What should the public sector do to incubate the Earth observation value-adding sector?

Position Paper on the Industry Agenda

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About eoVox

eoVox: Strengthening the Voice of the European & Canadian Earth Observation Industry

The European Space Agency (ESA) has initiated the eoVox activity to explore issues that affect the Earth Observation (EO) service industry sector in Europe and Canada.

eoVox is an opportunity for all companies to voice their viewpoint on the future of the European and Canadian EO service industry. The results will be looked at carefully by ESA in planning for the period 2008-13 to make sure that the needs of the industry are supported at the right scale, with the right mechanisms and of adequate duration.

The eoVox consortium is led by LogicaCMG UK Ltd. as prime contractor, and includes EARSC (the European Association of Remote Sensing Companies), the Swedish value-adding company Metria, the Canadian value-adding company C-CORE, and consultants ControlWare from Belgium and ESYS from the UK. More information can be found at www.eovox.org.

The eoVox consortium has prepared this Position Paper as part of its ongoing programme of activities to analyse and draw attention to the needs of the European and Canadian EO VA sector. This paper is being published in advance of an industry-wide consultation workshop to be held at ESA's ESRIN facility in Frascati, Italy on the 14th September 2006. The consortium welcomes and invites feedback on this paper from industry stakeholders, either in advance of or at the workshop event.

Please send all feedback, comments and views to the eoVox consortium c/o the project manager Chetan.Pradhan@logicacmg.com.

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1 Introduction

This section introduces the Earth observation value adding sector and the motivation for presenting this position paper.

Introducing the Earth Observation Value Adding Industry

Earth Observation (EO) is broadly the acquisition and exploitation of data acquired from remote (aircraft- or satellite-based) observations of the Earth – it covers a diverse range of remote sensing applications, including weather forecasting, environmental monitoring, surveillance and numerous scientific applications in the atmospheric, land and ocean domains. New applications for EO are continually being found, for example in the insurance industry (helping to assess risk) and in planning emergency response services (following natural disasters).

The EO Value Adding (VA) sector is the group of companies that processes the raw or semi-processed data from the remote sensing instruments, and converts the data into information that is commercially useful end users. The VA sector in Europe and Canada comprises about 250 Value Adding Companies or "VACs", each specialising in one or more specific thematic area.

The Current State of the Industry

The EO VA industry is an extremely diverse sector which develops products and services that address a wide range of thematic domains as mentioned above. To support these thematic domains, it produces a wide range of products, which vary greatly in terms of what they deliver and how they are produced,. As the applications are so diverse, no single company is able to cover very many of them. The typical profile of a VAC is a small, specialised organisation that focuses on one or two thematic and geographic areas, with small and perhaps steadily growing revenues. The industry is characterised by isolated expert groups offering niche services.

Recent surveys of the industry confirmed it is still very much an emerging sector with a fragmented industry structure and highly diverse and varied product and service supply mechanisms. As perceived by the industry itself, the following external factors are currently preventing the industry from stepping up and out of this mode and establishing itself as a sustainable and profitable industry in its own right:

- heterogeneous and fragmented user community
- insufficient and unreliable access to data for operational applications
- relatively high cost of the input raw material
- lack of long term commitment from large institutional customers.

The need for proactive support for the industry

This position paper sets out to answer the question: "What should the public sector do to incubate the Earth observation value-adding sector, and why?" The paper demonstrates that:

- The EO VA industry and its growth is strategically important to governments, public sector and private sector organisations throughout Europe and Canada;
- The industry needs to grow and consolidate to realise its full potential and deliver tangible long term benefits, but it is held back due to a number of factors that no individual company is able to tackle on its own or without support;
- There are sound arguments for the public sector to invest and "incubate" the sector to help it achieve this, with a clearly defined set of actions that will help the industry as a whole achieve the short and medium term objectives for growth and development.

The eoVox team invites public sector organisations across Europe and Canada to consider this paper and its recommendations carefully, and make firm commitment of the necessary resources to help incubate the industry and deliver the foreseen benefits.

2 Setting the Scene

This section explains why the EO VA industry exists in the first place, and describes the strategic and political importance of the industry.

2.1 Relevant Problems and Needs of the Public

Most countries worldwide acknowledge that planet Earth and its inhabitants will face serious environmental problems in the coming years and decades if serious action is not taken to respond to pressures or mitigate their impacts. This has triggered numerous initiatives, in the political arena, in governmental and non-governmental circles alike.

- ◊ In the economic and commercial domains: to manage resources efficiently, assess and manage risk, evaluate environmental impact and justify financial investments;
- ◊ In the scientific domain; to better understand the processes at work on, above and in the Earth;
- ◊ In the technological domain to develop better monitoring systems as well as remedies.

Humankind has realized that far from being a remote possibility, damage to the environment is starting to impact the lives of hundreds of millions of people. This acknowledgement and the early tackling of identified problems is accompanied by the more and more frequent use, consciously or not, of geographical information. Geographical information is understood as a widely spread type of information describing natural and built objects, phenomena, or groups of people when they are related to a specific position.

International environmental protocols, such as Kyoto (CO_2 – climate change) and Montreal (CFC – ozone depletion), as well as their related branching at European, national, local and regional levels have exacerbated the need for geographical information. Without geographical information there would indeed be no monitoring of natural resources, no possibility to check sustainable development and no possibility to manage properly any of the environmental problems which arise (as examples one just has to look at the latest Asian tsunamis, at the American hurricanes or at the humanitarian catastrophes resulting from earthquakes all over the world or from starvation in large regions of Africa).

There are two broad categories of geographical information collection, through *in-situ* survey/measurement or through remote sensing. The two are complementary, and both types of sensing incur significant costs both to establish the necessary infrastructure and then to operate and maintain it. However the capabilities of remote sensing are tremendous, in particular because of its capability to tackle simultaneously local, regional or global issues.

