National Aeronautics and Space Administration

NASA's Evolutionary Xenon Thruster–Commercial (NEXT–C)

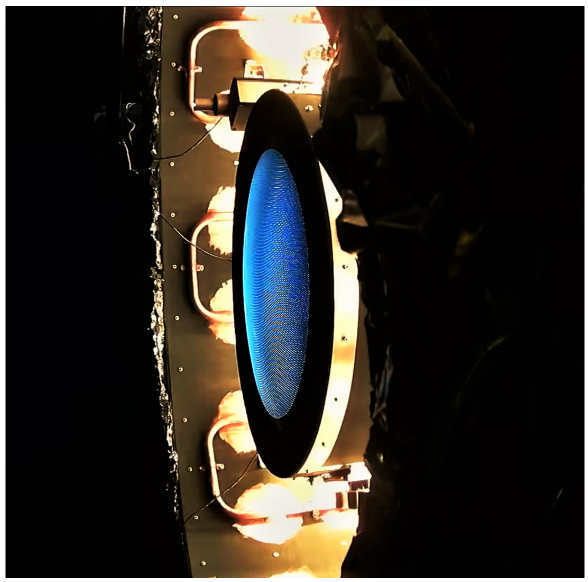
NASAfacts

NEXT Overview

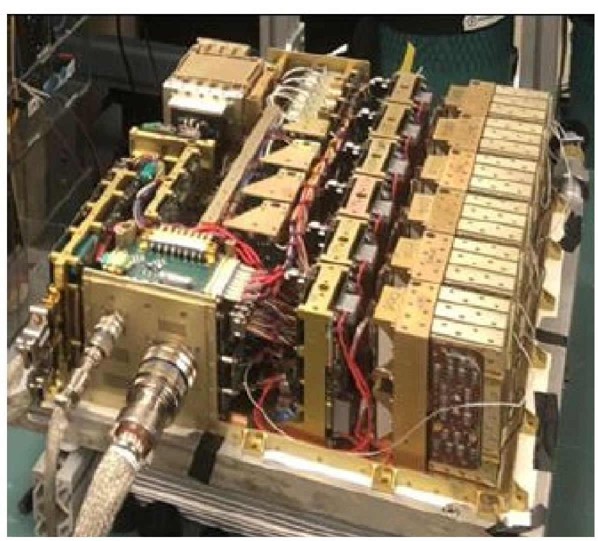
NASA's Evolutionary Xenon Thruster (NEXT) is a 7-kW class gridded ion thruster propulsion system. Gridded ion thrusters, first demonstrated at NASA Glenn Research Center (GRC) in 1959, are a type of electric propulsion that uses electric and magnetic fields to efficiently create and accelerate ions. These systems are capable of producing propellant exhaust velocities over ten times higher than conventional chemical rockets, leading to a highly efficient use of propellant to produce thrust. NEXT is an evolutionary design of the 2.3 kW NASA's Solar Electric Propulsion Technology Application Readiness (NSTAR) thruster that successfully propelled NASA's Deep Space 1 and Dawn missions. NEXT combines the best elements of NSTAR with cutting-edge design to yield a thruster with unparalleled specific impulse, specific mass, throttling range, and life capability. Higher efficiency and specific impulse, and lower specific mass, will reduce the wet propulsion system mass and part count. The higher propellant efficiency enables missions to reduce required on-board propellant, allowing for a larger delivered payload mass and a smaller launch vehicle. In addition, by combining NSTAR topologies with an advanced modular beam power supply, the power processing unit (PPU) is highly efficient over a broad throttle range, with a much lower specific mass.

