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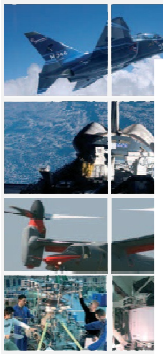

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European Seminar on "Technologies from Space Exploration"

Interests and expectations of NEREUS districts and local clusters

LOMBARDIA AEROSPACE CLUSTER

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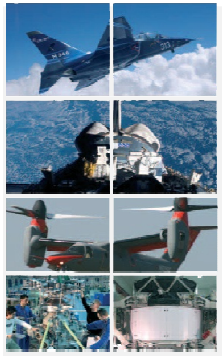
SECTOR PROFILE



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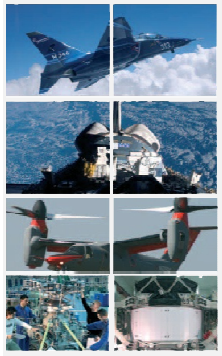

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Snapshot of Lombardia Aerospace Cluster

Update 2010

185 Companies

15,000 Employees

4.0 billion Euros Turnover

1.7 billion Euros Export

38 % Share on Italian aerospace export

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PRODUCTS

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- Trainer aircraft
- Helicopters and vertical flight technologies
- **Satellites and scientific payloads**
- Avionics and system integration
- Systems and Equipment
- Structures
- Mechanical component and subsystems
- Tools and systems
- Special materials
- Services

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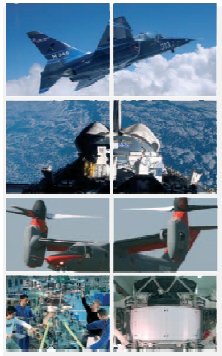
MAIN TECHNOLOGIES



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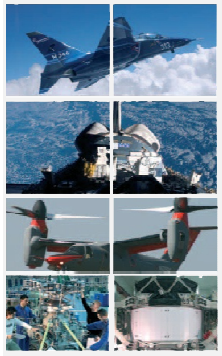

- Structures
- Mechanics
- Metal, composite, Special materials
- Electronic and electric
- Structural design methodologies
- Air fluid mechanics design methodologies
- Acoustic and vibration methodologies
- Information Technology
- Engines
- Other technologies

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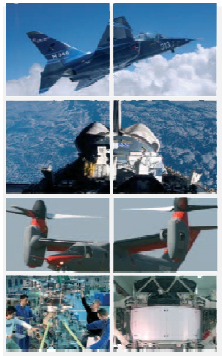
COMPANIES



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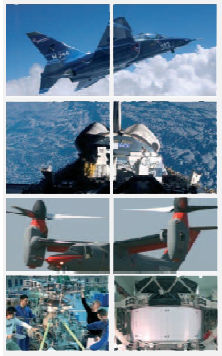

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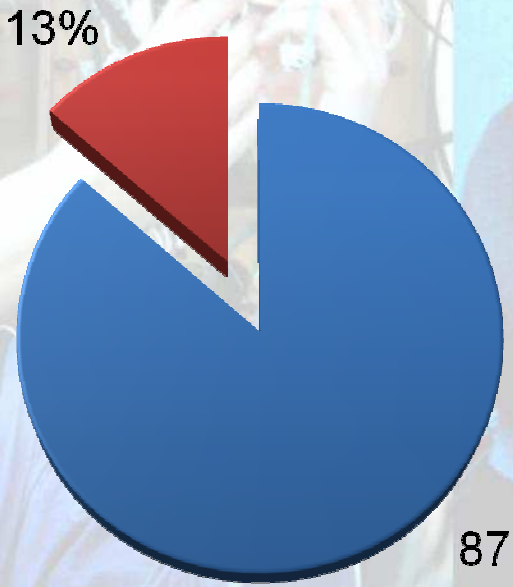
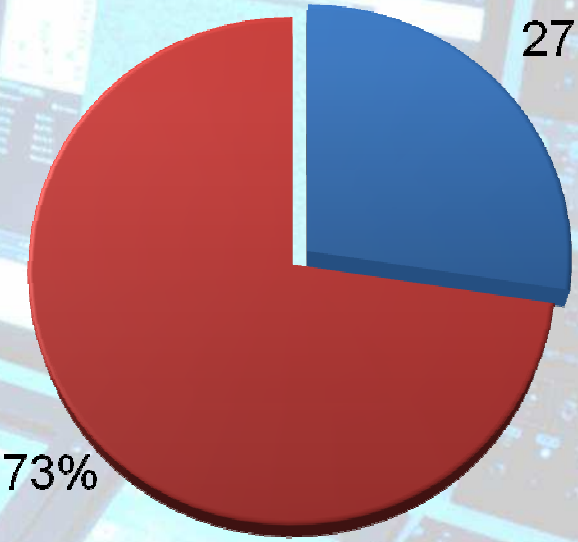
Companies distribution by dimension



