SPACECRAFT PROPULSION

WITH 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.

Our biggest orbital propulsion thruster, the 400N apogee engine, has placed hundreds of satellites in their final orbits.

With micro precision the RIT μX thruster brings space missions to the exact orbit.
Electric Propulsion

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

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

<table>
<thead>
<tr>
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<th>RIT μX</th>
<th>RIT 10 EVO</th>
<th>RIT 2X</th>
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<tbody>
<tr>
<td>Nominal Thrust</td>
<td>50 - 500 μN</td>
<td>5 mN</td>
<td>15 mN</td>
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<tr>
<td>Nominal Power</td>
<td>&lt; 50 W</td>
<td>145 W</td>
<td>435 W</td>
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<tr>
<td>Isp</td>
<td>300 - 3000s</td>
<td>&gt; 1900s</td>
<td>&gt; 3000s</td>
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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
FLOW DIAGRAM

SPACERRAFT

PPU
Power Processing Unit

The Power Processing Unit provides all power supply and control electronics to operate thruster, neutralizer, RFG and the valves to control the gas flow.

The PPU comprises the following functions and products:
- Interface control module ind. TM data via MIL-bus
- Positive and negative high voltage converter for the extraction grids
- NTR heating and operation keeping
- RFG power supply and command
- Thruster specific module to adapt to the specific thruster type

EPR-E (option)
Electronic Pressure Regulator Electronics

If needed the Electronic Pressure Regulator Electronics guarantees power and control to the EPR independent from S/C control.

EPR
Electronic Pressure Regulator

The Electronic Pressure Regulator reduces the high propellant gas inlet pressure down to a precisely regulated in-flight adjustable outlet value for the FCU.

Xe Tank

IF to cold gas S/S

FCU
Flow Control Unit

The Flow Control Unit ensures the appropriate propellant gas flow to be distributed to both thruster and neutralizer. It comprises an isolation valve in the inlet stream and one valve for each outlet.

NTR
Neutralizer

RIT 2X

RFG
Radio Frequency Generator

Electric interface

Fluidic interface
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.

### CHEMICAL PROPULSION COMPLETE RANGE OF THRUST

<table>
<thead>
<tr>
<th>MONOPROPELLANT THRUSTERS</th>
<th>BIPROPELLANT THRUSTERS</th>
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</thead>
<tbody>
<tr>
<td><strong>1N</strong></td>
<td><strong>20N</strong></td>
</tr>
<tr>
<td>THRUST RANGE</td>
<td>0.320 - 1.1 N</td>
</tr>
<tr>
<td>SPECIFIC IMPULSE</td>
<td>220 s</td>
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<tr>
<td>MASS FLOW RANGE</td>
<td>0.142 - 0.447 g/s</td>
</tr>
<tr>
<td>PROPELLANT</td>
<td>Hydrazine (N2H4), High Purity Grade</td>
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</table>
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.
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.
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

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

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
SHAPE MEMORY ALLOY VALVE

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