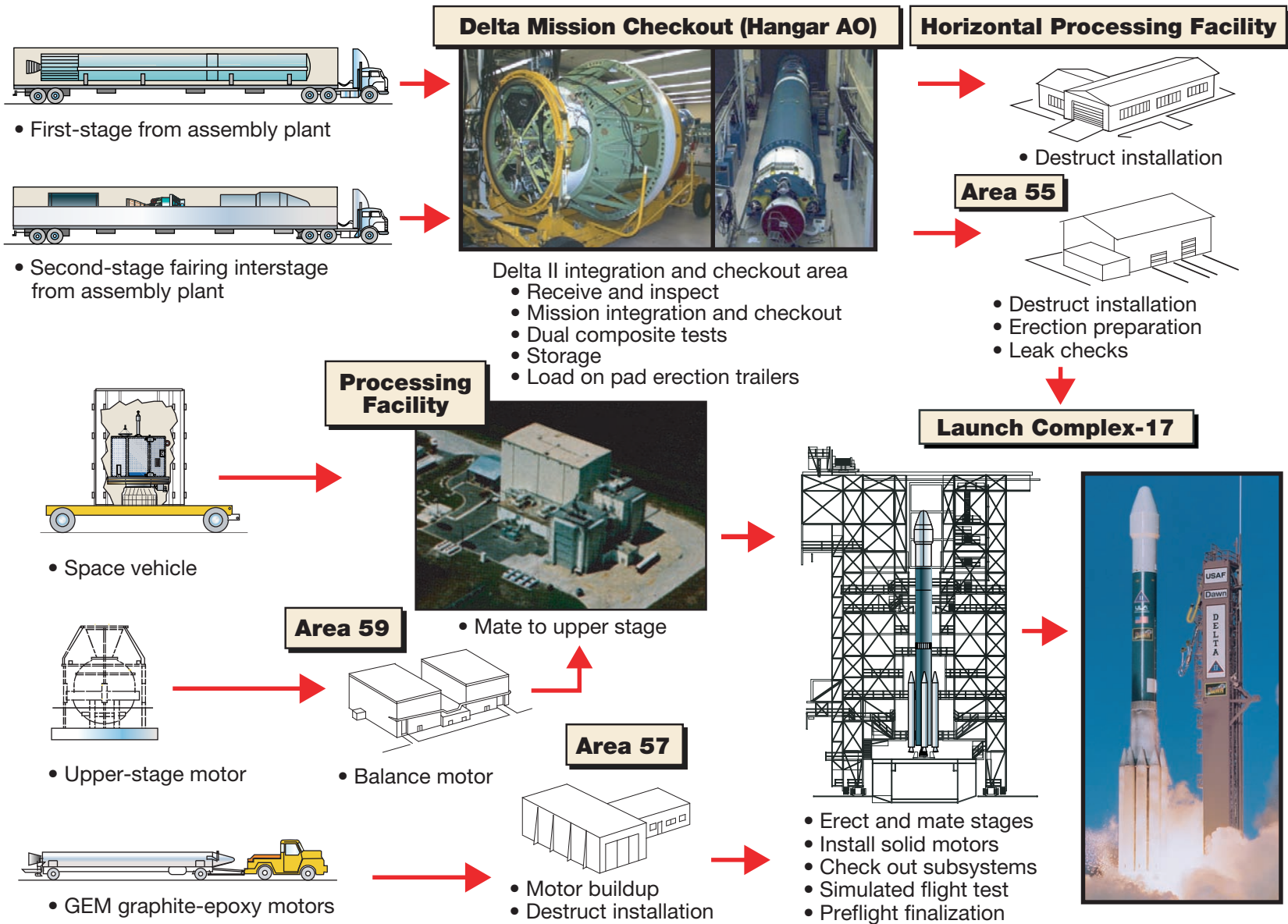
Wednesday, 26 September 2007



Delta II Operational Flow at Eastern Range



Total Vehicle Integration and Checkout at the Launch Site



Notes:



LOS ALAMOS NATIONAL LABORATORY • MPS-MAX PLANCK INSTITUTE

ASI-ITALIAN SPACE AGENCY

AEROSPACE CENTER • DLR-GERMANY

NASA • JPL

ORBITAL SCIENCES CORPORATION

UCLA

"A journey to the beginning of the solar system"

ULA
United Launch Alliance

DAWN
MISSION TO VESTA & CERES

Delta Launch Vehicle Programs

United Launch Alliance • 12257 South Wadsworth Boulevard • Littleton, CO 80125-8500 • (720) 922-7100 • www.ulalaunch.com