

Photonics Technologies for Space: Overview of Italian Space Agency Activities

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Technology Meeting on Micro and Nano-satellites in the New Space

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1. APPROACH FOR TECHNOLOGY DEVELOPMENT
2. PHOTONICS APPLICATION
3. ASI ACTIVITIES ON PHOTONICS
4. CONCLUSIONS

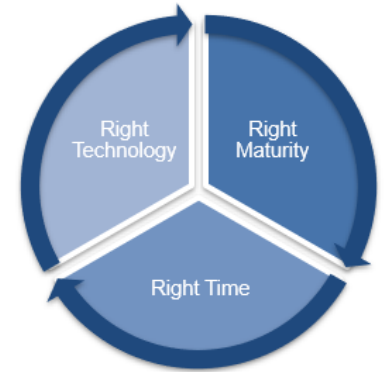
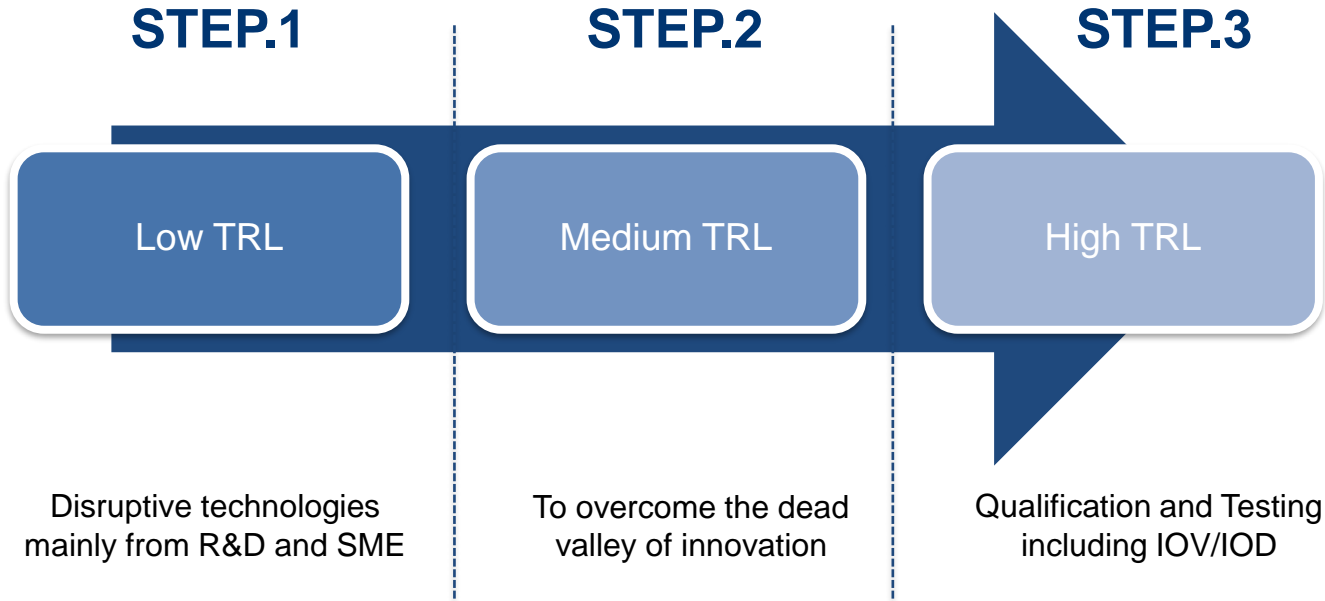


Approach for technology development

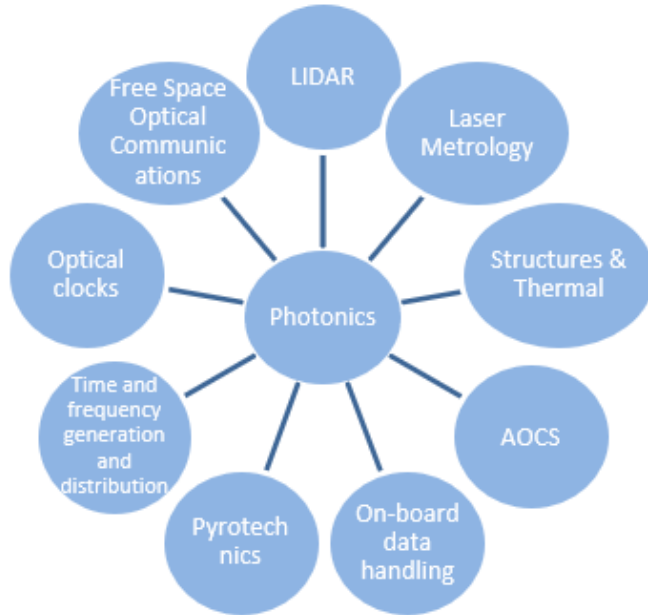
ASI technology program develops cutting-edge space technologies that enable missions and support the competitiveness of national operators



Multi STEP approach



Transversal Capabilities of Photonics



Sensors for attitude determination, “harness-less” equipments, oscillators, transceivers, beam splitter are just few examples of the transversal use of the photonics technology.



