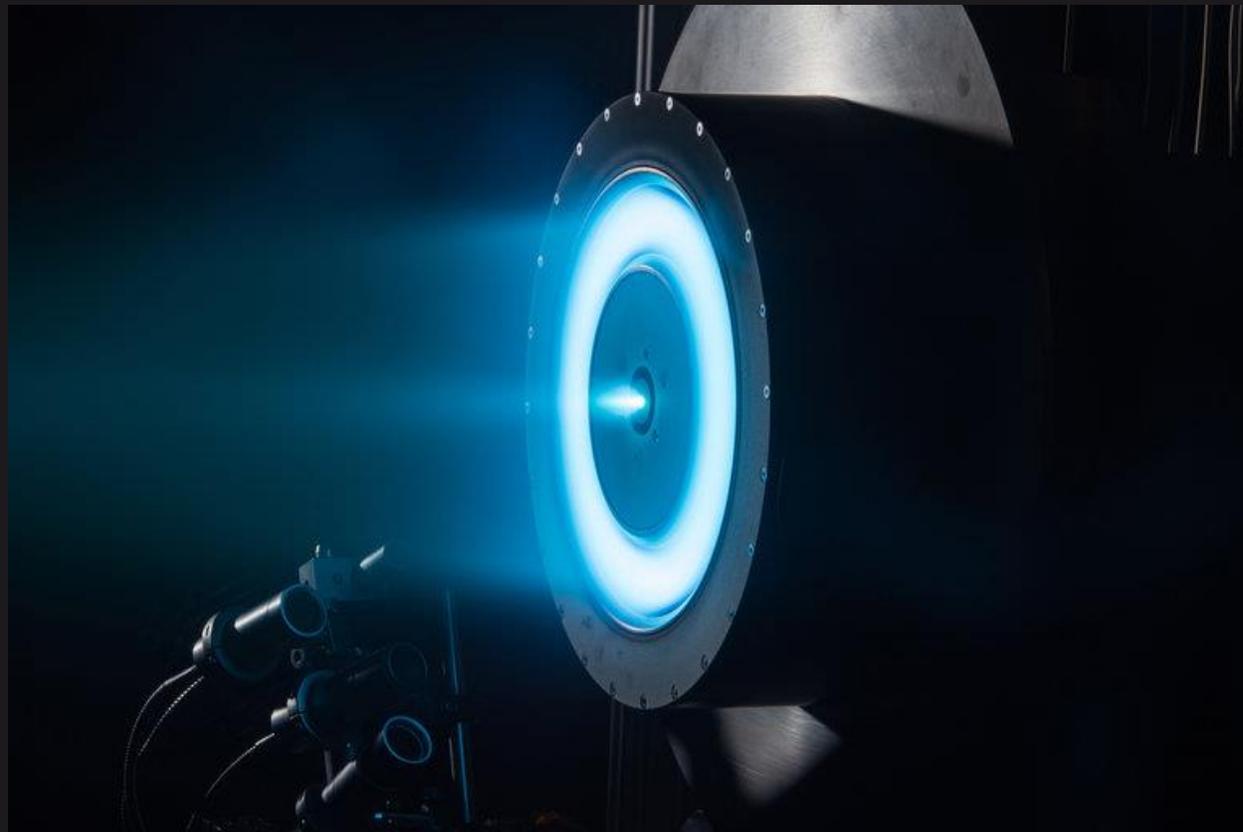


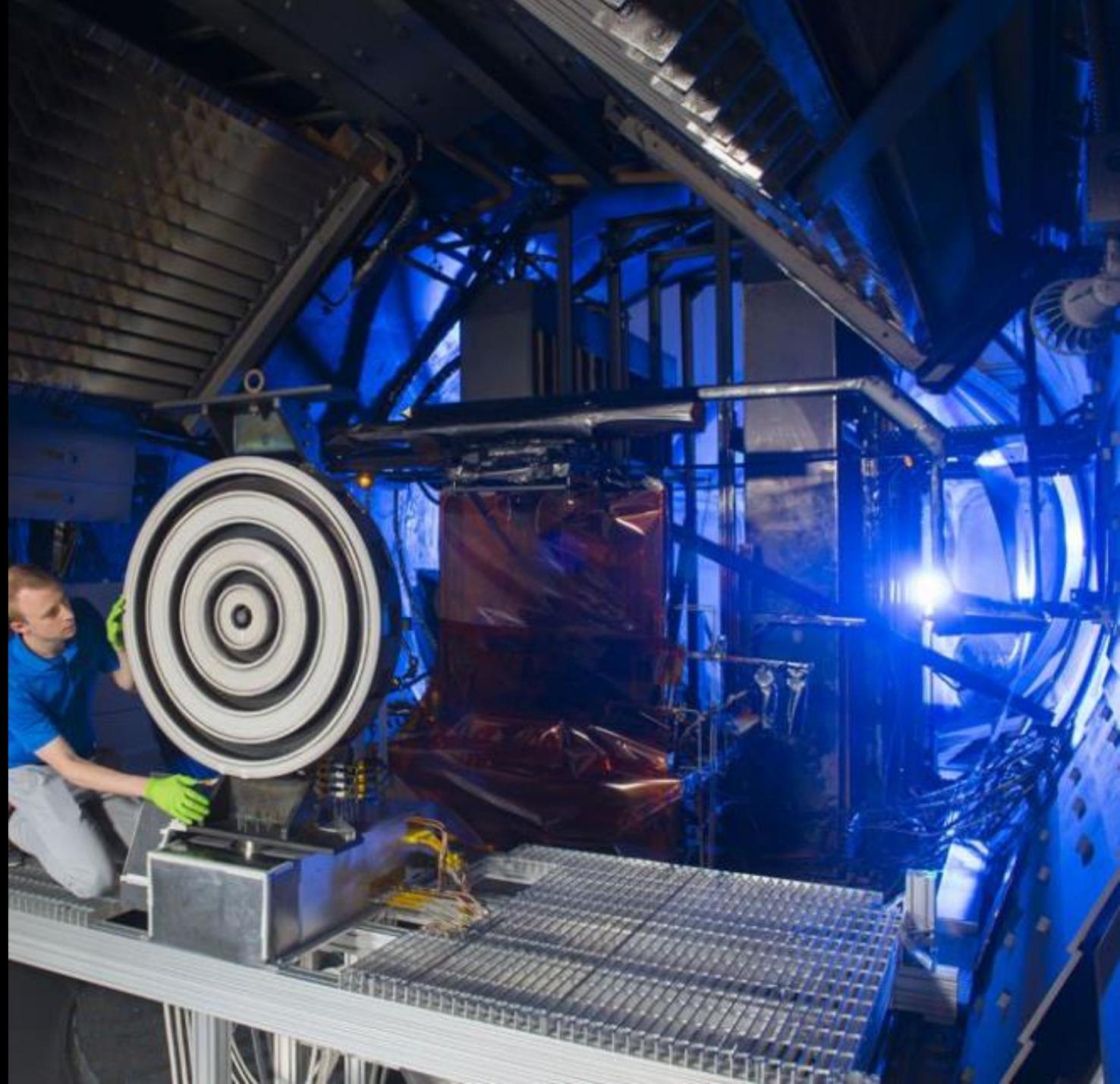
