

# SPACECRAFT PROPULSION

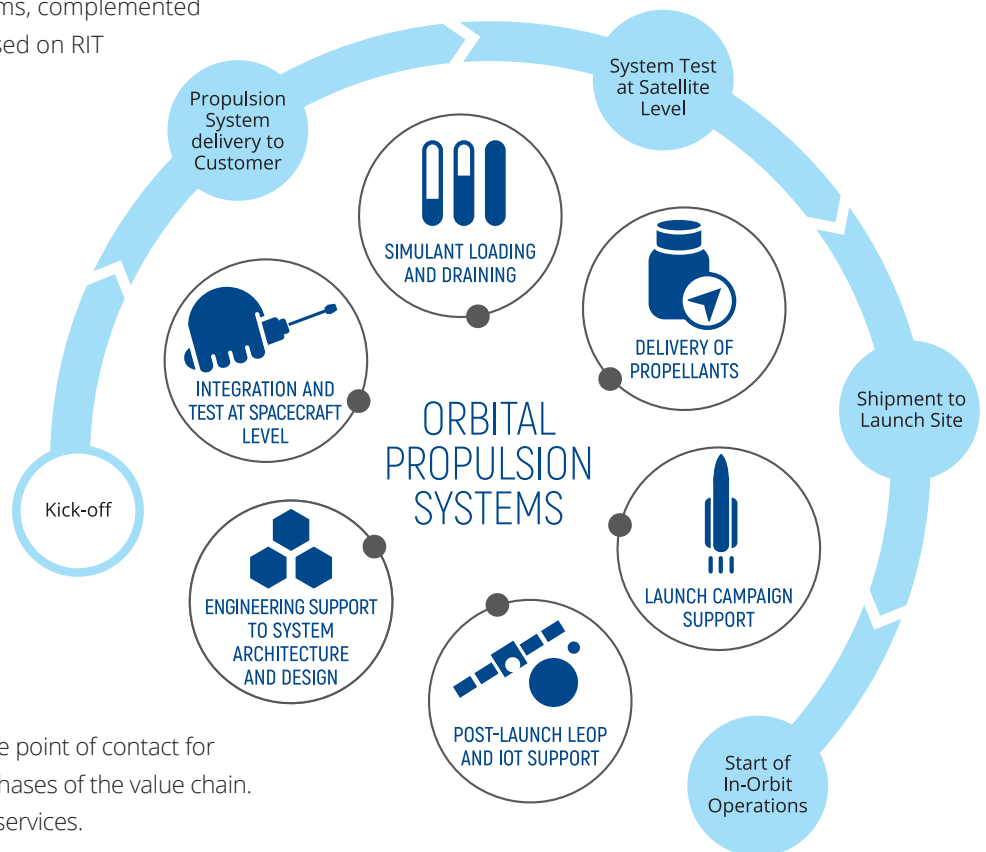
WITH THRUST AND PRECISION INTO SPACE



# THRUST AND PRECISION INTO SPACE

ArianeGroup is a market leader in spacecraft propulsion systems and equipment. For over 50 years, customers worldwide have been benefiting from a competitive portfolio of high quality products and services.

We cover the complete range of products and services related to orbital propulsion, from chemical monopropellant systems for smaller satellites to chemical bipropellant systems for larger platforms, complemented by the electric propulsion portfolio based on RIT (radiofrequency ion technology).

