

EUROPEAN LEADER

IN PROPULSION SYSTEMS FOR MISSILES



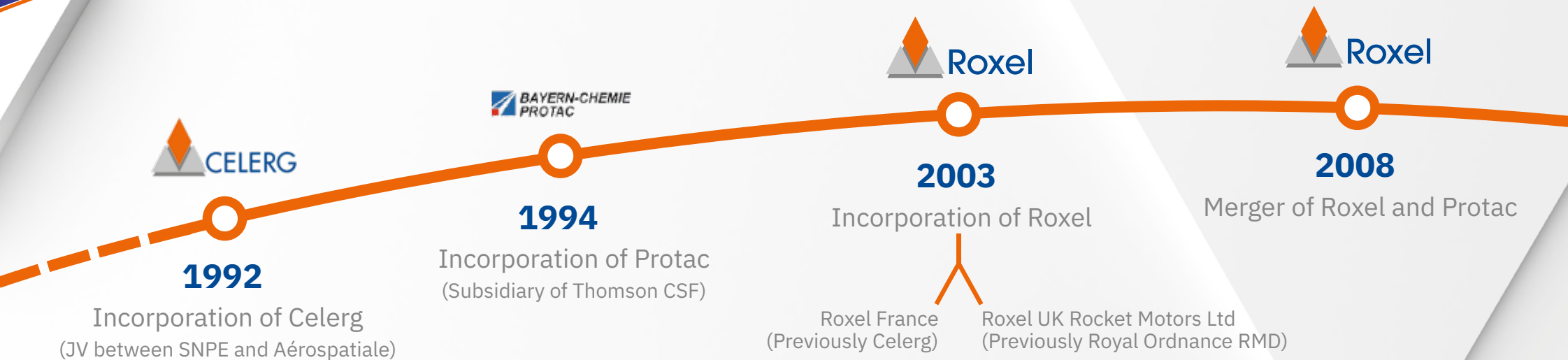
Roxel
Propulsion systems

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HISTORY & OWNERSHIP

Roxel, supporting Military Forces across Europe and beyond



Roxel is owned equally by MBDA and Safran.

Roxel was formed in 2003 to bring together the French and British design and manufacturing capabilities for propulsion systems. Roxel inherited its' prestigious predecessors (SNPE, Aérospatiale and British Aerospace (Royal Ordnance RMD)) centuries of knowledge of energetic materials and their applications for rockets and missiles.

SITE LOCATIONS

Industrial sites and specialisations

Summerfield

- Steel Strip Laminate Structures (SSL)
- Cast Double Base propellant (CDB)
- Integration and test capability
- Igniters
- Research and design department
- Test facilities

Saint-Médard-en-Jalles

- Composite propellant
- Extruded Double Base propellant (EDB)
- Rocket motors integration
- Research and design department
- Test facilities

