



HOT FIRING & TEST FACILITY ENGINEERING,  
GROUND EQUIPMENT & PROPELLANT SUPPLY,  
PROPULSION SYSTEM TEST & LAUNCH SUPPORT

**PROPULSION SERVICES**

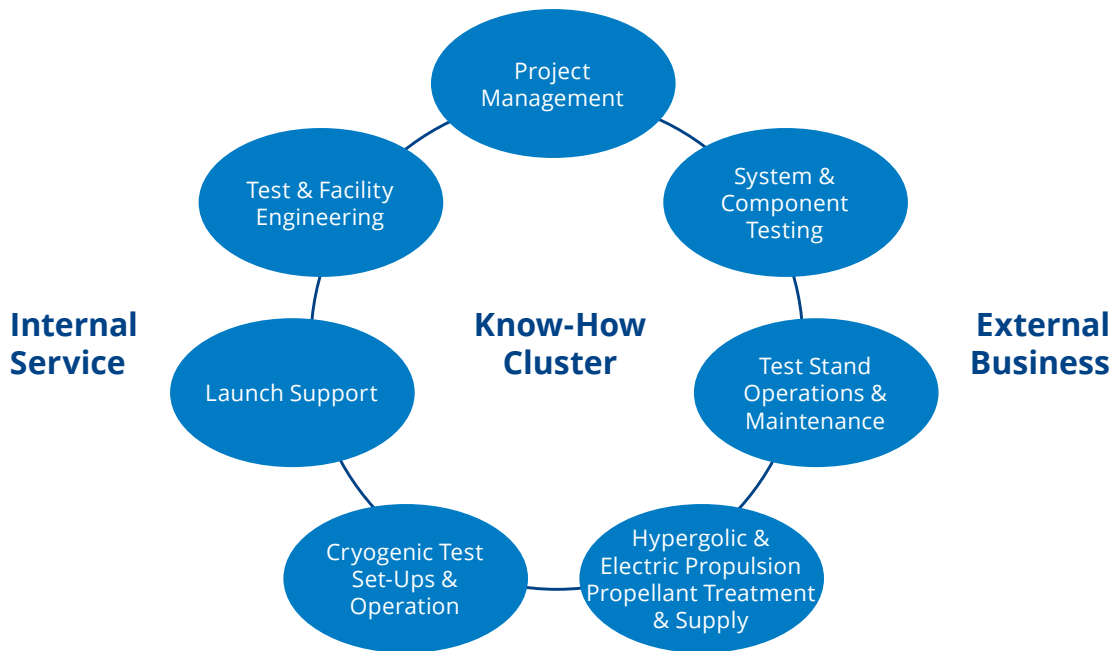
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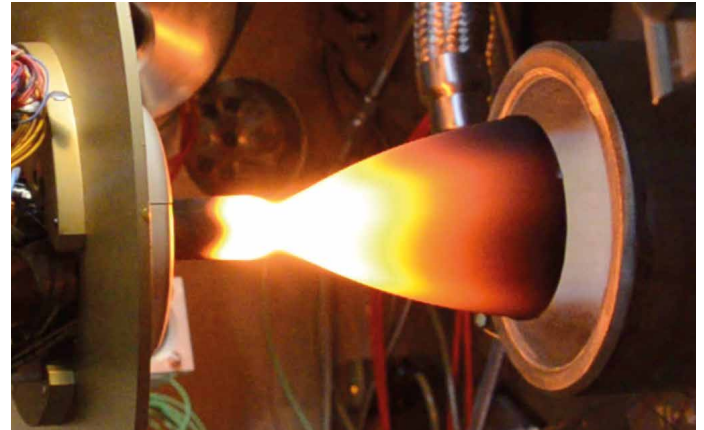
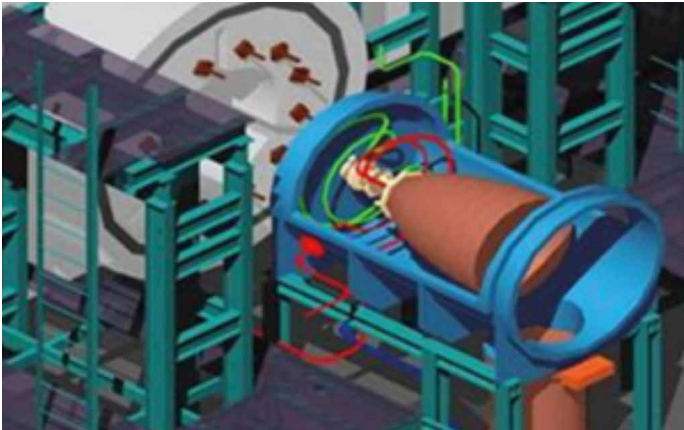
# PROPULSION SERVICES