This explains the increasing place of remote sensing in international environmental monitoring programs. A lot of new opportunities arise when remote sensing systems are set up to provide up to date, continuous and accurate environmental information (as well as historical trends) within geographical information systems. It creates new capabilities in the hands of decision makers, new hopes for sustainable development, new socio-economic benefits both through the public and the private sector and, last but not least, it allows the real birth of a geographical/value added information industry.

2.2 Strategic Importance of the EO VA Industry

The Earth Observation Value Adding industry is an emerging one. The limits of this industrial sector are fuzzy. Indeed everybody manipulating remote sensing or geographical information is doing it for a specific purpose to reach an expected result. This process of achieving a result is in itself a value adding process. Thus the Earth Observation Value Adding industry includes all the commercial players that:

- ◊ produce data - there is inherently a value adding process involved in data production even through the conversion from a pure electronic signal to a raw digital data
- ◊ process EO data from its raw state through different level to obtain 'GIS ready' information products
- ◊ integrate data in geographical information systems or exploit the data in any other way and for any purpose.

This industrial sector is thus expected to become very large, and even more so considering the numerous new observation systems that will be set up across the world in the coming years, in particular within the GMES and GEOSS initiatives, and also as national or private initiatives.

Since geographical information pervades all social and economic sectors, it is a key resource for all decision makers at public or private level. In a broader sense it thus has a strategic importance not only for defence and security but also for any government to be an acceptable and accepted player at the table of international negotiations – for instance on carbon trading, greenhouse gas quotas or on other essential socio-economic topics. It is one thing to ensure access to the right data thanks to developing the right data acquisition systems. It is another to ensure a capability to exploit those data in a secure, economically efficient, and operationally optimised way. This is where the EO VA industry is both crucial and at its best.

It must be stressed that the strategic importance of the VA sector can not only be found in the many new socio-economic benefits generated by the applications themselves but also in the creation of many new jobs to process and exploit the produced information. This is highly relevant to the Lisbon agenda, a priority of the European Union.

However the development of this industry has been largely left to itself without strong strategic direction, nor proper economic support to reach a critical size. The result is a strong fragmentation and still existing barriers to a real market entrance. Part of the solution could come from the public sector and part from the private sector.

2.3 The Political Scene

Accelerating evolution of the political scene on environmental issues presents an opportunity to acknowledge the strategic importance of the EO VA industry as well as to help its development.

There is now a convergence of bottom-up and top-down initiatives to monitor the environment. Locally driven initiatives are practical and well established. However in the EO domain, considering a) the large investment required and b) the success of global cooperation in solving meteorologists problems, top-down approaches from national or international organizations have taken the lead. Today the GEO, GMES and GEOSS top-down initiatives take care to include *in-situ* contributions as well as local and regional applications.

Moreover the regions themselves are getting organized with the so-called conference of European regions and many other initiatives in Europe to make sure that there is full coherence and consideration of their needs in defining and implementing future policies and systems.

Government and non-governmental institutions and associations alike are realizing that it is only through efficient co-ordination and synergy that the full benefits of the new monitoring programs can be reaped. Work on INSPIRE is a major example, showing influence on industry.

These developments at local, regional, national and international political levels are a new and potentially very fruitful opportunity for the European EO VA industry.

While the private sector has shown a willingness to play a role during the past thirty years, it can only realize its full potential if its initiatives are accompanied by government commitment to infrastructure financing, long term adoption of services, and the right legal and regulatory tools. Initiatives to reach a satisfactory situation must be on the EO VA industry roadmap and industry must ensure mutual collaboration with government institutions to secure good outcomes.

3 Current State of the EO VA Industry

This section draws upon two recent industry surveys of Canadian and European EO VACs to gain an understanding of the current state and views of the industry.

The first concerns the EOMD Industry survey published in 2004 carried out on behalf of ESA by Vega and Booz Allen Hamilton[1] (Ref X). The second is the 'Analysis of Industry Issues', published in May 2006, undertaken as part of the eoVox study.

3.1 Size and Health

Quantitative figures concerning the size and health of the Canadian and European EO value adding service industry can be obtained from the EOMD Industry Survey. The survey concluded that:

- It is estimated that the industry employs about 2900 people and generates a turnover of 285 million € (2002 numbers). Hence, the EO service Industry is very small compared to other high tech industries such as bio technology, ICT and GIS.
- The average revenue per employee also is in the lower end compared to other technical labour intensive industries.
- The majority of companies are small: 60% of companies have less than 30 employees.
- The growth rate of the industry is relatively good, on average about 6% per annum, yet it is dominated by less than 10 companies.

Thus, the EO Service Industry is still an emerging sector with a fragmented industry structure and highly diverse and varied product and service supply:

- A EO product (sales transaction) is typically a one-off project delivery or a customised core product.
- The majority of production costs (per unit) are labour costs.
- 75% of products are competing with non-EO products and 25% of EO products appear to have a degree of uniqueness.

The institutional market accounts for 78% of the customer base. Only 15% of the industry's combined turnover originates from customers outside Europe (Export market).

Land applications, e.g. cartography/security, natural resources monitoring are the dominant thematic market segments accounting for approximately two-thirds of the total turnover. Within the currently small market for Ocean applications, commercial applications are very important (e.g. marine/maritime and off-shore industries). In addition atmospheric applications (non-meteorology) are emerging, such as air quality and pollution monitoring.

Most EO products use data from multiple satellite sources. Integration with non EO data sources (ground sensors, socio-economic data) is also important for successful value adding, and so are data integration, assimilation and modelling. This is why the sector has a high level of technical sophistication and complexity.