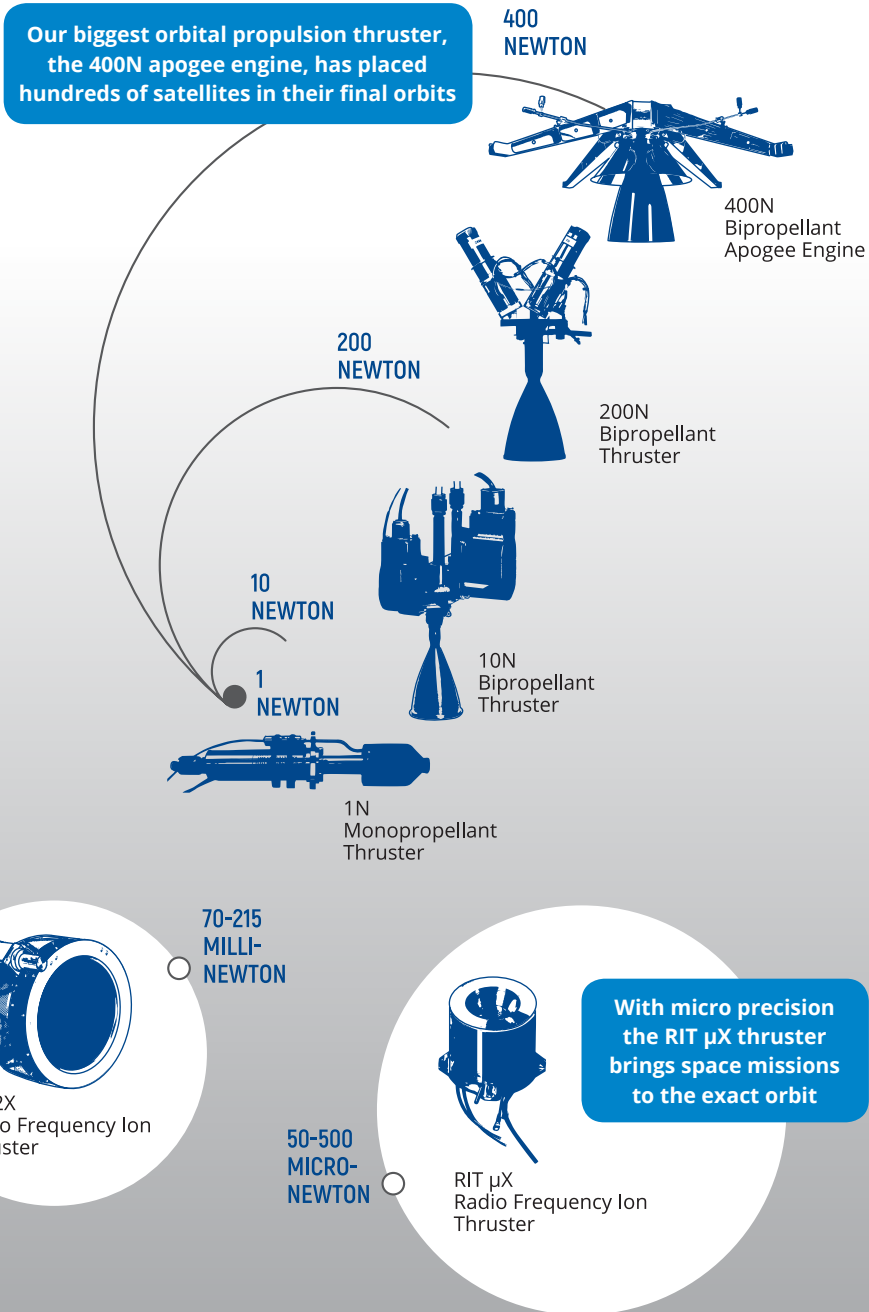


At ArianeGroup, customers have a single point of contact for the complete propulsion system at all phases of the value chain. From system design up to after-launch services.

All key equipment of ArianeGroup propulsion systems (thrusters, propellant tanks, and fluidic equipment) is produced in house.

# ALL ABOUT PRECISION

With our orbital propulsion thrusters and engines, our customers can be sure that their mission requirements related to propulsion will be fulfilled with pin-point precision.





# ELECTRIC PROPULSION

Radio frequency ion propulsion for orbit raising, station keeping, and deep space missions



RIT 2X

**ArianeGroup's electric space propulsion expertise is based on space-proven Radiofrequency Ion Technology (RIT). In this field, we produce complete propulsion systems, modules, thrusters, and related components.**

This technology features numerous advantages like high specific impulse therefore maximum propellant saving. Low system complexity is another strength of the RIT. The robust design concept with a large domain of operational stability, the large throttle range adaptable to available electric power, excellent thrust stability, fast thrust response and narrow ion beam complete the list of features that make any satellite platform flying with RIT Technology an optimized Full EP or Hybrid Platform. Furthermore, RIT allows change in operational parameter in orbit for optimization of mission conditions. Therefore high thrust or high Isp mode are possible.

