Europe et exploration spatiale

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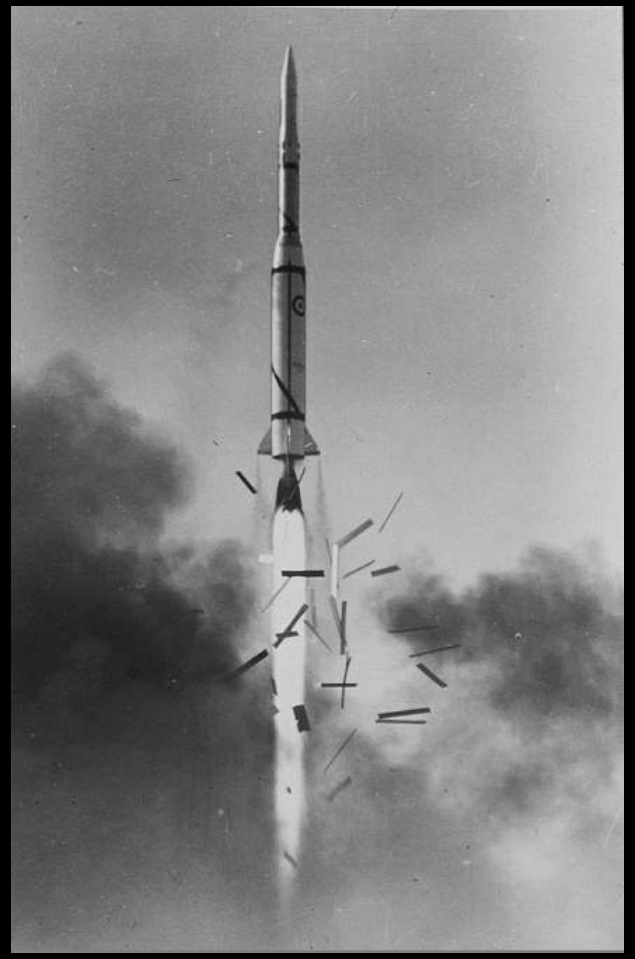
LA COOPERATION DANS LA COURSE A L'ESPACE

UN BREF HISTORIQUE



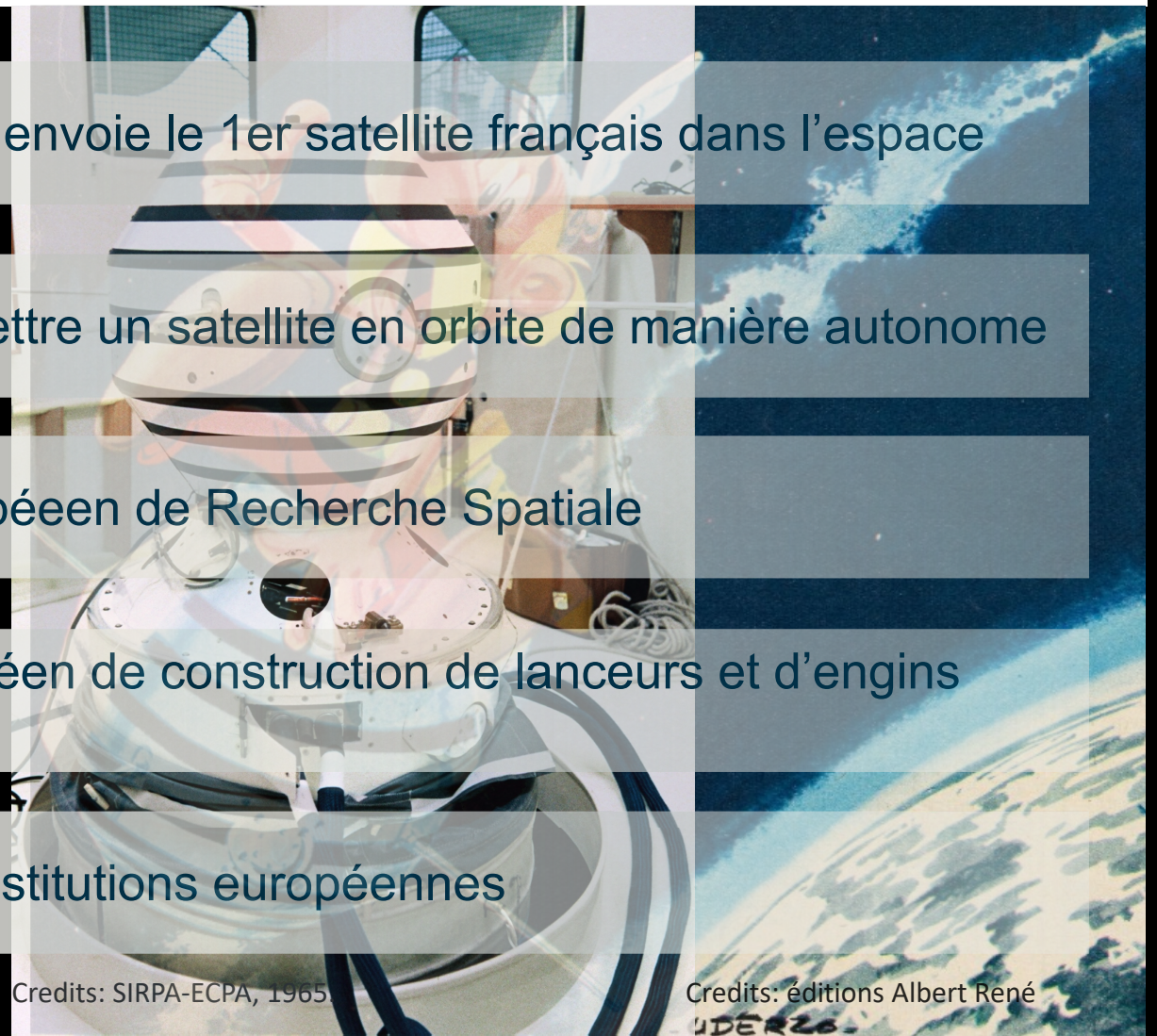
1965 : La Fusée Diamant envoie le 1er satellite français dans l'espace