## HOT FIRING & TEST FACILITY ENGINEERING, GROUND EQUIPMENT & PROPELLANT SUPPLY, PROPULSION SYSTEM TEST & LAUNCH SUPPORT.

Our commitment in space propulsion extends to a vast range of services in support of spacecraft and launcher propulsion. We provide these services for our own programs and also for external customer projects. Our engineering expertise is specialized in equipment, facilities and handling of chemical and electrical spacecraft propellants. Typical support services include:

- › Test facility design, engineering, operation and maintenance
  - › Hot firing and environmental test execution
  - › Propulsion testing from component to system level
  - › Propellant supply and delivery – worldwide
  - › Launch support at spaceports – worldwide
  - › Ground support equipment and safety equipment
  - › We make hazard operations safe for our customers
- › With a wide range of stationary and mobile equipment our operational team can react with high flexibility on customers request
  - › Thanks to the combination of internal and external projects, you can benefit from the enormous experience, heritage and know-how cluster of ArianeGroup.





### Ground Equipment and Test Facility Engineering

ArianeGroup provides international customers with complete support in the elaboration of test facility concepts, adaptation of existing test facilities and manufacturing of new test facilities.

Our experience covers the management of test facilities for storable propellants, cryogenic propellants as well as LOX/HC, handling thrust levels ranging from 0.5N to 1000 kN.

The range of solutions includes:

- › Feed system simulation and calculation
- › Fluid component design
- › Facility acceptance and documentation
- › Design of measurement and control systems
- › Failure Mode, Effects and Criticality Analysis (FMECA)
- › Consultancy during Manufacturing, Assembly, Integration and Test phases (MAIT)

### Hot Firing Tests

In our test facilities, ArianeGroup conducts hot firing tests of electric and chemical satellite thrusters and engines in the range of mN to 3000N, complete propulsion systems (ATV, MSG), launcher upper stages (Vinci, Aestus, VEGA AVUM) and launcher roll control systems (A5 SCA, VEGA RACS).

These tests are conducted in vacuum and sea-level test facilities with the following characteristics:

- › State-of-art HF (64channel à 102kSa/s) and LF data acquisition system, control and safety system
- › 2 to 3 cycle vacuum system (separated exhaust & ambient)
- › Performance of mission profile
- › Blow down and pressure regulated operational mode
- › Flexible and modular test set ups
- › 2 Test slidable positions (horizontal or vertical firing with thrust measurement)
- › Simultaneous firing ( e.g. of 4 Thrusters (Bracket) )
- › Characterization via pc, mprop, temperatures (120 NiCr-Ni)
- › Automatic sequences for firing, bracket cooling, etc.
- › 2 Positions for simultaneous / independent firings (5-400N)
- › 4 Positions for simultaneous / independent firings (1N)
- › High vacuum facilities for EP