# ION PROPULSION

The Future of Interplanetary Travel



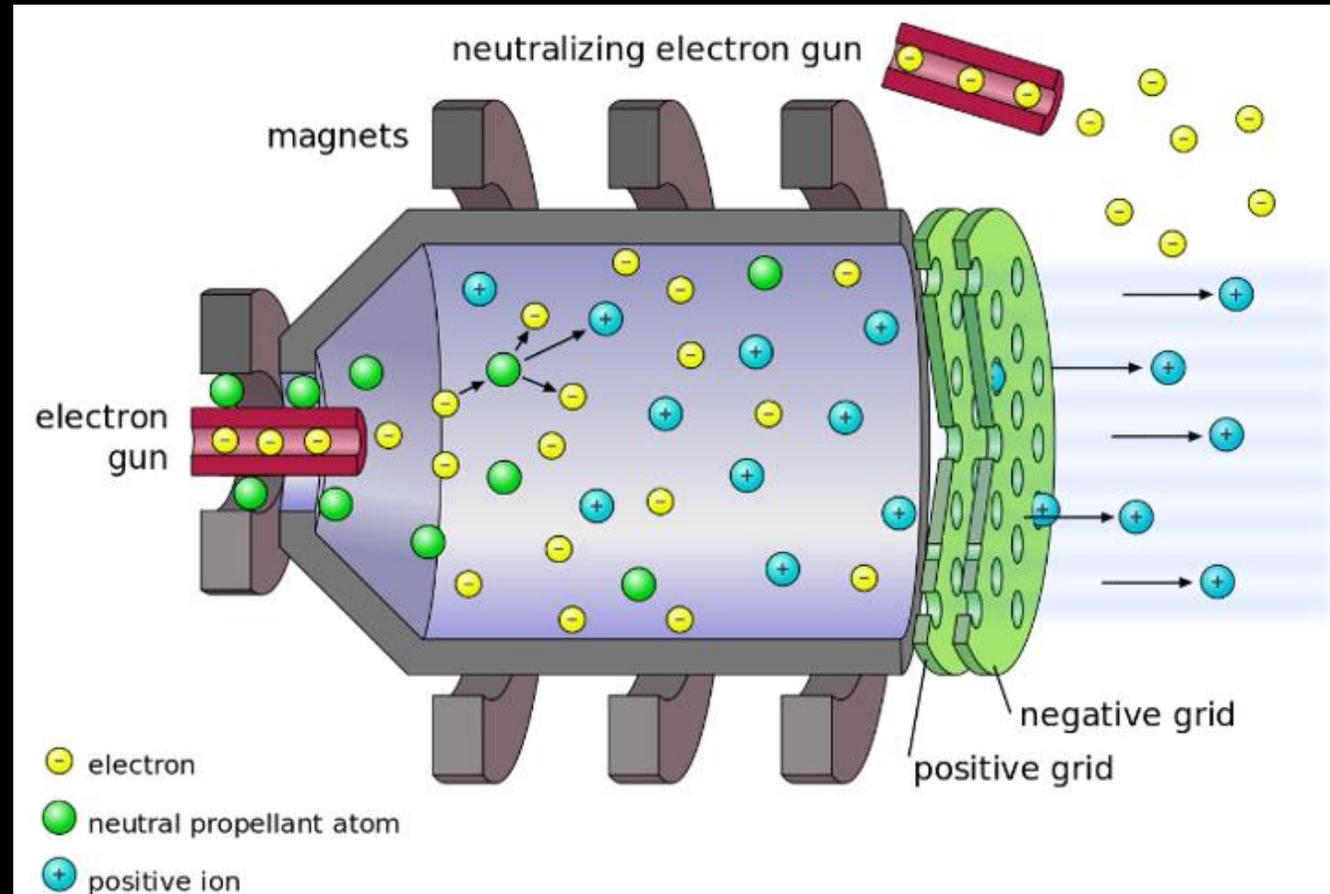
# What is it?