France = 3ème pays à mettre un satellite en orbite de manière autonome

Création du Conseil européeen de Recherche Spatiale

Création du Centre européen de construction de lanceurs et d'engins spaciaux

1975 : Fusion des deux institutions européennes



Credits: SIRPA-ECPA, 1965

Credits: éditions Albert René

LA COOPERATION DANS LA COURSE A L'ESPACE

Agences spatiales nationales

DLR

cnes CENTRE NATIONAL D'ÉTUDES SPATIALES

agenzia spaziale italiana

Industries du spatial

arianeGROUP

activespace technologies making space a global endeavour

Agence Spatiale Européenne

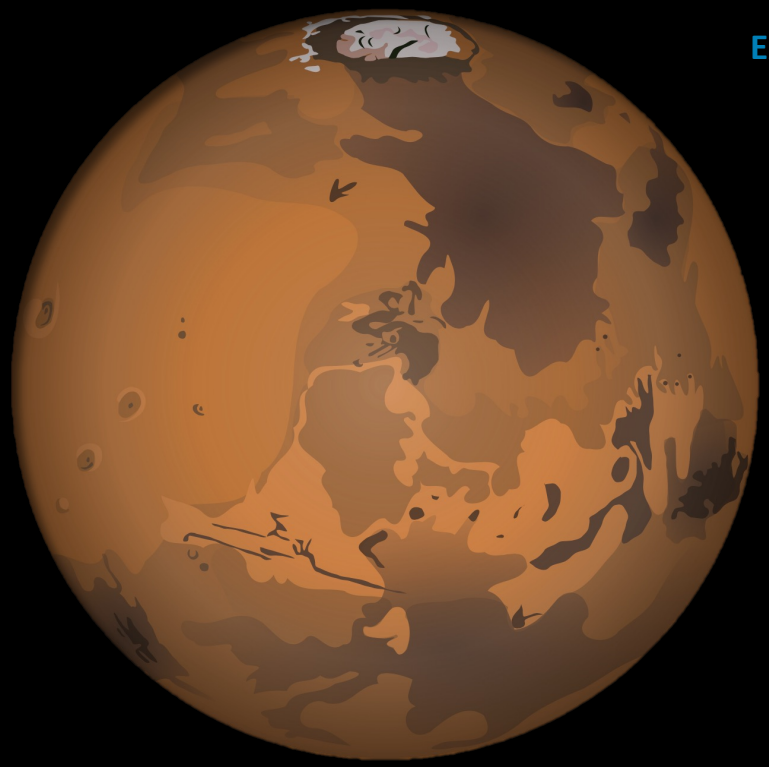
esa

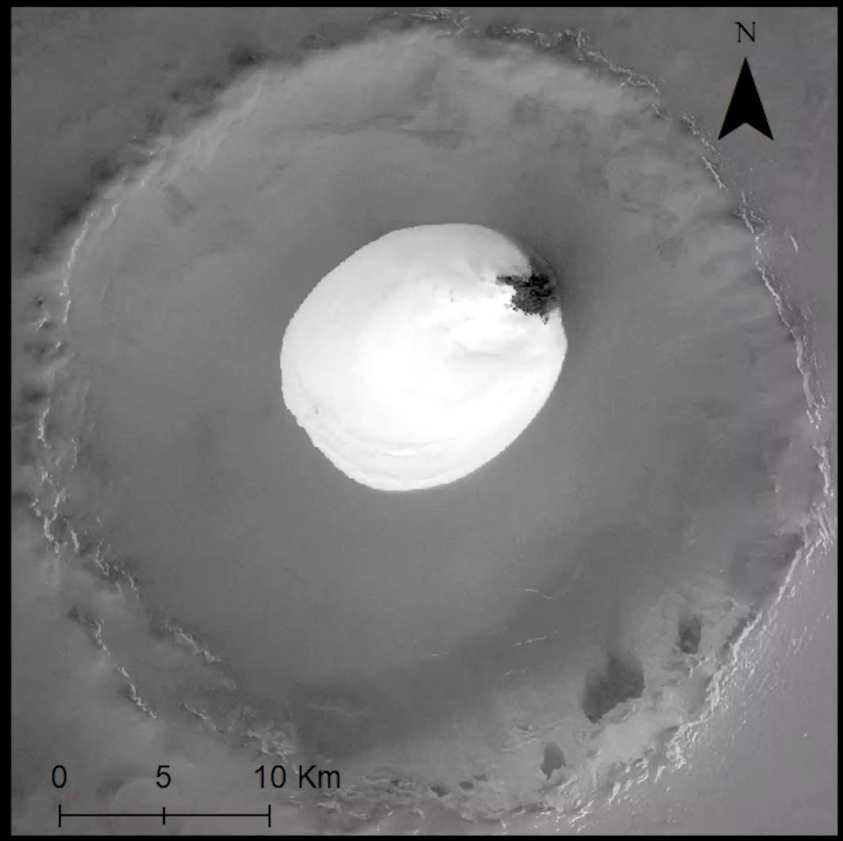