Le Plessis-Robinson

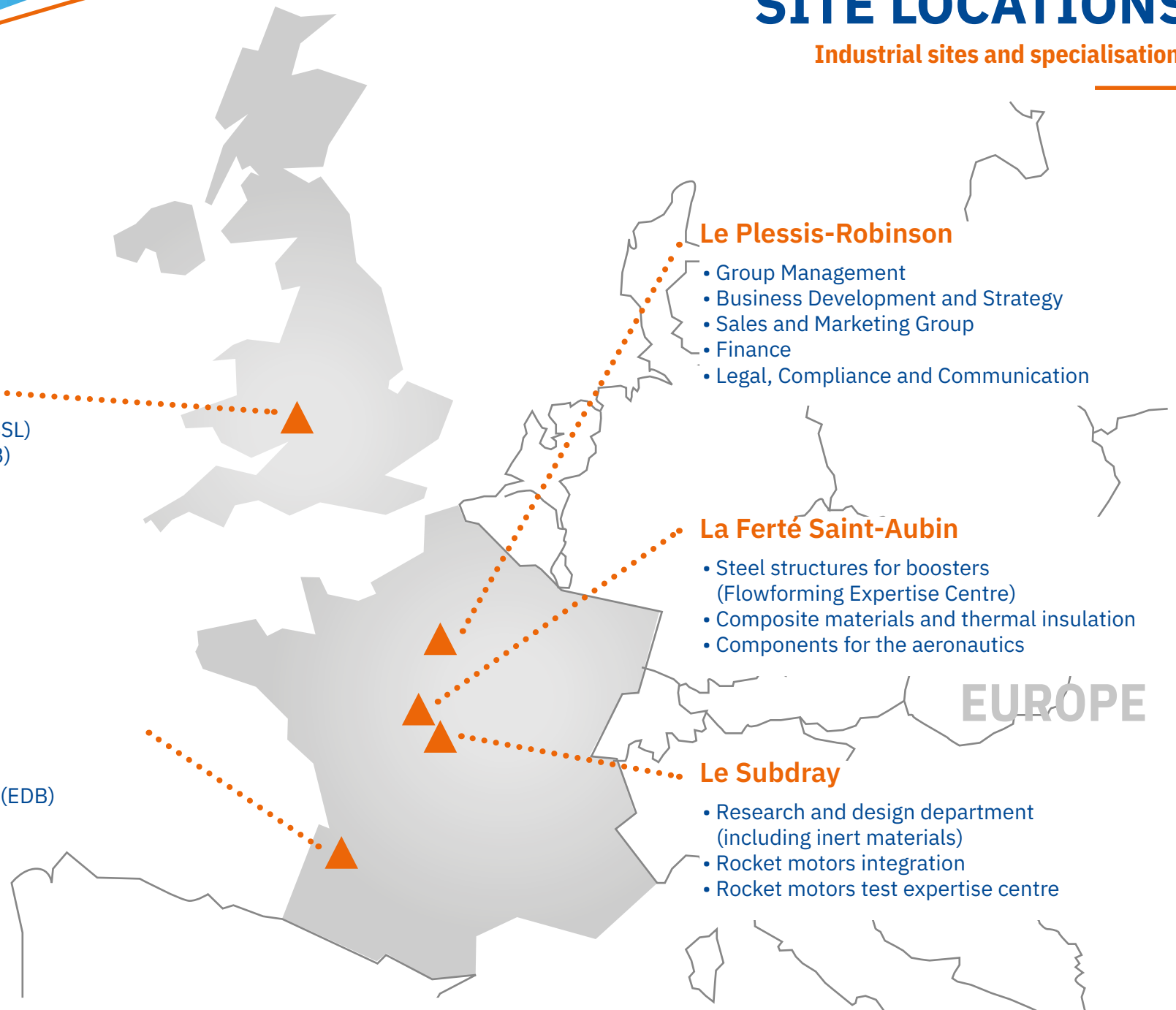
- Group Management
- Business Development and Strategy
- Sales and Marketing Group
- Finance
- Legal, Compliance and Communication

La Ferté Saint-Aubin

- Steel structures for boosters (Flowforming Expertise Centre)
- Composite materials and thermal insulation
- Components for the aeronautics

Le Subdray

- Research and design department (including inert materials)
- Rocket motors integration
- Rocket motors test expertise centre



CORPORATE GOVERNANCE

Executive Committee



Étienne GALAN
Chief Executive Officer

Group Business
Management System



Mark HARDMAN
Chief Programmes Officer

Programmes
UK Managing Director



François ROMOEUF
Industrial Director

Industrial
French Operations



Didier LE BOULCH
Chief Financial Officer

Finance



Jean-Michel GEORGES
Deputy Chief Programmes Officer

Risks Management & Mitigation
French Programmes



Stéphane CATREVAUX
VP Marketing & Sales

Marketing
Sales
Business Development



Emmanuel LEPAREUX
Chief Technology Officer

Engineering
Strategy



Bernard QUESADA
Quality Director

Quality



Marie-Line FAURE
Human Resources Director

Human Resources



Dave GOLBY
Procurement Director

Procurement



Sophie-Anne MAGDELEINE
General Secretary

Legal
Ethics & Compliance
Communication



Sylvie GRISON
Improvement & Digital Director

Improvement
Digital



OVERVIEW

Roxel, a major player in the field of tactical propulsion

60%

of the European Market in the propulsion domain

700
employees

120 to 150 M€
turnover

Roxel has worldwide activities in Europe, South America, North America, Middle East, Africa and Asia.

