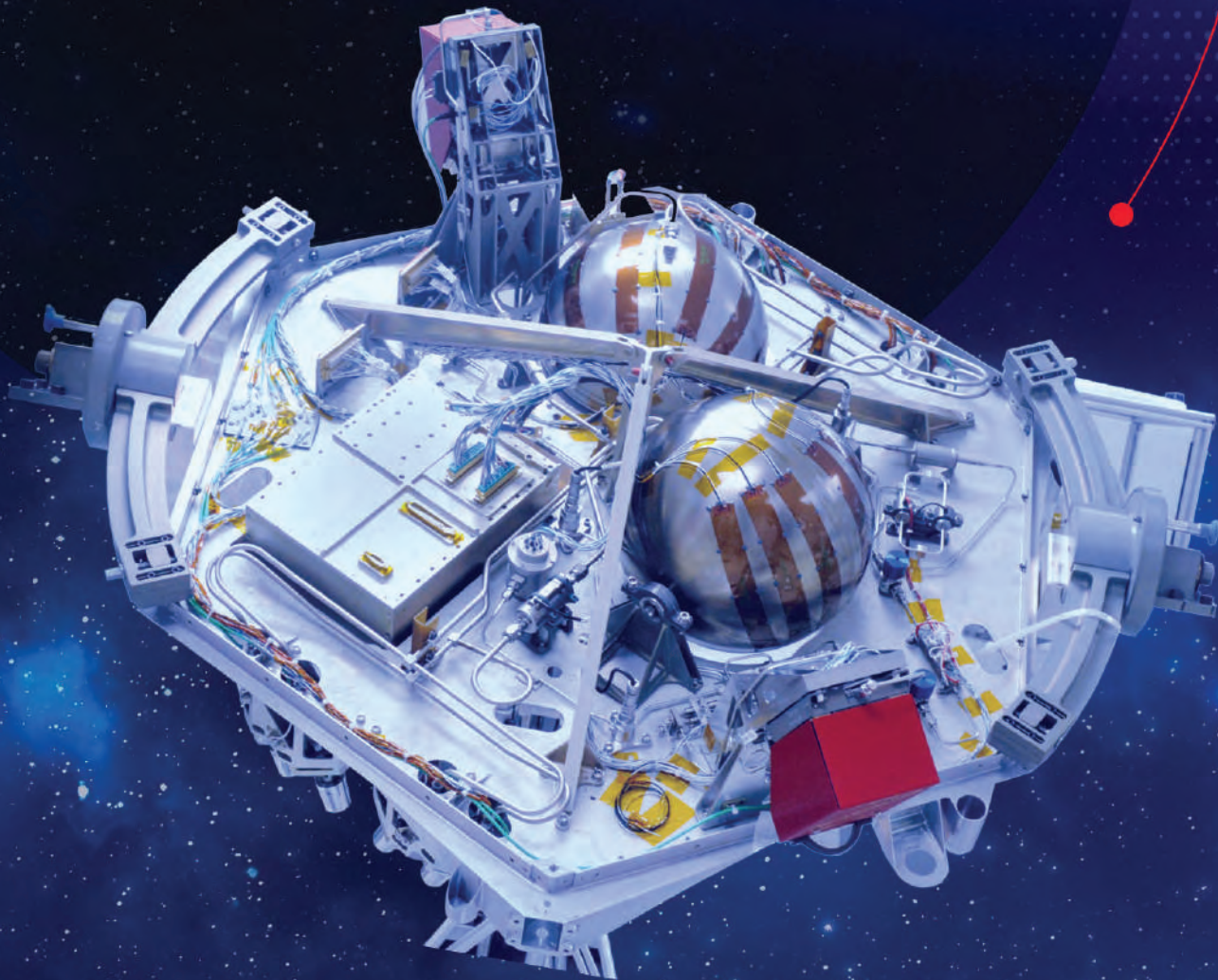


**SMART
AND TO THE
POINT.**

Space Propulsion

Propelled by Innovation



Venus

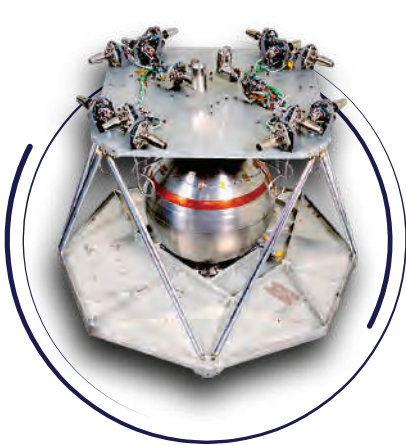


Rafael Space Propulsion

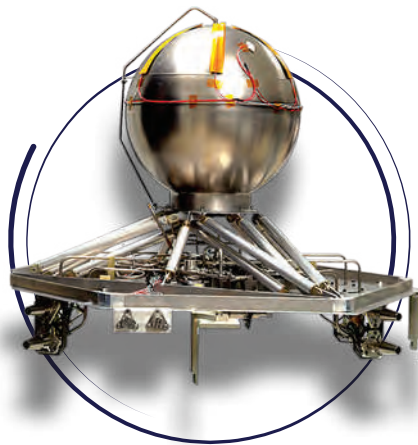
Gain the Rafael edge

Propulsion solutions propelled by innovation

- Rafael is an all-in-one source for propulsion systems and components: monopropellant hydrazine PS, electric PS, cold gas and hybrid systems
- Rafael provides a variety of state-of-the-art propulsion systems as turn key projects using adaptable architectures to ensure compatibility to mission requirements
- Rafael supports satellite providers from early design stages through the launch activity and during in-orbit operation
- Rafael supplies cutting-edge design and development services of space propulsion systems and components
- Featuring a mature manufacturing assembly integration and testing infrastructure & facilities



OFEQ



TecSAR



MEPS



Clean rooms exceeding 1000 m² **Metal Technology Center**

Rafael hosts a wide range of highly qualified state of the art manufacturing facilities:

- CAD/CAM, CNC machining
- Electro-Erosion
- Forming, hydro-spinning, deep hot and cold-drawing
- Surface treatment, heat treatment
- Welding (EBW, GTAW, GMAW, plasma), brazing
- Cutting, bending and flaring of titanium tubes



Clean Room Component Level



Clean Room PS-AIT