Union Européenne

PRINCIPALES REALISATIONS POUR L'EXPLORATION SPATIALE

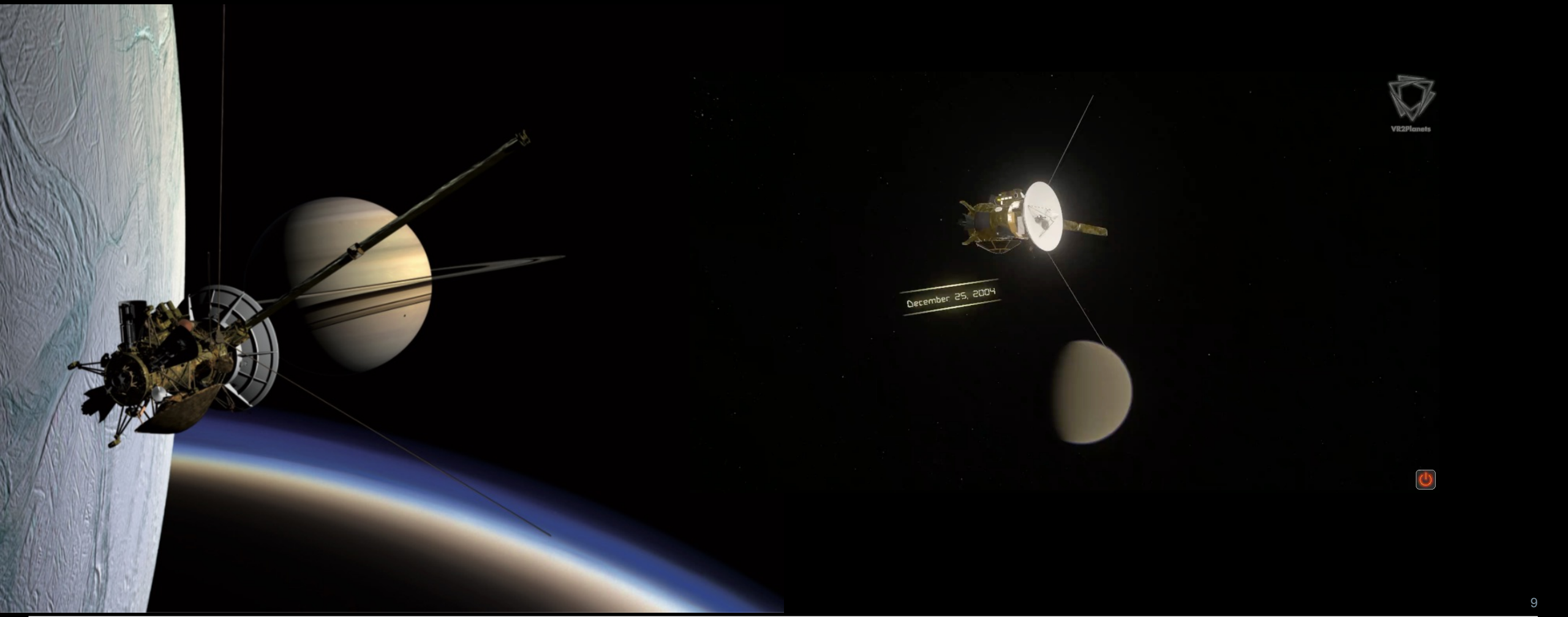
MARS EXPRESS

EXoMars - TGO





PRINCIPALES REALISATIONS POUR L'EXPLORATION SPATIALE



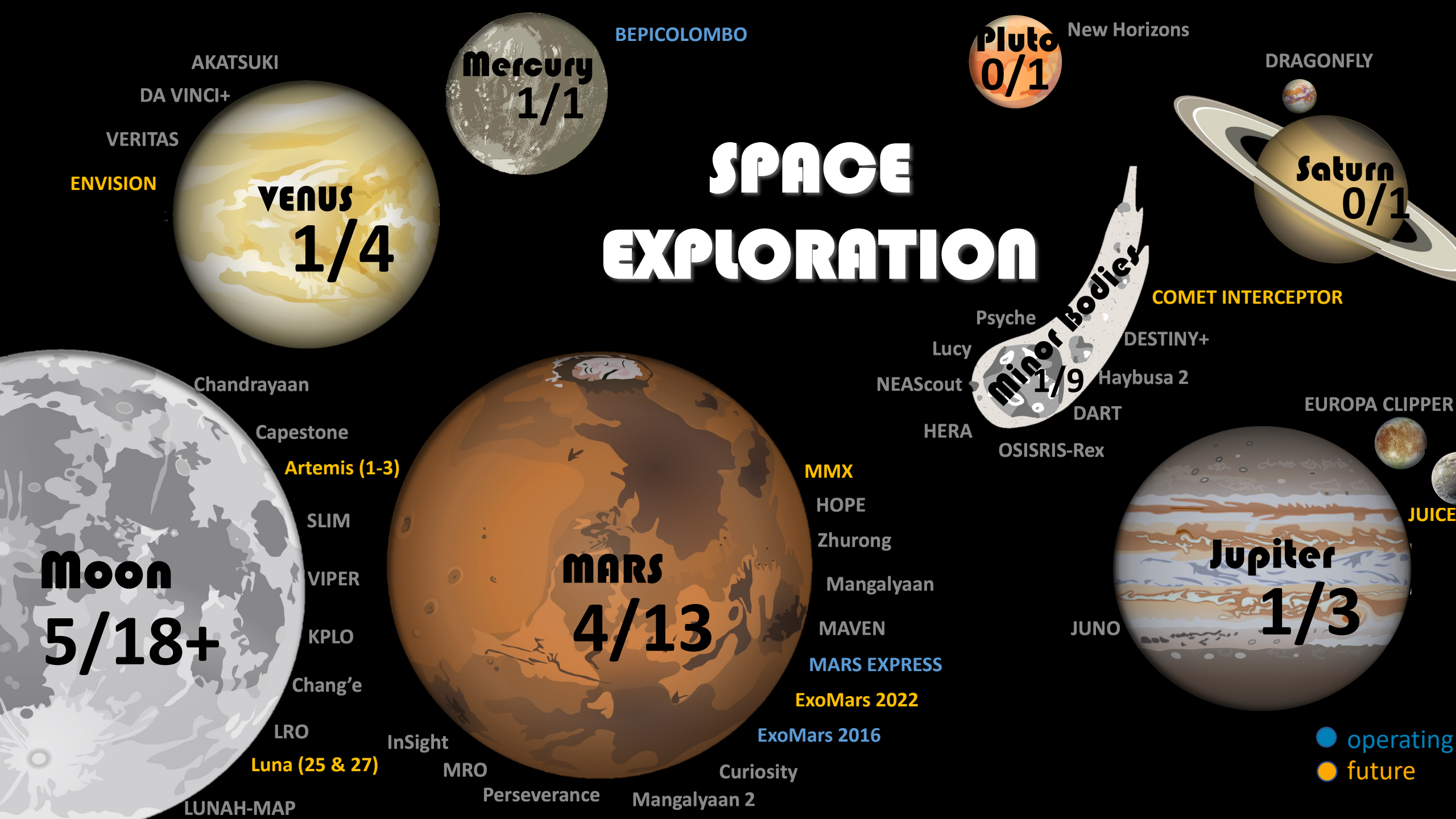
EUROPE & ESA

COMET

VR2Planets

PRINCIPALES REALISATIONS POUR L'EXPLORATION SPATIALE

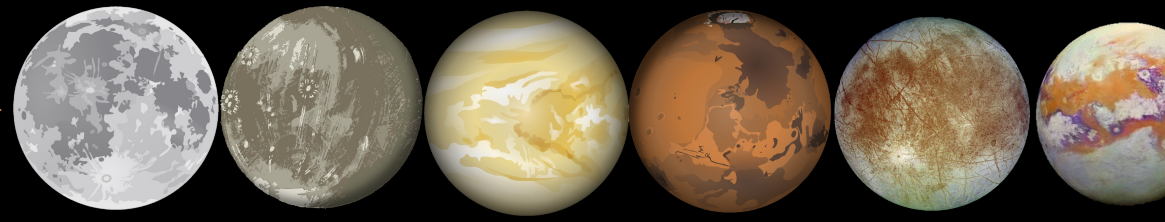
SPACE EXPLORATION



Planetary exploration

2010 2020 2030

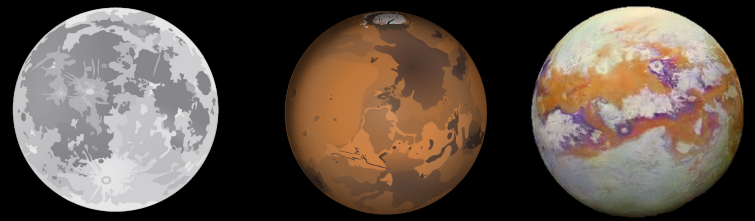
Planetary monitoring



Institutional and commercial lunar missions

Sample Return

Lander and mobility



EUROPE & SPACE EXPLORATION

MAJOR SCIENTIFIC QUESTIONS

ORIGINS of **PLANETARY SYSTEMS**