European leader in the design and manufacturing of solid rocket propulsion systems. Provider of Land, Sea and Air defence systems.

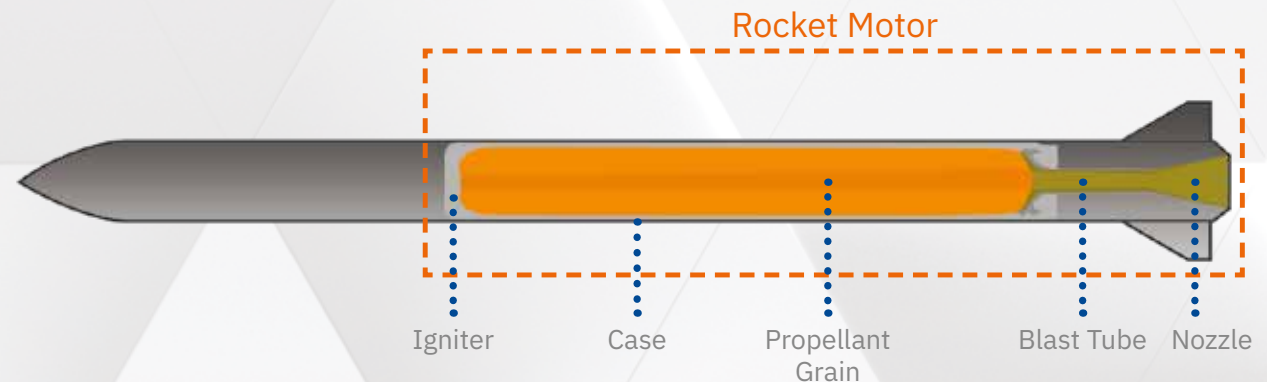
CORE COMPETENCIES & CAPABILITIES

Roxel offers the bespoke solutions implemented with the help of state-of-the-art technologies

Design / Development / Manufacturing of solid propulsion systems and related equipment for all types of rockets and missiles.

Expertise in Energetic Materials, Mechanical Structures and all elements of propulsion systems.

IM and minimum smoke represent a proven expertise in the propulsion domain.



MARKET SEGMENTS

Roxel offers a comprehensive range of propulsion systems used by all three armed forces (Land, Sea and Air) satisfying a range of current and future needs.

Roxel has a presence with both home and international customers working with the Prime System Integrators or Local Preferred Partners.