## RIT PERFORMANCE RANGES



RIT μX

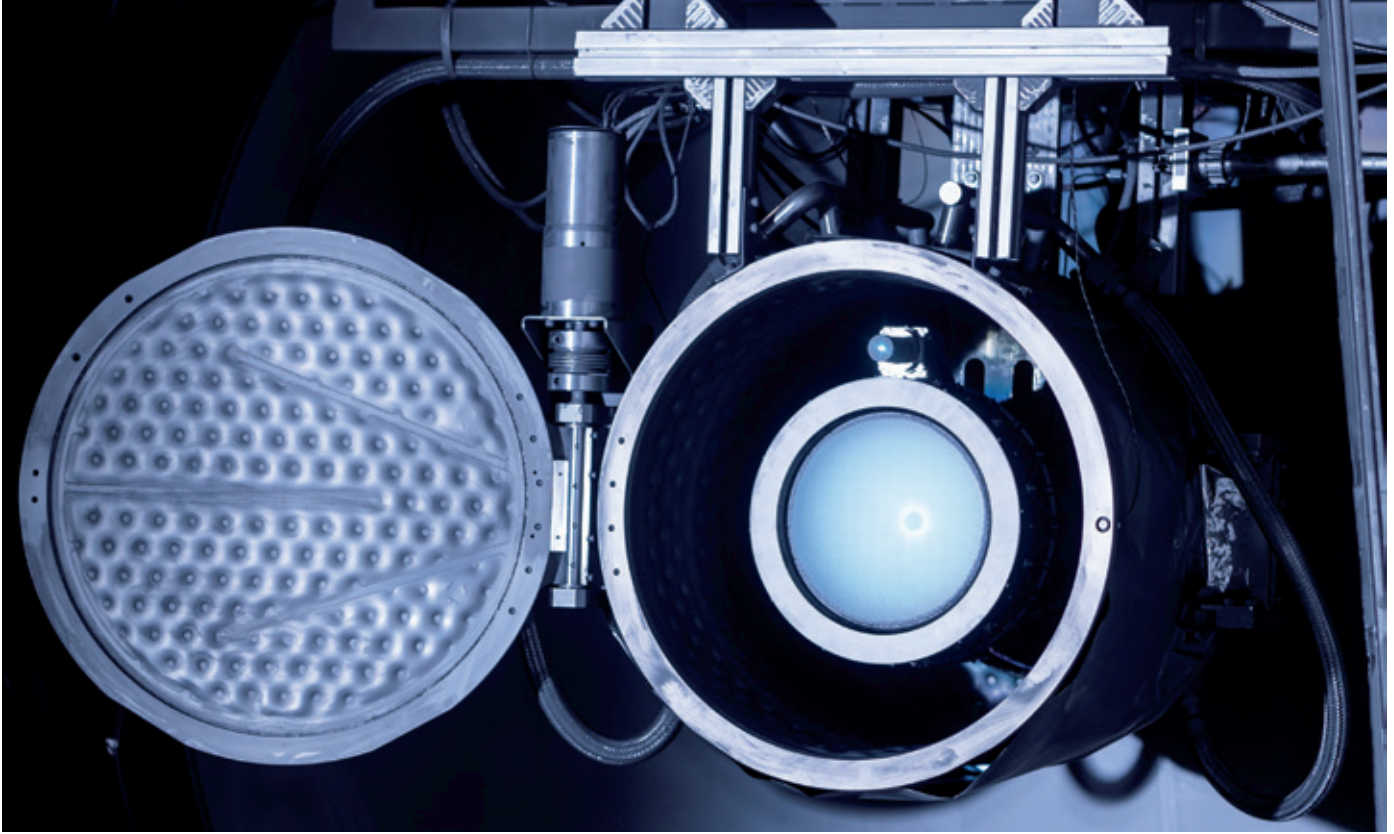
	RIT μX	RIT 10 EVO			RIT 2X		
Nominal Thrust	50 - 500 μN	5 mN	15 mN	25 mN	70-88 mN	151-171 mN	198-215 mN
Nominal Power	< 50 W	145 W	435 W	760 W	2000-2500 W	4000-4500 W	4800-5300 W
Isp	300 - 3000s	> 1900s	> 3000s	> 3200s	3400-3500s	3300-3500s	2450-2750s

## ARCLIGHT

Arclight is ArianeGroup's electric propulsion system solution for low-cost space missions. It is based on the space-proven RIT 10 thruster.