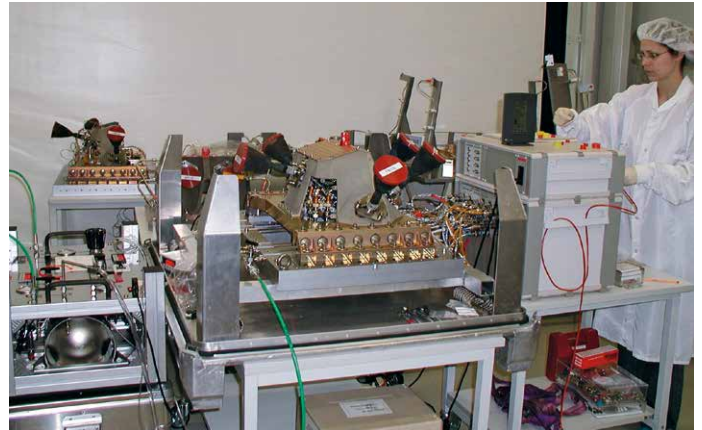




### Environmental System Test Support

ArianeGroup provides support for Spacecraft System environmental tests such as:

- › Final alignment of thruster after integration
- › Vibration tests
  - Loading / Un-loading of propellant tanks with simulation liquid (IPA, HFE7100, deion. water)
  - Pressurization of helium tanks with simulation gas (He, Argon)
  - Unloading of propellant tanks from simulation liquid
  - Drying of propellant tanks to a specified value of concentration
  - Reconfiguration of helium tanks (pressurization)
- › Thermal vacuum tests
  - conditioning of the propulsion system for tests
  - pressurization by He or N2
- › Final tests before / after transport to the launch site
  - Overall leak test of propulsion system
  - Final verification of functionality
  - End-to-end test of system with spacecraft telemetry/telecommand



### Propulsion Systemtest Support

Based on our comprehensive experience in Hypergolic and Electric propulsion systems, our team is involved in all component, subsystem and systemtests for propulsion systems.

- › development and qualification as well as incoming inspection tests for components (electrical, mechanical)
- › acceptance tests in-house and on customer sites worldwide (all over Europe, Israel, Argentina, Turkey, South Kourea)
- › support during technical interventions (exchange of components, etc.), anomalies, trouble shooting from component to system level







### Propellant Supply

We offer satellite manufacturers and prime contractors of launch vehicles unique solutions in the market by

- › engineering, realization and certification of Ground Support Equipment (loading Carts, Propellant Transport Container, etc.)
- › purifying Hydrazine to ultra high purity grade
- › treatment of  $N_2O_4$  to MON1 and MON3
- › de-gassing or saturation of propellants as well as
- › delivering worldwide propellants like  $N_2H_4$  (Hydrazine), MMH,  $N_2O_4$ (NTO), UDMH, Xenon



### Launch Support

Since 1972, our specialists have been providing spacecraft launch support services, with 100% success at major international launch sites including Baikonour Cosmodrome, Dombarovsky Cosmodrome (Yasny), Plesetzk Cosmodrome, Kourou Centre Spatial Guyanais, Kennedy Space Center (KSC), Cape Canaveral Air Force Station (CCAFS), Vandenberg Air Force Base (VAFB), Sea Launch Long Beach CA, Sriharikota (India), Xi Chang (Ch) and Tanegashima (Jap).

Based on our experience of all major space ports for launchers we can offer

- › Safety surveys of launch sites
- › worldwide fuelling spacecrafts (PMD-, bladder- and membrane tanks) and upper stages of launch vehicles
- › Our expertise and active involvement in propellant management, handling and fuelling operations is utilized to support our international customers.

Our team permanently participates in safety trainings and health checks. Due to a redundant staff, we can ensure a maximum of reliability and safety for all spacecraft loading activities.



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WE PROVIDE PROPULSION SYSTEM TEST SUPPORT,  
PROPELLANTS AND LAUNCH SUPPORT WORLDWIDE



Vandenberg ●

Kennedy Space Center ●

Kourou ●

Sea Launch ●

Bariloche ●





- Plesetzsk
- Stevenage
- Bremen
- Toulouse
- Cannes
- Madrid
- Friedrichshafen
- Turin
- Rom
- Ankara
- Tel Aviv
- Yasni
- Baikonur
- Shriharikota
- Xichang
- Daejon
- Tanegashima

#spaceenablers

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



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