

CECE



Pratt & Whitney Rocketdyne



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Sustainable Exploration Through Common and Extensible Propulsion Systems

Pratt & Whitney Rocketdyne (PWR) is applying its unmatched five-decade cryogenic upper-stage rocket engine experience to the development of propulsion systems that will support NASA's Vision for Space Exploration, which calls for humans to return to the moon by 2020 and eventually explore Mars and beyond.

Under contract to NASA, PWR is developing the Common Extensible Cryogenic Engine (CECE), a new deep-throttling, 15,000-pound thrust-class cryogenic rocket demonstrator engine, to validate technologies that support a wide range of lunar and in-space mission applications, such as crew exploration, lunar landing and transfer vehicles.

During a series of CECE ground tests accumulating over 5,000 seconds of hot-fire time, critical propulsion technologies and capabilities were validated in support of NASA's Constellation Program and its Altair Lunar Lander, whose mission is to descend from lunar orbit and land on the moon's surface. Operated during testing at the widest throttle range of any known high-performance cryogenic engine, the CECE demonstrated an unprecedented throttling range of 104 percent of potential power down to just eight percent thrust; a 13:1 deep-throttling capability. The CECE's incredible throttling capability is applicable not only to the moon missions but also to future planetary explorations.

The liquid oxygen and liquid hydrogen-fueled CECE technology development test bed evolved from the mature and flight-proven design of PWR's RL10 upper-stage engine, one of the safest and highest-performing rocket engines in the world. Since entering service in 1963, the RL10 has helped to launch government and commercial satellites into orbit and has powered space probe missions to nearly every planet in our solar system. Today, PWR's RL10 continues its legacy of exceptional launch support by providing upper-stage propulsion for the Atlas and Delta launch vehicles. Building upon the RL10 design, CECE incorporates a new injector and propellant feed

system to manage pressure, temperature and propellant flow throughout its range of throttled operation.

The CECE brings an unprecedented combination of technology, performance and reliability together in a single high-energy cryogenic package that provides an affordable, low-risk propulsion solution for multiple applications. Future propulsion systems derived from the CECE, will employ common, proven, design elements that can be readily tailored to meet specific mission requirements, significantly reducing development cost while maintaining unparalleled demonstrated reliability.



CECE	CECE Base Demo	Methane Option
Characteristics		
Propellants:	H ₂ /O ₂	CH ₄ /O ₂
Thrust:	15,000 lb	15,000 lb
Specific impulse:	>445 sec	>350 sec
Throttling:	10-20:1	3-5:1
Reliability:	>0.9995	>0.9995
Starts: (total)	50	50
Service life: (total)	10,000 sec	10,000 sec
Weight:	350 lb	350 lb
Human ratable:	Yes	Yes

PRATT & WHITNEY ROCKETDYNE, a United Technologies company with sites throughout the United States, is dedicated to providing advanced, reliable and cost-effective propulsion systems for spacecraft and missile propulsion systems and service.



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