For SpaceX, Falcon 9 reuse is now essential

Enlarge / SpaceX added a new core to its fleet with the Demo-2 mission in late May.

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On Tuesday, SpaceX will attempt to launch a 3.7-ton Global Positioning System (GPS) satellite for the US Air Force. This GPS III launch is scheduled to occur on a Falcon 9 rocket between 3:55pm ET and 4:10pm ET (19:56-20:10 UTC) from Cape Canaveral Air Force Station in Florida.

The launch marks the first time that SpaceX will seek to recover a booster used to launch a satellite for the US military. Although the launch was originally contracted to fly on an expendable booster, Space News reports that the US Space Force's Space and Missile Systems Center agreed to revise some mission requirements so SpaceX could fly back the booster. In return, the company took "several million dollars" off the price of the launch, which was originally awarded to SpaceX in 2017 for $96.5 million.

SpaceX needs this first stage back to help balance out a busy second half of the year.

On May 11, 2018, the company launched the first of its new "Block 5" version of its Falcon 9 rocket. This new version of the first stage incorporated all of the company's previous performance upgrades to the Falcon 9 rocket while also

maximizing its reuse. It worked—SpaceX has now flown two different Falcon 9 cores five times, and it may fly a first stage for the sixth time later this summer.

The success of the Block 5 rocket means that SpaceX has had to devote less time and resources to building Falcon 9 first stages. Since May 2018, it has launched 31 times on a Block 5 version of the Falcon 9 rocket—while using just 10 cores. Put another way, reuse has saved SpaceX the cost of 189 Merlin rocket engines, dozens of fuel tanks, and many complex avionics systems.

But just four of these ten first stages remain. In the last two years, SpaceX has lost a couple of the first stages—for example, in December 2018 a grid fin pump failure caused a first stage to land just offshore Florida—and it has purposely expended some during the launch of particularly heavy payloads. So of its fleet of 10 Falcon 9 rocket first stages (based upon input from readers and this resource at the r/SpaceX subreddit), SpaceX presently has only these cores in service for Falcon 9 launches:

Booster 1049

- Five missions flown (September, 2018-present)
- Days since last flight: 27
- Next flight: Unknown

Booster 1051

- Four missions flown (March, 2019-present)
- Days since last flight: 69 days
- Next flight: Starlink-9 (early July)

Booster 1058

- One mission flown (May, 2020-present)
- Days since last flight: 31
- Next flight: Unknown (possibly Anasis-2 in July)

Booster 1059

- Three missions flown (December, 2019-present)
- Days since last flight: 17
- Next flight: Unknown

Tuesday's launch of the Lockheed Martin-built GPS III satellite, therefore, will add a new booster to SpaceX's fleet of first stage rockets. The company has two more new Falcon 9 first stage boosters in the pipeline as well, with another GPS III mission coming in August and then the Crew-1 mission carrying four NASA astronauts to the International Space Station likely some time in September.

Nevertheless, SpaceX will have to be careful in managing its fleet. The company has a busy second half of 2020 planned, with approximately six additional Starlink internet satellite launches, several commercial missions, a couple of NASA launches, and a couple of US military launches on its manifest.

To complete all of these missions will require the company to continue to successfully return its first stages, push beyond five flights per booster, and possibly further reduce the turnaround time between missions. So far, the company's record for the time required to check and re-certify a Falcon 9 first stage for flight is 63 days.

The bottom line is that today's launch of a Falcon 9 rocket is an essential mission for the US Air Force. But for SpaceX, getting the new core back on the *Just Read the Instructions* droneship will be just as important to flying out a lengthy manifest in 2020. Reuse is no longer experimental; it's on the critical path.

The webcast below should begin about 15 minutes before the launch window opens.

[embedded content]

GPS III launch.
https://arstechnica.com/?p=1687383