MELiSSA Pilot Plant inaugurated

04.06.2009 **Research** - **Cristina Garmendia, Minister for Science and Innovation, Jean-Jacques Dordain, Director General of ESA, and Ana Ripoll, Rector of UAB, inaugurated the MELiSSA Pilot Plant at the UAB School of Engineering (ETSE). The laboratory is part of the European Space Agency (ESA) MELiSSA project and aims to be a unique facility in Europe for the demonstration of Closed Loop Life Support Systems, paving the way to human autonomy during long-duration space missions. MELiSSA is an artificial ecosystem for food, water and oxygen recovery from wastes, carbon dioxide and minerals. The MELiSSA Pilot Plant at UAB will integrate and demonstrate the associated technologies with a "crew" of 40 rats (equivalent in oxygen consumption to one person). This demonstration will be performed over a period of more than two years, which is considered a representative duration for human missions in space.**

MELiSSA is the acronym for Micro-Ecological Life Support System Alternative, an innovative Project of the European Space Agency that was initiated as part of a research programme on life support Technologies, in order to facilitate long duration manned space missions.

These types of missions cannot be performed without regenerative life support systems like MELiSSA and other ESA life support technologies that will drastically reduce the amount of logistics needed to support the crew (without recycling, 30T for a 1000 day Mars mission). For this, a closed ecological system is proposed, with the generation of edible material from higher plants and microalgae, revitalization of atmosphere for respiration, recovery of water, and recycling of the wastes generated by the crew and plant growth.

The MELiSSA project is targeting ideally the recycling of 100% of all chemical elements, i.e. a fully self-sustainable ecosystem without any resupply. In terms of processes, control, stability, safety, robustness, this target represents a very high challenge.

The recycling challenges of MELiSSA are reinforced by the closed environment conditions and the presence of humans. As a consequence, intensive characterization, comprehensive integration, verification, validation and qualification activities are mandatory steps in the development and validation of MELiSSA.

Collaboration was initiated with Universitat Autònoma de Barcelona in 1995. Since then, the MELiSSA Pilot Plant facility has been developed to provide a world class research facility and is today designed to achieve the preliminary terrestrial integration and demonstration of the MELiSSA concept at pilot scale, using animals as a model for the crew, through a progressive integrated testing and validation.

From today, the second generation laboratory for the MELiSSA Pilot Plant at UAB has started its activities. In it, a "crew" of 40 rats will mimic the respiration of one human, and will be part of the final demonstration experiment, with a duration of more than 2 years.

The development of the MELiSSA project has provided major scientific outputs (220 scientific publications) and a strong progress in the knowledge and understanding of closed artificial ecosystems. Important technological applications can be mentioned:
- for terrestrial applications, such as water treatment (e.g. in Europe, 1.8 million cubic metres of water treated every day with MELiSSA based technology), sparkling wine industry (using MELiSSA related biomass sensor), with the creation of 2 spin-off companies (IPStar, 2005, dealing with technology transfer of MELiSSA related terrestrial applications, and EZcol, 2007, start-up on cholesterol lowering owing to MELiSSA micro-organisms by-product),
- as well as for space applications, such as the follow-up of ATV (ESA's Automated Transfer Vehicle) bio contamination monitoring and control, and ESTEC becoming the European focal point for ISS microbial environmental quality (air, surfaces) and water quality.

The MELiSSA project is an international and multidisciplinary collaboration which began with a core team of nine partners, including ESA, i.e. SCK/CEN (Mol, B), VITO (Mol, B), University of Ghent (Ghent, B), Universitat Autonoma de Barcelona (Barcelona, E), University of Guelph (Guelph, CND),University Blaise Pascal (Clermont-Ferrand, F), SHERPA Engineering (Paris, F). The coordination of the Consortium is done by ESA, at the request of the rest of the partners. As the project develops, more and more European and Canadian companies and organizations are contributing to the joint venture, bringing complementary expertise where needed (today more than 30 organizations from 11 countries have contributed to MELiSSA).The scientists and engineers of MELiSSA are from various horizons (academic organizations, industries) and gather a comprehensive multidisciplinary expertise (microbiology, modelling, process engineering, biotechnology, system engineering, nutrition, automation, genomics, proteomics, etc.).