Executive Summary

Possible "Multiplier" Effect of ESA R&D Budgets

Business Catalysts Ltd

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2 Introduction

A study was undertaken by Business Catalysts Ltd under an ESA Contract with the aim of clarifying the situation with respect to the possible synergy between ESA technology budgets and other institutional funding available in Europe for innovation and R&D. The study was executed in three tasks as follows as required by the Statement of Work.

2.1 Task 1: Analysis of the legal framework

Analysis of the legal body of regulations and treaties upon which ESA is based and comparison with the corpus of local and EU regulations in Italy and the UK for public funding of innovation and R&D in order to provide a set of guidelines.

2.2 Task 2: Mapping of innovation support initiatives in ESA member states

The collection, summarising and categorization of the various support measures promoted across local, regional and national government agencies for the UK and Italy, with particular attention to initiatives targeting SMEs.

2.3 Task 3: Financial engineering: simulation of benefits from innovation support synergy

Using data obtained on the ESA technology funding in the TRP budget spent in the UK and Italy a financial simulation undertaken to quantify the maximum additional budget resources which could be made available through a synergic approach between ESA and national bodies.

2.4 Background

There has been growing recognition by the UK government and in other EU countries of the contribution to economic growth from the space sector which growing three times faster than the average for the rest of the economy. R&D investments in space research provide a multiplier effect on this growth and although government budgets are being constrained at this time of economic recession the indications are that national and regional investment in space R&D will be maintained.

3 Task 1: Analysis of Legal Framework

ESA industrial policy is based on the fair return principle, which regulates the geographical distribution of the Agency contracts between EU companies in proportion to the financial commitment of each Member State in ESA projects.

ESA rules about geographical partition of the contracts must be compatible with community rules about competition (current art. 81-86 Treaty of the European Communities - TEC) and with those that limit state aid, regulated by articles 87-89 TEC and aimed to the realization of a competition regime not distorted by public financial support to enterprises.

Keeping in mind that art 87 TEC ratifies a general principle of incompatibility with the common market of State aid to enterprises, it's important understand if ESA funding can determine such alterations to the commercial conditions.

Art. 87 TEC itself (paragraphs 2 and 3) provides certain exceptions to the general principle (par. 1) that forbids State aid and seems to allow a favourable interpretation to the compatibility of ESA industrial policy principles compared to antitrust community rules.

For the compatibility of ESA industrial policy with the community provisions it assists, particularly, the first part of art. 87.3 b), that enacts the possible compatibility with the common market of state aids "*to promote the execution of an important project of common European interest*".

This type of support contributes to the realization of the purposes expressed in art. 2 TEC (*(...) a harmonious, balanced and sustainable development of economic activities (...) the raising of the standard of living and quality of life, and economic and social cohesion and solidarity among Member States.*).

This orientation of the Commission received new strength by the Council Regulation (EC) No 994/98 This rule authorizes Commission to declare, through regulations, the preventive compatibility of some State aid of smaller competitive impact, among which, expressly, aid to SMEs and those to the research and development, exempting them from the anticipated obligation of notification according to the art. 88.3 TEC.

Such possibility was translated in the adoption of the Commission Regulation (EC) No 70/2001 and more importantly with the Commission Regulation (EC) No 364/2004.

With the first one the Commission has formally anticipated the exemption from the obligation of preventive notification of aid to SMEs.

With Regulation No 364/2004, EC Commission has formally recognized that aid for research and development can contribute to economic growth, strengthening competitiveness and boosting employment, and represent an incentive for SMEs to engage in more research and development.

The Council has empowered the Commission to adopt block exemption regulations for certain categories of horizontal aid (in favour of small and medium enterprises, research and development, environment protection, employment and training) and for aid below a given threshold. On this basis, Regulation 800/2008 "General Block Exemption Regulation (GBER)" provides for special rules on investment and employment aid exclusively for SMEs. The GBER allows Member States to grant several types of employment aid up to certain thresholds, without prior notification to the Commission. It also allows Member States to grant both general and specific training aid to companies totaling up to 80% of the eligible costs.

