Torino Seminar on "Technologies from Space Exploration"
October 18-19, 2011

EXECUTIVE SUMMARY

The Seminar was attended by around one hundred and eighty participants, from more than thirty organizations, belonging to ten European Regions. Hosted by NEREUS-Associate member ALTEC SpA on its premises in Piedmont, it was organized by Piedmont Region, which leads the NEREUS WG on "Technologies from Space Exploration" and NEREUS in collaboration with Thales Alenia Space.

Its aim was awareness rising of the benefits for European citizens through Space Exploration programs and involved technologies. The Seminar also wanted to bring its contribution in view of the third International Conference on Space Exploration to be held in Lucca in November 2011, highlighting the fact that the challenges associated with Space Exploration and Research promote economic growth by stimulating innovation, technology developments, education and training of highly skilled engineers and scientists, fully meeting a number of Europe 2020 priorities.

The Seminar was organized in two sessions, a political and a technical one. In the *welcome addresses* of the political session local, Italian and European Institutions confirmed their support to Space Exploration programs and related initiatives.
It was underlined that Space Exploration is a crucial strategic topic which embodies the desire for all of humankind to discover new horizons and landing on other planets: Space Exploration means, above all and ultimately, direct human presence, supported and preceded as appropriate by robotic missions.
There are four main enablers for Europe to proceed with Space Exploration: international cooperation, since it is a global endeavour; political vision and long-term commitments; technology; and the International Space Station (ISS), which is an extraordinary test bed for Exploration and the starting point of the global Exploration roadmap.
European efforts could be focussed on some key enabler technology pillars, such as:

- Entry, Descent and Landing capabilites
- Regenerative life support systems
- Ultra light and inflatable structures
- Energy sources, generation and storage
- Novel advanced propulsion systems
- Robotics, automation, remote control, and enhancement in human-robot interaction
- Advanced propulsion
- High temperature protective materials
- Applied nanotechnologies
- Rendezvous and Docking / Capture

Added value can be generated in areas such as the protection of the environment, energy, health and industrial processes; synergies can be exploited with non-space sectors (such as energy or environment), that could lead to spin-in or technology transfer opportunities with mutual benefit.

By conferring the EU a competence on space, the Lisbon Treaty puts in fact EU space policy at the service of the Union ultimate goal of ensuring the well-being of its people. From the Commission standpoint, it is important to encourage not only close links between Space Exploration and social and economic challenges but also to demonstrate its impact on innovation dynamics in different sectors.
Most expenditure on Space Exploration is used for contracting out innovative technology development activities. Numerous and well documented spin-off effects illustrate the result of using these innovative technologies, which give rise to valuable benefits for citizen's and economy. Targeted expenditure in Space Exploration can trigger major innovations in sectors such as health, secure access to energy and renewable energy, access to clean water, robotics and automation, as it was shown in the Seminar technical session.

In the round table, which followed the welcome addresses, the main discussion was about how to proceed with Exploration programs, taking into account both the current economic crisis and the uncertainties in exploration plans in the world (including in the US). It was underlined that any time is the right one to start the dialogue, aiming at defining international cooperation in line with individual plans, and that Europeans should take advantage of this economic situation to prepare the future space activities, first of all in terms of technology developments.
Mankind on Mars is indeed not an issue of *if*, but only of *when and/or how*. The next years shall be devoted to set-up the international long term vision in Space Exploration, sharing objectives – which means intermediate destinations, type of missions and scientific goals – and investments in a way commensurate to individual capacities, technical and financial.
This will be in particular a political challenge for Europe in its capacity to federate a global political, scientific and technology initiative.

The technical session of the second day was dedicated to the regional user needs with respect to space exploration, and the direct and indirect outcomes from those enabling technologies. From the regional user need perspective, the direct outcomes imply industrial developments in terms of technological innovation and high value-adding activities; the indirect ones produce knowledge spill-over in terms of supply chain qualification and empowerment, Research and qualified employment; while the enabling outcomes make service advances possible, in fields such as remote sensing, infomobility, telemedicine, and others.

Several examples of already realized spin-offs from exploration technologies were presented, applied to different sectors, such as environment, health, civil protection, renewable energy, that illustrate how innovations and technologies developed in the frame of Space Exploration can be commercially exploited.
These technology and knowledge transfers show the obvious benefits to maximize the return of investment in European space research; to provide cross-disciplinary opportunities; to provide economic potential and motivation for both technology donors and receivers.

It has to be recalled that a recent EC publication on Space Exploration and Innovation reports that 183 spin-offs, generating from ESA activities in the period 1997-2008, were identified, of which 37 (20%) originating from Space Exploration. This number represents a *lower bound estimate* as, in a number of cases, the origin of space spin-offs is not readily identifiable.

These 37 spin-offs equate to three spin-offs a year from a (current) space exploration annual budget of €0.6 billion per year.

The last part of the Seminar was dedicated to introduce existing European facilities, whose core mission is to promote space exploration among the broad public, whose possible evolution is proposed to be a European network of "Exploratoria", to offer a more effective and complementary product (promotion set up/promotion approach) to the public, to be definitely conscious of the fascinating scientific and technological world, and stimulating young active participation in its evolution.