FORMATION and DIVERSITY of planetary systems ARCHITECTURES

DIVERSITY of objects

Planetary Sytems COUPLING MECHANISMS

Emergence of potential HABITATS

DETECTION of LIFE

MERCURY

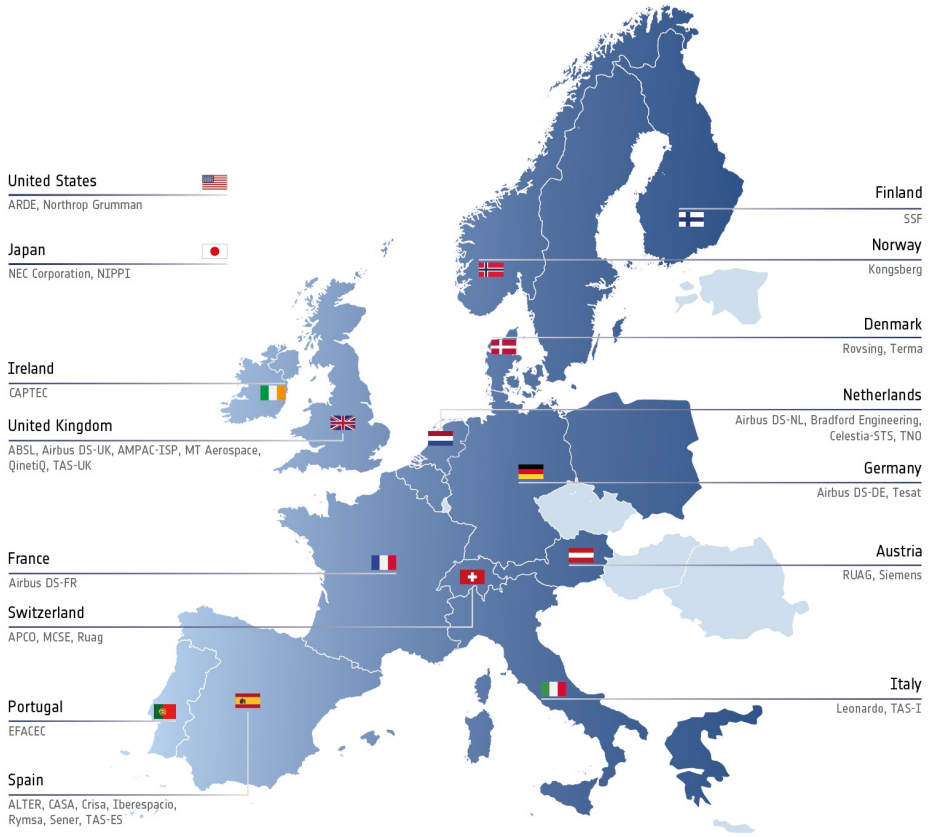
newgifs.com

Mercury:
Why is there ice in the polar craters of the scorched planet?
Why does Mercury have a magnetic field?
What are the mysterious 'hollows' on its surface?

ESA+JAXA
Bepicolombo

Launch: 20 October 2018
Operation around Mercure: dec. 2025

Industrials partners *(credits : ESA)*



MERCURY

newgifs.com

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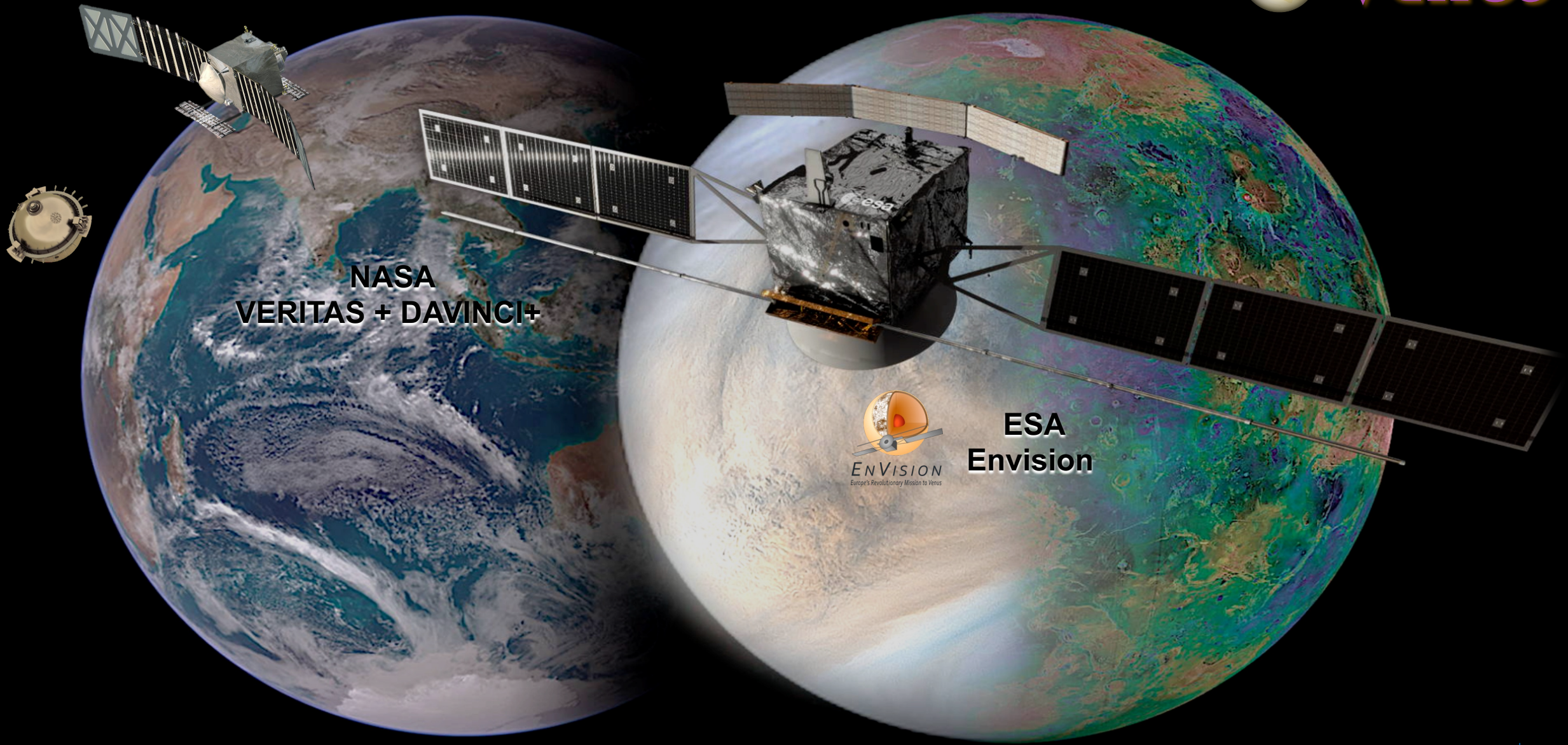
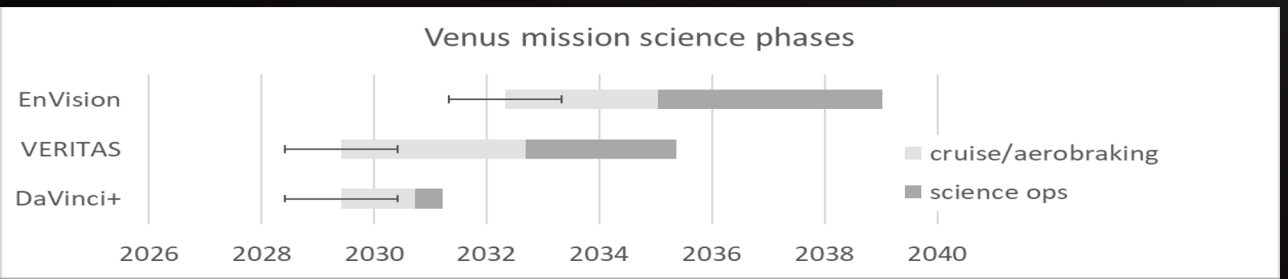
VENUS



