



Space Tracking and Surveillance System Demonstration

Mission Overview

Delta II 7920-10C
Cape Canaveral Air Force Station, FL
Space Launch Complex 17B





STSS Demonstration



The United Launch Alliance (ULA) takes great pride in launching the Space Tracking and Surveillance System (STSS) Demonstration (DEMO) mission for the Missile Defense Agency (MDA). STSS DEMO will be launched aboard a ULA Delta II 7920-10C launch vehicle from the Cape Canaveral Air Force Station (CCAFS), FL.

STSS DEMO is an element of the STSS program, a space-based sensor component of a layered Ballistic Missile Defense System (BMDS) designed for the overall mission of detection, tracking, and interception of ballistic missiles.

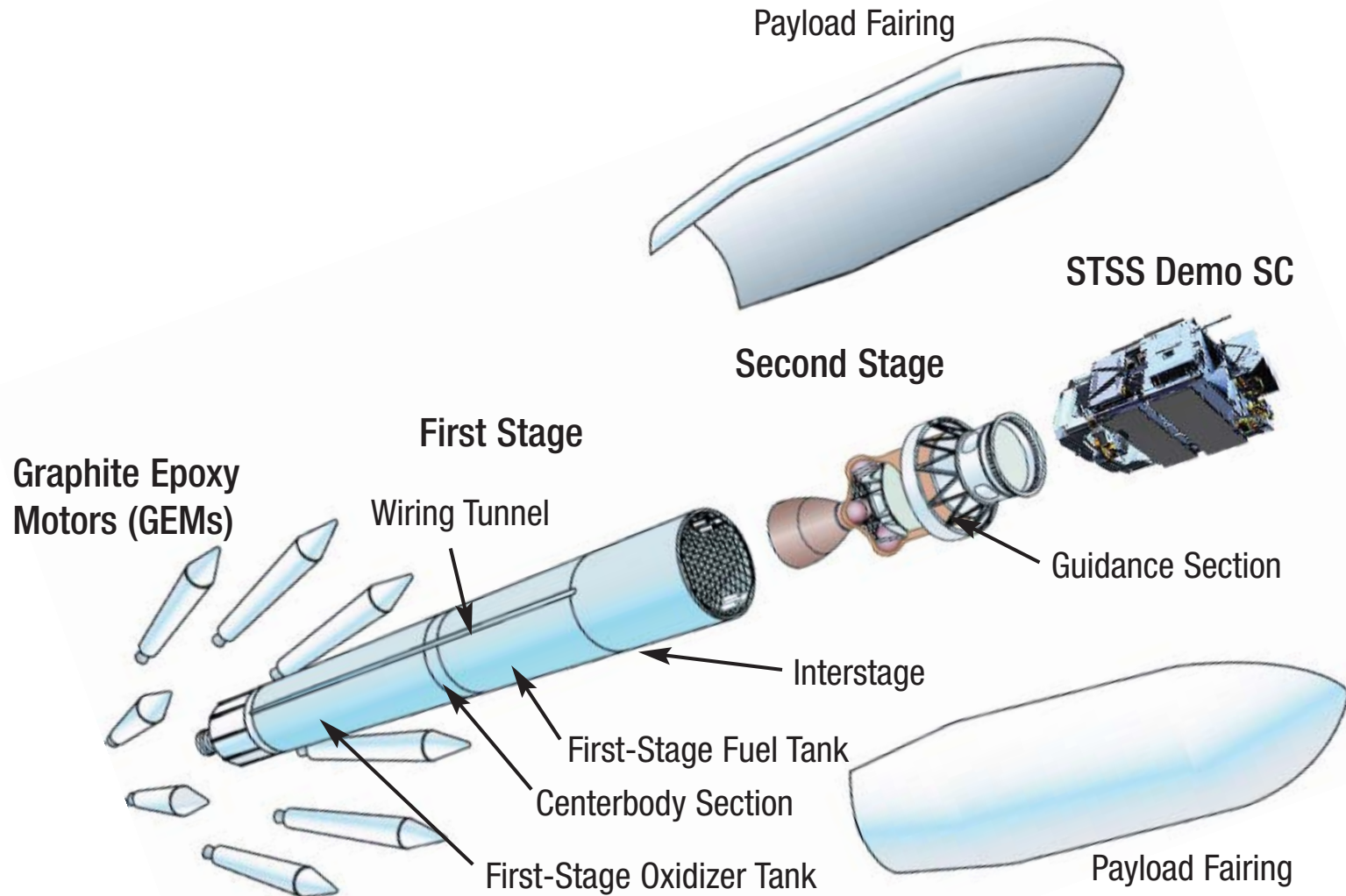
ULA provides the Delta II launch service under the NASA Launch Services (NLS) contract with the NASA Kennedy Space Center Launch Services Program. We are pleased that NASA once again selected the Delta II for this mission after many successful commercial, foreign, and government launches to Earth orbit and destinations throughout the solar system. My congratulations to the entire Delta team for its continued efforts in achieving this milestone.