[1] The State and Health of the European and Canadian EO Service Industry, August 2004, Vega & Booz Allen Hamilton

3.2 Views from the Industry

Based on more than 60 interviews with small and large EO VACs carried out in the beginning of 2006, the following views came across:

1. The case for improved representation

The majority of the VACs feel that the current representation of the downstream EO service sector is too weak and that the views and influence of the value adding specialists is out of balance with that of the larger aerospace companies which construct EO systems and public sector agencies and research institutes which provide information services.

A stronger lobbying position to influence future programmes, public development funding and to address some of the real obstacles to market development such as lack of operational data supply constitute the strongest (upstream) drivers for Industry representation.

A stronger industry representation is likewise believed to be crucial for creating fertile conditions for future market opportunities in the downstream commercial, professional and mass market sectors. Such opportunities could in future lead to significant new opportunities for wealth creation. As has resulted for in car navigation with the convergence of better accuracy and 'free to air' satellite navigation, digital road maps and mobile technology.

2. Drivers that affect supply and demand in the EO Service Sector

Over 60% of the VACs participating in the survey regarded GMES to be an important driver for future market development.

Many respondents believed GMES commercial spin-offs to be an important driver but just as many predicted a negative effect on existing commercial relationships. Based on past experience some doubt they can enter GMES "end-to-end" service chains created by players already active in GMES.

About half of all respondents regarded the development of innovative EO based services such as Location Based Services (LBS) and Geo-marketing as important drivers stressing the importance of applications taking advantages of synergy between different technologies.

At the same time lack of operational data supply was seen as an obstacle to market development, due to the timing of missions (5-10 years for Sentinels is too far ahead).

High input data costs in general were seen as a significant blocking factor on market development.

3. Industry Evolution

The keyword best summarising the future structure foreseen for the EO Industry is consolidation. Around 80% of respondents believed in industry consolidation whereby VACs are forming and will continue to form closer collaboration in order to become stronger and remain competitive in the future.

It is expected that the main large companies will grow bigger through absorption and expansion. Their prevailing strategy will be to provide end-to-end systems and to deliver standardized GIS ready products directly to the end-user. The large players will in particular benefit from GMES.

It is believed that smaller VACs will be absorbed or bought up either by the big EO players or by complementary players or end user organisations (in-sourcing), disappear, grow bigger by networking or sustain as niche players. At the same time small new players, mainly spin-offs from universities, will keep emerging as there are low entrance barriers into the industry. VACs do not necessarily see these changes as a threat or as a negative thing. Rather turbulence is seen by many current players as a natural consequence or positive indication of the industry maturing, and a phenomenon that can also open up new opportunities.

4. Expectations from a Trade Association

Three main roles of an EO Trade Association have been identified; these are (1) to act as a common voice for the industry; (2) to establish synergies by facilitating collaboration with non-EO players to optimise the development of applications from synergistic technologies (e.g. satellite navigation/ communication, mobile technologies etc); and (3) to promote the combined capabilities of the EO Service Sector.

A "wish list" of the main activities of an EO Trade Association, as compiled from the survey included:

- professional lobbying to influence future EO programmes;
- network facilitation;
- market intelligence gathering;
- export facilitation/support;
- communication on what is going on.

5. Feedback concerning development financing to support VACs

- Respondents were very positive about ESA EO application development projects (EOMD, DUE etc.) since they were seen as being uniquely tailored to small and medium sized VACs.
- The Geo-return (ESA) constraint was seen as an issue creating an imbalanced tendering process and, given the capabilities of Europe and Canada, did not result in the optimal solutions which normally arise from free competition.
- Recommendations for further funding included testing new ideas in new thematic domains, user demonstration with new users and advanced technologies, commercial market development with new business approach and export oriented initiatives towards new regions.
- Recommendations for improvement included a) less prescriptive SOW b) more freedom and flexibility in proposal/project implementation to maximise innovativeness and c) introduction of a pre-screening service to minimise efforts lost due to the high level of competition.
- The EC funding programme instruments, e.g. the large FP6 Integrated Projects were not regarded as a very efficient way of conducting EO applications development, for several reasons such as management burden, inappropriate funding structure, very high cost of winning and long lead times (incompatible with most businesses).

4 Context in which the EO VA Industry Operates

This section identifies the most important influences upon and trends within the sector.

4.1 Factors Affecting the Sector's Development

Below is a brief description of impending external factors and their likely impact on VACs.

- The current market for the EO VACs is mainly the public sector. The GMES and GEO initiatives will affect the VACs considerably.
    - The R&D activities within GMES will decrease in the coming years, with a stronger focus on operational activities through the development of the recurrent satellite infrastructure based on the Sentinel missions.
    - GMES will increase market volumes considerably and new market segments within the European public sector will be addressed by a portfolio of services comprising EO-derived data combined with *in-situ* data of various kinds.
    - The commercial conditions for supply of GMES services are currently subject to discussion, but in all likelihood it will be next to impossible for VACs to address the public market with services that are not part of GMES. This implies that the market for SAR data and for optical data with coarser resolution than 5-10 meters will – in practise – be monopolised by the GMES service providers.
    - For the VACs that are not currently involved in GMES, the challenge is to either get involved in GMES or leave the market segment that is interested in optical data and SAR-data with coarser resolution than 5-10 meters.
    - There is also a possibility, as yet untested, for an upcoming product portfolio consisting of "GMES spin-offs" that target the export, commercial professional or personal information markets. These would be value added products and services for non-European customers, the private sector and mass markets derived from the standard GMES products and services.
- The industry is highly dependent upon the quality of its data supply (in terms of revisit, resolution, fitness for purpose, timeliness, access to data, …), which is - and has been - a hampering factor in the development of a commercially viable industry. The commercial value of the data supply has improved over the last few years through the introduction of optical VHR and airborne digital cameras. In the near future, improvements in data quality are expected to continue, perhaps at an even greater rate.
    - More optical VHR-sensors with even better resolution (~ 0.5 m) within 2 years.
    - "Commercial" VHR SAR sensors, with up to 1 m resolution within 1-2 years.
    - EO satellites from space nations like India, Israel, China, Taiwan, Korea, Thailand and Brazil exist already and improved systems are planned.
    - The development of viable "small sats" has enabled (and will continue to enable) new entrants like Nigeria, Algeria and other countries to launch EO satellites. However, the importance of these for most European VACs is expected to be small, at least within the near future.
    - Existing civilian institutional players such as ESA, NASA/NOAA, CSA, JAXA, ISRO and KARI are launching new satellites, mainly designed to serve the environmental sector.
    - Dual-use satellites, mainly in the VHR optical and SAR segments.
- The market has an increased focus on product specifications which means that the method of data collection is becoming less relevant. If the EO sector can adapt to this