Employees distribution by company dimension



SME PRIME CONTRACTORS

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PRIME CONTRACTORS

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AgustaWestland , helicopters

Alenia Aermacchi, aircraft traines

CGS Compagnia Generale per lo Spazio, satellites and scientific payloads

Selex Galileo, avionics, radar

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LOMBARDIA AEROSPACE CLUSTER:
TECHNOLOGICAL COMPETENCE

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Level 1

- Trainer aircraft
- Helicopters and vertical flight
- Satellites and scientific payloads

- **Services**: research & development, design & engineering

Level 2

- Avionics and system integration
- Systems and Equipment
- Structures
- Tools and system for production, testing and maintenance
- Special materials

Level 3

- Mechanical component and subsystems

Generic materials — **Level 4**

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EVOLUTION: FROM A SECTOR TO A CLUSTER

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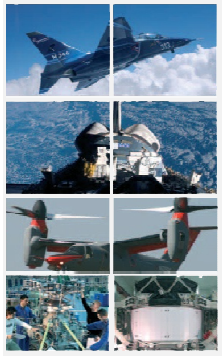

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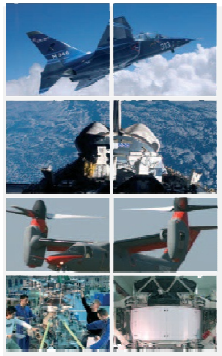
MISSION OF LOMBARDIA AEROSPACE CLUSTER



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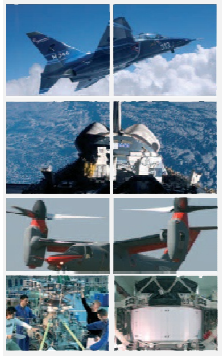

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ABOUT 75 MEMBER COMPANIES

ONE MAIN GOAL:

Promote the autonomous growth of the SMEs

By means of:

- Encouraging the growth of Supply Chain through the support to innovation and the creation of best practices
- Supporting Internationalization and Marketing
- Seizing opportunities for collaboration
- Developing Education and training
- Catching Finance opportunities

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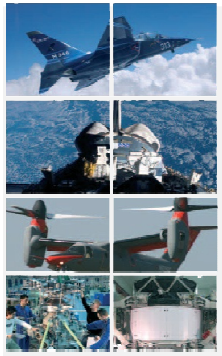
MAIN ACTIVITIES



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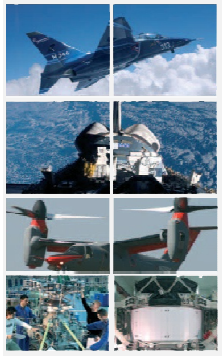

How to reach the goals: Working Groups

- **Nucleo Tecnico Scientifico** (NTS): coordinate R&I activities, covers the whole range of products, services, technologies
- **Space**: collaborate with NTS, strategic roles of space programmes (ex.: NEREUS)
- **Supply Chain**: promote industrial collaboration, develop best practices (ex.: KPIs; LEAN; E-scouting ; Web site…)
- **Internationalisation & Marketing**: links and networking (EACP; Air show, fairs…)
- **Education & Training**:policies, "design" of E&T initiatives; M&A master -LIUC
- **Funding**: catching opportunities, steering new ones

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SPECIFIC COMPETENCES

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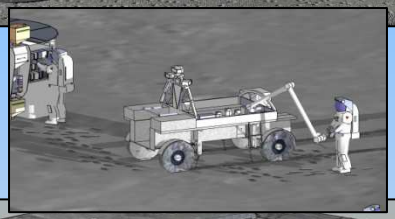
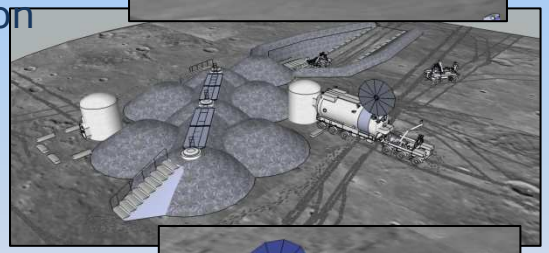
Mission Analysis:

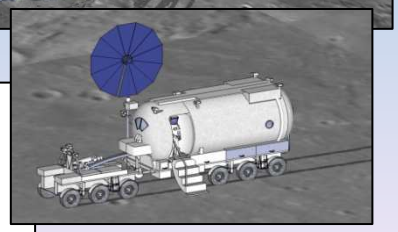
- Planetary Surface Exploration Missions and Architectures Definition
- International Exploration Scenarios Identification and Definition
- Mission Planning and Scheduling
- Space and Planetary Environments Knowledge