A handwritten signature in black ink, appearing to read "V L Thorp", is centered on the page.

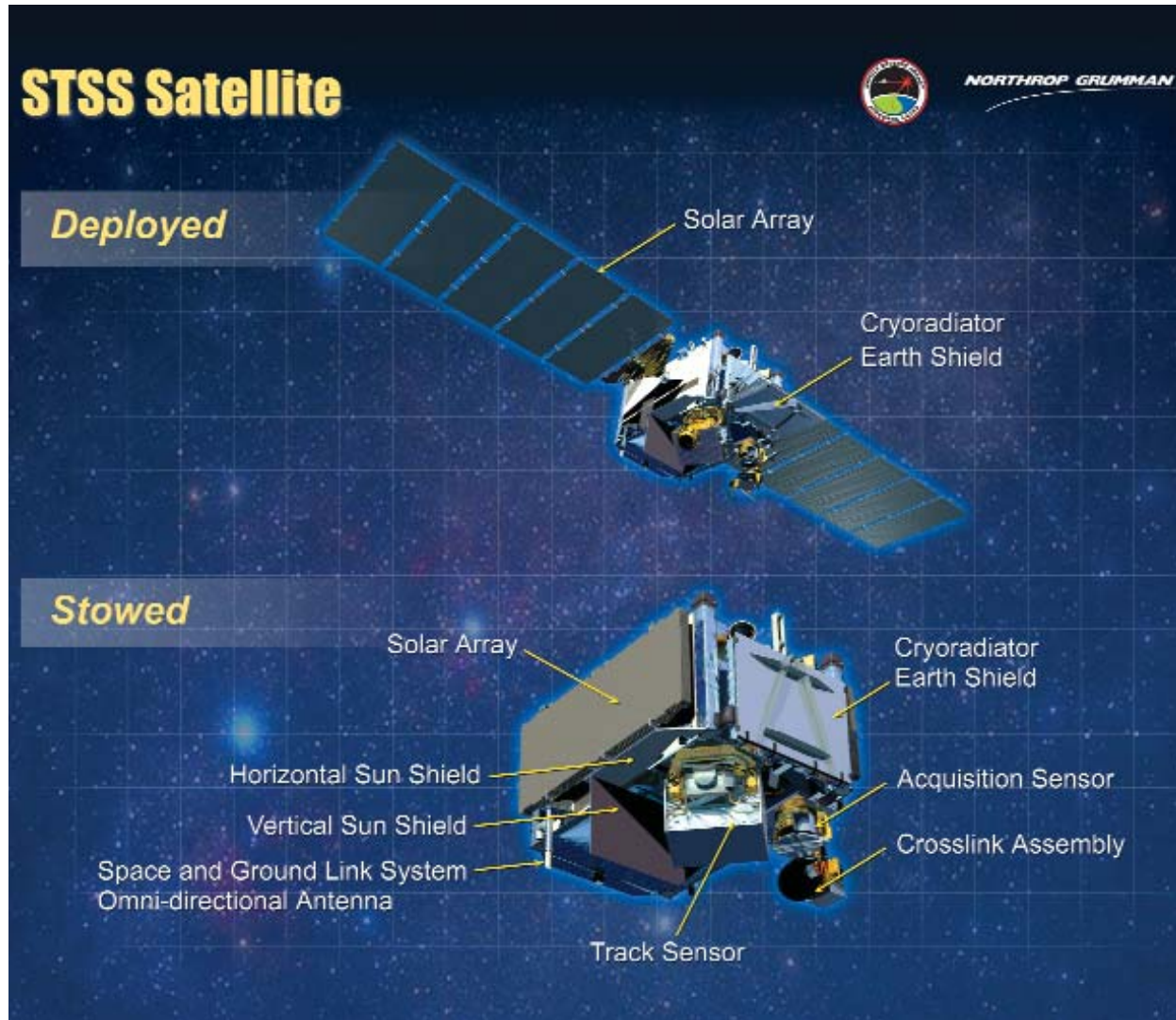
Vernon L. Thorp
NASA Program Manager
United Launch Alliance

