



# PULSAR

*Prototype of an Ultra Large  
Structure Assembly Robot*



3rd PERASPERA workshop  
Project presentation

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Tuesday, April 2<sup>nd</sup> 2019

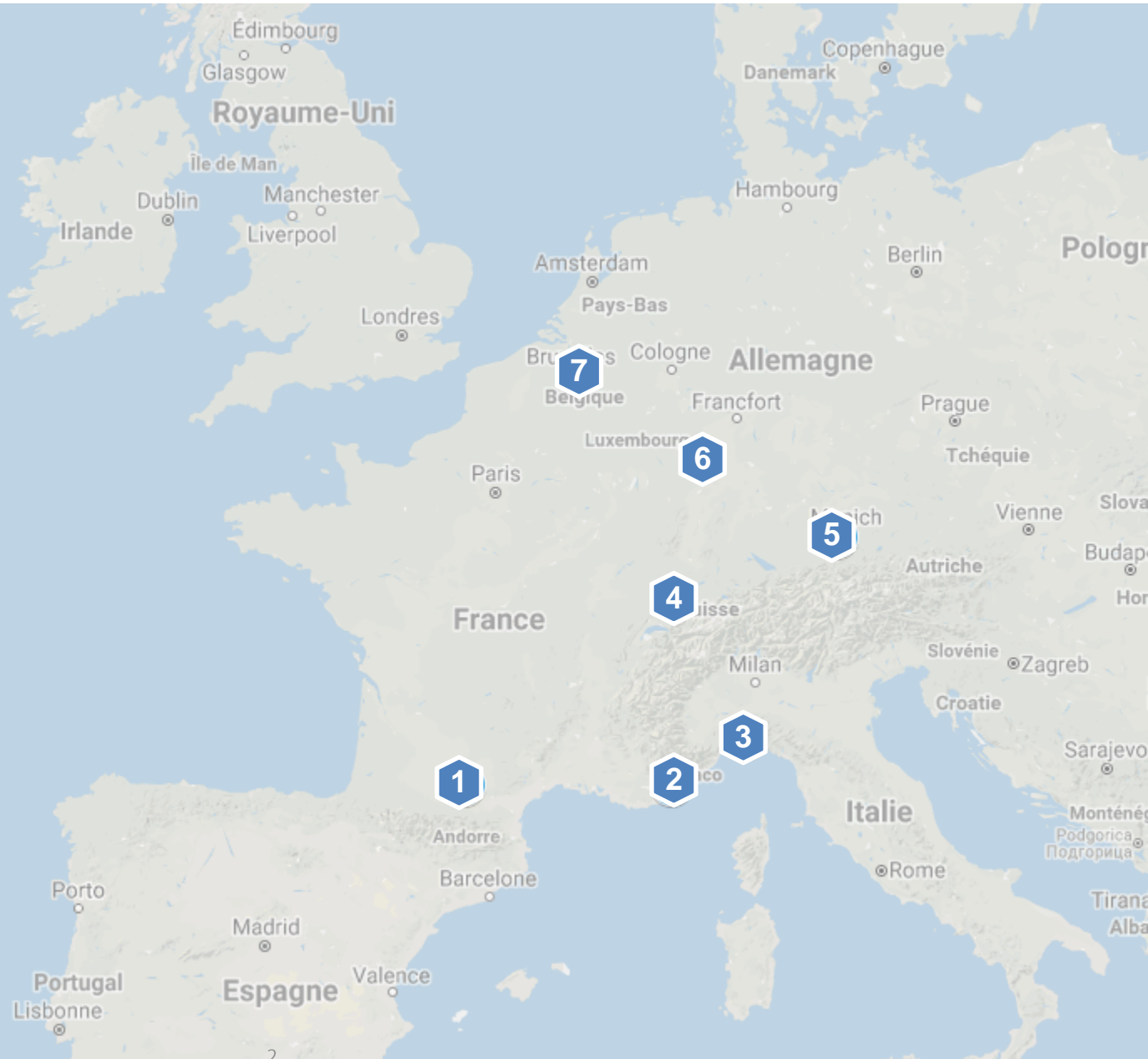
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Brussels





