National Space Plan

Executive Summary

Drafting Group for a National Space Strategy and Programme
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1 Introduction

Preamble

This document is addressed to policy/decision makers to define a National Space Plan composed of a strategy for Space and an associated programme. This is achieved by:

- defining the context of Space and its activities
- proposing guidelines and actions to maximise the return of the public investment

The development of the Czech space sector is closely tied to European space policies and the strategies of the European Space Agency and European Union. At the conference "The ambitions of Europe in Space" which took place in Brussels in October 2009 and at the 1st EU-ESA International Conference on Space Exploration held in Prague in October 2009, leading representatives of the European Union and European Space Agency emphasized the changes which the space sector has gone through. The space sector and its activities are no longer merely the concern of science; it concerns a sector with immense economic, strategic and economic potential which affects all domains of our lives.

Concurrently with the accession of the Czech Republic to the European Space Agency, a corresponding strong shift in the approach towards space activities had to take place in the Czech Republic. This was considerably conditioned and accelerated by the government decision to candidate the Czech Republic to host the European Global Navigation Satellite Systems Supervisory Authority (GSA) and made possible by the very successful cooperation with ESA (PECS) that prepared the Czech Republic for ESA membership. The activities of the European Space Agency transcend the competencies of a single ministry. In this regard, space is an area of economic activity with the highest potential for innovation and represents a springboard to drive Czech industry's competitiveness. For the European Union, space is a political and economic challenge that can also address the current economic crisis and strengthen the position of the European Union in the global economy.

Premises

The Czech Republic has had a long tradition in utilization of space for scientific purposes. Several scientific payloads and sensors were developed, as well as small scientific satellites. These activities, taking into account the different economic and social context, were implemented mostly in scientific institutions with small industrial involvement and little economic consideration or sustainability.

In the last 20 years the Czech Republic has undertaken enormous political, economic and social changes. In this period it has become a member of the European Union, sharing its strategic objectives, namely:

- Develop space applications to serve Europe's public policies, enterprises and citizens;
- Meet Europe's security and defence needs;
- Foster competitive and innovative industries;

- Contribute to the knowledge-based society;
- Secure access to technologies, systems and capabilities for independence and cooperation.

In this same period the economic development of the Czech Republic has been remarkable even if, at this stage, its competitiveness is mainly based on the relatively low cost of its economy. The OECD[1] and Eurostat[2] statistics show a high level of high technological content of its exports, comparable to Denmark or even Germany, while having a low number of patents and publications (20 and 30 times smaller than Denmark and Germany, respectively). This data suggests that the products manufactured in the Czech Republic have an intellectual propriety outside of the country. In the evolution of its economy it will be necessary to address this issue by increasing its added value. {REC IPR}

In this frame, space-related activities can be seen as a unique tool to influence economic development by creating virtuous examples and best-practices to be used in other sectors of the economy. The economic impact considered as a "return-on-investment" in space activities is in the order of a factor of 4.5 as estimated by the OECD in Norway[3] and Denmark[4], similar or even higher values have been previously reported elsewhere. The need to retain and absorb the intellectual capital that is created in its academia and industry is, as well, an essential requirement to ensure the "return-on-investment". Space exploration must not be considered as an end in itself but as an economic instrument for development and innovation. {REC ROI & EU Procurement}

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Space activities are generally characterised by their high technological content, multi-disciplinarity, complexity, extreme visibility and often high cost. At this stage it is not conceivable for the Czech Republic to have an independent space programme with all its requirements; as this would entail substantial investments with dubious sustainability. For this reason the main tool for the Czech Republic to influence, develop and participate in space must be through its membership of the European Space Agency where all European space-related research and developments are carried out leading to systems that are then commercialised and exploited by other European organisations (examples of this are EUMETSAT, Arianespace, Eutelsat, EGNOS or the future Galileo operator). On the other hand not all types of activities in the interest of the Czech Republic will be possible to implement under ESA or other international organizations. For this reason a national programme is necessary to complement the especially the participation in ESA is necessary. {REC National Programme}

[1] OECD SCIENCE, TECHNOLOGY AND INDUSTRY OUTLOOK 2008 – ISBN 978-92-64-04991-8, OECD 2008.
[2] EUROSTAT, Patent Applications to the European Patent Office (EPO) - Number of applications per million inhabitants, http://epp.eurostat.ec.europa.eu/tgm/graph.do?tab=graph&plugin=1&language=en&pcode=tsiir060 and High-tech exports – Exports of high technology products as a share of total exports, http://epp.eurostat.ec.europa.eu/tgm/graph.do?tab=graph&plugin=1&language=en&pcode=tsiir160
[3] The Space Economy at a Glance 2007, OECD 2007, pages 89-90, note that in this document the "return-on-investment" is called "spin-off effects". In practice what is meant is the number of Euros that a single Euro of investment in ESA programmes generates in the national the economy.
[4] Evaluation of Danish Industrial Activities in the European Space Agency (ESA), Danish Agency for Science, Technology and Innovation, 2008.

