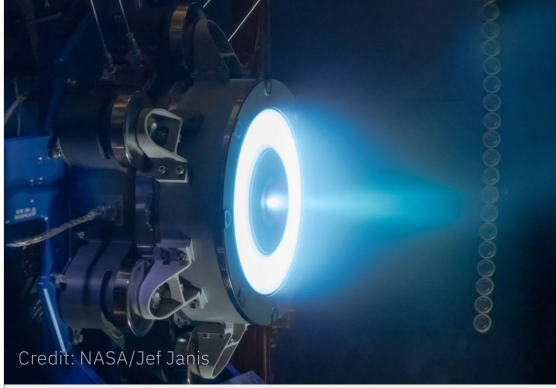
ELECTRIC PROPULSION SYSTEMS


Credit: NASA/Jef Janis

L3Harris is the world leader in electric propulsion systems that support commercial, civil and defense applications.

We have delivered more than 600 thrusters, which have flown on more than 250 spacecraft. From the development of Improved Electrothermal Hydrazine Thrusters (ImpEHTs) and arcjet propulsion systems in the 1980s, followed by Hall current thrusters and gridded ion propulsion systems in the 21st century, L3Harris has a proven record of successfully developing and deploying electric propulsion (EP) systems.

BENEFITS OF EP SYSTEMS

- High specific impulse (ISP) propulsion systems reduce launch mass by requiring less propellant, which in turn lowers launch costs
- Reducing propellant mass allows for increased payload capacity and/or extended spacecraft maneuverability and mission durations with the same amount of propellant
- Electric propulsion enables future crewed deep space missions by efficiently transferring cargo and payloads to deep space in advance of crew arrival, enabling human exploration of the Moon and Mars

ARCJET SYSTEMS

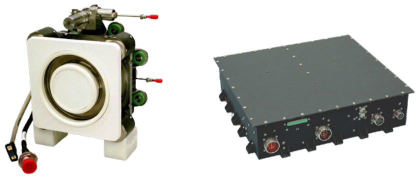
L3Harris has developed and flown three different classes of arcjet systems that range in power from 1.5 kW to 26 kW, having flown on over 70 satellites.

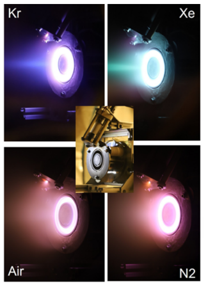
ION PROPULSION SYSTEMS

L3Harris' NEXT-C, 7 kW ion propulsion system was successfully demonstrated in 2021 during NASA's Divert Asteroid Redirection Test (DART).

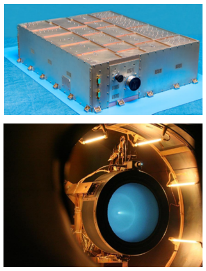
HALL CURRENT THRUSTER SYSTEMS

L3Harris has flown both 3 kW and 4.5 kW Hall Current Thruster (HCT) systems on eleven different satellites, starting in 2010. We also have delivered three 12 kW Advanced Electric Propulsion System (AEPS) flight thrusters that will be used to propel the NASA-developed Power and Propulsion Element, a spacecraft bus the agency has baselined for use on the Space Reactor-1 (SR-1) Freedom mission to Mars. We are currently developing a 1kW class Advanced Multi-Propellant (AMP) HCT system for very low Earth orbit and multi-mode missions that can operate on multiple propellant types, including air and hydrazine.


XR-5 Hall Current Thruster and PPU



1kW AMP Hall Current Thruster


NEXT-C 7kW Ion Thruster and PPU

KEY FEATURES

- Efficient satellite transfer and station keeping
- Powering deep space missions when large delta V and thrust throttling are required
- Due to their tremendous efficiency (high Isp), EP systems use less propellant compared to conventional chemical propulsion systems


