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Europe's Plan for Innovation – How Can Space Technology Contribute to Solve the Economic Crisis?

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Space technology is set to be part of Europe's Plan of Innovation as being one of the main technologies of the future. By this space technology actually gets more public attention than it has got in recent years and high expectations have been raised. It seems as if space technology is regarded as an universal remedy to solve Europe's tasks concerning the economic crisis, innovation policy and sustained economic growth. In this paper, a critical analysis will raise the awareness of the associated chances and opportunities. It will show how space technology can contribute to this plan and what problems might occur.

The setting

During its session on 10 and 11 December 2008, the European Council approved a European Economic Recovery Plan, which, besides several short-term actions, includes an appeal to invest in the future through a European plan for innovation. The respective paragraph reads as follows:

"Europe must continue to invest in its future. That is the price of its future prosperity. The European Council calls for the launching of a European plan for innovation, combined with the development of the European Research Area and with reflection on the future of the Lisbon Strategy beyond 2010, encompassing all the conditions for sustainable development and the main technologies of the future (inter alia energy, information technology, nanotechnologies, space technology and services derived from it, and life sciences)[1]."

Space technology is listed as one key technology to assure Europe's prosperity and growth.

On its session on 29 May 2009, the Space Council also deliberated on this approach and encouraged all involved parties to implement several measures, based on existing instruments[2].

Currently, the Plan of Innovation is in preparation and will be presented early in 2010. The final decision about how it will be structured and what means will be included is up to the next European Commission, taking up its work in October 2009.

So far, three segments have been identified by the Commission to have a high innovative potential. These are

- Space science and exploration.
- Critical technologies for strategic non-dependence.
- Space and security.

The focus on space is not new, although it may seem so at a first glance. In fact, one of the aims of DG Enterprise is to "strengthen the space sector and to improve security technology[3]." However, a study based on stakeholders' opinions has recently shown that the activities of DG Enterprise concerning space have remained mostly unknown to the majority of companies[4].

1 Council of the European Union: Brussels European Council, 11 and 12 December 2008, Presidency conclusions, 13 February 2009, 17271/1/08, Rev 1, p. 8

2 ESA: Orientations from the sixth Space Council, ESA/C(2009)64, 1 June 2009, p. 2-3

3 DG Enterprise and Industry: Outlining the main goals, http://ec.europa.eu/enterprise/dg/objectives/index_en.htm

4 Evaluation of DG Enterprise and industry's policies in view of the new Commission – External Stakeholders' views,

The assignment for DG Enterprise to deal with space technology has resulted from the increasing commercial aspects of space, mainly by the rapid development in the application sector. While ESA is, broadly speaking, mainly dealing with space research for scientific purposes, the EU Commission/DG Enterprise is in charge for commercial/industrial aspects of space activities. Due to these different starting points, there have been some coordination problems, as ESA sums up: "Improving the governance of space activities should be encouraged in order to generate better coordination and pool resources, achieve coherence within common long-term roadmaps, shared commitments and efficiency, and accelerate growth of the sector. Better coordinating actions between the European Commission, the European GNSS Supervisory Authority, the European Space Agency and all the other stakeholders are necessary in order to avoid fragmentation of efforts and accelerate innovation for downstream space applications[5]."

With the objective to foster space technology to support Europe's innovation capacities and its sustained economic growth, one should take the chance to better coordinate the activities of the involved parties. Implementing adequate means that allow the prosperous further development of space technology on the one hand and the improved involvement of companies and opening of the space sector, especially for SME's, on the other hand, could be the key for this formulated goal. But firstly, it is essential to obtain a common understanding for the aim to integrate space technology in Europe's Innovation policy within the different European and national bodies that deal with space.

How can space technology contribute to this objective?