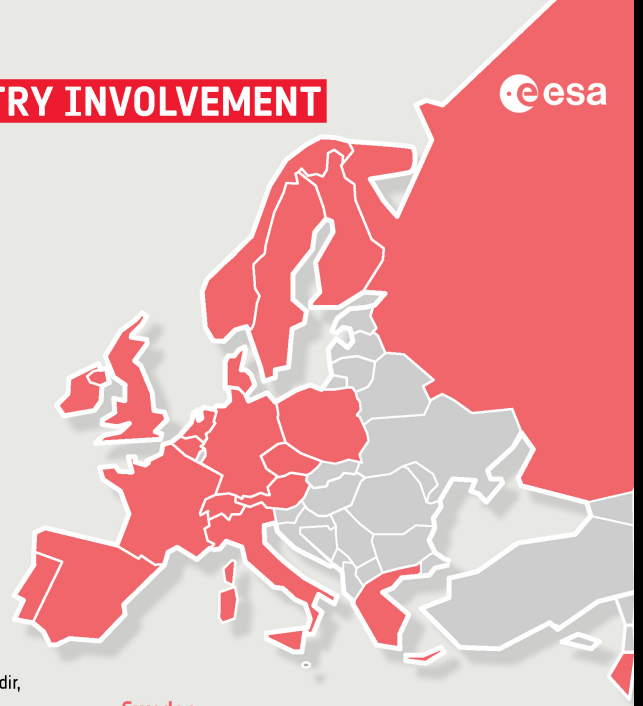
Credits: JAXA / ISAS / DARTS / Damia Bouic / VR2Planets.

VENUS


Venus mission science phases
EnVision
VERITAS
DaVinci+
cruise/aerobraking
science ops
2026
2028
2030
2032
2034
2036
2038
2040

EXOMARS INDUSTRY INVOLVEMENT

Map of European contributions



Austria
RUAG, Joanneum Research, VRVis, Siemens

Belgium
ASTEK, OHB-BE, QinetiQ, TAS-BE, Trasys

Czech Republic
Frentech Aerospace

Denmark
Terma

Finland
Patria, Space Systems

France
Airbus DS-FR, Axon, ETS, LMD, SAFT, Sofradir, Souriau, TAS-F Cannes, 3D Plus

Germany
Airbus DS-DE, Airbus DE, Azur Space, DSI, ETS, Gerling Holz & Co., Faulhaber, Maxon Computer GmbH, OHB, Rockwell Collins

Greece
TEMMA

Ireland
Microsemi

Italy
Acotec, Aero Sekur, ALTEC, CISAS-UniPD, Corista, D'Appollonia, Elital, EniProgetti, IRSPS, Leonardo, Sitael Aerospace, TAS-I, Telespazio

Netherlands
Aerospace Propulsion Products BV, Bradford, ETS, Deltares, TNO, Celestia STS, Airbus DS-NL

Norway
Kongsberg

Poland
Sener

Portugal
Active Space Tecnhologies, Critical Software, Deimos, GMV, HPS, IST

Spain
Airbus-DS-E, Crisa, Deimos, GMV, Iberespacio, INTA, RYMSA, Sener, TAS-ES, TRYO Aerospace, TTI

Sweden
RUAG, SSC

Switzerland
Almatech, APCO, Clemessey, Fisba Optik AG, Maxon, RUAG, SEM, TASiCH

United Kingdom
ABSL, Airbus DS-UK, Axon Cable Ltd, Cinch Connectors Ltd, Datasat Europe Limited, Fluid Gravity Engineering Ltd, G&H, QinetiQ, Qioptiq, SciSys, RAL Space, TAS-UK, Tessella, Te2v, Thin Metal Coatings, Vorticity

Russia
IKI RAS, Khrunichev SRPC, Lavochkin Association, TsENKI, TsNIIMash

United States
ASNA, ATK-PSI, EMS, ERG, GD-OTS, Haigh-Farr, Honeywell, JPL, Mu Space, NEA Electronics, NSC, Tech Ord

Canada
MDA, Neptec

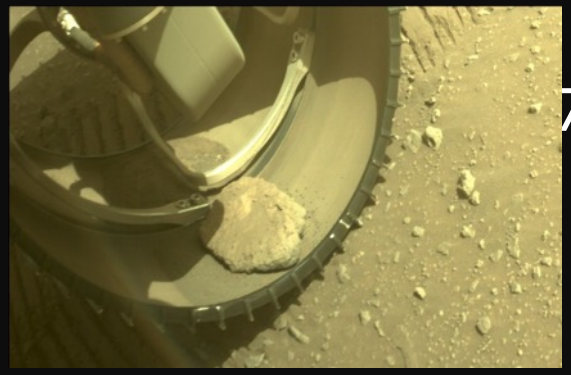
Israel
Rafael

MARS

credits: ESA

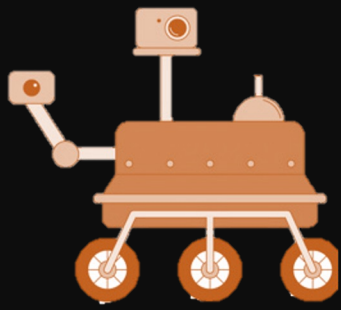
-> MARTIAN ROVERS

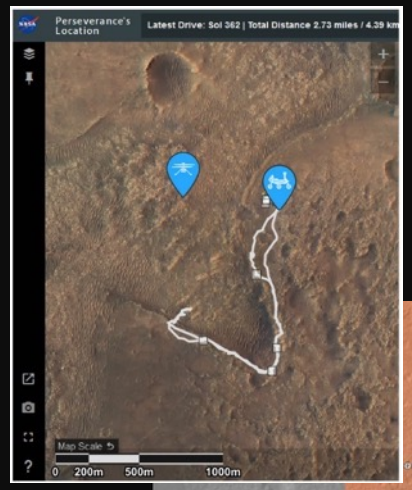
Perseverance : Un an sur Mars (7 échantillons prélevés et scellés, 4 km, en route pour le Delta de Jezero)



Curiosity : 10 ans sur Mars (27 km), accède à une nouvelle unité géologique (le « Pediment »)

Exomars – Rover martien européen « Rosalind Franklin » fortement compromis par la crise en Ukraine (0 km) ☹





