

SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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FROM MARS TO OUTER PLANETS: ROBOTIC SPACECRAFT BUILDING BLOCKS AND
ASSOCIATED TECHNOLOGICAL PREPARATION**Abstract**

ExoMars represents a golden opportunity for Europe to enter the age of large planetary orbiters. In this presentation Thales Alenia Space reports how, beyond ExoMars, building blocks for large orbiters and more generally, mother ships will play a key-role in the exploration of our System. Future missions will require orbiters not only around Mars or other inner planets but also around Jupiter, Saturn, Uranus and around some of their major moons. Some asteroids, small or large, in the Main Belt or in the Trojan clouds will also see new missions, after Hayabusa and Dawn. The multiplication of new targets in the distant reaches of our Solar System will also keep the need for New-horizons-like fly-by missions, requiring innovative architectures to further enhance the science-to-cost ratio. We first review the target missions of the next decade and the constraints they place on the physical and functional architecture of the main spacecraft. With chemical propulsion the large wet mass-to-dry mass ratio combined with the need for an efficient structural index determines the physical architecture. With electrical propulsion, the staging trade-off is always fundamental with an outcome depending upon the depth of the gravity well of the target. Architectures based upon a mother ship with ancillaries prove very well adapted to fly-by missions and to missions to multiple satellite-systems. The science and/or exploration mission constrains as usual the face allocation, directly through the payload accommodation requirements and indirectly through the needs related to power generation needs and communication with Earth. All in all, the multiplicity of needs makes the case for building blocks that minimize non-recurring costs across this vast array of missions: we identify those potential physical and functional building blocks. We then review the key technologies required to achieve such missions and organize them into a technological road map.