Hot Firing test facility

which includes 5 Firing Chambers

- Chambers for 10÷1 N class thrusters
- Chamber for High Thrust thrusters and/or system tests
- Chamber for Hall effect thruster & EP system firing



CNC Machine



EP Firing Chamber

Propulsion Systems by Platforms

EROS, OFEQ, TECSAR, Venus	Hydrazine
Slosh-Sat	Cold Gas
Venus	Electrical
Israeli launcher, Vega	RACS

Propellant Tanks by Satellites

Myriad programs, Prisma	PEPT 230
Venus, international customer	PEPT 260
Proteus programs, Giove-B, OFEQ, TECSAR	PEPT 420
Galileo IOV, IXV	PEPT 590
Globalstar-2, O3b, Sentinel	PEPT 590 GB
Slosh Sat	GSU-1L
Venus	Xenon

Thrusters by Satellites

Galileo IOV, Globalstar-2, O3B, Sentinel, Venus, international customer, Aquarius/SAC-D	1 N
EROS, OFEQ, TECSAR	5 N
EROS, OFEQ, TECSAR	25 N
Venus	IHET Hall Effect 300W

Thrusters by Launchers

Israeli launcher	25 N RACS
International customer	45 N
Israeli launcher, Vega	200 N class



Manor-Advanced Defense Technologies Division

Tel: +(972)73-335-7263

Email: manor@rafael.co.il

HQ Tel: +(972)73-335-4714

Fax: +(972)73-335-4657

Email: Intl-mkt@rafael.co.il

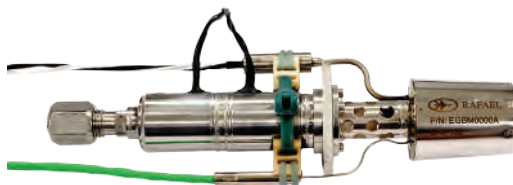
www.rafael.co.il

Satellite Thrusters

Product Name

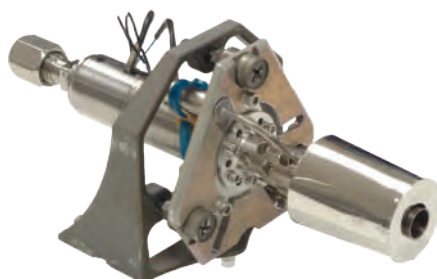
Main Heritage

1N Thruster



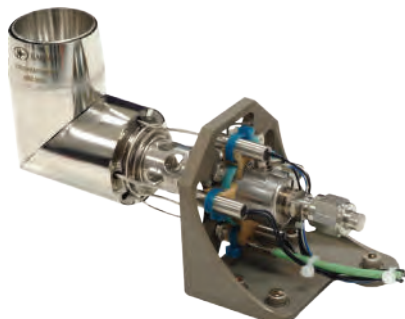
- Galileo IOV
- Globalstar-2
- O3B
- Sentinel-1
- NEOSAT
- Venus
- PRISMA
- SAC-D