AIR-DEFENCE

Aster
Mica VL
Mica NG VL
Camm
Starstreak
RBS 70/90



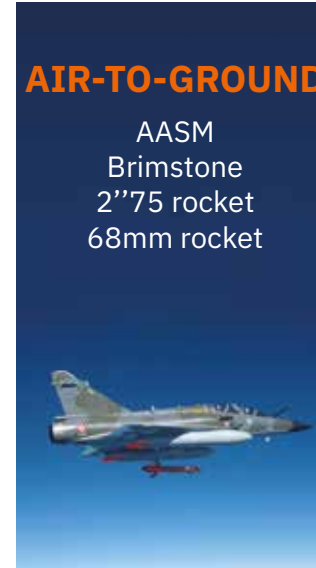
ANTI-SHIP

Exocet
RBS 15
Marte ER
FASGW(H)/ANL



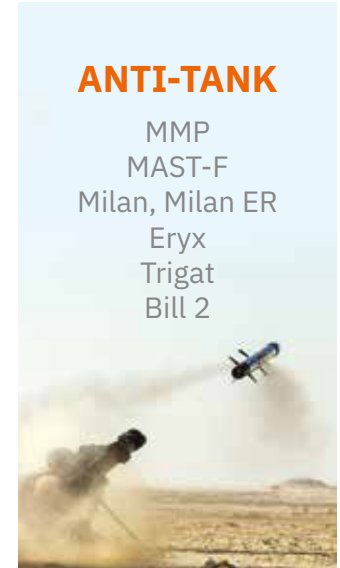
AIR-TO-GROUND

AASM
Brimstone
2"75 rocket
68mm rocket



ANTI-TANK

MMP
MAST-F
Milan, Milan ER
Eryx
Trigat
Bill 2



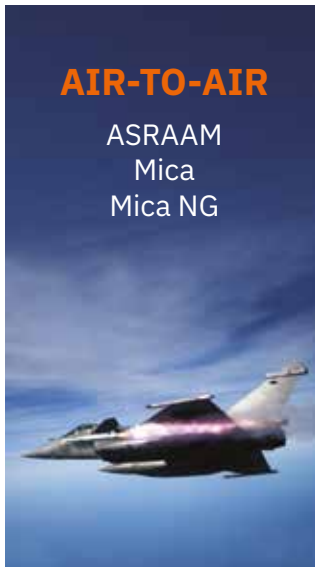
GROUND-TO-GROUND

122 mm rocket
G-MLRS rocket/LRU
RRPR



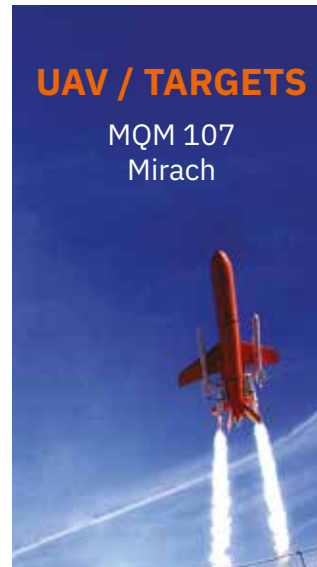
AIR-TO-AIR

ASRAAM
Mica
Mica NG



UAV / TARGETS

MQM 107
Mirach



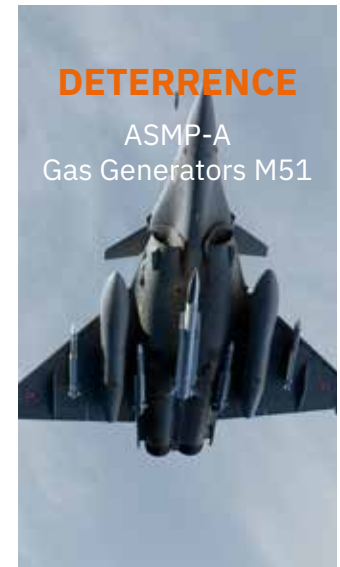
NAVAL CRUISE

MdCN

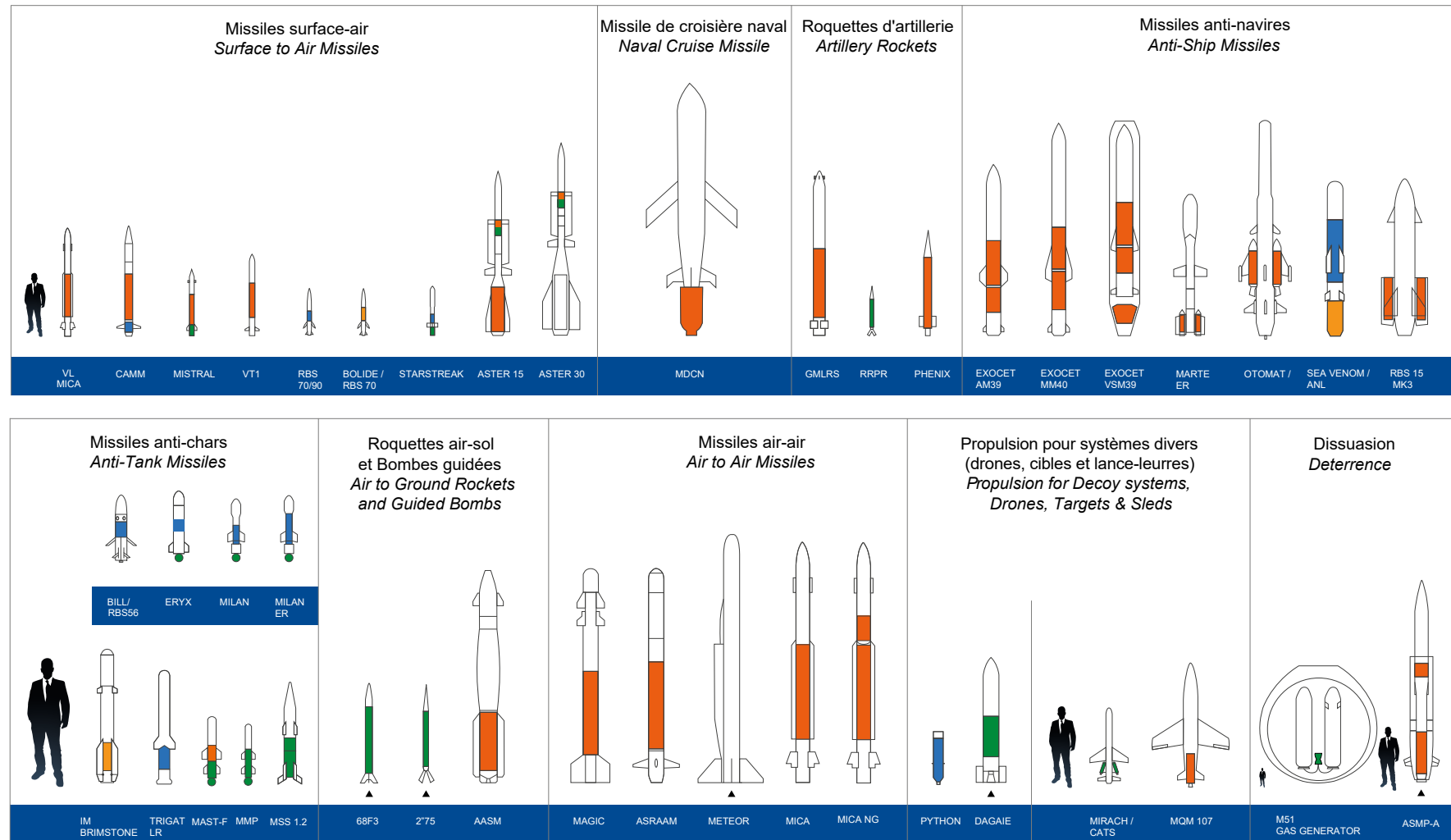


DETERRENCE

ASMP-A
Gas Generators M51



MARKET SEGMENTS



□ Nom du missile
Missile name

■ SD
EXTRUDED DOUBLE BASE

■ EPICETE
CAST DOUBLE BASE

■ NITRAMITE ER
ELASTOMER MODIFIED CDB

■ COMPOSITE
COMPOSITE

▲ Chargement propulsif ou structures conçus & réalisés par Roxel
Propellant charge or cases designed & manufactured by Roxel

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MANUFACTURING PROCESSES

Roxel, a Company mastering all types of components for tactical rocket motors

Manufacturing of Inert Components and Rocket Motors Integration

- Thermal insulations, composite material component
- Steel Strip Laminate (SSL) motor case manufacture
- Kevlar Overwound Aluminium (KOA)
- Flowforming motor case manufacture
- Filament winding over propellant
- Laser welding at motor final assembly

Propellant and Charge Manufacture

- Stamping
- Extrusion
- Machining
- Finish to form charge geometry
- Automated charge handling



Industrial Excellence

Roxel is focussed on achieving industrial excellence and employs the Lean-Sigma approach to Manufacturing. Our main priorities: Safety of our Staff, Quality of our Products, Production Performance, Continuous Improvement, Supply Chain Management, Industrial Strategy, Leadership Management and Minimising Environmental Impact.

