

By Tereza Pultarova

Dragon: A Breakthrough Mission

The Dragon mission is a milestone for international spaceflight. This is the first time that a commercial spacecraft has flown to the ISS and docked with the Station," European astronaut André Kuipers wrote in his blog after the Dragon capsule departed from the International Space Station and headed for splash down into the waves of the Pacific Ocean. "You could say a new era of spaceflight have begun," the astronaut concluded, "soon private companies will take people to and from space." Kuipers, together with his American counterpart astronaut Don Pettit, was in charge of the berthing operations. On the 26th of May, the whole world was watching as these two men carefully operated the two spacecraft and the robotic arm to connect the private space capsule to the Harmony node of the space station. Especially nervous, but also incredibly relieved, was Elon Musk, the former PayPal entrepreneur and Dragon's spiritual father. Back in 2002, he founded Space

Exploration Technologies (SpaceX) and invested \$100 million dollars of his own money in his vision to provide cost effective space transportation. Ten years later he is celebrating a major success that some liken to the achievements of NASA in the Apollo era.

A Journey to Make History

It was probably one of the biggest events in the world of spaceflight in the whole year. If 2011 was a year of nostalgia because of the Space Shuttle retirement, 2012 is a year of excitement and thrill about a new age of private spaceflight.

But the journey wasn't all that easy. In August 2006 SpaceX signed a \$1.6 billion contract with NASA as a part of the space agency's Commercial Orbital Transportation Services program (COTS). It happened right after the fail-

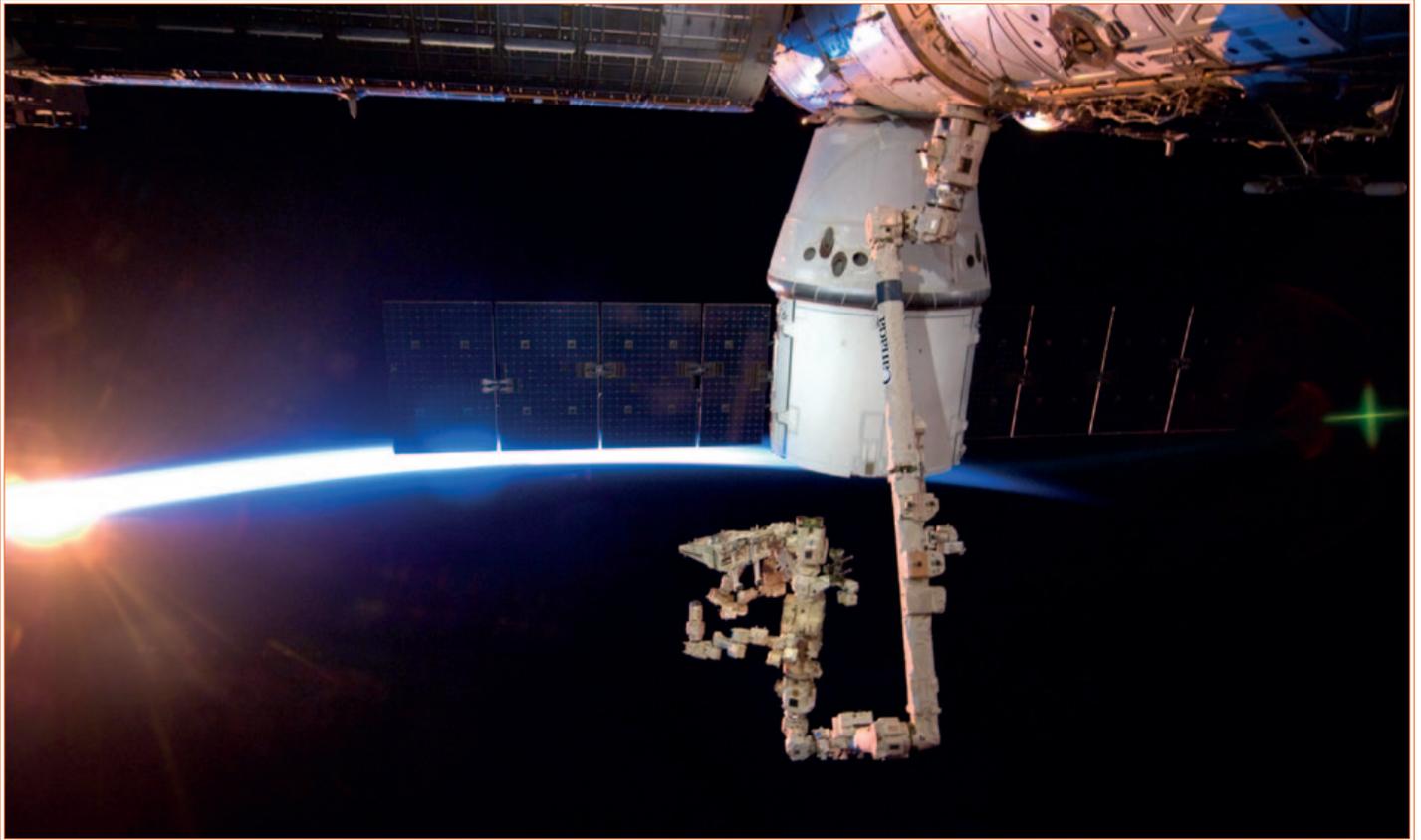
“Kuipers: The Dragon mission is a milestone for international spaceflight,”