3.1 The Way to Recognise the Eligible Funding

With the publication of the so-called "Pacchetto Monti" (November 2005), the Commission provided guidelines to define as lawful even financial support to companies not-selected through public contract, on their suitability to modify the *par condicio* between the economic operators into the EU market:

1. The funding is necessary to the functioning of the economic public interest service (necessity criterion);

2. The funding amount can't exceed necessary costs originated by the public service obligations, taking account of the concerning incomes and the profit margin for the company (proportionality criterion);

3. The company is charged with specific public service obligations through one or more official acts, prescribing the nature and duration of such obligations and parameters for compensation account (assignment)

Recently, the Commission has adopted an "*European Plan of economic recovery*", addressed to the productive system recovery from the actual financial crisis.

It's provided a discipline of State aid to small/medium enterprises for Research, Development and Innovation (R&D&I).

In particular:

— aid to R&D project, in particular aid to the main research until the 100% of eligible costs and aid to industrial research until the ceiling of 80% of eligible costs in case of small enterprises;

— Aid to new innovative enterprises, aid to innovation poles, aid for consulting services about innovation and for supporting innovation services;

— Aid for the loan of highly qualified personnel, aid to technical feasibility studies, aid to innovation of processes and of the organization in services, aid addressed to covering industrial property right expenses of the small/medium enterprises.

3.2 2.2 Handbook on Community State Aid Rules for SMEs

EU Commission intervened supplying the guidelines for a correct application of Regulation 800/2008, by a "Vademecum", published the 30 January 2009, enclosing a clarifying synthesis of community dispositions on state aid grants to SMEs in the actual context of financial crisis.

The Vademecum reserves State aid only to the most competitive SMEs: innovation and research; high energetic efficiency standards; formation; jobs improvement and growth of job quality index.

3.3 2.3 State Aid for Research, Development and Innovation.

The category of aid for research and development programmes (fundamental, industrial and experimental research) includes: aid for technical feasibility studies; aid for industrial property rights costs; aid for the loan of highly qualified personnel; aid to young innovative enterprises; aid for organizing innovation in the sector of services; aid for to the Innovation Poles. These types of aid are considered compatible under the art. 87.3. TEC when it's verified the respect of provisions about beneficiary subjects, financed activity, the aid amount and the incentive effect.

The incentive effect is the requirement to establish the compatibility of a State aid for R&D&I activities.

The aid has to induce the beneficiary in changing his behaviour, by inducing it to increase its R&D&I activity level and realize projects that, otherwise, can't be realized or could only to a limited extent.

In fact, the Commission says that State aid for research, development and innovation are allowed under the art. 87, par. 3, lett. b), TEC in case of aid "*to promote the execution of an important project of common European interest*".

The clarifications made by the Vademecum permit to public agencies to supply aid for SMEs, to rightly establish public support measures and fully profiting of community rules addressed to the advantage of economic operators.

3.4 Admissibility of Cumulating Aid to Research and Development in Italian Legislation

Italian law confirm the European tendency to privilege each kind of bonus aimed at financing research, development and technological innovation activities by the preferential policy about the cumulating of some fiscal facilities (tax credit) with others support interventions.

The Department of Economic Development cleared that is possible cumulate tax credit with other interventions to industrial research and pre-competitive development activities and EU Commission recognized that fiscal measure of tax credit isn't a State aid.

3.5 Conclusions

The purpose of this work was to outline the economic and judicial background of state aid in the European Union, and to see how the development of state aid has been in the last decade. The basic assumptions about state aid are that it distorts competition, inflicts an efficiency loss and thereby reduce welfare. This is the notion that has lead to the basic prohibition of state aid, and the need for supranational regulation. However, the economic theory also provided situations when state aid might be used as a tool for remedying market failures that occur in the common market, a rationale that has lead to the exceptions from the general prohibition. These situations are meant to be covered by the rules on "horizontal aid", meaning aid that does not favour a certain industry sector but is granted to target a specific area where a market failure is present.

Regulations, decisions and communications of the EU Commission, but also sentences of Court of Justice and of some National Court, underlined that it's possible to address some benefits to the applicant enterprises, if the pursued purposes aren't censored by the Commission because of some infringements of the EU Treaty about free and loyal competition in the common and national markets.