Generally spoken, the answer to the question if space technology can be a key technology for Europe's innovation policy would be yes. But the question is not whether, but how space technology can contribute to this objective. First of all, it is remarkable to find space technology in one row with energy or nanotechnologies as one key technology to invest in Europe's future. But it is striking that space technology is mentioned as a whole without any distinctions being made. This is essential, because in many aspects, space technology is different from other technologies, due to its topic. Therefore, one should focus on some distinctive features of space technology to analyse in what respect space technology can contribute to and be integrated in Europe's Innovation policy.

Many opinions that have been voiced since the European Council has published its European Economic Recovery Plan seem to have no doubt that space technology indeed can support these European objectives. Claims for more public funding for the space sector were formulated shortly after the decision in order to achieve the aims formulated by the European Council. But this is only a very short-sighted view, as this would support the space sector, but not the innovation potential or the economic growth in Europe.

In the fields of space technology that are suitable to support Europe's innovation policy, the access has to become easier for companies so that they can develop marketable applications and services out of it. The aim of economic growth through space technology will not only be achieved by big enterprises, but also by SME's, which pro-rata is by far the bigger group. Therefore, it will be an important question to analyse in which way SME's can participate in space technology und benefit from it.

However, there are also some concerns to be regarded. One major objection was firstly stated by the Europe Innova Panel[6]: The measures to be taken here will only be suitable for the minority of EU member states, as space technology belongs to high-technologies sectors. Not every European country has substantial technological capacities or even a

Framework Contract on Evaluations ENTR / 04 / 093, Lot 1, Final Report, Re-submitted: 21 April 2009

[5] European Space Agency, Council at Ministerial Level: Discussion note on Space and Innovation, ESA/C-M(2009)2, 20 May 2009, p. 6-7

[6] "Europe INNOVA is an extrovert initiative. It aims to integrate external information and expertise to be as practical as possible. Input from and discussion with high level European experts is very valuable. For this reason Innovation Panels are a central element of the Sectoral Innovation Watch project and the Europe INNOVA initiative. Sectoral Innovation Watch aspires to provide policy-makers and stakeholders with a more comprehensive understanding of sectoral innovation performance, including barriers, drivers and challenges across the European Union. The Panels complement these analytical findings with sector-specific priorities for action, and formulate questions and issues to be addressed by the project. During the first phase of the Sectoral Innovation Watch project (2006-2008), five rounds of "Sectoral Innovation Panels" were convened, whereas the second project phase (2008-2010) foresees instead a series of cross-sectoral "Thematic panels". http://www.europe-innova.org/index.jsp?type=page&lg=en&classificationId=4962&classificationName=Innovation%20Panels&cid=5089

(space) industry[7]. Therefore, at the moment the possible benefits of space technology will mainly be reserved for the Western European countries with a high level industry[8]. It will take other countries some more years to catch up with the technological standard of these nations. Until then, this means a considerable competitive disadvantage for these countries.

Furthermore, one should not forget that there is a kind of societal responsibility of space technology as it, mainly by means of Earth observation, can help to cope with global issues like food and water problems in developing countries, climate change, Safety of Life-applications, etc.

Here the question is to be answered where to draw the line between commercial purposes and societal responsibility which might lead to the question of possible market regulations.

The "Space Market"

Space technology is generally not market-driven. In order to clarify the development of space technology, a model created by Walter Peeters from the International Space University can be consulted (see Figure 1).[9]