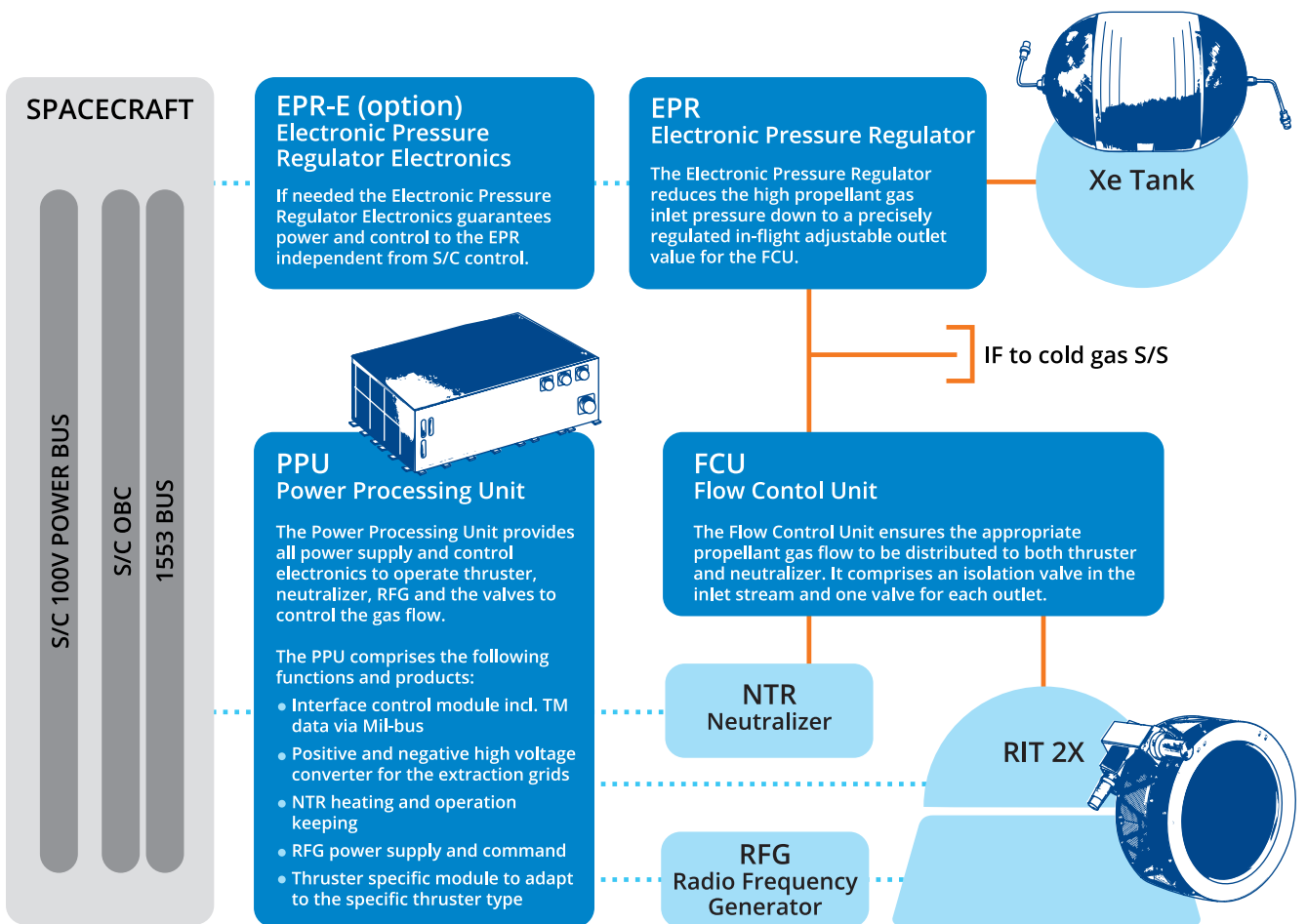
- Simple system with one string and one function point
- Highly integrated electronics
- Optimized for small satellites and mega constellations
- Designed for industrialized production
- Short lead times