- **Launch Period:** 1 September 2009 – 14 February 2010
- **Vehicle Configuration:** 7920-10C
- **Launch Location:** CCAFS SLC-17B
- **Spacecraft (SC) weight:** 4,947 lb (2,244 kg)
- **Orbit :** 1,350 km at 58°
- **Mission Unique Requirements:**
 - Two 61-pin Umbilical Connectors
 - Separation Sequencing Interface
 - Launch Vehicle Separation Monitor and Camera
 - Space Vehicle (SV)-provided PAF (OIS)
 - Auxiliary Air Conditioning System

Delta II 7920-10 Launch Vehicle



STSS Demo Mission Description



STSS Demo Spacecraft Configuration



- **Orbit Criteria (defined at SECO-2)**
 - Perigee Altitude 728.94±5.4 nmi (1,350±10.1 km)
 - Apogee Altitude 728.94±5.4 nmi (1,350±10.1 km)
 - True-of-Date Inclination 58.00 ± 0.05 deg
- **Launch Parameters**
 - Site CCAFS Complex SLC-17
 - Vehicle Configuration Delta II 7920-10
 - Window One hour (daily) rounded to the nearest whole minute, such that a minimum of 6 hours of early orbit operations occur in sunlight, beginning at SECO 2
- **Probability of Command Shutdown (PCS) ≥ 99.78%**
- **Spacecraft Mass (nominal) 4,947 lbs (2,244 kg)**

- Fairing Separation
 - Free Molecular Heating Rate (FMHR) $\leq 0.1 \text{ BTU/ft}^2\text{-sec}$
 - Post-Separation Sun Angles > 5.7 degrees to the (4) Star Tracker Assembly boresights for more than 15 minutes cumulatively
- Coast Thermal Attitude
 - Sun Angles 90 ± 10 deg from vehicle centerline ($+X_{LV}$ axis)
 - Rate $1.8 - 2.0$ deg/sec
- SC Separation
 - Attitude
 - SV 1 $+Z_{pL}$ axis is aligned along the local horizontal in the direction of the velocity vector; Y_{pL} toward nadir direction
 - SV 2 $+Z_{pL}$ axis is aligned along the local horizontal in the direction opposite of the velocity vector; $-Y_{pL}$ axis toward nadir direction

- 7920-10C launch from CCAFS Space Launch Complex 17B (SLC-17B)
- Flight azimuth of 65 degrees
 - European downrange overflight; trajectory designed to stay off of major population centers (Previous European Overflight mission was Mars Odyssey)
- 6/3 GEM solid motors firing sequence
- Boost trajectory designed to meet controllability, structural, and environmental constraints while maximizing vehicle performance
- Direct flight azimuth mode employed for initial boost phase (combined pitch/yaw)
 - Quad II oriented downrange after final solid motor separation
- Double dogleg maneuver performed during boost to increase inclination (first during air-lit GEM burn, second after air-lit GEM separation)
- Main engine cutoff (MECO) occurs at depletion of first-stage propellants
- Second-stage separation occurs 8 sec after MECO; Stage II ignited 5.5 sec later
- Payload fairing jettisoned when free molecular heating rate ≤ 0.1 BTU/ft²-sec
- 10-second duration dogleg maneuver performed just after fairing jettison to increase inclination
- Second-stage, first burn places vehicle in a 100 x 830 nmi (185 x 1,537 km) orbit with an inclination of 54.60 deg