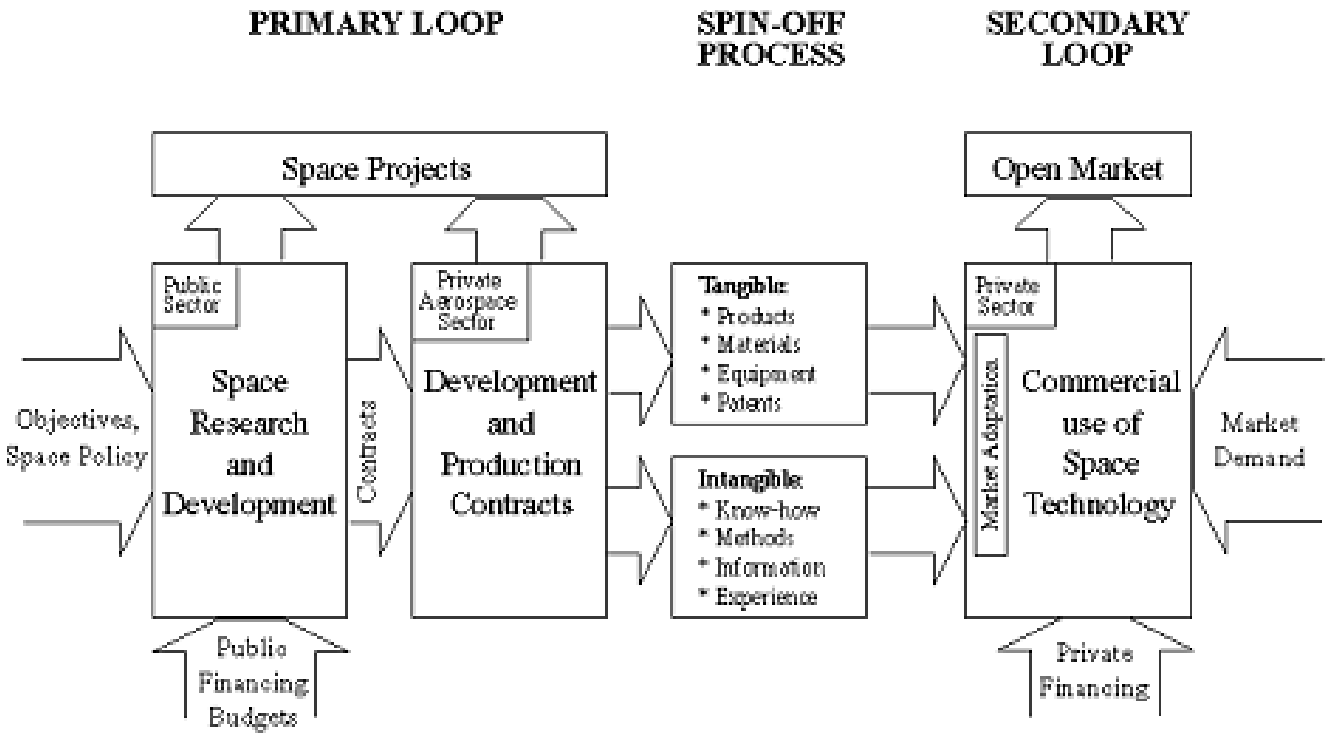

Figure 1: Space Market Model by Walter Peeters, ISU

[7] Europe Innova – Innovation Watch, Sectoral Innovation Panels – Space, Report from the Second Panel Meeting, Valencia, 29 November 2006, p.6

[8] As listed in: Czech Presidency: Space, Competitiveness and Innovation: Space activities and their potential contribution to Europe's Global Competitiveness and Innovation Potential, Brussels, 30 January 2009, p. 4-5

[9] From Walter Peeters: Space Marketing, Kluwer 2000

Looking at the process of developing and using space technology, one has to distinguish two main phases. The first one is core space research and business meant to access and explore outer space. Usually, this part of space technology is characterised by extremely long product cycles and high level research as well as high level capital investment. The objectives for this research are often determined by national or international governmental space policies. The main budgets come from public funding. In fact, space research is considerably subsidised, although in recent years, there is a tendency to try new financing models like Public-Private-Partnerships (PPP) for space missions, e.g. for TerraSAR-X or for telecommunication missions. Generally, this part of space research and technology does not need a diversification of the process or lots of new technologies in short time. It is also not very applicable for involving SME's as it is mainly performed by research institutes, national space agencies and the "big" players of space industry. SME's are involved as subcontractors, delivering special components for orbiters, cameras, robonauts, etc.

