Mission: GPS II-5

Launch Vehicle: Delta 4

Launch Date: February 20, 2014

Launch Window: 8:40 - 8:59 p.m.

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Fact SHEET

Delta rockets have been flying for more than 50 years, but the Delta 4 dwarfs its predecessors in sheer size and Earth-shaking power to launch much larger cargos than possible in the past.

Development of Delta 4 began in the mid-1990s, giving the Delta team the chance to create a fleet of heavy-lift rockets that would fly through at least 2020, lofting commercial, military and civilian spacecraft. The Delta 4 family features a brand new first stage and main engine, rebuilt launch pads at Cape Canaveral, Florida, and Vandenberg Air Force Base in California, and a new rocket manufacturing plant in Decatur, Alabama.

Image Credit: Pat Corkery/ United Launch Alliance

There are five versions of the Delta 4 launcher, each incrementally increasing the size or weight of the payload to be placed in space. All configurations feature a Common Booster Core first stage and Rocketdyne-made RS-68 liquid hydrogen/liquid oxygen main engine and an upper stage with Aerojet Rocketdyne's RL10B-2 cryogenic engine.

The upper stage and RL10 have already flown on the Delta 3 rocket, along with the Delta program's proven avionics and Redundant Inertial Flight Control Assembly (RIFCA) guidance computer.

What separates the different variants is the use of either two or four Alliant-made strap-on solid rocket motors and the selection of either a four- or five-meter diameter nose cone to enclose the satellite cargo. The solids are larger, more powerful cousins to the Delta 2 and Delta 3 motors.

The most basic version of Delta 4, known as Delta 4 Medium, is just the two-stage vehicle, no solid motors and a four-meter fairing.

As its name suggests, the Common Booster Core is "common" across all Delta 4s. A CBC measures about 150 feet (38 meters) in length, 16 feet (5 meters) in diameter and weighs 54,000 pounds unfueled.

Looking from the bottom to the top, the RS-68 powerplant and engine section are at the base of the stage. The liquid hydrogen tank accounts for about two-thirds of the stage. That portion of the CBC is covered by orange foam insulation. The white band is the known as the centerbody. The next orange section is the first stage liquid oxygen tank.

To provide additional thrust at liftoff, the Delta Medium+ rockets will sport either two or four solid-fueled strap-on boosters by ATK. The 43-foot tall motors are attached to the first stage by a ball-and-socket design.

Manufactured by Alliant Techsystems, these third-generation graphite-epoxy motors are advanced and larger versions of the boosters developed for Delta 2 and Delta 3 rockets.

The Delta 4 motors are dubbed GEM-60 because they are 60 inches (1.55 meters) in diameter. They can fly with nozzles that are either fixed or can swivel or gimbal to help steer the rocket in flight.

For the Delta 4 Medium and Medium+ 4,2 rockets, an interstage adapter that tapers from the five-meter first stage to the four-meter upper stage is used to join the two stages of the rocket. The Medium+ and Heavy rockets with five-meter upper stages have a straight barrel-like interstage.

The RL10B-2 engine, equipment shelf and liquid oxygen tank are hidden within the rocket's interstage during launch. Once the first stage has completed firing, it and the attached interstage are jettisoned to reveal the RL10. As seen on the launch pad, the top orange band of the rocket is the upper stage liquid hydrogen tank.

The stage carries about 20,400 kg (45,000 pounds) of propellant for a total burn time of around 14 minutes. A normal mission to geosynchronous transfer orbit features two firings.

For the bigger members of the Delta 4 family -- Medium+ 5,2; 5,4; and Heavy -- the stage is enlarged to five-meters in diameter in order to carry more propellant. The oxygen tank is lengthened by a half-meter and the hydrogen tank goes from four to five meters in diameter. The total fuel load is increased to 27,200 kg (60,000 pounds), extending the stage's firing time to nearly 19 minutes.

The RL10B-2 engine -- developed by Aerojet Rocketdyne on five decades of RL10 heritage -- has the world's largest carbon-carbon extendible nozzle that drops into place just after the first stage falls away. The cryogenic engine produces a thrust of 110 kN (24,750 pounds) and a specific impulse of 465.5 seconds. It has a total service life of 3,500 seconds and 15 starts, including ground testing.

Atop the upper stage sits the payload attach fitting and the satellite cargo enclosed within the fairing. The nose cone can either be a four-meter composite shroud, the new five-meter composite fairing or a five-meter aluminum fairing that Boeing already builds.