DTO Flight Mode Sequence of Events

Event	Time (Seconds)
Liftoff	0.0
Mach 1	32.4
Maximum Dynamic Pressure	47.0
6 Ground-Lit GEMs Burnout	63.1
3 Air-Lit GEMs Ignition	65.5
Jettison 3 Ground-Lit GEMs	66.0
Jettison 3 Ground-Lit GEMs	67.0
Dogleg Maneuver	70.0 – 100.0
Maneuver Back to 0° Angle-of-Attack for Solid Motor Drop	100.0 – 132.0
3 Air-Lit GEMs Burnout	128.8
Jettison 3 Air-Lit GEMs	131.5
Dogleg Maneuver	132.0 – 150.0
MECO	263.3
First-Stage Separation	271.3
Second-Stage Ignition	276.8
Jettison Fairing	281.0
Dogleg Maneuver	283.0 – 293.0
First, Second-Stage Cutoff (SECO 1)	632.3

- Following SECO, vehicle reoriented to desired coast attitude
- Following thermal roll maneuver, vehicle reoriented to restart burn attitude
- Second-stage restart occurs at 2,550.0 seconds over Diego Garcia tracking station
- Following SECO 2, vehicle reoriented to SV 1 separation attitude
- SV 1 separates 252 seconds after SECO 2
- After SV 1 separation, vehicle reoriented to SV 2 separation, which occurs 445 seconds after SV 1 separation
- After SV 2 separation, vehicle coasts to perform the evasive burn and the second-stage depletion burn in view of Vandenberg tracking station to safe the stage

DTO Flight Mode Sequence of Events (Cont.)

Event	Time (Seconds)
SECO 1	632.3
Begin Maneuver to Coast Thermal Attitude	800.0
End Maneuver to Coast Thermal Attitude	1,000.0
Begin Coast Thermal Roll Maneuver	1,010.0
End Coast Thermal Roll Maneuver	2,050.0
Begin Maneuver to Restart Attitude	2,100.0
End Maneuver to Restart Attitude	2,350.0
Second-Stage Restart Ignition	2,550.0
SECO 2	2,617.0
Begin SV 1 Separation Attitude Maneuver	2,670.0
End SV 1 Separation Attitude Maneuver	2,810.0
SV 1 Separation	2,869.0
Begin Second-Stage Retro	3,041.0
End Second-Stage Retro	3,083.5
Begin SV 2 Separation Attitude Maneuver	3,090.0
End SV 2 Separation Attitude Maneuver	3,290.0
SV 2 Separation	3,314.0