trend, for instance by supplying products and services that are following acknowledged standards, are GIS-ready, have a certified quality and are independent of data sources, then this will help to secure long term customers and open up new market segments.

- General awareness of EO capabilities is increasing, partly due to the "Google Earth effect". Google Earth and Microsoft Virtual Earth themselves present a new market for EO products. They have also opened up a new business model for EO outside the traditional 'information product' sales approach. Already the "Google Earth effect" has stimulated new demand from customers that has led to new EO products and services.
- Broader technological developments of course have an effect on EO VACs and the environment in which they work. For instance broadband, LBS, on-line micro-payments and web services will all continue to open up new business models. Taken together with these technologies, the integration of environmental sensor data (of which GMES is an important part) is becoming a new, economically disruptive technology.
- The high price of EO data has been and continues to be a barrier to value adding. European policy on PSI is complicated by conflicting economic philosophies at national level ranging from complete freedom to active protection of government monopolies and full cost recovery at the point of use. GMES will cause the debate to be opened once again. This issue is discussed in the next section.

4.2 Trends in the Earth Observation Industry

As described in Section 3, the industry is currently too fragmented to enable it to develop and drive the market. However, quite recent mergers and acquisitions have been moves towards vertical integration. Some parts of the EO industry are also considering horizontal integration with the bigger GI-sector.

Even though there has been some restructuring towards 'operational' readiness, it can be argued that a full re-structuring in the next two to four years would be premature because

a) Firm commitments to build the planned new medium and high resolution operational EO systems are not yet in place.

b) Many R&D activities still need to be carried out to ensure that some product and service portfolios meet the requirements of the new public sector market.

c) The commitment by the public sector to purchase products and services through the VAC channel is not yet assured.

It is therefore expected that public support is still required to develop the market.

4.3 Export Markets

Many of the European/Canadian VACs want to extend export sales since only approximately 15% of the industry's turnover originates from export.

Few companies can afford the high cost of sale and the risks involved in conventional export activities, Companies with a product suitable for export markets usually have to start from scratch in terms of a) identifying the right target markets b) finding or attracting potential customers and b) once found, educating the potential customers about EO capabilities.

GMES could provide a European platform for export opportunities, including opportunities in government departments and agencies outside Europe.

Taking the above into account, targeted public sector support for export activities can be justified.

5 Opportunities and Challenges for the EO VA Industry

In this section, we look to the future of the EO VA Industry with an eye on the opportunities on the horizon, and the challenges and risks that this poses to small and large SMEs in the sector.

5.1 Opportunities for the Industry

The EO VA Industry is faced with considerable untapped opportunity within national and European markets as well as the rest of the world. Significant growth in the demand for geospatial information in general (reflected by increasing uptake of GIS) is good news for the VA industry. However, in this respect industry needs to face the competition from other more traditional (and often more easily understood) information sources. Opportunities in services from small satellites and VHR data should also continually be explored by VACs.

The increasing importance of climate change by way of the Kyoto Protocol is raising the profile of environmental monitoring world-wide. It goes without saying that EO will play a key role in any large-scale environmental monitoring programme. By its very nature, environmental monitoring will in all likelihood be funded by the public sector for the foreseeable future (justified by considerable socio-economic benefits). The advantage being that the public sector takes a longer-term view than the private sector, and this could offer the EO industry, at least in the medium term, security in contract acquisition.

In Europe, GMES will clearly offer the biggest opportunity for operational information provision. Despite funding in the medium-term from R&D budgets (FP7), the expectation is for the provision of end-to-end operational services (and not service development). Many of these services will be well suited to private sector provision, but many public sector agencies are also seeking to in-source such services and are strongly positioned to do so.

With a view to making these opportunities concrete, the EO VAC industry needs to be strengthened so that it can secure from national and European administrations a) significant roles in service provision and b) freer access (easy and at marginal cost) to Public Sector Information (PSI) and data from EO missions funded out of the public purse (e.g. GMES).

Noting that over 50% of the market for PSI is comprised of geographical information, this is likely also to have a significant impact on the EO VAC sector. It can be argued that PSI, which is not otherwise restricted by security or *bona fide* commercial interests, should be made available to the value adding community at no cost or reproduction cost. Citing the situation in the US, a case can be made that such a policy enables new products and services to be launched, and new markets, jobs and wealth to be created (Pira 2000 – see box below).

> The Pira 2000 study[2] estimated that in 1999 the US PSI market was up to five times the size of the EU market. They attribute this competitive advantage in the exploitation of PSI to 'knowledge of the enabling technologies, coupled with access to locally relevant information'. They argue that European countries could at least double the size of their industry by pricing PSI to recover costs, and that governments would easily recoup in extra tax receipts what they would lose by removing all charges for PSI.