- Propulsion system using ionized atoms to provide thrust
- Small acceleration for long periods of time
- Large changes in speed for long haul missions



# How does it work?

- Electrons fired at neutral propellant atoms to create charged ions
- Charged ions influenced by voltage to move toward rear of engine chamber
- Ions fired out of the thruster by charged plates called grids



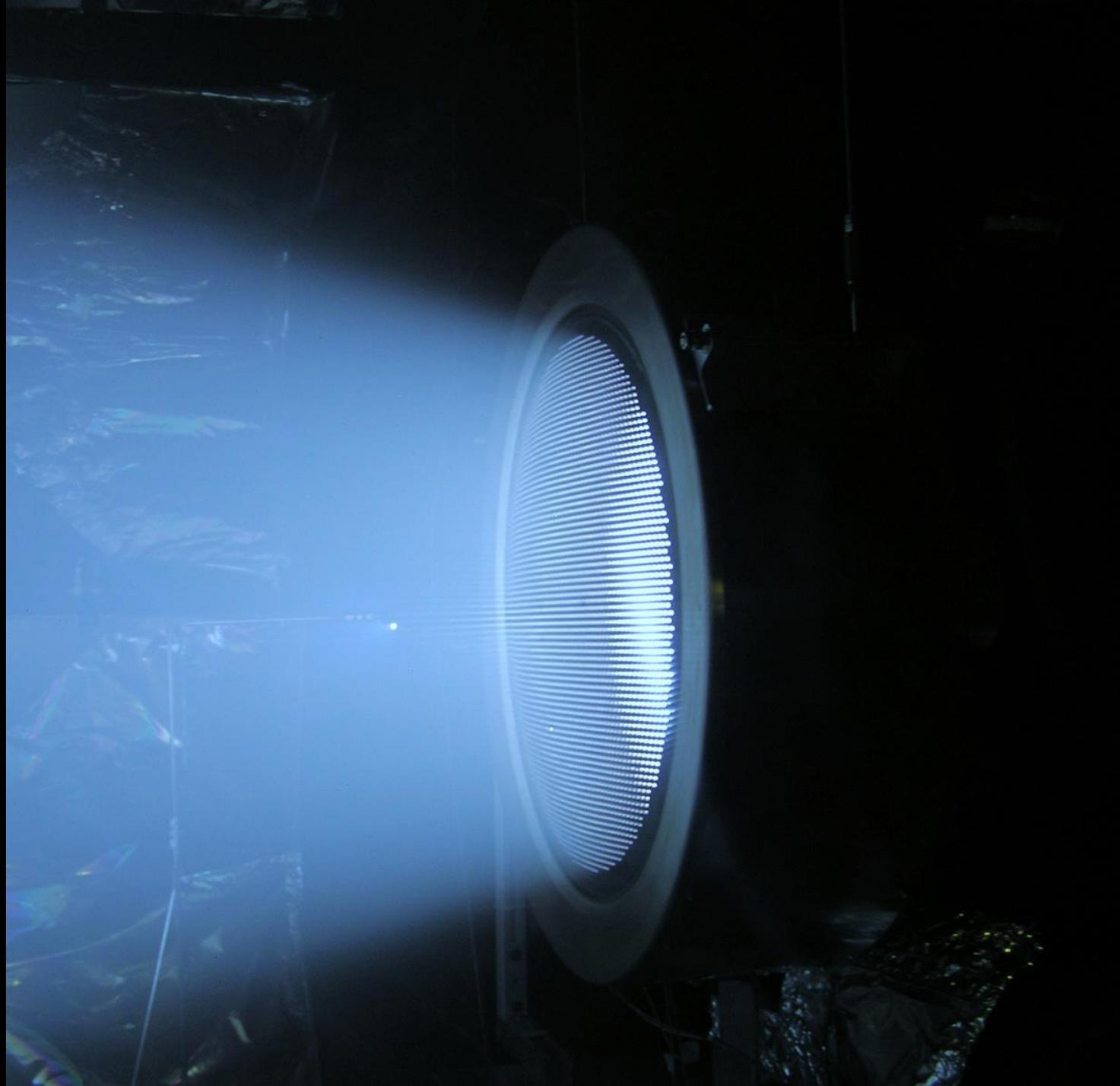


# Ion Thrusters vs. Chemical Rockets

- Chemical Rockets provide large amounts of energy in short amounts of time
- Ion thrusters provide constant small amounts of energy for extended periods of time
- Ion engines do not have the capability to get spacecraft from surface to orbit
- Ion engines can be best used for long haul missions in conjunction with chemical rockets