NASA HAS BASELINED L3HARRIS' AEPS THRUSTERS FOR USE ON THE SR-1 FREEDOM MISSION

L3HARRIS IN-SPACE ELECTRIC PROPULSION SYSTEMS

Model Designation	TRL, Production Status	Thrust, mN	Isp, Sec	Propellant	Input Power, kW	Input Voltage	Efficiency	Mass, kg	Envelope, mm	Command Interface
ImpEHT System Components										
MR-502 Thruster	9, AP	360-800	294-303	N2H4	0.610-0.885	24.5-29.5	23%	0.87	88 x 60 x 198	N/A
MR-502 PPU	9, AP	N/A	N/A	N/A	0.912-1.824	15-29	>97%	2	279 x 94.2 x 146	Discrete
Arcjet System Components										
ESEX Thruster	8, NP	1,880	800	NH3	26	90-130	27%	12	584 x 460 x 460	N/A
ESEX PCU	9, NP	N/A	N/A	N/A	27.2	160-240	>93%	48	467 x 610 x 15	Discrete
MR-510 Thruster	9, AP	222-258	585-615	N2H4	1.53-2.04	105-140	39%-40%	1.6	240 x 123 x 87	N/A
MR-509 PCU	9, AP	N/A	N/A	N2H4	1.78	65-96	>91%	6.2	310 x 220 x 85 (ht)	Discrete
MR-510 70V PCU	4, Dev	N/A	N/A	N/A	4.55 (w/2 AJTs)	70 +/- 2	>87%	19.1	630 x 375 x 130	Serial Data Bus
MR-510 100V PCU	9, AP	N/A	N/A	N/A	4.55 (w/2 AJTs)	100 +/- 2	>87%	19.1	630 x 375 x 130	Serial Data Bus
MR-512 PCU	9, AP	N/A	N/A	N2H4	1.78	31-51	>91%	6.2	310 x 220 x 95 (ht)	Discrete
Hall Current Thruster System Components										
XR-5, Thruster	9, NP	117-290	1,670-2,020	Xe	1-4.5	300-400	>50%	12.3	208 x 250 x 140 (ht)	N/A
XR-5 26V PPU	9, AP	N/A	N/A	N/A	3.5	36 +/- 1.5	>90%	20	460 x 394 x 143 (ht)	Mil-Std-1553B
XR-5 70V PPU	9, AP	N/A	N/A	N/A	3.3-4.9	80 +/- 2	>92%	12.5	430 x 400 x 110 (ht)	Mil-Std-1553B
AEPS Thruster	7, AP	390-600	1,900-3,000	Xe	12.5	300-600	>65%	<47	530 (dia) x 210 (ht)	N/A
AEPS PPU	6, Dev	N/A	N/A	N/A	13.3	95-140	>94%	<50	520 x 900 x 200 (ht)	Mil-Std-1553B
NGHTS Thruster	5, Dev	150-500	1,600-2,100	Xe	3-7	240-500	>50%	<25	260 (dia) x 140 (ht)	N/A
NGHTS PPU	3, Dev	N/A	N/A	N/A	8	100 +/- 2	>95%	TBD	TBD	Mil-Std-1553B
AMP Thruster	4, Dev	15-125	1,000-2,000 (depends on prop)	Xe, Kr, N2, Air, hydrazine	0.5-2	200-400	20-50% (depends on prop)	<6	200 x 140 x 80 (ht)	N/A
Ion Propulsion System Components										
NEXT-C Thruster	8, AP	25-323	1,395-4,155	Xe	0.51-6.81	1,800 grids	32%-70%	<14	700 (dia) x 480 (ht)	N/A
NEXT-C PPU	8, AP	N/A	N/A	N/A	0.64-7.33	80-160	>93%	<36	410 x 510 x 140 (ht)	RS-485
AdvNEXT Thruster	4, Dev	70-330	2,679-3,382	Xe	1.6-8.2	1,200 grids	61%-67%	<14	700 (dia) x 480 (ht)	N/A
AdvNEXT PPU	5-6, Dev	N/A	N/A	N/A	1.8-8.9	95-105	>93%	<36	410 x 510 x 140 (ht)	RS-485

Production Status Legend: *AP = In active production, NP = Not in active production, Dev = In development*

Electric Propulsion Systems

L3HARRIS®

1025 W. NASA Boulevard
Melbourne, FL 32919

L3Harris.com