The new paradigm introduced by Google Earth has not only stimulated interest in EO content that was previously not widely available to the public but also serves as a platform and catalyser for the development of a whole set of new products and services. Rather than viewing this free service as a threat, the EO industry should take courage from the fact that in other industries free services have often stimulated the demand for paying services. A relevant example is GPS which was originally conceived as a national defence program, then got introduced in civil and citizen circles thanks to an easy access to data, and now together with the future European

[2] Commercial exploitation of Europe's public sector information, Pira International, 20 September 2000.

system Galileo is opening up new commercial domains in Navigation, Positioning and Tracking. In car navigation alone is fast becoming a 'must have' in a new mass market and there are many other new products and services across the navigation sector.

5.2 Risks and Challenges

In this section, the risks and challenges facing the VAC industry are briefly outlined. Due to the diversity in nature of these risks and challenges, they are summarised as bulleted items.

5.2.1 Risks

- Industry snapshots from 1997, 2000 and 2003[3] would seem to indicate a **strengthening of business in national markets**, but at the expense of a reduction by half of commercial activities outside Europe.
- The EO VA market remains constrained by the **lack of operational data supply** and high data costs (even though prices have somewhat fallen) where smaller VACs lack negotiating power with data suppliers.
- The industry remains immature by staying **focused on pre-commercial product** and service development rather than offering operational products and services for commercial and public sector customers.
- Market development activities (e.g. awareness and demonstration activities) by SMEs remain limited due to lack of resources. **Industry fragmentation** makes common activities difficult.
- Due to their typical **technology push** approach (rather than a true customer-based approach), the EO industry is not able to best capitalise on the rapid growth in the demand for geospatial information and looses out to other, more conventional, information providers.
- Contracts for GMES service provision will take place via instruments used in FP6, e.g. Integrated Projects which are **inadequate financial instruments** when one considers the size of the industrial actors and the short-term return on investment.
- European VACs, especially SME's, begin to **rely too extensively on public funding** and **fail to diversify** towards other markets and private customers.

5.2.2 Challenges

- The VAC industry starts to promote its products and services to customers as optimal **geospatial information solutions** without focussing on the EO-technologies on which they are based.
- The EO industry should adopt a truly **customer-based approach** and not just pay lip service to it. This can be achieved by correctly assessing what geospatial information the customer wants without initially, at least, being unnecessarily constrained by the limitations of EO.
- VACs should wean themselves off R&D funding in favour of **providing operational services**, albeit for the public sector (e.g. GMES). Dependency on public sector funding *per se* is not in itself a negative characteristic of the sector, only if this is funding for continual product & service developments (that are quite often not taken to market) rather than for operational service provision.

[3] European EO Industry and market: 1998 snapshot , December 1998, ESYS plc
[3] European EO Industry and market: 2001 snapshot and GMES Benefits Framework, September 2001, ESYS plc
[3] The State and Health of the European and Canadian EO Service Industry, August 2004, Vega & Booz Allen Hamilton

- The industry is highly fragmented in a myriad of application domains. The agreement of common issues (e.g. to be address by a TA) will be challenging, and best resolved by **focusing on high level issues**, e.g. data policy, GMES procurement mechanisms, etc.
- Especially small VACs will need to set up more **formalised, longer term partnerships** in order to respond to GMES calls for end-to-end service provision. This could be horizontal partnerships (between different application areas and geographical regions) and vertical partnerships along the information production value chain. This mitigates the twin risks that the industry as a whole will be unable to deliver and that bigger players will try to dominate GMES service provision.
- The timescale of **GMES** (fast track services to be developed in the 2008-2013 timescale) is beyond the current planning timeline of small VACs. However, it would be advantageous for them to have partnerships in place to respond to the first calls in 2008.
- The VAC industry should lobby for **alternative funding mechanisms** from the EC for GMES services despite the origin of the funding, i.e. R&D budgets under FP7. The Integrated Projects instrument is not ideal for SMEs and a much more direct type of contract and rapid payment mechanism should be found that is more similar to commercial procurement. With the management of GMES now residing in DG-Enterprise it is hoped that they might be more amenable to suggestions from industry.
- Industry must be organised to be able **to deliver effectively** upon EC requests for EO services of the order €80-100m per year
- VAC should define a strategy to help **federate customers**, in particular within industry. The user community is too fragmented so that the critical threshold for true efficiency and sizeable return on investment for product development is rarely reached. The right levels and scales must be adopted associated with actions responding to the common issues of industrial users (such large industry issues would include Corporate Sustainable Development, Natural Resources, Insurance, etc, to name just a few).
- VACs should proactively **grow their international customer base**. Europe and Canada have the advantages of being multi-lingual and experience of working in a multi-cultural environment. The existence of strong development programmes between Europe and less developed regions of the world could be exploited by the VACs to target new export markets. In addition, many member states still have strong links to and bilateral agreements with ex-colonies for trade and technology transfer purposes.
- With the view to new EO missions planned under GMES, the industry should start to lobby public authorities at national and European levels to adopt a **new approach to data access and especially with respect to pricing** which is closer to that adopted in the USA. This can be justified by significant expected growth in industry within a corresponding increase in tax receipts to off-set the public investment.

In addition to these risks and challenges, the VAC industry can take pointers from the trends and experiences of other non-geospatial market sectors as well. See Appendix B for items identified as relevant from other industries studied under other activities within eoVox.

6 Investment Strategies

This section considers the available options for investment in the EO value adding industry, and the mechanisms for generating returns on investments through sustainable revenue growth.