The study of community discipline and Italian law has shown that in the innovation and technological development sector there aren't relevant obstacles to consider facilitations granted by national governments (funding, exemptions and fiscal bonus, etc.) as legitimate operations. This is the consequence of the tendency to facilitate those economic operators (SMEs) wishing to undertake or consolidate their own presence in the community scenery with innovative initiatives in the research and technological development field.

4 Task 2; Mapping of innovation support initiatives in ESA member states

Italy and United Kingdom were mapped in some depth by Business Catalysts and more limited information was gathered on support initiatives in Portugal for Task 2.

In the UK innovative funding is provided at national government level through separate departments of state in accordance with departmental objectives. In January 2010 in a government announcement a statement was issued about the formation of the British National Space Centre as an Agency for co-ordination of space activities. Funding is also provided by Regional Development Agencies to develop their regions science and industry. Little if any, direct initiative funding was found from local governments, but some indirect funding for infrastructure and facilities in grants to universities has been noted but not included in this study.

In Italy funding is also provided at national level through government ministries and regional authorities.

National and European (e.g. 7th Framework Programme or ESF grants) funding schemes for technology research and development encompass a very large amount of financial resources which are available to European institutions for improving their competitiveness and develop new products. A recent estimate[1] shows that for all sectors about 50 B€ funding was made available by EU countries in 2007 for research and development activities through the various active schemes: of these about 30 B€ were allocated to specific initiatives and programmes (including 2.9 B€ for ESA activities), but at least 20 B€ were available through open calls and tenders and unrestricted support actions.

As correctly pointed out in the study Statement of Work, ESA's accounting rules seem to allow (or even to implicitly encourage) this synergic approach: contracts assigned by ESA are managed (by

both Agency and industry) as industrial procurements even in those cases in which a significant fraction of the funding is in fact supposed to cover development costs. Expenses incurred by companies for performing these R&D activities are therefore formally eligible for additional funding through EU or national schemes. Indeed many small and large space companies and institutes are already taking advantage of this in order to increase their capability of developing and marketing new space technologies.

In this scenario, ESA funding is used as a "seed" upon which additional funds can be brought in to cover sequential product development phases: while ESA technology projects are usually targeting initial development efforts (e.g. through TRP), national general purpose funds can be used (similarly to GSTP) to further increase product maturity up to (in certain cases) full qualification.

When considering many national funding schemes, it can be seen that no advance cash is made available: therefore companies using these funds for developing technology are working under a negative cash flow for the most part of the project, which can be a difficult challenge to cope with especially for SMEs. In other cases, the time needed to apply for and then receive national funds could be much longer than the characteristic time of an ESA focused technology initiative, therefore the national funding could become available too late to have any positive impact on the technology readiness for ESA purposes.

4.1 Innovation funding in Italy

Funding for scientific and technology innovation in Italy is managed at different levels by different bodies. It can sometimes be difficult to understand the various schemes, and unfortunately at the moment there is no unified source of information for companies interested in accessing these funds for product development support.

The Ministry of Education, University and Research (MIUR) is managing funds through a diverse set of financial instruments, addressing essentially the needs of Universities and public research bodies. Some of the financial instruments are also exploited to a lesser extent by private research organizations and by industry; however this is usually in the form of complementary support actions which cannot be used for the actual development phase of a new product or technology. These support action funds could serve the space sector; however most of the contribution to space by MIUR is occurring through funding channelled by the Italian Space Agency (ASI), of which ESA is already made aware through the institutional links to the Italian delegation. For this reason the MIUR funds will not be examined in the present work.

The Ministry of Economic Development (MSE) is managing funds addressing the needs of industry, in particular for investment in new manufacturing technologies, new products and new markets. These funds constitute the bulk of available funding to Italian industry for new product development, and as such also for development of space products.

The Ministry of Defence (MD) is managing funds addressing the development of technologies of military use, according to the National Plan for Military Research (PNRM). PNRM identifies space as a defence priority and therefore parts of these actions are concerned with space technology. Quantification of the funds managed by MD which could benefit the space sector is however difficult, although it should be highlighted that these are by no means negligible. For this reason MD funds will not be examined in the present work.