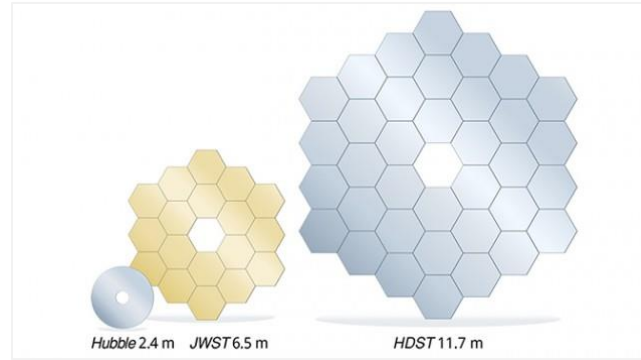
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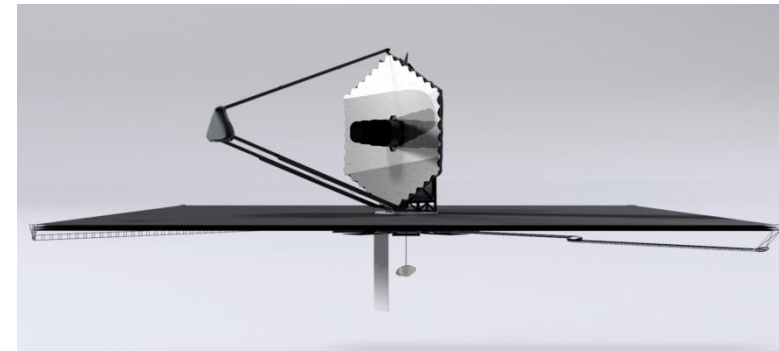
## Assemble mirror tiles of a telescope primary mirror

- Structure rigidity
- Adjustable optical faces
- Mirror size
- AOCS



## Prepare the technology to assemble large and scalable structures in space

- Fully autonomous primary mirror assembly
- Precision mirror tile positioning
- Extended mobility of the overall structure
- Use of generic connector

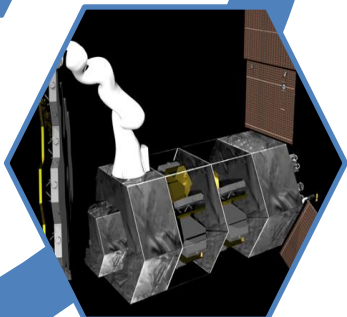




demonstrator of Precise Assembly  
of Mirror Tiles  
**dPAMT**



demonstrator of Large  
Structure Assembly in Free  
Floating Environment  
**dLSAFFE**



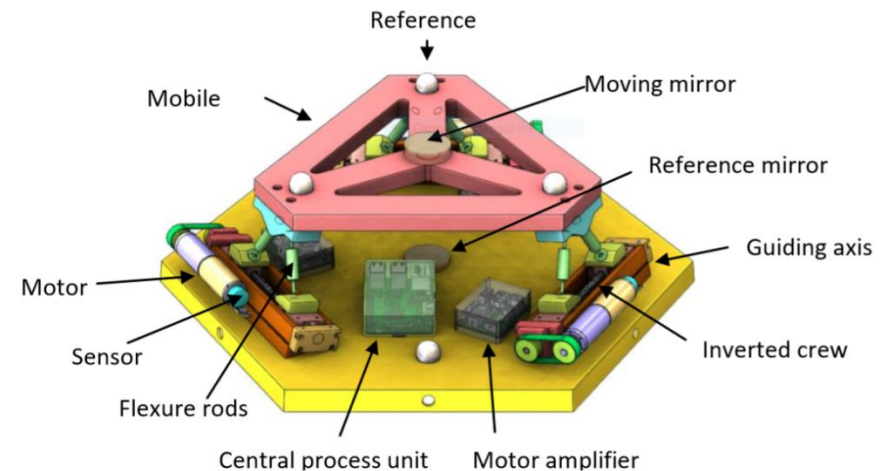
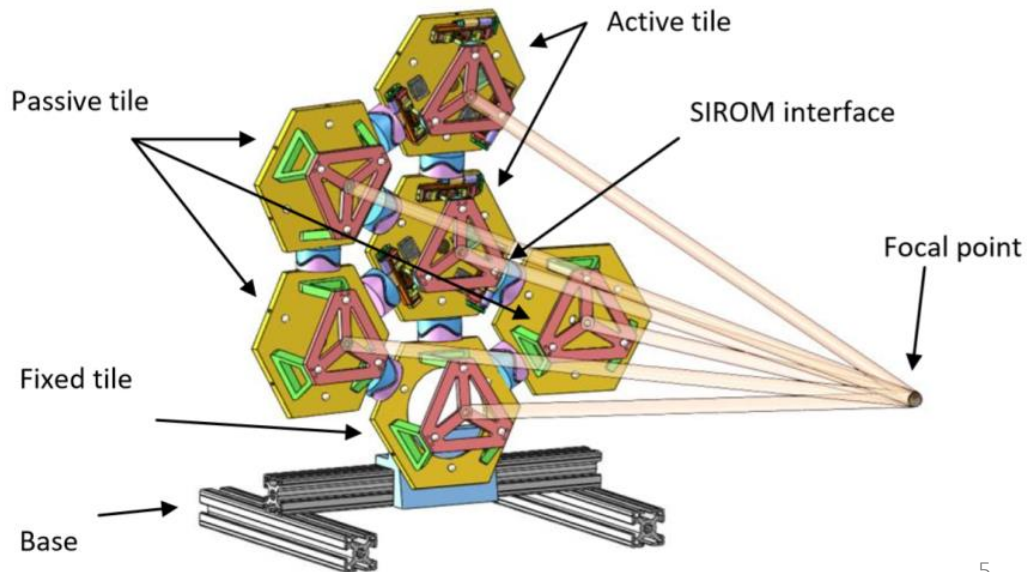
demonstrator of In-Space  
Assembly in Simulation  
**dISAS**