6.1 Options for Investment

A few options are available today for the EO VA industry for investment. The option to be chosen depends on the type of application to be pursued:

1. Go Public

Typically public applications such as environmental monitoring, meteorology and climatology are natural channelled here. Today the main EO applications developed to a fully operational level fall in this category. The funding can be through EU, ESA, European Investment Bank and national government, or through government agencies such as EUMETSAT, the European Environmental Agency or national institutions. This can create a problem of in-sourcing or government monopoly in some cases, which reduces the accessible budget for industry. As of today the best hope for public investment in Europe is in GMES. The way the planned annual budget of 80 to 100 millions euros for services will be spent is not defined. It is however necessary that the European VA industry is not denied the opportunity to respond to such a challenge considering the importance of its workforce in this area, its built-up experience and its ability to create additional wealth through private sector activities.

2. Go Public/Private

This approach nicknamed “PPP” has seen its emergence in the US with anchor tenancy approaches in Earth Observation, which sees a success mainly thanks to defence customers. PPP has been proposed and implemented for the Galileo navigation system. PPP has not yet been implemented in Earth Observation in Europe but people are wary about its possible use after the difficulties being encountered on Galileo and the failure of the LANDSAT commercialisation programme. Nevertheless this remains a possibility in Europe.

PPP financing of ground based service delivery infrastructure elements warrants further consideration as a means of smoothing budgetary commitments.

3. Go Private

Partial financing through venture capital providers has been used in Europe to set up the Rapid Eye program between German and Canadian investors with apparent success, although there is also public investment in this programme and the program is not in orbit yet. Private investment is also claimed to be a part of the TERRASAR program in Germany with joint funding by government and EADS.

In general however the culture of business angels and risk investors is not as developed in Europe as in the US and the evolution will be slow.

Strong actions to innovate in funding mechanisms must be undertaken in Europe both at the institutional and industry levels.

6.2 Sustainable Revenue Growth

The return on investment is again largely a function of the application considered. The case for return on public investment will be explored in the next section.

In terms of private funding the return on investment will essentially take the form of revenues from data or revenues from services.

Revenues from data are obtained mainly through data sales to institutional entities such as the European Union or the US government. In the same way as SPOT IMAGE sold large amounts

of images to the US government, the US company Digital Globe has sold large quantities of high resolution satellite data to the European Commission through its EURIMAGE European distributor. This is a mechanism which works. Nevertheless the return on investment from data sales would probably not be sufficient to sustain activity if not for the support of the US government anchor tenancy.

Revenues from services are the main revenues of value-adding companies. Several tens of small European companies are involved in this domain with various level of success. The size of their revenues explains why in most cases they have personnel in the 10 to 50 people range. A few companies, subsidiaries of large groups, can be larger and get larger revenues, but most of the time only a small fraction of their overall revenue comes from services. Outside the public sector, the most commercially successful activities of these companies are in providing professional services to large companies in sectors such as oil or insurance.

7 The Case for Public Funding

A few major elements are at the core of the case for public funding of EO VA activities.

First, the majority of the Earth Observation applications, and the majority of the users identified today, are in the public service realm. It encompasses pollution monitoring, water management, coastal zone surveillance, risk management, vegetation monitoring, natural resources inventory, defence and many other applications.

Second, so far, such services when delivered by small VA companies to the public have generated little profit: specifications are often unclear or evolving so there are often milestone payment delays and with little scope for redress. No single small VA company would go in a legal fight to defend itself against a large institution. It is therefore risky for VA companies to invest in public applications, even if they want to be proactive there. The development of new operational applications itself is indeed quite expensive and time consuming and not suitable for VACs alone.

Third, the development of remote sensing applications is in general quite specific to the user requesting it so that it has little recurring use on private markets. Though it may be possible to repeat sales to other governments (export of services or know-how).

Fourth, some fear the EO VA industry might be too small today to cover all the public needs, even though it is tailored to meet the first GMES budget allocations. For the future there are thus two possibilities: either in-sourcing in public institutions or the development of the VA industry sector. Unlike government agencies the VA sector has great freedom to create additional jobs in markets outside the public sector. There are good prospects for development of export capabilities and turnover.

Thus public funding for VA companies is a win-win situation. The public institutions get their applications developed and delivered efficiently in a competitive environment. The VA companies get a stable business base allowing their survival and development on the export front.

For the short to mid-term (206-2010) public funding is a *sine qua non* condition for the development of public services and for the growth to maturity of the EO VA industry. It must include in this period full public funding of the infrastructures as well as full coverage of public applications development and implementation costs.

8 Road Map for the Development of the EO VA Sector

The roadmap for the EO VA industry is structured considering first its two identified ends.

One is the present period, 2006, the second is the horizon beyond which we believe our predictions or expectations are unreliable. This horizon is put at 2015. The speed of technological developments and the social and economic issues do not reasonably allow us to look further at this stage.

The main focus of an industrial sector is to generate services and profits as well as provide employment. Thus the preliminary strategic objectives for European VA industry in 2020 can be summarised as follows.

- **Generated large revenues from services in the order of billions of Euros**

  This number is in line with predictions on the development of the geo-information market. In the short term sufficient levels of public investment must be provided.

  This must be based on the *assurance that there is a suitable operational data supply and acceptable data and price policy, in particular in favour of VACs.*

  It is also quite obvious that governments should invest in the application domains that are of primary importance to them.

- **Have a large and stable workforce.**

  Today the work force in EO VA industry is of the order of a few thousand at maximum. There is a real potential for growth in line with the Lisbon Agenda.

- **Cover all the out-sourcing needs of European institutions in terms of environmental monitoring**

  European institutions have been the first users and customers of the VA sector. It is only logical that the public needs be fulfilled in priority. However *specific policies and financing must be put in place to allow VACs to develop operational products and services instead of focusing on pre-commercial product development. In particular FP 6 mechanisms are not suitable and FP 7 mechanisms are still under discussion.*

  Enforcement of environmental policy and legislation must be accompanied by the participation of European Industry in the actual implementation of Environmental policy.

