

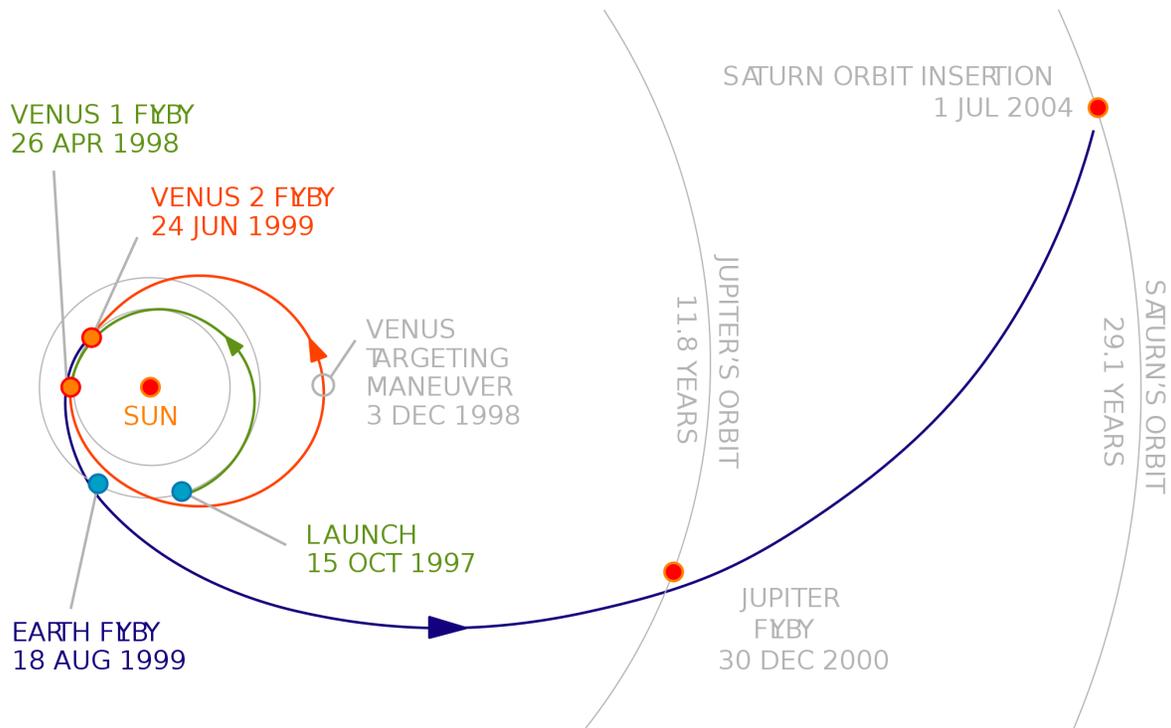
# Spacecraft Speeds

## Trajectory and Velocity of the Cassini and New Horizons Spacecraft

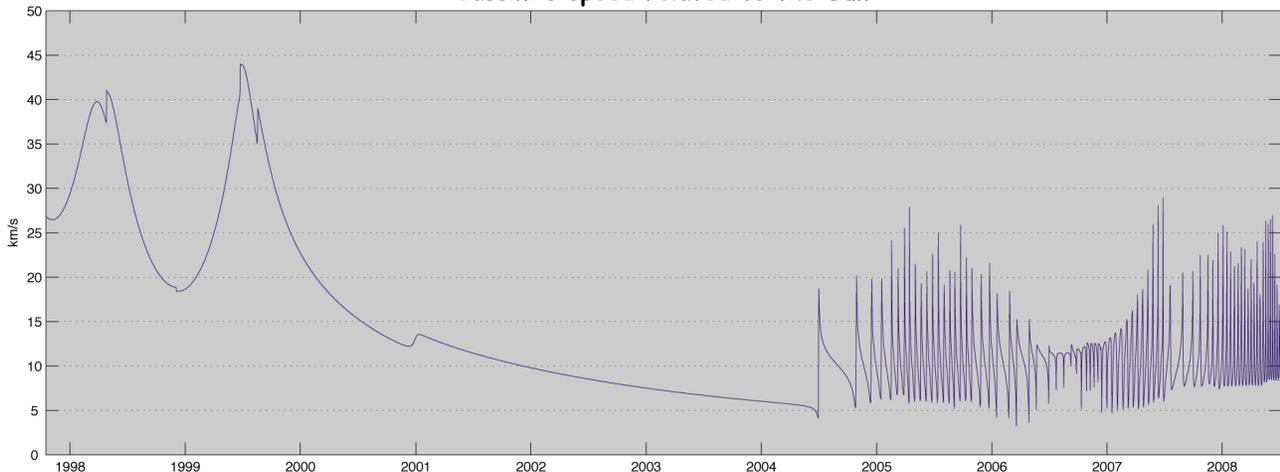
This information was provided by Tom Rudman, Galaxy Guide on the Thursday morning team:

Regarding the speed of spacecraft like Juno, the speed is not constant because transfer orbits of spacecraft to planets are elliptical or hyperbolic. I was curious on what typical speeds are so I did some research. I could not find any details for the Juno spacecraft, so I looked at two others, Cassini (Saturn) and New Horizons (Pluto). New Horizons left Earth at the fastest speed of any spacecraft.

The plot below shows Cassini's velocity over its life, relative to the Sun. It had two Venus gravitational-assist fly-bys and one at Earth. You can see the fly-bys and their increase on the spacecraft's velocity. You can also see the velocity drop off as it gets further from the Sun. The fly-bys change the velocity of the spacecraft as the orbit is the closest to the Sun (velocity highest) and you can see the affect on Cassini's orbit. New Horizons' mission profile had a gravity assist from Jupiter (Feb 2007) and is headed to a fly by of Pluto in July 2015 (which is fast). Juno's mission profile has one gravity assist from Earth and its velocity will be lower than Cassini's.



Cassini's speed related to the Sun



## Speed Comparisons

	<u>Cassini</u>	<u>New Horizons</u>
Spacecraft weight	12,593 lb (Size of a school bus)	1050 lbs (Size of a piano)
Launch Vehicle	TIVB-Centaur	Atlas V 551 (5 solid motors)
Leaving Earth (Relative to Earth)		36,000 mph (16 km/sec)
Jupiter Fly by (Relative to the sun)	29,000 mph (13 km/sec)	51,000 mph (23 km/sec)
1.8 billion miles, halfway to Pluto (Relative to the sun)	NA	35,000 mph (15.8 km/sec)

New Horizons past the moon's orbit in 9 hours after launch (it took Apollo a few days) and it reached Jupiter in 1 year, Cassini took 3 years.