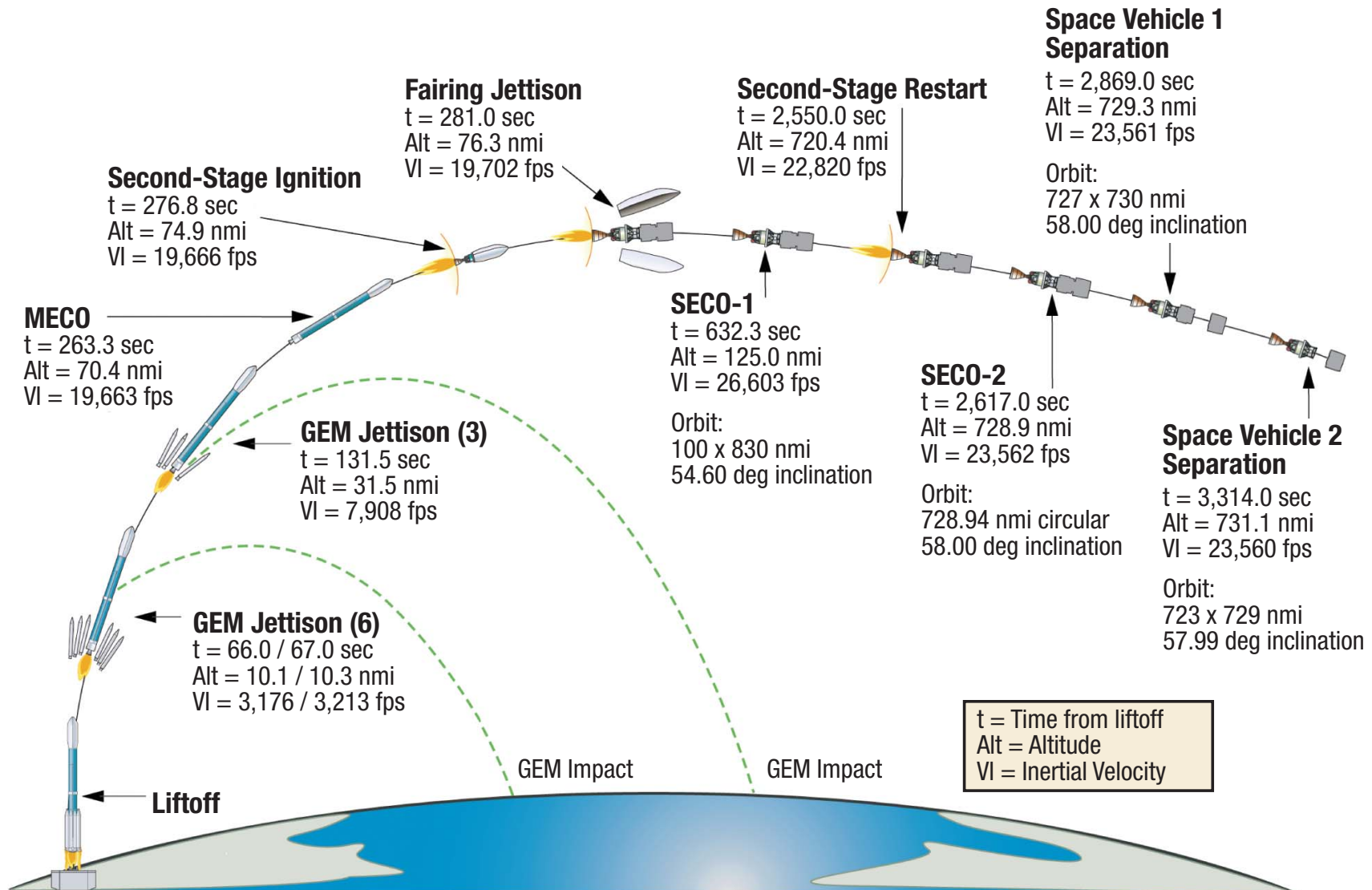
DTO Flight Mode Description (Cont.)