→ LUNAR MISSIONS

MISSION	AGENCY/LAUNCH DATE	DESCRIPTION/OBJECTIVES
Queqiao	CNSA 2018	Communication relay satellite.
Chang'e-4	CNSA 2018	Far side scientific lander and rover.
Chandrayaan-2	ISRO 2019	Polar scientific orbiter, lander, and rover.
Chang'e-5	CNSA 2020	Near side sample return.
Luna 25	Roscosmos 2021	Lunar volatile prospecting. Soft landing technology demonstration.
Chandrayaan-3	ISRO 2021	Lunar polar lander and rover.
Artemis I	NASA/ESA 2021	Uncrewed Orion/ESM flight with science and technology payloads. Deployment of cubesats in lunar orbit.
SLIM	JAXA 2021/22	Pinpoint landing technology demonstration.
KPLO	KARI 2022	Polar scientific and technology demonstration orbiter.
Chang'e-6	CNSA 2022-2024	Polar volatiles sample return.
VIPER	NASA 2023	Lunar polar rover. Polar science and volatiles.
LUPEX	JAXA/ISRO 2023/24	Polar lander and rover. Polar science and understanding the distribution and characterization of volatiles.
Luna 26	Roscosmos 2024	Polar scientific orbiter. Polar volatiles mapping.
Luna 27	Roscosmos with ESA 2025	Polar science, volatile prospecting and acquisition. Drill technology demonstration.
EL3 (TBC)	ESA 2027/2028	Science and/or logistic capabilities.
Luna 28	Roscosmos 2027	Cryogenic polar volatiles sample return.
ISRU demo	ESA 2027	In-situ end-to-end extraction of oxygen from lunar regolith.
Chang'e-7	2023-2030	Prototype of International Lunar Research Station (ILRS).
Chang'e-8	2023-2030	Prototype of International Lunar Research Station (ILRS).
Mid Lander	JAXA Late 2020's	Transport logistics and/or science.
Korea lunar lander	KARI 2030	Technology demonstration.

credits: Table 2, GER 2020 supplement

ISECG Agencies world Map

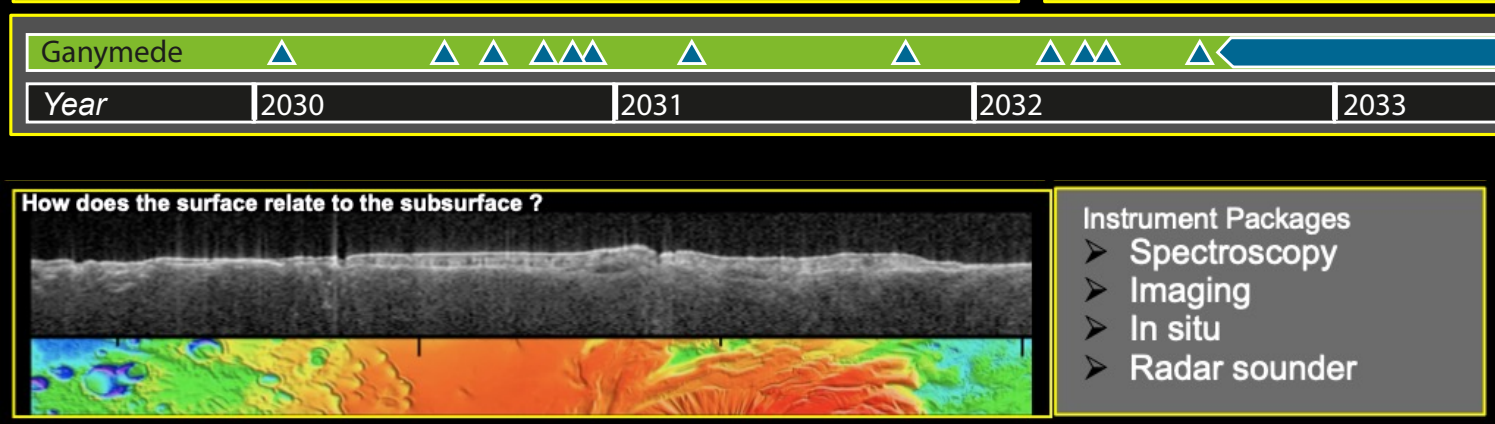
ICY MOONS

JUICE measurements

- Tidal deformations
- Rotation
- Magnetic induction

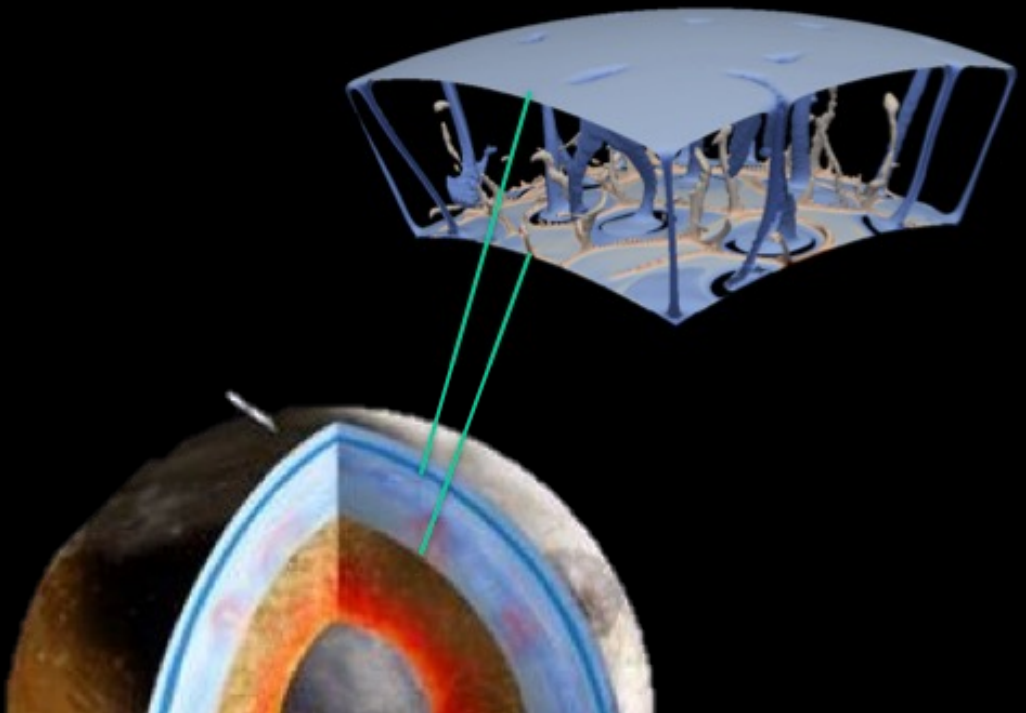
Instrument Packages

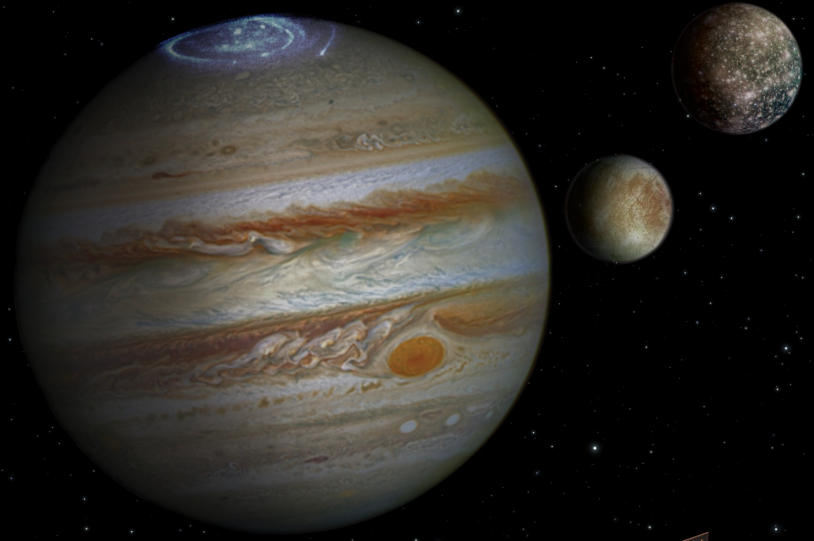
- In situ Fields and Particles
- Imaging
- Sounders and Radio Science