  Generally the tuning of EC programmes must be made in consultation with Industry.

- **Have EO-based information smoothly and transparently integrated in all economic and industrial sectors**

  EO-based and geo-information in general have their natural place in geographical information systems. Tomorrow those GIS will be present everywhere. So also should information products derived from EO. *Links with other information technologies and related application domains must be fostered and standards and certification protocols must be developed and generalised.*

  For the same objective more formalised long term partnership must be established (both horizontally between different application domains and geographic regions and vertically in the value chain).

- **Have a strong trade association at least on a par with American or Asian equivalents**

  It is expected that the Asian region will develop quite fast and be on a par with the US. Just in the sophisticated satellite domain alone, it can be seen how dynamic the Indian and Chinese programmes are, not to mention the already well established Japanese and the upcoming Korean programmes. It is thus expected that they will also achieve autonomy in

value-adding and have active trade associations, whatever the structure of such associations could be as a function of local political choices.

A European Trade association and public institutions must work together.

Elements of the action plan for the development of the EO TA have been analysed in the EOVOX project.

- **Play a <u>leading role on the export</u> market**

  The international market forces at work in geo-information are mostly today in the area of provision of geographical information systems and satellite images. The domain of services is an emerging one. It is expected that by 2020 all continents will be able to play a role there and stronger market forces will be at work. It is thus essential to take advantage of the edge European companies have today to strengthen this domain of activity. The first period (2006-2010) must be dedicated to the operationalisation of services before being able to export them in the medium-term.

  Market development activities of VAC's must be supported due to their lack of own resources (examples are provided by EOMD).

With these objectives in mind, the strategic road map for the industry can be charted as follows:

Summary of Short Term Objectives: 2006-2010

- Lobby large scale public services to be funded and delivered through the private sector
- Lay the ground work for web service development
- Develop public applications to the furthest extent and ensure sufficient levels of public investment
- Setup increased synergies between EO, Navigation and Telecoms
- Prepare European independence and autonomy in operational environmental monitoring
- Consolidate and enlarge the existing companies and their trade association EARSC
- Achieve significant growth in the export market for services

Generate revenues of 1 billion euros in 2010 by having the VA getting more involved in developing services using the synergy between EO and other techniques (GPS, GIS, LBS…) than on EO alone.

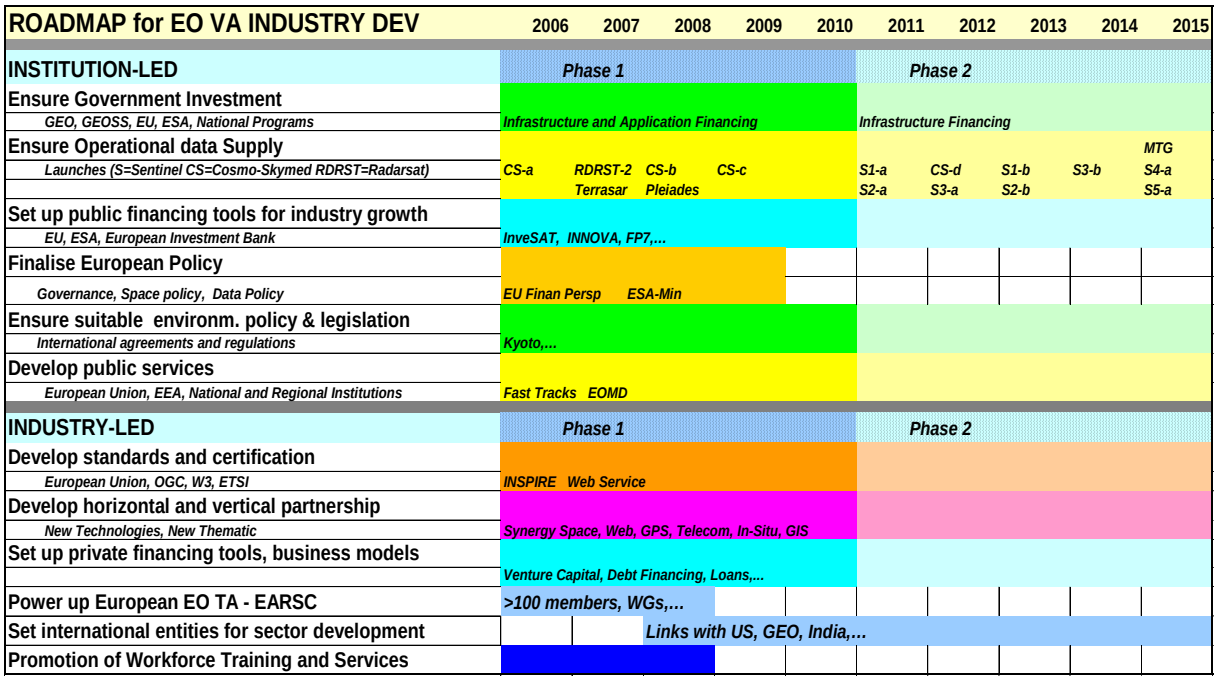
Summary of Medium-Term Objectives: 2010-2015

- Cover all the needs of European public institutions
- Large scale development of synergistic geo-information applications based on EO, Navigation and Telecoms
- Increase involvement in diverse economic and industrial sectors
- Achieve European independence and autonomy in operational environmental monitoring
- Start consideration of PPP
- Develop partnership beyond Europe

- Achieve significant growth in the export market for services
- Get involved in all economic and industrial sectors
- Be a leader in export markets.

Generate revenues of 5 billion euros in 2015.

A bar chart representing these elements is shown below.