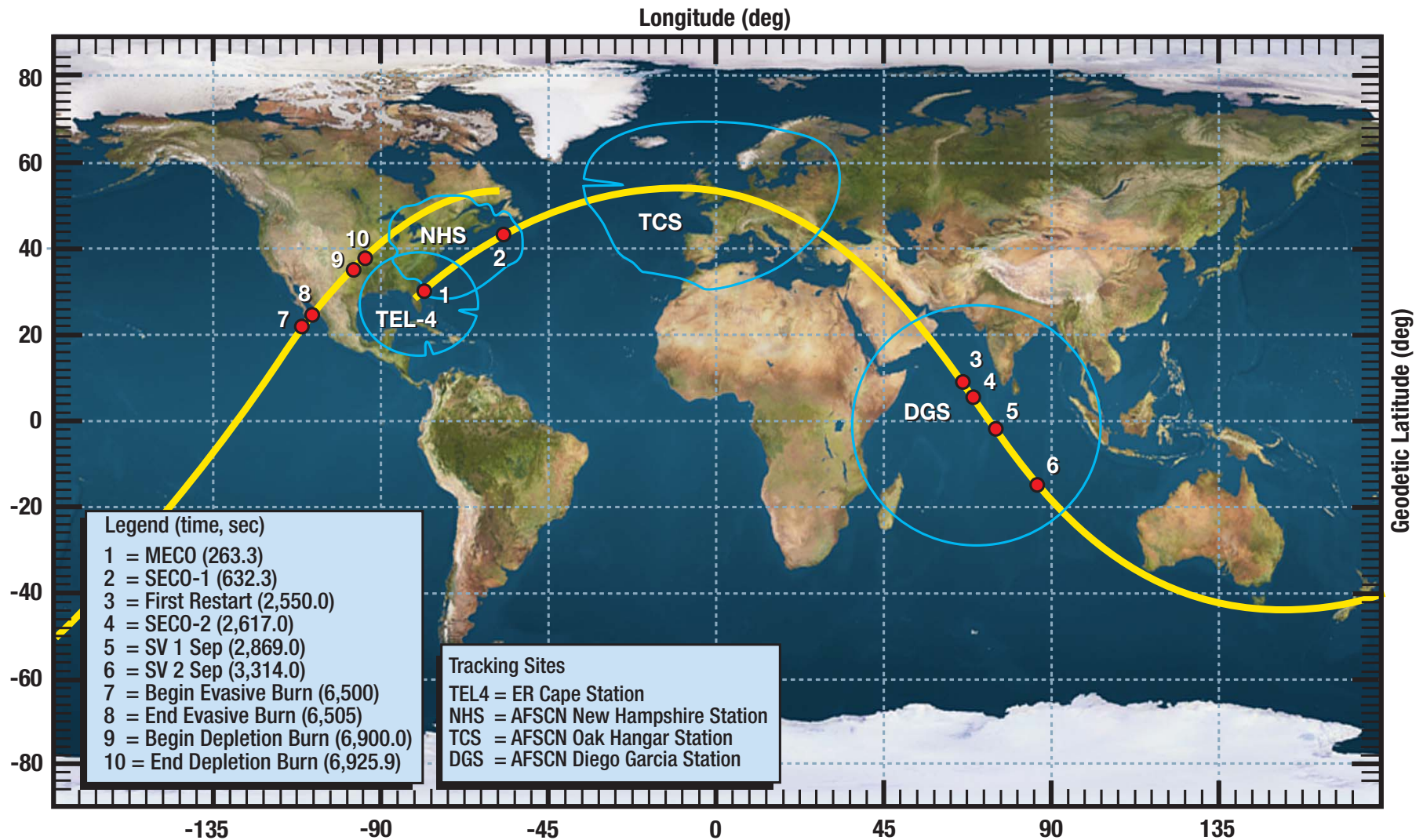
- **Following SV 2 separation, vehicle reoriented to desired evasive burn attitude**
- **Second-stage second restart (evasive burn) occurs at 6,500.0 seconds over Vandenberg tracking station and in site of JDMTA**
- **Following SECO 3, vehicle reoriented to depletion burn attitude**
- **Second-stage third restart (depletion burn) occurs at 6,900.0 seconds over Vandenberg tracking station and in site of JDMTA**

DTO Flight Mode Sequence of Events (Concl.)