**PULSAR  
Core  
Components**

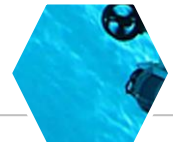


## Focus: High-precision assembly of demonstrator Segmented Mirror Tiles (dSMTs)

- 1G conditions
- Last cm assembly
  - Fine assembly with perception, RV & visual servoing fonctionnalités
- Assembly planner
  - Increasing assembly difficulties : 1, 2, 3 tiles
  - Grasp planner & motion planner
- Demonstration of dSMT mirror adjustment system

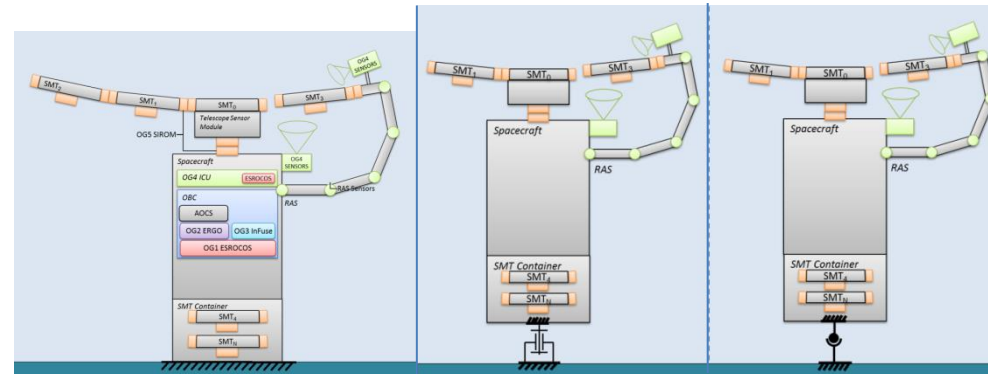
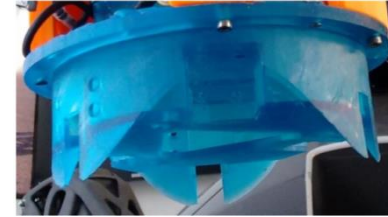






## Focus: Demonstration of extended mobility

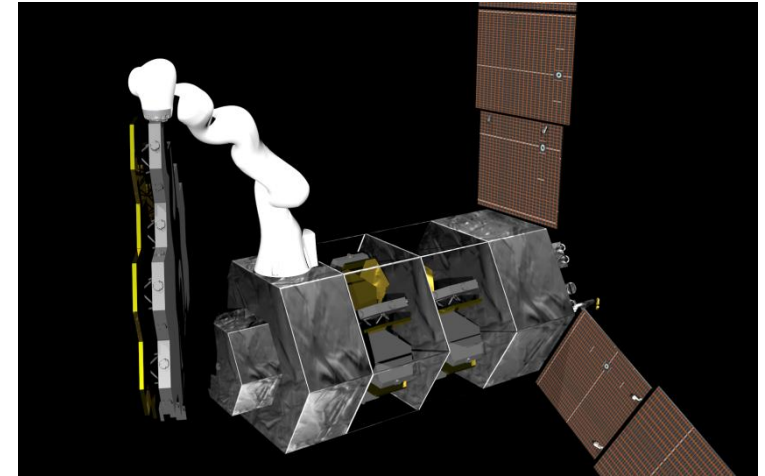
- Neutral buoyancy environment
  - Underwater test bench
- Specific underwater component design
  - Robotic arm
  - S/C and tiles storage mockup
  - Pre-assembled mirror mockup
- Progressive release of S/C DOF
  - Measure force torque during motion
  - Design AOCS





## Focus: Demonstrate dynamic behaviour in microgravity

- Simulation engine
  - Perception and/or other sensors
- AOCS design
  - Robust  $H_\infty$  control
  - Ensure pointing accuracy during
    - Deployment phase: disturbance torques
    - Scientific observation phase: flexible modes
  - Validate real-time AOCS performance
- AOCS implementation
  - Develop auto-coding tools



- Oil and gas industry
  - Underwater unmaned vehicle
  - Autonomous manipulation and underwater assembly
  - Visual quality control
- Defense and security
  - UAV autonomous mission control
  - Vision based localisation
- Autonomous car
  - Model based localisation and visual servoing
- High precision opto-mechanics
  - Common generic mechanical, power and data interface
  - High resolution hexapods and active mechanical system for precise alignment
- Factory of the future
  - Robotic assembly of components
- Flexible S/C modeling
  - AOCS design
  - dISAS





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Thank you



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