However, apart from the original purpose of such a space mission, there are lots of products and special materials that are needed to carry out such a mission. Researchers with specialised know-how and expertise also play an important role in this context. Although they belong to core space research/business these products and people are indeed open for the common market and can be employed for the commercial use of space technology. In this second phase space technology can be used in a market-demanded way by developing it further to numerous spaced-related applications, services and products. This second phase offers the potential for economic growth by opening space technology for enterprises of any kind. By this, refined, marketable products and services can be developed with profitable benefits for the dispelling company.

The main reason why space technologies are so successfully transferable is their original purpose which is to provide access to and explore outer space. Usually, these technologies are designed to withstand extreme conditions. They are checked, if possible, under space conditions in special test surroundings to make sure they are highly resistant for outer space conditions. Normally, the conditions on earth are not that requiring, therefore these products and services work excellent in non-space applications.

However, what is used for commercial purposes is, in most cases, not space technology itself, but applications and services that derive from it or that can be achieved by it.
The countless benefits of space technologies for daily life will not be described here again. It is a fact that numerous products contain elements that originate from space technology. The actuator for an airbag, for example, comes from space technology, as do fireproof garments for firefighters. Roboters that are meant to explore foreign planets do excellent work in the industrial production sector. Anyway, most of these products and services are nothing but incidental fall-outs from their original purpose.

In the past years, the situation has slightly changed: especially in the field of communication and navigation, Earth observation or robotics, the trend turns to develop products and services that may derive from space technologies, but are meant to be used on Earth. It has definitely to be stated that these products and applications are very successful and regarded as having a high innovation potential.

According to the Second Panel Meeting of Europe Innova Space Innovation Panel, there are mainly four areas[10] that can be considered as the most promising potential lead markets[11] in the field of European space technologies:

1. Galileo and its relevant navigation applications.
2. Telecommunication applications through space. Within this field, European companies are in leading positions, and to a large extent the market is already operational.
3. Earth observation and remote sensing with its various applications within environmental observations.
4. Space launchers.

[10] Europe Innova – Innovation Watch, Sectoral Innovation Panels – Space, Report from the Second Panel Meeting, Valencia, 29 November 2006, p.9

[11] Definition: "A lead market is the market of a product or service in a given geographical area, where the diffusion process of an internationally successful innovation (technological or nontechnological) first took off and is sustained and expanded through a wide range of different services.
A 'lead market' is not necessarily the country or market where the innovation was first developed, or even used for the first time.", DG Enterprise, A Lead Market Initiative for Europe, http://ec.europa.eu/enterprise/policies/innovation/policy/lead-market-initiative/index_en.htm

From these four areas, the first two would apply to the described second phase, whereas the last two would refer to the first phase, the core space technology business. Space-based navigation and telecommunication bear a bunch of possibilities. Numerous products and services for almost every part of life, be it traffic management, health care, disaster management, security, TV broadcasting, etc. are conceivable. In fact, this is already a fast growing market which avails itself of the proceeded technological achievements in space technology. Companies engaged in this field of space technology have encountered enormous growth rates in the past ten years. By for instance being able to bring more data faster and in high (that means with deducted possible faults) quality down to Earth, new telecommunication applications can be developed. This is a market for many companies, even those who are busy in niche markets.

Space launchers and remote sensing on the other side are only relevant to a limited number of enterprises. Nevertheless, those comparable few companies can have big economic success in this field.

By all this enthusiasm and seemingly endless possibilities, one should not forget that space is also a field with a high economic risk. This is true for the research part as well as for the commercial part of space technology. Technical failure, space debris, calibration problems or other defects of satellites can cause severe consequences: TV programmes, mobile communication services, traffic management (air, street and ship) may not work properly; there are numerous consequences for daily life that can occur if certain satellites break down. This also affects the commercial success of several products and applications in a considerable way. Relying on or working with space technology can be an enormous risk, which cannot be insured.