ure during the maiden flight of Falcon 1, a small partially reusable rocket, which exploded immediately after lift off due to a fuel line rupture.

As a part of the COTS contract, SpaceX committed to design and demonstrate a launch system that would be able to provide regular resupply missions to the ISS. The retirement of the Space Shuttle was already planned and instead of developing a new family of launchers and spacecraft for near Earth space travel, NASA wanted ▶▶



The first attempt to send Dragon towards the ISS was stopped by an automated program that had identified a faulty check valve in the last second of the countdown. - Credits: NASA



The Dragon connected to the International Space Station. - Credits: NASA

to focus on deep space exploration and eventual human missions to an asteroid or Mars. SpaceX was expected to become the first regular private provider to take the burden of regular missions to ISS off NASA's shoulders.

The first demonstration flight of Dragon took place in December 2010, two years after it was initially scheduled. Still, it was enough for SpaceX to become the first private company ever to succeed in launching, orbiting, and recovering a spacecraft. Dragon was sent to space atop the medium lift Falcon 9 rocket, successfully reached orbit, and twice circled around the Earth. After a controlled reentry, it was recovered from the Pacific Ocean off the coast of Mexico.

It took another year and a half to bring Dragon to its rendezvous with the International Space Station. The historical flight was subject to extreme scrutiny: previously governmental agencies had exclusive access to space in the framework of the human space program. "The whole Gemini program had test objectives that, in essence, are all being condensed into this one mission," said Jeff Greason, founder and CEO of rival company XCOR Aerospace. "If they get even halfway there, that's still one for the books."

Three, Two, One and Lift Off... Oh, Actually, Cut Off!

The test flight required to prove the ability of Dragon to berth with the ISS was initially scheduled for December 2011. It was the last milestone to be completed before the private capsule starts delivering regular supplies of food, water, scientific experiments, and propellant to the orbital outpost. Dragon would also restore the capability, lost

“Dragon restores the capability to return voluminous material to Earth,”

with the Space Shuttle, to return voluminous material to Earth.

The software controlling the automated spacecraft was mainly responsible for the delay of the last test flight. After the April rescheduling, SpaceX founder Elon Musk explained to the media that the system was basically too sensitive: "the Dragon essentially gets scared and runs away when it shouldn't," he said.

After final approval by NASA, ISS managers, and SpaceX engineers, Falcon 9 with the Dragon capsule aboard was standing on the launch pad in Cape Canaveral on early morning May 19, ready to blast off. But instead of relief and celebrations came a rather heart stopping moment. Even NASA announcer George Diller was at a loss for words when, after the successful countdown and beginning of the ignition sequence, the rocket didn't go anywhere. Speaking on the live footage from the attempted launch, Diller was heard counting: "Three, two, one, zero and liftoff!" When he realized that the rocket was still on the pad, he reported: "We've had a cutoff! Liftoff did not occur." Later on, a faulty check valve was determined as the reason why the automatic computer stopped the launch in the last second.

Due to the fuel demanding orbital maneuvers ahead of Dragon, its launch ▶▶



European astronaut André Kuipers unloading supplies from inside the capsule.