Opportunities and Challenges

OPPORTUNITIES

Sustainability

The Photonics technology is progressively expanding its use in many terrestrial fields

Resources

The use of photonics for space applications represents a huge technological leap for energy efficiency, reduction of mass and dimensions, data handling

Flexibility

The flexibility given by photonics starts to call the attention of developers of navigation, radar and optical missions.

CHALLENGES

Availability of components

The new space economy, requires cheaper and fast missions in order to satisfy the implementation of downstream applications.

New architectures and traditional techniques

Photonics require to be implemented in existing architectures, need for R&D and new design solutions

Dependability

Space Environment & Space Qualification is not cheap, process qualification takes time and resources

Main interests in photonics



✓ Communications

- Optical communications
- Intra-sat, inter-sat connectivity
- Microwave photonics for RF links
- Quantum communications

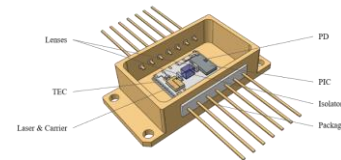
✓ Sensing

- Lidar
- Photonics-based radar
- Distributed optical sensors
- Lab on chip

(some) ASI activities in photonics

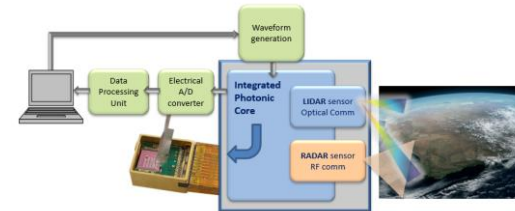
Photonic Integrated Circuits (PICs)

- Chip scale micro integration of multiple optical elements



Photonic Space Packaging

- Development of advanced photonics packaging technologies for space environments and applications

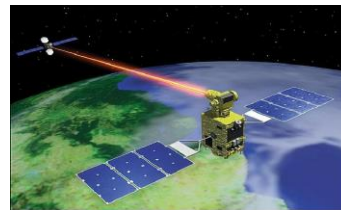


Photonics for Remote Sensing-Satellite Platforms

- Flexible and light weight payloads using microwave photonic and integrated photonics equipment (RADAR and LIDAR)

Quantum Communications for Space

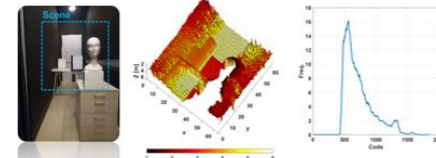
- Quantum Key Distribution
- Integrated Photonics for Space QuComm



AOCS sensors

- High performances photonic gyroscope

First hit
Auto-sensitivity off

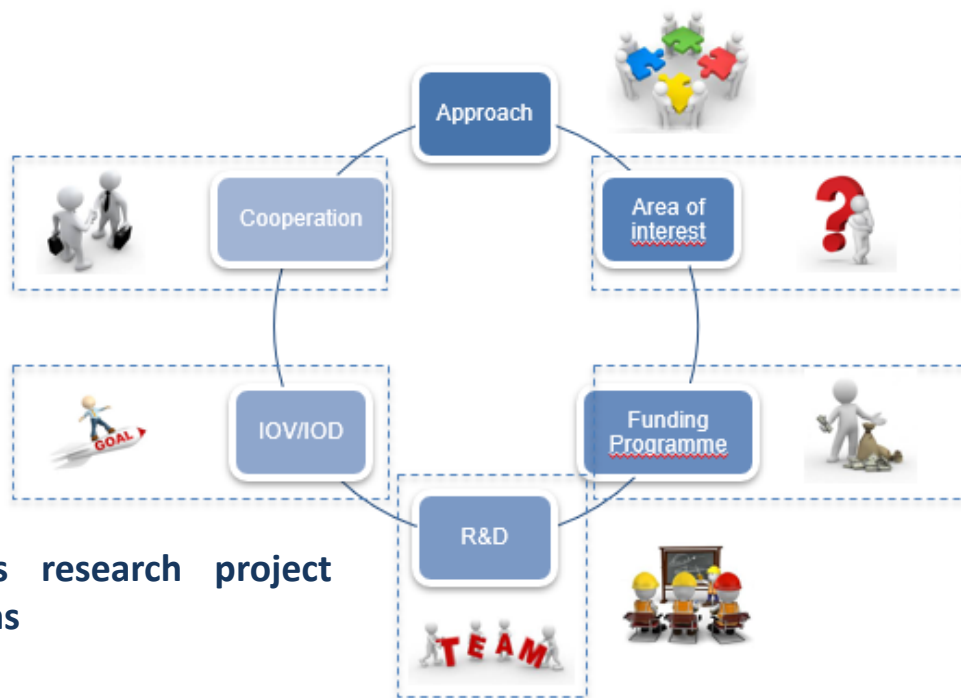


Photonic technologies can be used in:

- Scientific / Commercial Payloads
- Satellites / Launchers
 - Systems
 - Subsystems
 - Components
- Ground Segment

ASI activities in photonics encompass research project spanning from low TRL to IOV/IOD missions

Calls and opportunities have been defined even to enhance spin-in activities





Agenzia Spaziale Italiana

THANK YOU FOR YOUR ATTENTION

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