System Input Power Range, kW	0.6 – 7.4
Thrust, mN	25-235
Maximum Specific Impulse, s	4220
Maximum Thruster Efficiency	70%
Maximum PPU Efficiency	94%
Maximum Beam Current, A	3.52
Maximum Beam Voltage, V	1800
Thruster Mass (with harness), kg	<14
PPU Mass, kg	<36

NEXT was developed for a wide range of NASA science missions, including Flagship, New Frontiers and Discovery class missions. Several missions are enhanced or enabled by NEXT over state-of-the-art electric propulsion and chemical alternatives. NEXT is ideal for many classes of NASA science missions because it reduces on-board propellant and accommodates large changes in input power over mission trajectories into deep space. NEXT may also shorten the mission trip time by avoiding multiple planet fly-bys that chemical propulsion spacecraft need for a boost.

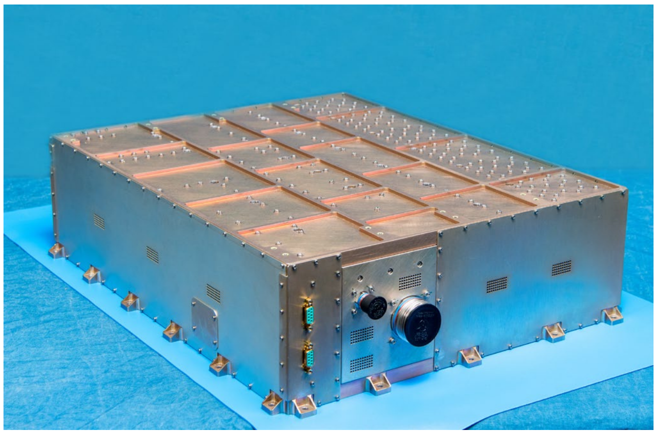


By 2012, high fidelity NEXT hardware was produced by the government/industry team, including a flight prototype model (PM) thruster, an engineering model (EM) PPU, EM propellant management assemblies, a breadboard gimbal, and control unit simulators.



The NEXT-C Project

The NASA's Evolutionary Xenon Thruster – Commercial (NEXT-C) project, funded by NASA's Planetary Science Division, was initiated in 2015 to complete development of the NEXT system for use on future missions. Aerojet Rocketdyne was awarded the contract with ZIN Technologies as a major subcontractor. In 2019, the NEXT-C project was directed to provide a flight thruster and PPU for the Double Asteroid Redirection Test (DART) mission.



In 2019, Aerojet Rocketdyne and ZIN Technologies completed fabrication of the DART flight thruster and PPU and began protoflight testing. Component level testing, including performance, random and sine vibration, and thermal vacuum testing was performed on both thruster and PPU, while the PPU also underwent EMI/EMC and extended burn-in testing. The flight thruster and PPU were then integrated together for system testing at NASA GRC, with the PPU operated by flight software provided by the Johns Hopkins University Applied Physics Laboratory (APL). Flight testing was successfully completed in February 2020, with the hardware being accepted by NASA in summer 2020 and subsequently delivered to APL. The flight thruster and PPU were then integrated onto the DART spacecraft, which is scheduled for launch in November 2021 – February 2022. DART will be the first flight of the NEXT-C technology.

What's Next for NEXT?

NASA GRC, Aerojet Rocketdyne, and ZIN Technologies will continue to provide mission support to DART to ensure a successful flight demonstration of the NEXT-C technology. In addition, NASA GRC is presently developing a testbed for ground-based investigations which will facilitate rapid anomaly resolution in the events issues are encountered during NEXT-C commissioning and subsequent operations.

NASA GRC is also exploring expansion of NEXT-C's capabilities to higher thrust-to-power operation, under an Interagency Agreement with the United States Space Force (USSF). These higher thrust, lower specific impulse operating conditions are more desirable for Earth-orbiting applications where high propellant efficiency isn't as critical as it is for NASA deep space science missions. Thruster and PPU development efforts are underway that will achieve higher input power and thrust necessary for more optimal commercial Earth orbit and military Cislunar applications. By expanding system capabilities even further, NEXT will enhance and enable even more future missions for industry, NASA and other government agencies.

https://next-c.grc.nasa.gov/

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