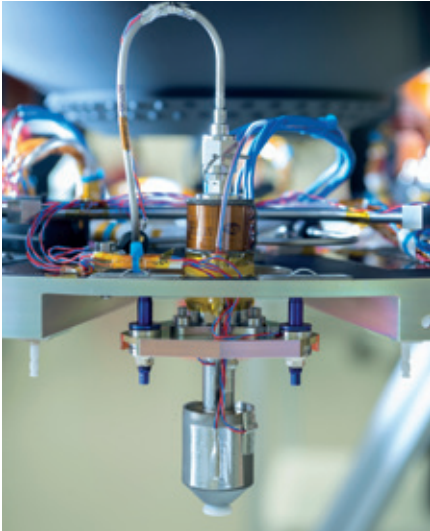
RIT 2X TEST

# FLOW DIAGRAM



..... Electric interface

———— Fluidic interface



# CHEMICAL PROPULSION

ArianeGroup's chemical propulsion portfolio brings all kinds of commercial, exploration and human-rated missions into the precise orbit.

ArianeGroup develops, produces, and tests chemical monopropellant and bipropellant components and systems for different type of missions.

From small LEO platforms up to sophisticated exploration missions, ArianeGroup can support customers worldwide with the right propulsion for any space destination.



Monopropellant  
1N



Monopropellant  
400N



Bipropellant  