Appendix A: Consolidated Development Actions for Public Sector Funding

These actions are needed to achieve the short and medium term objectives:

Possible Actions to Support General Development of the EO Industry

What	Why
Secure the continuity, quality and fitness for purpose of medium and high resolution EO data for public sector services.	The public sector needs the data, but end users are so scattered across the public sector that a single 'anchor tenant' does not exist. Therefore the public sector needs to finance the infrastructure for acquisition and delivery.
Evidence gathering for Pan-European data policy e.g. Study, focusing on GMES, to identify what PSI should be made available to European industry at no cost or low cost and under what conditions of access and re-use. To include cost-benefit analysis.	A change of policy on the commercial cost of PSI is crucial for wealth creation.
Actions to encourage commercial delivery of public sector EO services. e.g. Study to identify public sector EO services suitable for commercial operation in each member state. Develop model service level agreements which can be used as a template by public sector agencies.	Action is necessary to counter institutional in-sourcing because institutions have privileged access to information, skills and facilities.
RTD actions: support the development of new products and services taking into account planned missions for which firm funding commitments have been achieved.	Industry alone is unable to make pure commercial business cases for RTD considering the long lead times and development risk. It is in ESA and EC interests to ensure that products and services reach operational readiness as soon as possible after the start of new EO missions.
Export actions: support pilot projects to transfer proven applications to non-European/non-ESA countries.	Continuing existing action, already justified.
Make infrastructure for high volume data access and processing available to the private sector.	High bandwidth data transfer and high speed computing are increasingly necessary for service delivery. These are already well resourced in public agencies.
Establish service processes and models for quality assurance and certification of EO products and services. Bring about a regulatory and business model for certification activities that allows them to be offered by the private sector.	Quality is a barrier to development fo the EO sector, independent quality control is a service which customers will be prepared to pay for (directly or indirectly) in a mature operational market.

Possible Actions Specifically to Support the Development of an EOTA

What	Why
Fund an EOTA secretary general (part time) for a period of 5 years	A Secretary General will improve the effectiveness of the EOTA: in policy development, maximising benefits to all members, ensuring unity of purpose and transparency etc. A condition of the funding is to follow a plan to grow the association's revenue (through membership and income generation), so the post becomes self financing.
Support (e.g. by shared cost financing) the EOTA to promote the industry's strengths at international, regional and national government levels. E.g. events, brochure, showcase.	It is in the interests of ESA and the EC to ensure that the EO VA industry is able to present its capabilities and advantages with maximum coherence and credibility.
Support the EOTA to create and maintain for three years an on-line trade directory targeted to downstream users.	Such a directory is needed because it will help to federate customers. It is best done by a TA, but the TA does not have resources to set it up. After 3 years the maintenance should be financed by the TA.
Continue actions to develop the EO value adding market. Existing activities and new ones. e.g. resource the EOTA in designing a data access service allowing commercial exploitation of public sector EO imagery	Data policy restraints and cost of raw materials are significant barriers to market development.
Provide funds, administered by the EOTA, to support the involvement of SMEs in trade association working groups (technical and policy development).	SMEs have much to contribute but will not join EOTA because they cannot afford the time it takes to participate.
Support the participation of TA representative(s) in communicating ESA/EC policy to members and maintaining TA policy: e.g. summarising papers, developing Agency/ EC working groups.	Understanding ESA/EC policy and developing a formal response to it is very time consuming. Industry often does not have mature and credible views on policy because it lacks insufficient resources to develop them.
Support actions by the EOTA to facilitate VACs in partnering more effectively. e.g. subsidise 'show and tell' meetings with other players in the value chain. e.g. Knowledge transfer schemes e.g. Business innovation networks.	Helps to overcome fragmentation of the industry. Effective partnering sometimes does not happen because of ignorance and suspicion. Facilitation resources will have a strong benefit and a TA is well placed help partnering occur through its networking activities.

Appendix B: Pointers from other industries examined in the eoVox study

The following lessons and insights from other industries examined during the eoVox study provide useful pointers for consideration by the Earth observation value adding industry.

Content management industry

This sector comprises companies of all sizes involved in systems and software to manage content – records management, enterprise content, libraries, data repositories. Like EO, it has evolved from very fragmented origins where small, specialist suppliers offered proprietary solutions to mainly government clients. That has radically changed over the past decade as suppliers and technologies have converged, thanks to the internet and an increasing use of open, common standards such as XML.

The main association in this sector – AIIM – has played a pivotal role at the interface between suppliers and customers and offers services to both. By providing independent advice on rapidly changing technologies and continual professional development for information management practitioners, it has created informed clients who can confidently procure and deploy the latest information systems. This then stimulates demand for new products. In a market where budgets run into millions, interventions by associations like AIIM can have a significant impact on fostering the industry.

Music/recording industry

Like EO, the music industry has had to make a difficult transition to new business models, driven by the growth of websites offering free or low cost recordings. The main recording companies were initially reluctant to provide content as individual recordings, fearing that this would threaten revenue from sales of albums. In reality, consumers wanted both and an entirely new market – music downloads – was opened up in parallel to traditional channels.

For EO, there may be lessons to learn even though the markets for EO data are not primarily in consumer areas where the potential for high volume sales might persuade data owners to adopt lower cost models.

Google Earth-like applications could be the instrument which has the same effect on the future EO industry as the early “Napster” download service has had on the music industry.

Smart cards

The European smartcard industry comprises mainly small-medium sized companies, often created as a spin-off from European funded R&D projects. When smartcards first began to show potential for widespread application for financial and security purposes, individual companies lacked the capacity and credibility to make the most of the considerable opportunities. They also faced the problem that the end user – the man in the street – had no interest in what the technology involved, only the benefits that it offered. The Eurosmart association was created to give the industry a voice and to make sure that European companies got a share of a rapidly growing market.

By focusing on standards as a means to opening up the market and by customising its activities for each distinct applications domain, the association has significantly raised the visibility of the smartcard industry.