Regional governments are managing funds intended to stimulate local industrial development and competitiveness. These funds are mostly part of the European Union regional incentives but are managed locally, each regional government deciding how to use and (if appropriate) on which technological domain. Regional innovation funds are often targeted at SME, and have simplified participation requirements. As such they seem of particular interest to complement ESA small studies and small procurements restricted to SME, but also to initiate more comprehensive and large undertakings for large companies.

4.2 National, regional and local space expenditure in the UK

The breakdown of funding by the UK on space related areas as reported by the British National Space Agency in Financial year 2008-2009 is shown in € million for **UK Contributors (not including Regional Development Agencies)**

	MOD	STFC	NERC	Met Office	Defra	DECC	DIUS	Total
Earth Observation								
National			5.56		0.20		0.98	6.74
ESA	0.50		37.13		1.00		3.08	41.71
Eumetsat				20.00				20.00
AATSR						0.75		0.75
Space Science and Exploration								
National		34.80						34.80
ESA		71.27						71.27
Telecoms and Navigation								
National							0.35	0.35
ESA							57.51	57.51
Technology								
National	0.10						0.40	0.50
ESA								0.00
Transportation								
National								0.00
ESA							6.31	6.31
Other National							0.37	0.37
ESA General Budget		12.27	9.99				5.5	27.76
Total	0.60	118.34	52.68	20.00	1.20	0.75	74.50	268.07

MOD is Ministry of Defence

STFC is Science and Technology Facilities Council

NERC is National Environment Research Council

Met Office is Metrological Office

Defra is Department for the Environmental Food and Rural Affairs

DECC is Department of Energy and Climate Change

DIUS is Department for Innovation, Universities and Skills

The major part of the funding is paid to ESA (over 60%) and of the remainder spent within the UK that from STFC for £34.8 million is by far the most significant.

STFC exists primarily to fund UK university researchers in the fields of astronomy, space science, particle physics and nuclear physics. Major new projects such as participation in large experiments or missions, new instrument development or instrument upgrades which require funding of more than £500,000 are funded through assessment by the projects peer review panel (PPRP). Applications are either from academic institutions alone or in combination with industry. Statements of interest are submitted to STFC either independently or after discussions with the relevant programme manager or following a call such as for ESA's Cosmic Vision programme. These are reviewed by the Particle Physics, Astronomy & Nuclear Science committee (PPAN) which either rejects the proposal outright or invites submission of a full proposal. Scrutiny of the full proposal by the Projects Peer Review Panel (PPRP) with, if necessary, a Resource & Management Review meeting, plus a visiting panel composed of external individuals and PPRP members, and external referees, will result in either approval or rejection.

NERC has no equivalent national programme to that of STFC. There are however two budget lines available to the Earth Observation community in the absence of a national technology programme, the Centre for Earth Observation Instrumentation (CEOI) line and the "Mission Support" Line whose main focus is the exploitation of EO satellite data and is managed by the National Centre for Earth Observation at the University of Reading.

The Centre for Earth Observation and Instrumentation is a multi-partner organisation consisting of representatives from the companies EADS Astrium and Qinetiq, the University of Leicester and STFC's Rutherford Appleton Laboratory. It is supported by NERC and by the Technology Strategy Board (TSB). Since its inception the CEOI has issued three calls, for both large and small (seed corn), types of proposals. The former have a fixed budget but no theme. Consortia submitting proposals must include industrial and academic partnerships and must contain a science case and a technology & development case. The proposals are reviewed by a panel of independent reviewers. A condition

of applications is that submitting organisations must supply private venture (PV) funds to between 50 and 25% of the proposals. Seed corn proposals are capped at £50,000. Applications take the form of a single proposal comprising six sections including a technical proposal, financial information, and company/institution background and eligibility information.