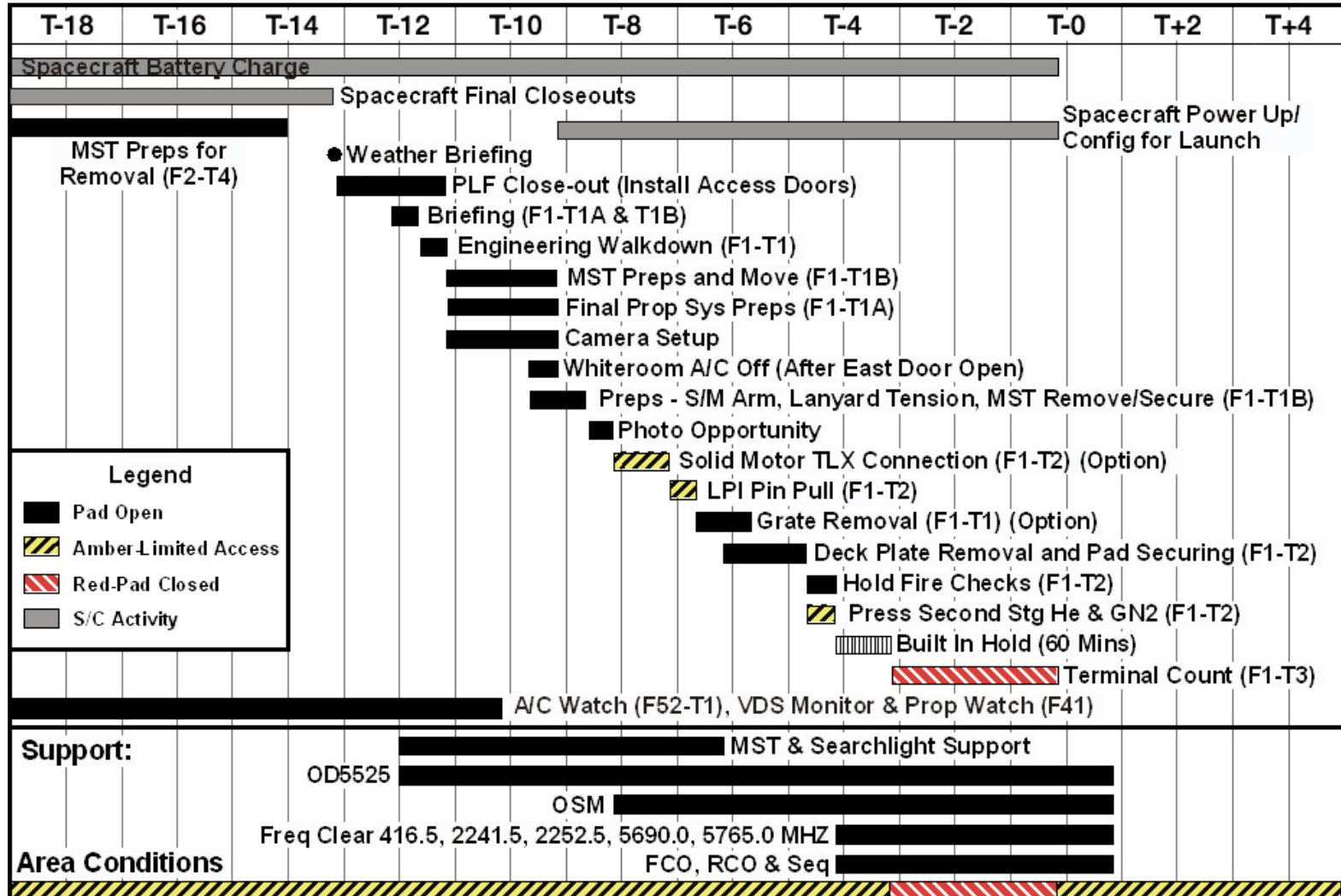
Event	Time (Seconds)
SV 2 Separation	3,314.0
Begin Maneuver to Evasive Burn Attitude	5,900.0
End Maneuver to Evasive Burn Attitude	6,300.0
Second Restart – Second-Stage Ignition (Evasive Burn)	6,500.0
SECO 3	6,505.0
Begin Maneuver to Depletion Burn Attitude	6,580.0
End Maneuver to Depletion Burn Attitude	6,780.0
Third Restart – Second-Stage Ignition (Depletion Burn)	6,900.0
Begin Depletion Burn first Pitch/Yaw Maneuver	6,901.5
Begin Depletion Burn second Pitch/Yaw Maneuver	6,909.5
Depletion Initiation	6,910.0
SECO 4	6,925.9
End Depletion Burn Maneuver	7,500.0

STSS DEMO Flight Profile





T-Times (In Hours)



Legend

- Pad Open
- ▨ Amber-Limited Access
- ▨ Red-Pad Closed
- S/C Activity