Normally, no one is liable for any failures or damages. Institutions and companies who are engaged in this field usually bear the considerable financial risk all by themselves. For future activities, this is an important fact for companies which want to participate in space technology. Beside other economic risks, they will also have to calculate the risks of possible technical drop-outs or similar failures.

The role of SME

At the moment, the involvement of SME's in space technology is rather small, but should nevertheless not be underestimated.

SME's are involved in core space technology usually as sub-contractors who deliver single, but important components for launch vehicles, orbiters, robonauts, radars or satellites. This is not really innovative, but a reliable niche market for these SME's. There are many reasons why there are only a few SME's working in this sector. First of all, there are the special conditions of space research and space technology. One major problem is the standardisation of space products which follows the rules of ECSS- and not the ISO-standard many companies are familiar with. Several other special regulations such as ITAR (International Traffic in Arms Regulations) also exist. Not many SME's fulfil these requirements.

The majority of SME's in space technology can be found in the market of navigation and communication applications. Many companies develop often very specialised products based on space technology here. These products are sometimes meant for a very special kind and therefore limited number of customers, like e.g. satnav-devices for handicapped people. Nevertheless, the amount of companies operating in this field is quite high, due to the fact that services and products are not subject to those strict regulations and requirements as in core space technology. The products developed here are usually subject to common ISO-standards and to normal market regulations.

To achieve a measurable effect on the economic growth by means of space technology, it is inevitable to strengthen and to foster the involvement of SME's in these delineated markets. As economic growth is only measurable in a greater scope, the number of SME's using space technology has to be considerably increased in order to show an effect.

Dual use

A considerable part of space research and space technology is of military origin. The purpose is mostly national defence and security. Therefore, financing comes from national defence budgets. Usually, military research is strictly separated from non-military

research and is reckoned not to be transferable. However, there is a grey-zone of the so called dual use: tools, applications or research results in general that can be used both for military and civil purposes. But based on daily experience, one has to state that this usually does not work. There are only very few examples for dual use applications. Due to the utmost secrecy in many military domains, dual use or transfer from military research results to civil purposes is often prohibited by military bodies. Companies engaged in this field generally belong to the defence industry sector and are subject to secrecy regulations as well. However, successful dual use applications often originate from the field of security research as environmental monitoring, traffic management, etc. It has been proven that they are indeed suitable for many companies and therefore can be used to support Europe's innovation strength.

Recommendations

First of all, it has to be stated that space research and space technology are not originally meant for gaining economic benefits or to sustain Europe's economic growth or innovation policy. Its purpose lies in the exploration of outer space which, of course, has lots of effects for other sciences and life on Earth itself. These objectives still have first priority, therefore, space technology does not follow typical market-rules. But space technology could be better embedded into and be more open to innovation tools. Formal barriers that deter especially SME's from participating in space projects or from developing ideas of their own have to be minimised. The following recommendations can help to integrate space technology in Europe's Plan of Innovation:

- Innovation clusters as of Europe Innova and ESA incubators are highly recommended. Those clusters link big companies, SME's and researchers and by this build excellent networks[12].
- More information on open space tenders with appropriate topics should be available to give companies the opportunity to apply as subcontractors. More information on subcontracting in general should be accessible on the space technology information panels.
- Not only technology transfer, but also transfer of human potential should be fostered. For this aim, a virtual human resources pool in the space sector should be built up.
- Many companies are not fully aware of the possibilities of space technologies and in what respect they can contribute to it due to a lack of information showing potential for commercialisation in non space related markets[13]. For this reason, it is recommended to establish a website similar to the "NASA at home/NASA city" site[14], on which NASA explains products and technologies of daily life that have their origin in NASA research. By this, the information will spread rapidly and the number of companies willing to engage in space technology and its spin-offs will increase.
- Companies must be qualified to some extent to get successfully involved in space technology. Special training courses in e.g. ECSS-standardisation and risk management should be offered to make sure these companies fulfil all requirements.
- It is reasonable to limit the number of information portals, websites and clusters to ensure the quality of the work. Space is a global business, therefore, it does not make any sense to break the information down to the level of regional Chambers of Commerce and Industry. The information should be available at the local CCI's throughout Europe, but all this information should lead to some central information points, websites, and portals. A limited amount of information portals guarantees a similar quality of information and allows those who provide the information as well as those who retrieve them to have a similar information level.
- A simple access to information portals and websites as well as to innovation clusters should be provided. Many SME's will eschew administrative barriers which are only time and money consuming. For instance, registration forms which have to be filled in prior to any access to contact data or other relevant information will have an obstructive effect.

[12] Many stakeholders share this view, see also: Europe Innova – Innovation Watch, Sectoral Innovation Panels – Space, Report from the Second Panel Meeting, Valencia, 29 November 2006, p.8 or

[13] Europe Innova Innovation Panels – Space, Report from the Third Panel Meeting, Vienna, 31 November 2007, p.3

[14] http://www.nasa.gov/externalflash/nasacity/landing.htm

- Generally, public procurement is inevitable to develop new technologies. Therefore, more public funding should be available for the development of space-based applications and products. More specific calls like for downstream or earth observation applications should be established. Besides the public procurement, more private investment from the industry is needed, too, as public funding will not be able to cover all niches and special features of space technology. Public funding can only react to formulated needs, this is why real innovation might result from private investments in risky, but promising new applications and products.
- The space sector itself has to be more open to ideas coming from other fields. Representatives of space industry and space institutions should take part in trans-sectoral innovation clusters and networks to identify common needs. Regardless, the space sector should not only listen to the demands of the non-space sectors, but should pro-actively formulate its own expectations and needs: in what respect is an intensified collaboration with industry desirable? To what projects or missions can companies contribute?
- National space programmes have to be strengthened in order to be able to predict the possible spin-offs. At the moment, national space programmes, as far as they exist, often depend on external factors. For example in the current economic crisis, many space projects were postponed or cancelled, such as several moon projects in certain countries. If one wants to be able to assess the results and the outcome of current space projects, one has to make space programs as autonomous and predictable as possible.
- To bridge the gap between industry needs and the space sector, more lobbying or intermediation is needed. The number of facilitators who are familiar with both sides, the space community and the industrial sector, should be enhanced.

Conclusions

Commercialisation has considerably changed the space era over the last few years. Some opinions state that this process was initiated by reduced public funding which worked as a catalyst[15]. Space industry has proactively reacted to this new situation by forming strategic alliances, in the first place to be able to reach the global space market. Whatever the reasons might have been, nowadays one has to deal with a growing market that was never meant to be one. High expectations have been raised against the background of the economic crisis. Economic growth will not be achieved by some few big new contracts, but by an increasing number of players in this market. According to this will have to be the focal point for all the upcoming measures.

In order to make this new approach a successful one, firstly the Commission and the space sector have to define some basic conditions to achieve a common basis. The fostering of space technology as a key technology for Europe's innovation policy will only be successful if every party approves and benefits from the measures to be taken.

At the functional level, it will be important to distinguish between sectors that are suitable for innovation measures and those which are not. If one manages not to mingle core space research and technology and its spin-offs, then, in fact there could be a measurable economic effect by fostering the spin-offs and the increased integration of SME's. But core space research will be also essentially needed in the future. These often quite risky missions need time to test and will only be successful without any pressure to succeed economically.

[15] E.g. in Walter Peeters: Space commercialisation trends and consequences for the workforce, Acta Astronautica, Volume 53, Number 4, August 2003 , pp. 833-840(8) Elsevier Science Ltd. 2003

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