RDAs are strengthening and growing regional economies, guided by the principles of sustainability to ensure a healthy long term future for everyone. Each RDA is working with partners to build on their region's natural assets, develop the knowledge-based economy, revitalise places and meet the needs of regional businesses

A joint investment of £36m by East of England Development Agency, EEDA; South East England Development Agency, SEEDA and London Development Agency, LDA helped the UK Company EADS Astrium win a €500m contract from the European Space Agency to develop the most technically advanced civilian satellite in the world – the Alphasat XL. The project will bring significant economic and social benefits to the UK, including creating and retaining over 500 high technology jobs within the greater South East region during the development and operation of the satellite.

4.3 Portugal

Portugal has only been a full member of ESA since November 2000 and is building up its space capabilities.

The Portuguese Space Strategy has the main objectives:

- The use of Space Systems for management of Natural resources, creation of added value services and products from operational programmes, Security of people and goods, environmental monitoring and surveying climate changes;
- The focus on the country's vast Ocean area Continent-Azores-Madeira through monitoring and surveillance
- The use of Space for co-operation with the Community of Portuguese speaking countries
- The establishment of an international image of industrial and scientific excellence;
- The integration of industry and academia in the several phases of added value Space activities, namely in the area of Navigation, Telecommunications and Earth Observation

The management and coordination of space activities in Portugal has been carried out by the Portuguese Space Office, under the responsibility of the Portuguese Ministry of Science, Technology and Higher Education.

National Expenditure on Space and related technology activities in 2007 was 0.7 million € and the ESA-Portugal Task force has contributed to identify the players and the areas where Portuguese participation could be an asset

Above information on Portugal was derived from European Space Technology Master Plan 2008

5 Task 3: Financial engineering; simulation of benefits from innovation support synergy

A review of the line items in the ESA TRP budget for Italy and UK compared to the line item entries in the national budgets did not reveal any duplication of R&D and this was expected as all bodies try to make the best use of limited funds. ESA publishes its budget plans and issues IPC papers setting out the technology planning for forthcoming missions such as Cosmic Vision that provide overall guidance.

In addressing a financial simulation for fund matching there were no obvious candidate technologies as ESA already coordinates with member countries on R&D. Instead a financial simulation of the benefits to GDP from R&D investment in space was developed.

A financial model for multiplier effect of relationship between R&D investment and GDP is:

Fspace1=A*Ftotal*(GDPspace/GDPtotal)

Where **Fspace1** is the yearly funding available to space industry,

Ftotal is the total yearly funding available,

GDPspace is the space industrial output,

GDPtotal is the total industrial output, *A* is a corrective coefficient.

The value of **A** expresses the ability of the industrial sector to attract a proportionally larger or smaller share of funding with respect to the arithmetic weight on the total GDP. Although a precise figure for **A** is difficult to determine, a qualitative analysis of the published results for various recent

call for proposals managed by the Regional Government of Tuscany and of Lazio (which were monitored by the study authors during the 2005-2009 timeframe) show that in the case of space industry the value of **A i**s significantly larger than 1 (the average over a few call for proposals showing **A=5** for space sector). In other words, space industry is able to attract a larger than proportional share of innovation funding in Italy.

A specific analysis of the coefficient *A* is beyond the scope of the present study; however qualitative reasoning (supported by a review of the award criteria for the main recent funding calls) can help understanding some essential reasons for the competitiveness of space industry in this arena:

- Innovation calls award points to proposals which are related to high technology industrial sectors: space fulfills this requirement
- Innovation calls award points to proposals which are related to high-added value productions: space fulfills this requirement
- Innovation calls award points to production which are labour intensive, therefore having a potentially higher positive return on employment: space fulfills this requirement
- Space industry is well trained in the definition and presentation of product development plans, therefore generating (in average) higher quality proposals

Investment in space technology by ESA is € 230 million, with investment from national institutions of a similar amount and industry also investing €130 million. As percentage of space GDP this represents about 0.45 % which may not be high in comparison with other high tech businesses but is still substantial. *This figure was derived from the ESA European Technology Master Plan for 2008 plus an addition for industry R&D expenditure*.