ENERGETIC MATERIALS

Roxel, a Company mastering all types of energetic materials dedicated to solid propulsion



Double Base Propellants

- Cast Double Base (CDB)
- Cross-Linked Double Base (XLDB)
- Elastomer-Modified CDB (EMCDB)
- Extruded Double Base (EDB)
- Lead Free Double Base

Composite Propellants

- Cast

Igniter Powder

- Initiation device
- Ignition device

Advanced Lead Free Energetic Propellants

Roxel is developing many high energy advanced propellants:

- Smokeless composite propellants based on energetic binders

These propellants offer the following advantages:

- High specific impulse, minimum smoke
- Lead free formulations (REACH compliant and no lead in the rocket efflux)
- Particularly suitable for Anti-Tank Missiles

Propellants Main Characteristics and Operational Applications

Extruded Double Base	Smokeless, plateau effect, low cost, large accessible burn rate range, stamped geometry ease to achieve high constructive index
Cast Double Base	Smokeless, plateau effect, manufacturing process allows to manufacture boost-sustain (Bi-Composition) Charge Design, Large accessible burn rate range
Classic Composite	Reduced smoke, high specific impulse, achieved mechanical performances enable to optimise constructive index for case bonded design, large accessible burn rate range, low shock sensitivity, pressure exponent adapted for thrust modulation
Advanced Propellants	Smokeless, high specific impulse, ballistic performances adapted for Boost-Sustain Charge Design and Thrust Modulation applications



SUPPORT SERVICES

Roxel, providing customers with bespoke solutions for a wide range of applications

Rocket motor testing

- Static testing under controlled conditions
- Extensive environmental test facilities including underwater test facilities

Post Design Services

- Existing ammunition stock survey (Rocket Motor)
- Life evaluation services
- Ageing Process

Disposal

- Missile and Rocket Motor Dismounting
- Firing containment under water
- Automated Processing Area
- Controlled Gas Components Ejections
- Environment friendly

Training Courses

- Developing skills and knowledge related to missile and rocket motors
- Bespoke training courses on request

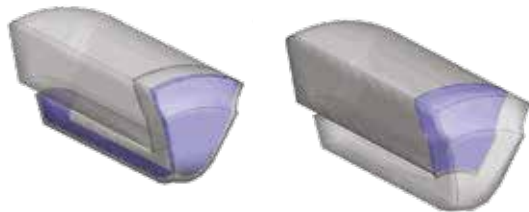
Expertise, Consulting for Development, Analysis

- Technical support and expertise
- Characterisation study
- Feasibility study

Roxel offers a full range of technology to manage the thrust of propulsion systems:

Thrust Modulation

- Dual and Multi-Level Thrust Profiles
- Dual Systems (Snail Charge)
- Dual Pulse
- Discrete Variable Thrust (DVT) or Continuous (CVT)



"Snail" charge burning phases

Thrust Vector Control (TVC)

- Jet Deflectors
- Jet Vanes
- Flexible Nozzles
- Jet Deviator



Hybrid Propulsion (studies, tests)

Soft Vertical Launch (SVL)

Divert Attitude and Control System (DACS)

- PIF Aster

TECHNOLOGY INNOVATION

Roxel, investing in innovation, facilities and industrial processes for the future

3D Printing / Additive Manufacturing

- Additive Manufacturing of Metallic Components
- Manufacturing of Toolings, Masks and Fixtures
- First Trials of Titanium Nozzles for an Anti-Tank Missile

ResonantAcoustic® Mixing

- Decrease mixing time
- Significant reduction of the variability of the properties of resins and glues
- Inhibition systems