Instrument Packages

- Spectroscopy
- Imaging
- In situ
- Radar sounder





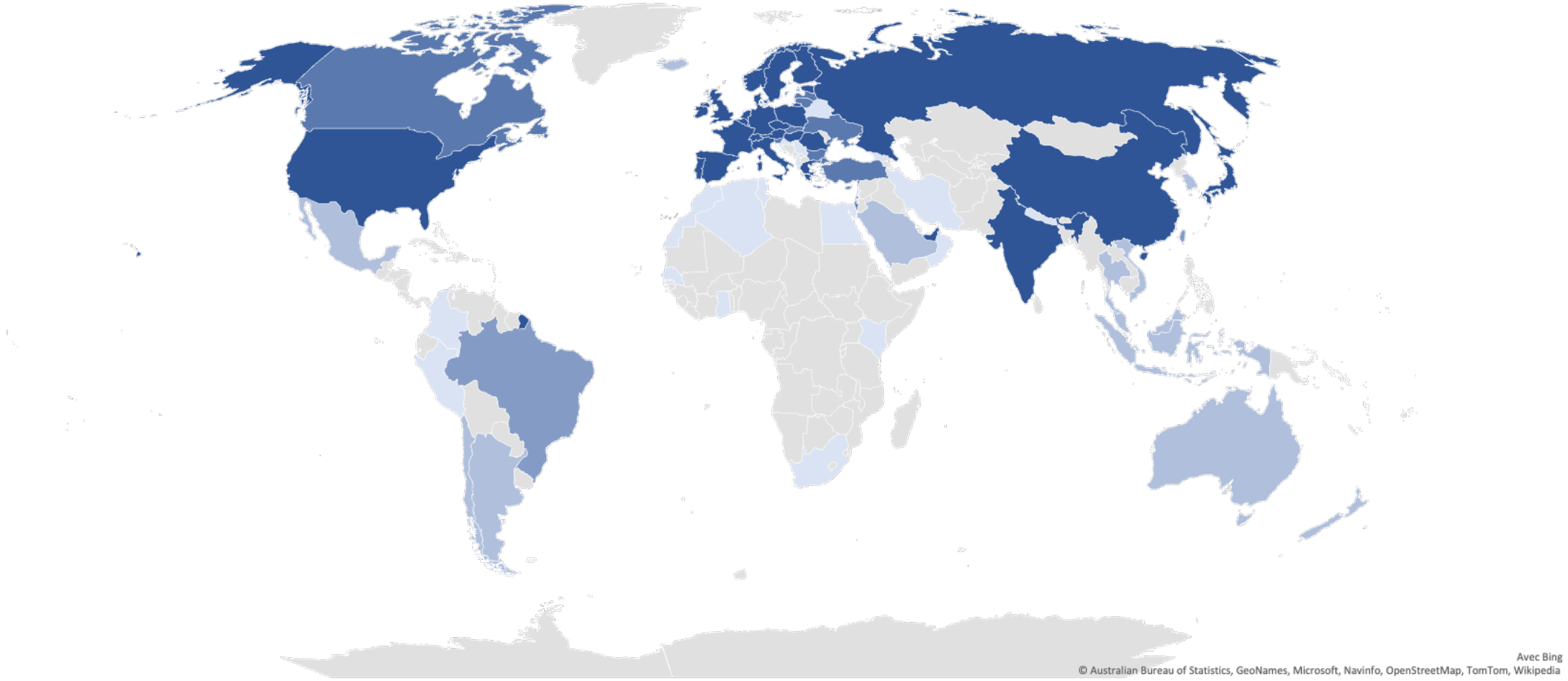
ESA

JUpiter ICy moon Explorer (JUICE)

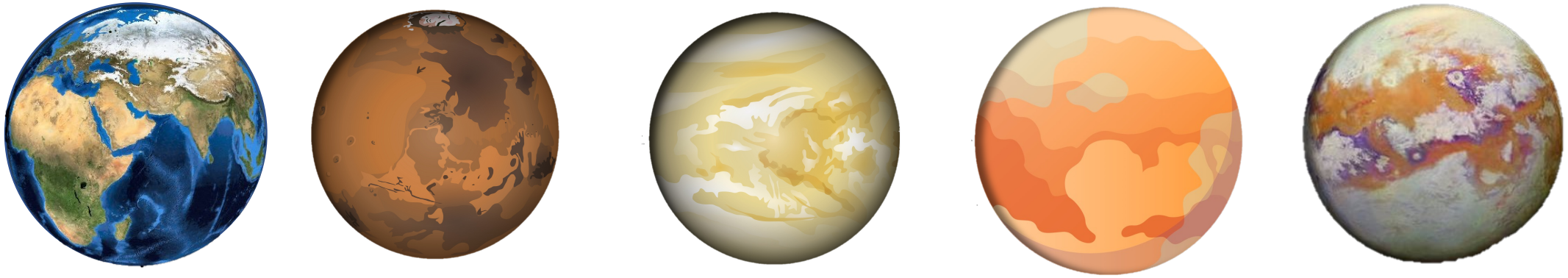
Launch planned in September 2022
Operation around Jupiter: 2031-2034
Orbit insertion around Ganymede: 2034-35