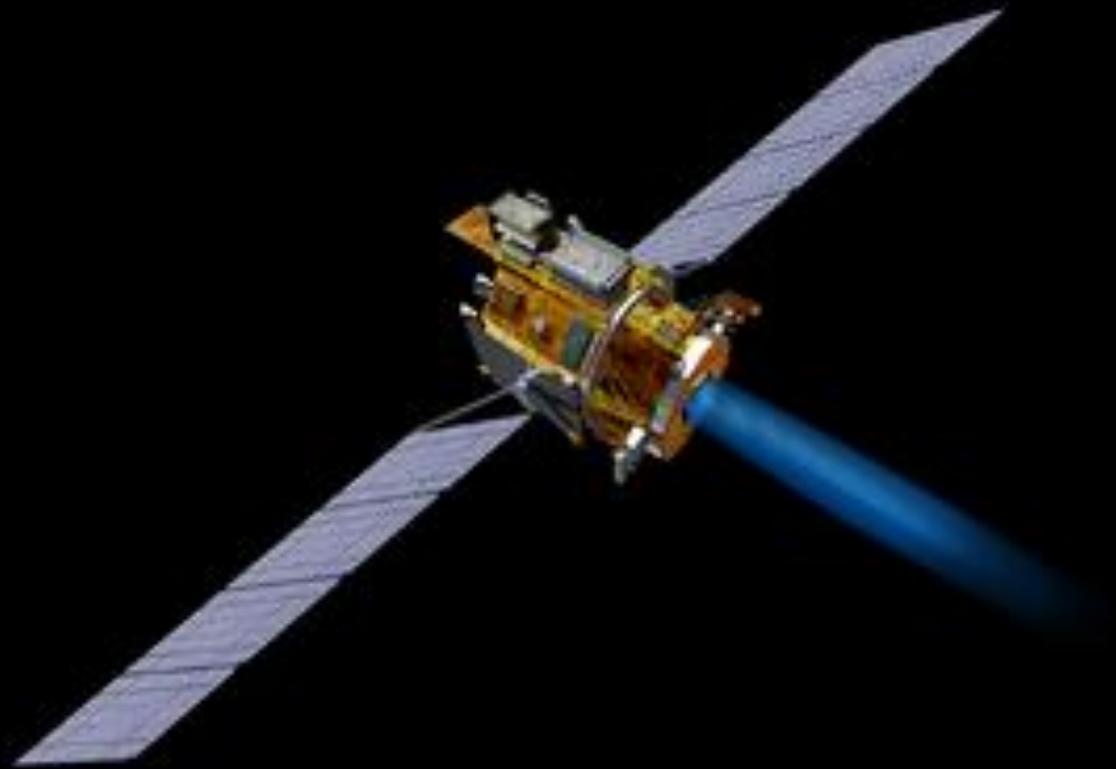
# Benefits of Ion Propulsion

- Accelerates atoms to 90 km/s
  - 90% efficiency (vs 35% efficiency traditional propulsion)
  - Lightweight, requires much less propellant
  - Reliability, has been tested to run without fail for over 6 years
- 