5N Thruster



- OFEQ
- EROS
- TECSAR
- SAOCOM

25N Thruster



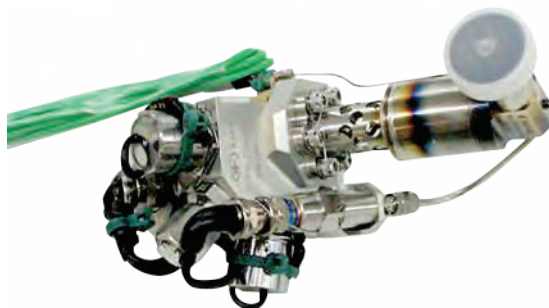
- OFEQ
- EROS
- TECSAR

Launcher Thrusters

Product Name

Sat. Program

**25N
RACS Thruster**



Israeli Satellite
launcher

**45N
Thruster**



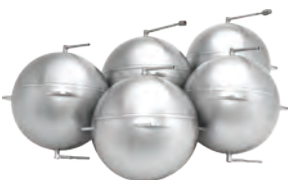
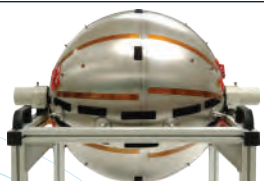
Satellite
launcher

**200N Class
RACS Thruster**



Israeli Satellite
launcher

Propellant Tanks

Component		Tank Nominal Volume [L]	Propellant Qualified Capacity [L]
PEPT- 200		3.7	3.3
PEPT- 230		6	4.5
PEPT- 260		9.3	7.0
PEPT- 330		17.5	15.4
PEPT- 420N		37.5	30
PEPT- 590I		102.5	75
PEPT- 590GB		204	154

Propellant Tanks

Positive Expulsion Propellant Tank – General Description

RAFAEL's Positive Expulsion Propellant Tanks (PEPT) are made of two thin-walled 6Al-4V titanium alloy hemispheres .

Positive fuel expulsion is provided by an EPDM-based rubber diaphragm retained in the tanks.

Pressurant and propellant ports are weldable, 1/4" titanium tubes.

The Propellant Tanks are made of the following parts:

- Lower hemisphere
- Upper hemisphere
- Cylindrical elongation sections – if needed
- EPDM-based, silica-free rubber diaphragm

Integration to a complete tank is accomplished through peripheral Electron Beam Welding (EBW).

Hemispheres are hot-formed and machined to final dimensions (exclude PEPT-200).

The design of the hemispheres enables the incorporation of integral pressurant and propellant ports.

The diaphragm has a life expectancy of 15 years when used with hydrazine propellant and has been qualified for various missions and satellite busses, such as Globalstar2, Myriade, Galileo, Exomars, Neosat and others. The diaphragm has further been qualified for use with ADN-based environmental-friendly ("green") propellant.

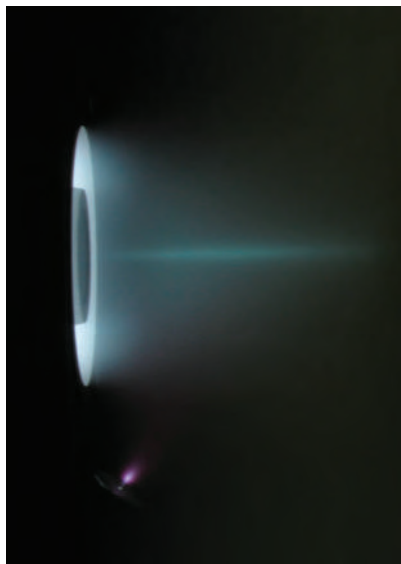
Electric Propulsion Systems

Product Name

Main Characteristics

R-200

Hall Thruster



Discharge Power: 100 - 300 W
Thrust: 5 - 14 mN
Total Impulse: > 200 kN - sec

R-200EPS

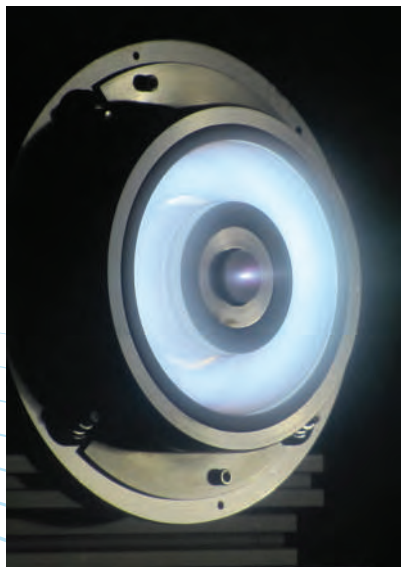
Plug & Play
Propulsion
System

Input Power: 140 - 350 W
Thrust: 5 - 14 mN
Specific Impulse: 800 - 1,300 sec
Total Impulse: > 400 kN - sec

Configuration: 2×Thruster Units,
PPU, Propellant Tank, Propellant
Feed System

R-800

Hall Thruster



Discharge Power: 450 - 900 W
Thrust: 24 - 53 mN
Total Impulse: > 750 kN - sec

R-800EPS

Plug & Play
Propulsion
System

Input Power: 500 - 1000 W
Thrust: 24 - 53 mN
Specific Impulse: 1300 - 1550 sec
Total Impulse: > 1.5 mN - sec

Configuration: 2×Thruster Units,
PPU, Propellant Tank, Propellant
Feed System