This level of R&D investment in space activities results in a high and significant GDP return that exceeds the average return for other businesses and it could be expected that an increase in R&D investment would further increase GDP. Already applications for research grants exceed the available national budgets and many good, well thought out proposals are rejected because of lack of funding. But, in the current recession it is unlikely that governments will increase R&D funding, so it is necessary to make the best use of available funds from national, ESA and the EU sources through coordination.

ESA is a major source of R&D on Space and contributes some 50% of the R&D budgets through the TRP, ATRES and GSTP programmes. ESA works closely with national agencies to coordinate technology developments and has the best complete picture of the needs for technology innovation for the future space activities of Europe. Under a joint EU/.ESA secretariat the technology platform for European Space technologies with a number of objectives to facilitating interactions between the space sector and related non-space technology platforms is being coordinated Already ESA is seeking to obtain the best value from R&D investment through coordination and harmonization to minimize duplication. An example of this cooperation is the planning for the science Cosmic Vision programme with national agencies setting out their objectives and ESA releasing an IPC paper for consideration by member countries.

The EU through the Framework programme is a major and growing source of funding for R&D in space and there are further opportunities in other themes in the Framework programme. The Security theme in the 7th Framework programme with a budget of €1.4 billion over the next seven years and space systems can provide a useful contribution to this area through development of dual use technology.

As correctly pointed out in the study Statement of Work, ESA's accounting rules seem to allow (or even to implicitly encourage) this synergic approach: contracts assigned by ESA are managed (by both Agency and industry) as industrial procurements even in those cases in which a significant fraction of the funding is in fact supposed to cover development costs. Expenses incurred by companies for performing these R&D activities are therefore formally eligible for additional funding through EU or national schemes. Indeed many small and large space companies and institutes are already taking advantage of this in order to increase their capability of developing and marketing new space technologies.

In this scenario, ESA funding is used as a "seed" upon which additional funds can be brought in to cover sequential product development phases: while ESA technology projects are usually targeting initial development efforts (e.g. through TRP), national general purpose funds can be used (similarly to GSTP) to further increase product maturity up to (in certain cases) full qualification.

It is widely recognised that SMEs are both innovative and the future employment growth engines. Special arrangements by institutions and governments are made to encourage SMEs by reducing the self contribution requirements for R&D grants. However, arranging finance has been a major problem for SMEs seeking to grow and the UK has in 2010 announced a new funding arrangement for SMEs.

For instance, when considering many national funding schemes, it can be seen that no advance cash is made available: therefore companies using these funds for developing technology are working under a negative cash flow for the most part of the project, which can be a difficult challenge to cope with especially for SMEs. In other cases, the time needed to apply for and then receive national funds could be much longer than the characteristic time of an ESA focused technology initiative, therefore the national funding could become available too late to have any positive impact on the technology readiness for ESA purposes.

These (and other) issues may be addressed by increasing the awareness of ESA officers about the rules and timeframes of non-ESA funding schemes, encouraging them to consider the possibility of tapping additional resources from the early stages of their technology planning process and involving industry in this process in order to increase their interest and willingness to pursue different funding sources.

6 Conclusions

Although only a very simplified (and mostly qualitative) analysis could be performed a few important points can be concluded that show the multiplier benefits from R&D investment:

- Space businesses make significant GDP contributions that have grown at more than 5% per annum over the last 10 years. Adequate R & D expenditure is essential in maintaining this growth.
- Activities generated as spin off from Space systems are increasing and also make a useful GDP contribution.
- With increasing awareness of environmental issues, new space based monitoring capabilities are useful tools for environmental matters and disaster emergencies.

ESA leads coordination with national space agencies on R&D activities to minimise duplication and waste, and also liaises with the EU on their R&D budgets. With the Lisbon Treaty now in force the EU sees it has `joint competency` with ESA on space matters which could bring some changes in the way

that R&D budgets are awarded but EU rules on eligible funding do not change . With regard to SMEs the EU and other bodies give preferential treatment to funding for R&D.

In the UK a new International space centre is being set up at Harwell next to the ESA Space centre for innovation which together with the formation of the UK Space Agency will bring a focus and coordination of UK space activities rather than the uncoordinated way of the recent years. Making available the facilities at these two space centres to SMEs will be of major help to them for development purposes.

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