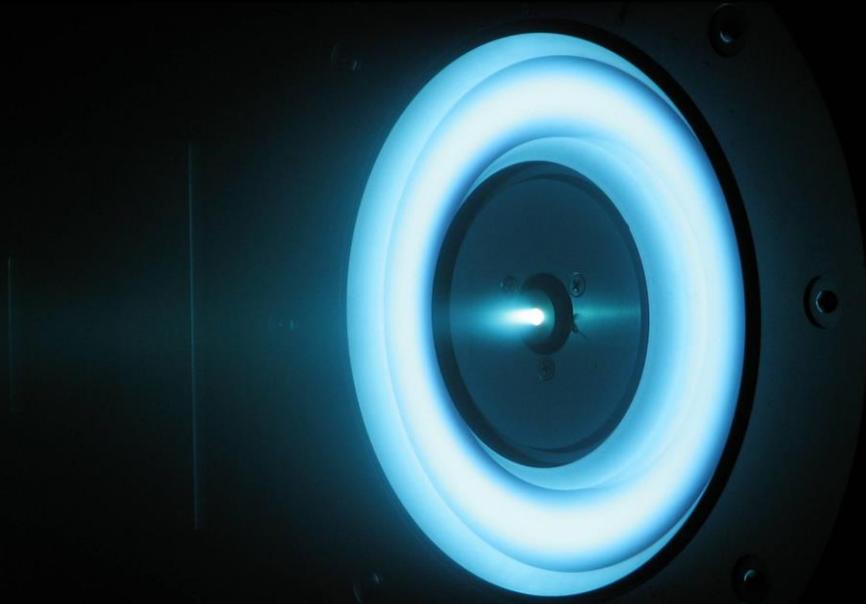
# Uses of Ion Engines

- Developed by NASA Glenn since late 1950s
- First tested in space 1964
- Deep Space 1 primary propulsion system 1998
- Used on 100s of Earth communication satellites

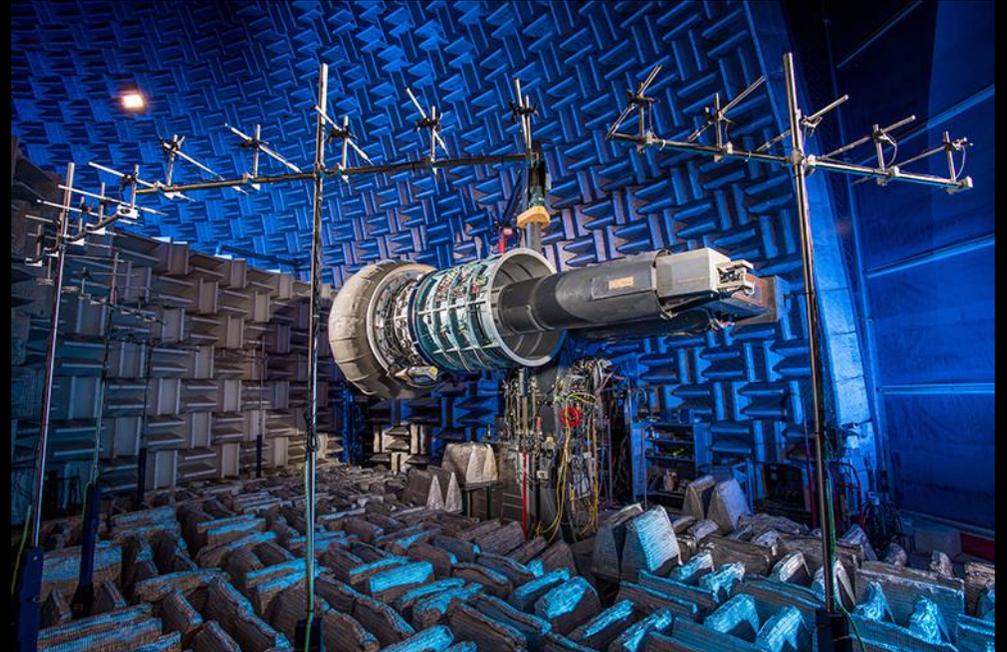


# Future of Ion Engines

NASA Evolutionary Xenon Thruster (NEXT) has been tested to run for over 6 years continuously



X3 thruster developed at University of Michigan operates at 3x power level of previous generation NSTAR thruster



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