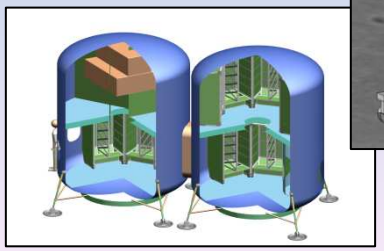
System Design:

- System and subsystem Design
- Interplanetary and Planetary Human Habitat
- Planetary Surface Scientific Exploration, Transportation and Resources Supply Systems
- Operations Definition
- Software Development
- Specific Competences on :
    - Power generation and handling
    - In-situ Resource Utilization
    - Guidance, Navigation and Control
    - Precision Landing
    - Thermal Control
    - Mechanics
    - Robotics









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SPECIFIC COMPETENCES

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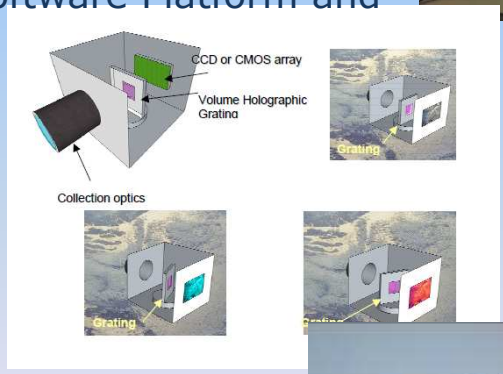
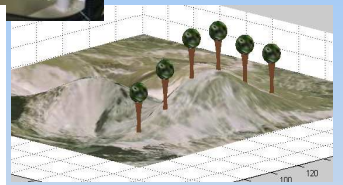
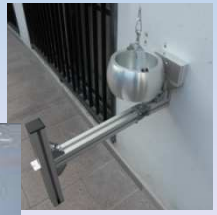
Technological Development:

- Innovative Technologies Studies
- Potential Impacts on Terrestrial Technologies and Applications
- Breadboard Definition and MAIT
- Specific Developed Technologies:
- Regenerative Fuel Cell
- Oxygen Extraction from Lunar Regolith
- Martian Sample Canister Capture Mechanism
- Radiation Protection for Human Applications
- Cross-applications Vision-based GNC software Platform and Simulator
- X-band mirrors development
- Adaprive Optics
- Diffraction and Ological Optics

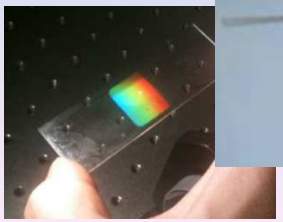






Test Facilities:

- Test Setup Design and MAIT
- Specific Developed Facilities:
- Precision Landing Ground Test Facility
- Impacts Material Characterization Facility



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SPECIFIC COMPETENCES

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Developed in the frame of an ESA programme the Dextrous Robot System (DEXARM) is a lightweight robotic arm to be used for diverse space robotics applications in which the manipulation/intervention tasks were originally conceived for humans.
The applications are typically:

- external or internal servicing of Space Station platforms (e.g. EUROBOT)
- robotics for planetary exploration (e.g. AURORA).

Dextrous Robot Arm configuration

Dexarm Joint integrated with carbon fibre limb

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SPECIFIC COMPETENCES

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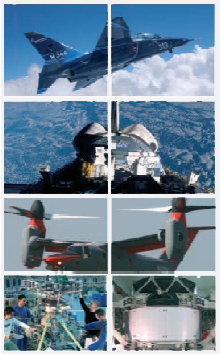

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Sample, Drill and Distribution system (ASI)

- Installed on the lander module of Rosetta
- Launch 2004, presently in flight, expected landing date 2014

Rosetta mission artist's view

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SPECIFIC COMPETENCES

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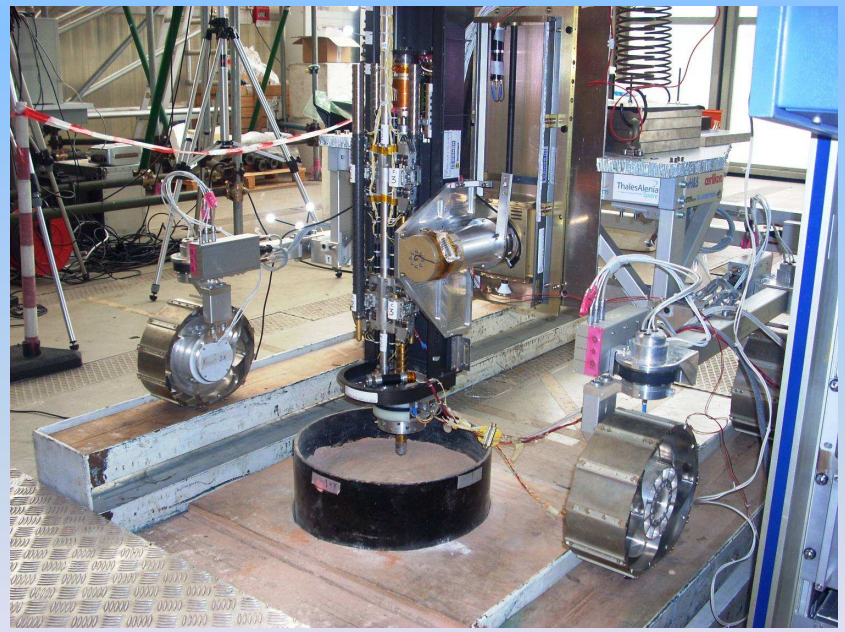
First mission of the AURORA planetary exploration programme of ESA: ExoMars Drill