CONCLUSION

HIGHLY COMPETITVE ZONE OF STRATEGIC POLITICAL AND ECONOMICAL INFLUENCE



CONCLUSION

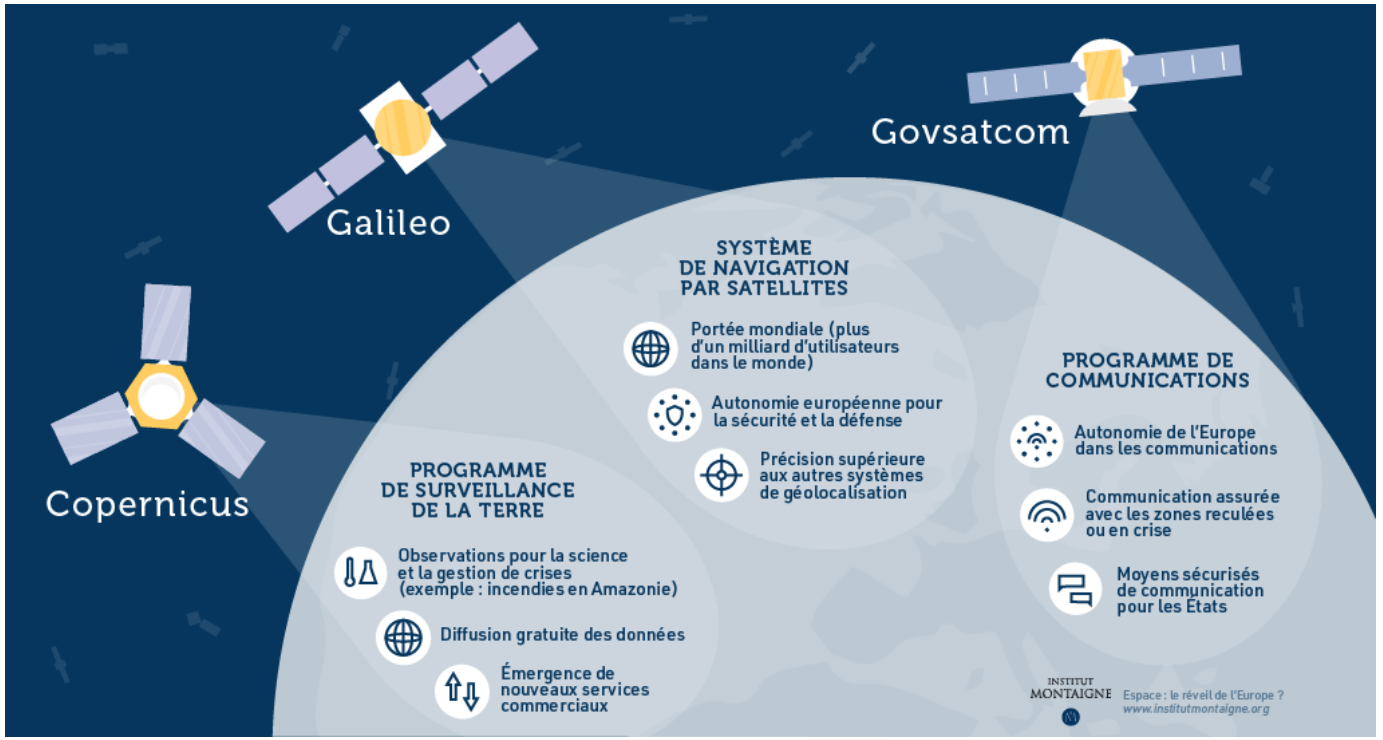


La planétologie comparée :
étudier les autres planètes pour mieux comprendre la Terre **!**

CONCLUSION

LE PROGRAMME SPATIAL EUROPEEN

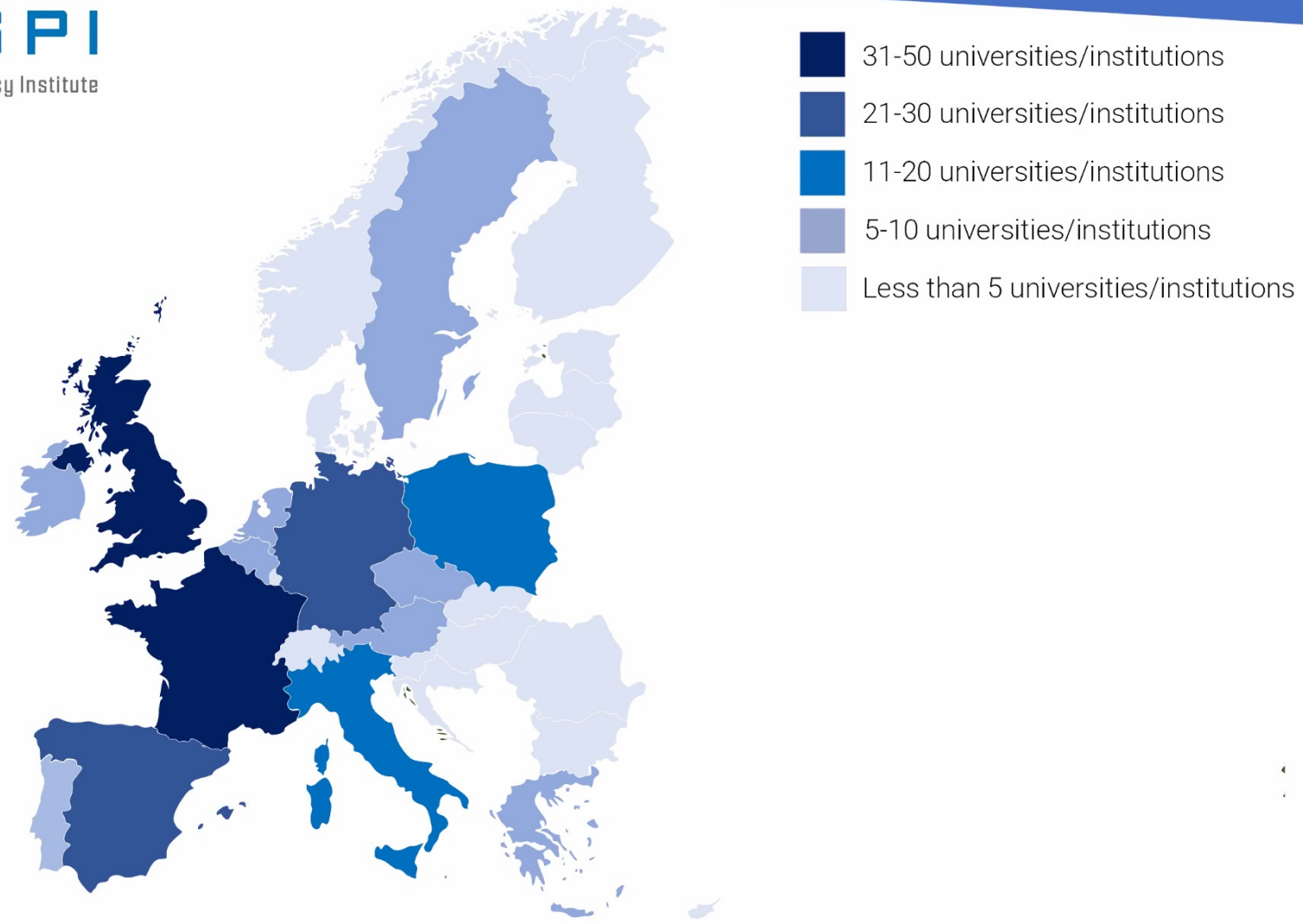
L'exploration spatiale n'est qu'une partie d'un programme spatial de l'Europe avec des problématiques bien terrestres et des enjeux beaucoup plus larges :



- géopolitiques et diplomatiques
- environnementaux et climatiques
- indépendance technologique / autonomie
- services aux citoyens
- économique
- Code de la route spatial

POURSUIVRE SES ETUDES DANS LE SPATIAL

ESPI
European Space Policy Institute



Distribution of universities/institutions offering space curricula by country