Delta 4 Family

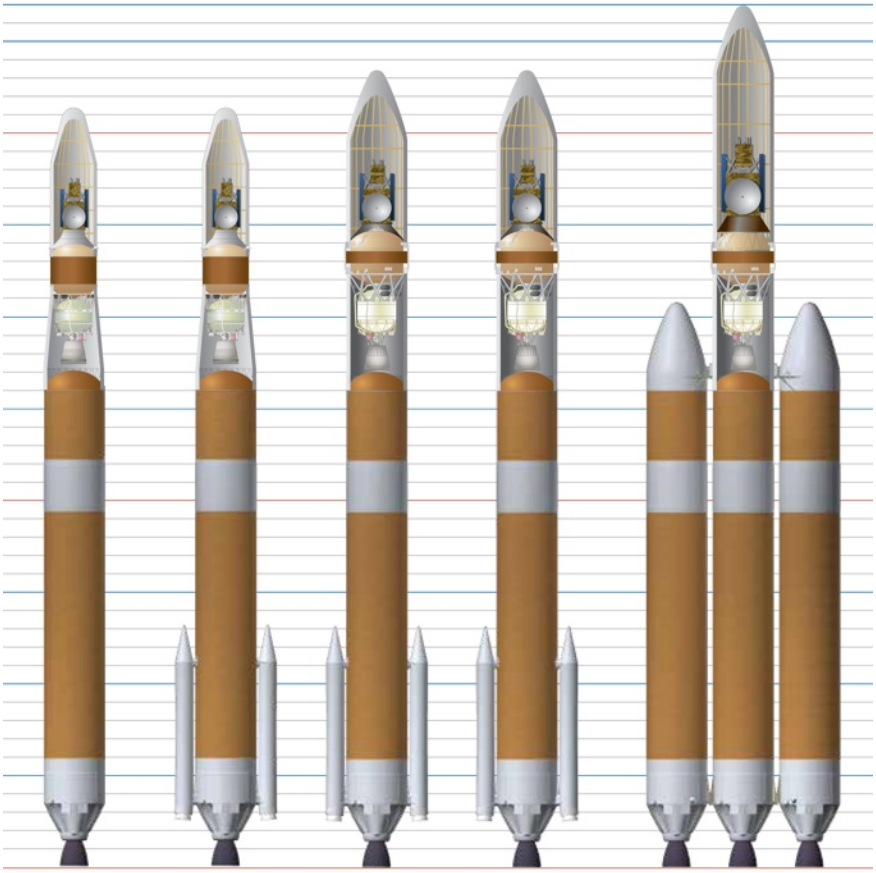

Image Credit: United Launch Alliance

Delta 4 Flight history

NUMBER	DATE	TIME / SITE	PAYLOAD	CONFIG	RESULT
1-Delta 293	20-Nov-02	5:39 p.m. CC	Eutelsat W5	Medium+ 4,2	Success
2-Delta 296	10-Mar-03	7:59 p.m. CC	DSCS A3	Medium	Success
3-Delta 301	29-Aug-03	7:13 p.m. CC	DSCS B6	Medium	Success
4-Delta 310	21-Dec-04	4:50 p.m. CC	DemoSat	Heavy	Partial
5-Delta 315	24-May-06	6:11 p.m. CC	GOES N	Medium+ 4,2	Success
6-Delta 317	27-Jun-06	8:33 p.m. VA	NROL-22	Medium+ 4,2	Success
7-Delta 320	4-Nov-06	5:53 a.m. VA	DMSP F17	Medium	Success
8-Delta 329	10-Nov-07	8:50 p.m. CC	DSP 23	Heavy	Success
9-Delta 337	17-Jan-09	9:47 p.m. CC	NROL-26	Heavy	Success
10-Delta 342	27-Jun-09	6:51 p.m. CC	GOES O	Medium+ 4,2	Success
11-Delta 346	5-Dec-09	8:47 p.m. CC	WGS 3	Medium+ 5,4	Success
12-Delta 348	4-Mar-10	6:57 p.m. CC	GOES P	Medium+ 4,2	Success
13-Delta 249	27-May-10	11:00 p.m. CC	GPS 2F-1	Medium+ 4,2	Success
14-Delta 351	21-Nov-10	5:58 p.m. CC	NROL-32	Heavy	Success
15-Delta 352	20-Jan-11	1:10 p.m. VA	NROL-49	Heavy	Success
16-Delta 353	11-Mar-11	6:38 p.m. CC	NROL-27	Medium+ 4,2	Success
17-Delta 355	16-Jul-11	2:41 a.m. CC	GPS 2F-2	Medium+ 4,2	Success
18-Delta 358	19-Jan-12	7:38 p.m. CC	WGS 4	Medium+ 5,4	Success
19-Delta 359	3-Apr-12	4:12 p.m. VA	NROL-25	Medium+ 5,2	Success
20-Delta 360	29-Jun-12	9:15 a.m. CC	NROL-15	Heavy	Success
21-Delta 361	4-Oct-12	8:10 a.m. CC	GPS 2F-3	Medium+ 4,2	Success
22-Delta 362	24-May-13	8:27 p.m. CC	WGS 5	Medium+ 5,4	Success
23-Delta 363	7-Aug-13	8:29 p.m. CC	WGS 6	Medium+ 5,4	Success
24-Delta 364	28-Aug-13	11:03 a.m. VA	NROL-65	Heavy	Success

Image Credit: Walter Scriptunas II