Credits: NASA

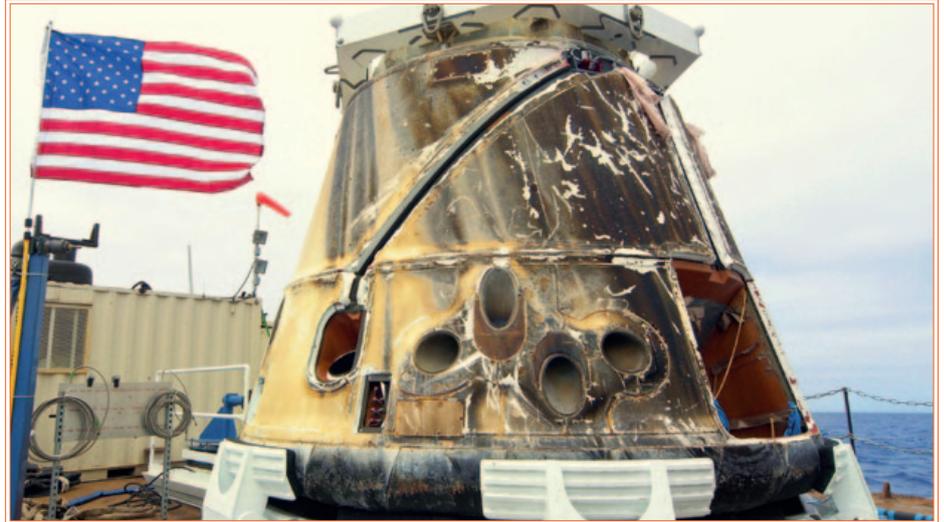
window was extremely narrow. Once the right second was missed, SpaceX had to wait for another three days to embark on its maiden mission towards the ISS.

What's Next?

I think it really shows that commercial spaceflight can be successful," Musk commented after Dragon concluded its mission by splashing into the waters of the Pacific Ocean on the morning of June 1. "This mission worked for the first time right out of the gate. It was done, obviously, in close partnership with NASA, but in a different way, and it shows that that different way works and we should reinforce that," he said.

But what is coming next? Aren't the expectations too high? Is the onset of private human spaceflight really going to turn the space travel into a treat available for everyone? The first regular service flight of Dragon might take place as early as September. And there are other players lining up to prove their abilities. The next commercial vessel that will attempt to rendezvous with ISS could be Orbital Science's Cygnus vehicle in December, while Boeing, Virgin Galactic, and Alliant Techsystems are working hard to reach their milestones.

It seems that just a few decades after the end of the space race between the USA and USSR, a new competitive paradigm is on the rise: the paradigm of free market competition in space. And while the legal community will probably have considerable work to do to adjust the current framework to the new circumstances, the ambitious dreams



The spacecraft was successfully recovered after splashing down into the Pacific Ocean. Recovery will allow restoring large downmass capability which had been lost with retirement of the Space Shuttle. - Credits: SpaceX

of those involved are already one step closer.

Last year, NASA awarded SpaceX additional \$75 million to develop a revolutionary launch abort system that would enable Dragon to safely carry astronauts to orbit. This milestone should be achieved by 2015 and regain America the ability to send crews in space aboard a US vehicle.

Speaking with CBS earlier this year, Musk revealed that his ambitions are even more daring: "I think it's important that humanity become a multi-planet species, I think most people would

“Musk: It's important that humanity become a multi-planet species,”

agree that a future where we are a spacefaring civilization is inspiring and exciting compared with one where we are forever confined to Earth until some eventual extinction event. That's really why I started SpaceX.”

Working towards his goals steadily, Musk included an on-target propulsive landing system into the human rated version of the Dragon capsule. This feature could potentially enable it to land on other planetary bodies with less dense atmosphere, or no atmosphere at all.

At the same time, SpaceX is developing the Falcon Heavy, a rocket capable of lifting up to 53 metric tons to low Earth orbit. Several studies are considering the use of Falcon Heavy and modified Dragon capsules to send large scientific payloads to Mars, a scenario technically within the capability of SpaceX's hardware. Bringing these ideas to the extreme, Dutch private venture Mars One has recently unveiled its plan for human colonization of the red planet by 2023 using vehicles derived from the Dragon capsule.



Mars One proposed an ambitious plan to colonize Mars by 2023 using vehicles derived from the Dragon capsule. - Credits: Mars One