- **Drill**: soil and subsoil sample collection and delivery to the Sample Preparation & Distribution System (SPDS)
- **MA_MISS** (MArs Multispectral Imager for Subsurface Studies): VIS/IR spectrometer embedded into the Drill for analyzing the internal surface of the borehole generated by the Drill
- **Drill & SPDS Control System**: electronics and software to drive the Drill and the SPDS mechanisms



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SPECIFIC COMPETENCES

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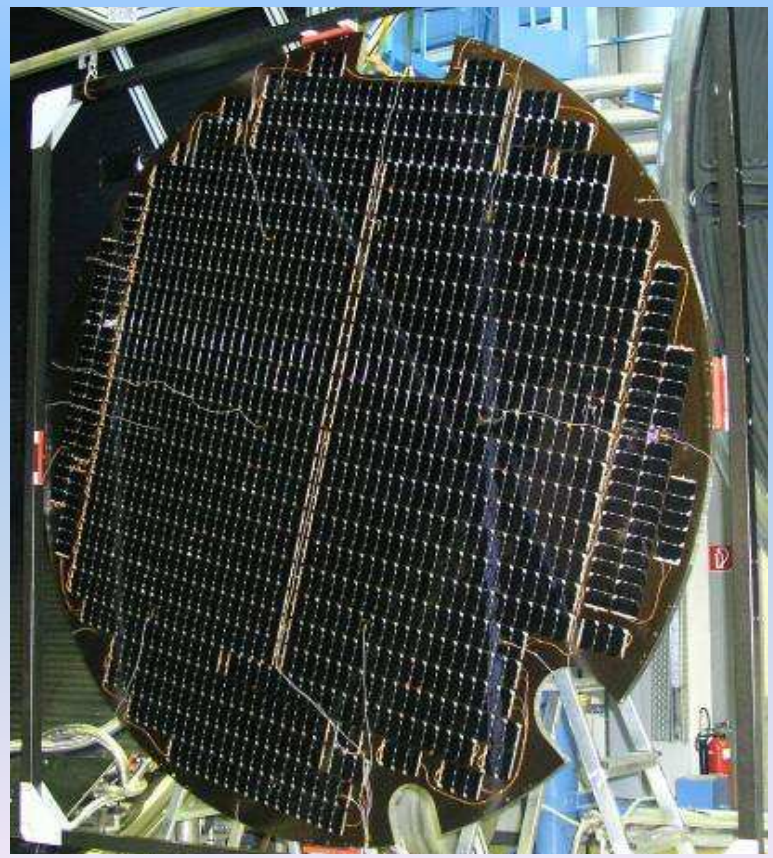
Solar generators electrical network for several Space Exploration missions

- **Rosetta** (more than 12 kW installed on Orbiter and Lander) with Silicon Low Intensity Low Temperature solar cells, specifically developed for the comet environment – launched 2004
- **Herschel and Plank** (overall 6 kW installed) with Triple Junction GaAs solar cells, 27% efficiency – launched 2009
- **GAIA** (about 4 kW installed) with Triple Junction GaAs solar cells, 28% efficiency – launch planned 2013



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From Space to Everyday Life

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Regenerative Fuel Cells:

- Benefits From Space Technologies
- PEM technology adapt to a wide spread of applications
- High Performance
- High reliability and lifetime
- Closed regenerative configuration
- Main Terrestrial Applications
  - Stationary (Electric power production, Distributed power generation, Back-up power source, Combined hot water production)
  - Mobile (Automotive, Unmanned aerial vehicles, Water vehicles, submarines, bathyscaphe)
  - Portable (Consumer Electronics, Weather stations, APUs)

Vision-based Guidance, Navigation and Control:

- Benefits From Space Technologies
- Autonomous terrain identification and reconstruction
- Autonomous dynamics and attitude evaluation
- Advanced vision-based GNC algorithms
- Main Terrestrial Applications
- GPS-less environments
- UAV (e.g. fire monitoring)
- Support for manned helicopter landing

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