*Rocket motor filled with
RAM-mixed propellant*



*Additive manufactured
motor case*

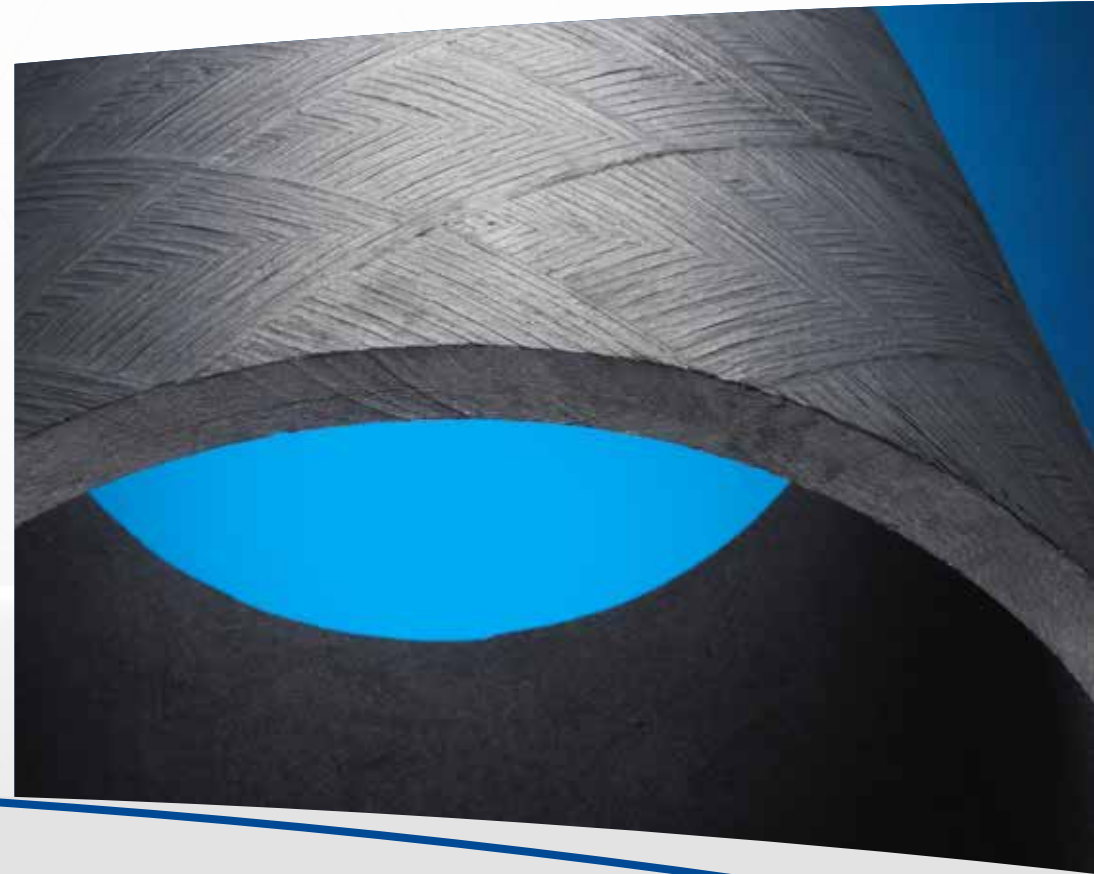
SIGNATURE CONTROL & INSENSITIVE MUNITIONS

Roxel, a world leader in IM Technology

- Proven capability of designing systems to pass the IM tests
- IM systems successfully fielded into service

Signature Control (Stealth)

- Improved through plume transmission for command signals
- Working across the electromagnetic spectrum
- Smoke reduction



*Without additive
Flame unsuppressed*

*With additive
Flame suppressed*

Bullet impact test

Roxel is a member of the IM European Manufacturing Group (IMEMG).

Roxel is a partner for MSIAC "Munitions Safety Information Analysis Center" activities.

COOPERATION WITH THE MISSILES INDUSTRIES

OUR CUSTOMERS ARE OUR PRIORITY



ROXEL IS A MEMBER OF



CONTACTS

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NOTES

NOTES



ROXEL IS AN
ISO9001:2015 / EN9100:2016 / ISO14001:2015
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