10N



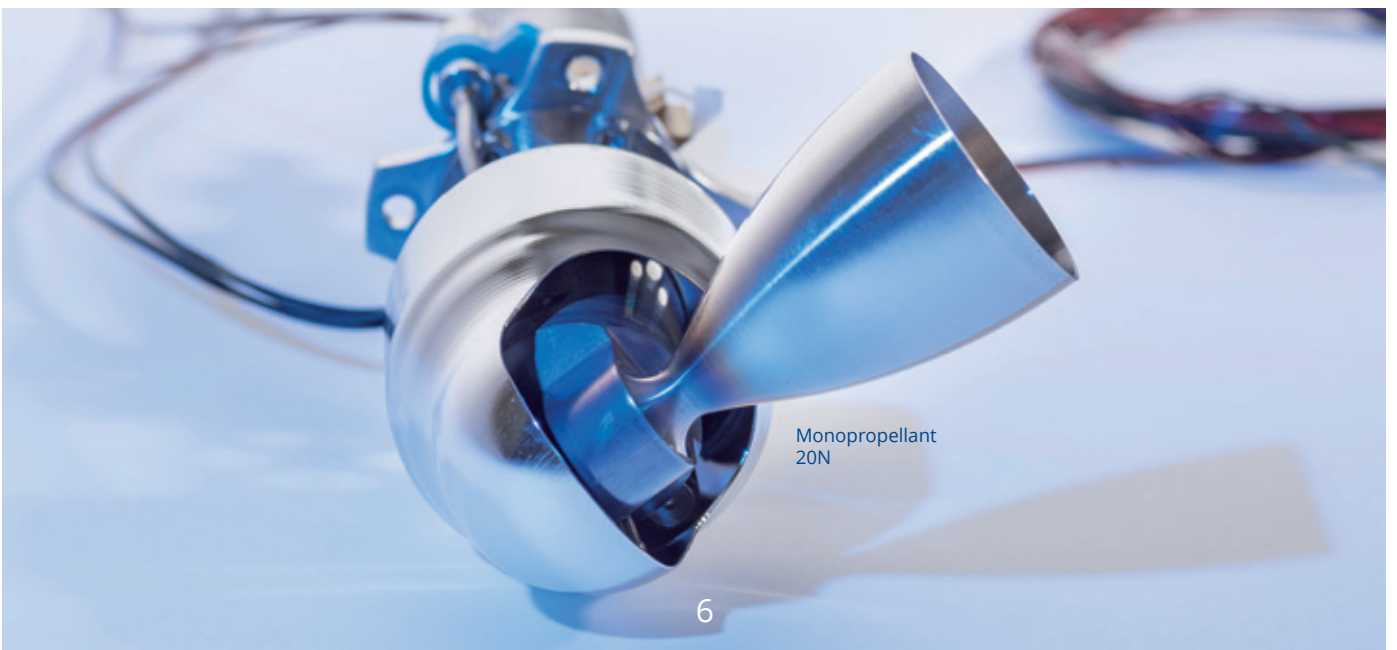
Bipropellant  
200N



Bipropellant  
400N

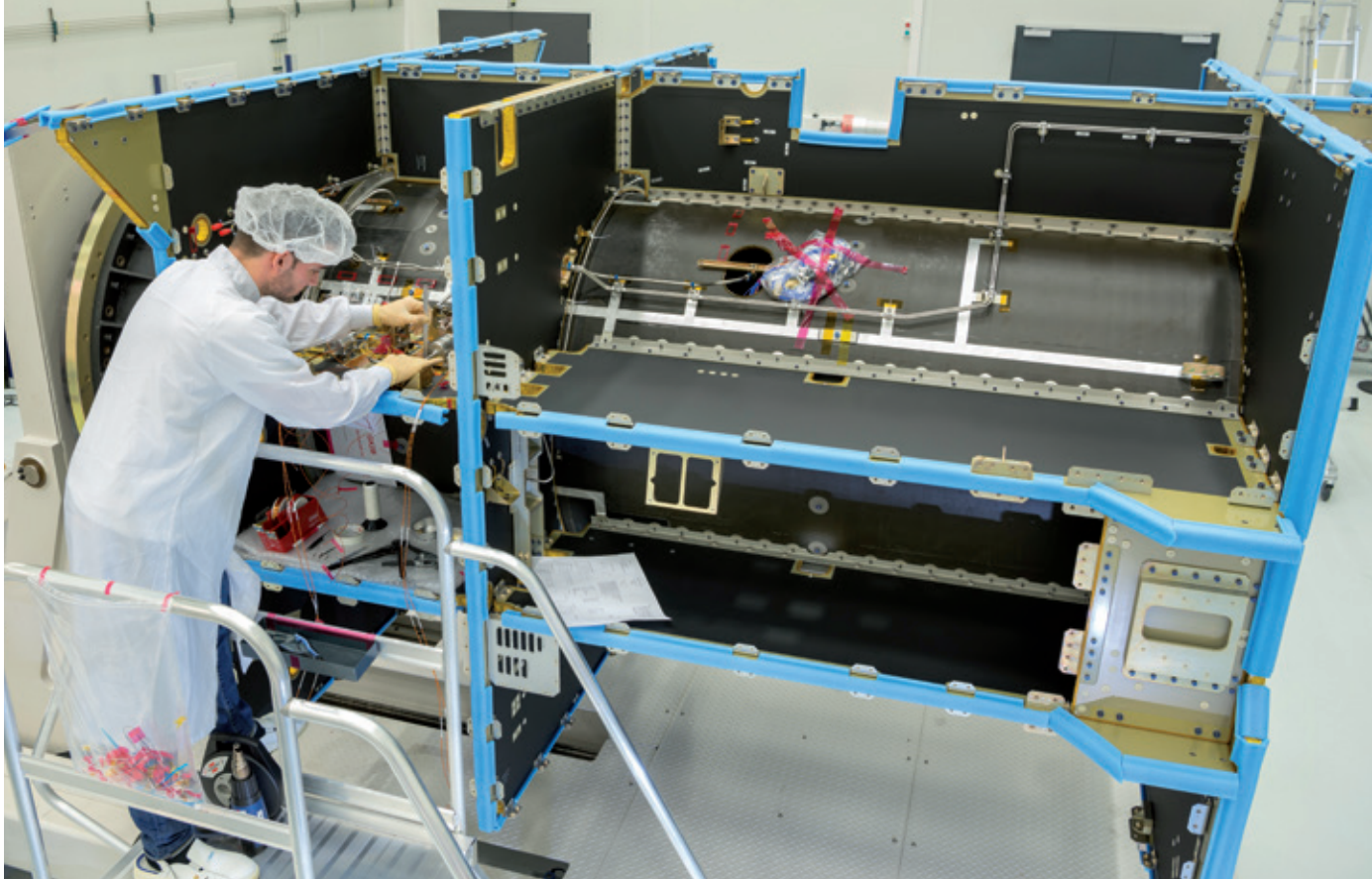
## CHEMICAL PROPULSION COMPLETE RANGE OF THRUST

	MONOPROPELLANT THRUSTERS			BIPROPELLANT THRUSTERS			
	1N	20N	400N	10N	200N	400N Model S400-12	400N Model S400-15
THRUST RANGE	0.320 - 1.1 N	7.9 - 24.6 N	120 - 420N	6.0 - 12.5 N	180N - 285 N	420 N	425 N
SPECIFIC IMPULSE	220 s	230 s	220 s	292 s	270 s	318 s	321 s
MASS FLOW RANGE	0.142 - 0.447 g/s	3.2 - 10.4 g/s	58 - 190 g/s	2.30 - 4.20 g/s	60 - 100 g/s	110 - 142 g/s	
PROPELLANT	Hydrazine (N2H4), High Purity Grade			Fuel: MMH Oxidiser: N2O4, MON-1, MON-3			



Monopropellant  
20N





INTEGRATION OF A CHEMICAL BIPROPELLANT SYSTEM

## COMPLETE SYSTEMS

ArianeGroup's expertise in the design, manufacturing, assembly, integration, and test of complete propulsion systems has contributed to hundreds of successful space missions worldwide. For over 50 years, we have been supplying propulsion systems in support of hundreds of major international satellites and spacecraft. We provide standard propulsion systems and we design and develop customized systems to the specific needs of our customers.

In addition to propulsion systems based on conventional hydrazine, ArianeGroup develops propulsion systems with alternative propellants that comply best to technical, safety and environmental requirements.



Chemical propulsion system for lander application

INTEGRATION OF A CHEMICAL MONOPROPELLANT SYSTEM









# PROPELLANT TANKS FOR MONOPROPELLANT AND BI-PROPELLANT SYSTEMS

A qualified and experienced team for propellant tank development and production

**ArianeGroup develops and produces propellant tanks for chemical monopropellant and bipropellant systems in its tank center.**

The spectrum of different tank types includes surface tension tanks, bladder tanks, propellant tanks for spin-stabilized spacecraft, aluminum-alloy diaphragm tank and tanks with liquid center of gravity control.

With different geometries, from spherical shell to cassini shape and with volume capacities ranging from 58 liters up to 2,100 liters, ArianeGroup responds to a wide range of satellite platform requirements. Most tanks are made of titanium to ensure high load at low weight.

ArianeGroup has created standard designs to optimize the product line, and also makes its engineering experience available for individual customer requirements.

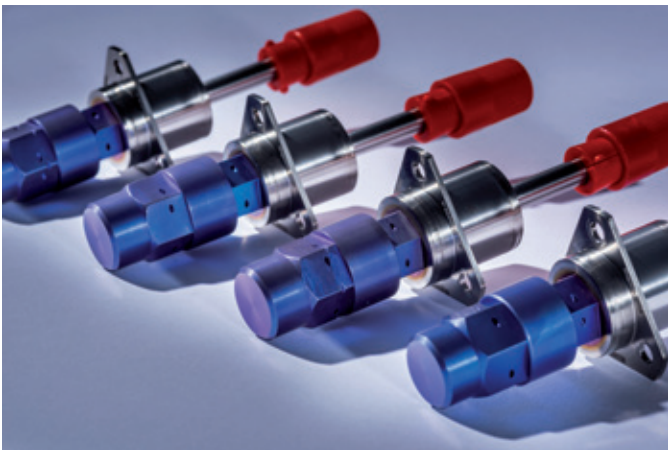
## NON-DESTRUCTIVE INSPECTION



# FLUIDIC EQUIPMENT

Valves for the fill, drain, isolation, control and regulation of propellants and pressurants.

To ensure the highest possible quality, reliability, and performance of our spacecraft propulsion systems and thrusters, we design, develop and produce our own valves for the control of propellants and pressurants.



## FILL & DRAIN VALVE

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### Characteristics

- Two-failure tolerant
- Three inhibits against external leakage
- Helium/Xenon high pressure valves with MEOP 310 bar
- Hydrazine low pressure valves with MEOP 37 bar



## PYROVALVE

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### Characteristics

- Normally closed and normally opened valve
- ESA standard redundant pyro initiators
- All-welded titanium design
- MEOP: 310 bar
- Fluid compatibility: helium, argon, xenon, nitrogen, MON, MMH, hydrazine, deionized water, IPA





INTEGRATION OF PROPELLANT ISOLATION ASSEMBLY



## SHAPE MEMORY ALLOY VALVE

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### Characteristics

- Normally closed valve
- Non pyrotechnical NiTi actuator
- Simple electrical activation (ESCC 4009 heater)
- All-welded titanium design
- MEOP: 345 bar
- Fluid compatibility: helium, argon, xenon, nitrogen, MON, MMH, hydrazine, deionized water, IPA
- Lifetime 22.5 years on orbit / 10 on ground

#spaceenablers

[www.ariane.group](http://www.ariane.group)



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