1.1 Recommendations

In this Chapter the recommendations stemming from all information, discussion and considerations from the National Space Plan are presented.

1.2 Vision

The long-term vision for the Czech Republic should encompass several long-term objectives to ensure that the Czech Republic:

- Has an international image of industrial and scientific excellence,
- Is a high value-added economy,
- Is competitive and innovative,
- Is capable of absorbing and retaining the intellectual capital it creates,
- Is an example of a virtuous complementarity and cooperation between its industrial and academic tissues,
- Is an expert user of space resources and infrastructure in operational products and services (EO, Navigation, etc).

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1.3 Mid-term objectives (2016)

To ensure that Czech Republic is on the way to accomplish the Vision above it will necessary to achieve the following mid-term objectives by 2016:

- Czech investment in space has an appropriate return,
- The Czech Republic has the necessary competences (industrial, academic, project management) and infrastructures exist to sustain the long-term vision,
- The interaction between Academia and Industry exists and is well balanced,
- The Czech Republic has efficient and effective space coordination.

1.4 Evaluation Criteria (2016)

To evaluate whether the mid-term objectives were achieved in 2016 it is necessary to define quantifiable evaluation criteria. The following are proposed:

- An overall industrial return in ESA of at least 84%
- Balanced participation of academia and industry (at least 80% in industry).
- A minimum of 1 Czech-owned sustainable space product is being supplied or about to be supplied
- At least one sustainable commercial activity related to services or applications exploiting space
- One on-going project, outside of Space Science, with a excellent example of cooperation/integration of academia/industry.
- Has a formalised structure supporting space activities

Comment [JPVPB1]: Changed 86% 84% as discussed in the first meeting

Comment [JPVPB2]: Changed 85% 80%

1.5 Evaluation and Review of Objectives

The mid-term objectives of Section 1.37.2 should be evaluated under the light of the evaluation criteria of Section 1.47.3 in 2016. At this date a new or revised National Space Plan should be formulated.

1.6 Programmes and actions to be implemented

To achieve the vision and the mid-term objectives it will be necessary to undertake a number of actions. Below the actions are divided by theme.

1.6.1 General Actions

Space exploration must not be considered as an end in itself but as an economic instrument for development and innovation. Due to objective, largely economic reasons, the Czech Republic cannot support all space activities. Therefore, it will aim its support mainly at those activities or programmes with the potential to bring the largest added value to the Czech Republic, its national economy and its physical and legal entities from the strategic, economic and security point of view. Generally, those space activities or programmes that will lead to higher potential benefits across several areas of the space activity will be favoured.

1.6.1.1 Return-on-Investment

Space-related activities are a unique tool to influence economic development by creating virtuous examples and best-practices to be used in other sectors of the economy. The economic impact considered as a "return-on-investment" in space activities is in the order of a factor of 4.5. The need to retain and absorb the intellectual capital that is created in the Czech Republic is also an essential requirement to ensure the "return-on-investment".

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Space and ESA activities especially, should be seen as an opportunity, in a full-funding frame, to develop technologies, products and services that will be then exploited elsewhere, maximizing the "return-on-investment".

To maximize the "return-on-investment" publicly funded entities (e.g. VZLU) should not lead specific projects, except possibly in the implementation of scientific missions, however they may play a very important role by providing know-how, scientific/engineering and management support as well as test facilities.

The collaboration between academia and industry, exploiting their natural roles and missions, is a key for a successful technological development and innovation with a high content of added value and pre-condition to economic sustainability. This collaboration with knowledge transfer should be supported using national schemes.

The Czech Republic will also aim at creating an environment for the transfer of knowledge acquired through space activities including results from research, technology development and services into other fields. Furthermore, the Czech Republic will focus on establishing an environment for knowledge transfer from other sectors to the space sector.

In order for Czech industrial entities to actively participate in the development of new technologies and their ultimate implementation/application, it is desirable that they participate in relevant projects from their initial stage when directions and goals are defined.

1.6.1.2 Intellectual Property Rights and Innovation

All R&D activities funded with public funds should aim towards developing their own IPR and the exploitation of these rights should take place in the Czech Republic.

This does not exclude that, for the purpose of acquisition of know-how, fully licensed products may be manufactured and/or exploited in the Czech Republic.

It is also not excluded that where ESA requires the ownership of the IPR for operational or continuity reasons, activities are funded ensuring a competitive advantage for academia or industry on the maintenance, upgrade or development of the systems developed.

All activities under this space plan should consider the ownership of the IPR and the exploitation of these rights.

In this frame, for both low and high Technology Readiness Level (TRL) technologies, the role of IPR and patents is crucial to ensure the property of the technology at the base of future products, applications and services that can bring benefits across the whole of the Czech economy. For this purpose a scheme to support academia and industry to ensure the registration of patents and protection of the IPR must be devised urgently with a specific strategy.

The property of the technology however, is not the only condition necessary to achieve these benefits. It is also necessary to ensure, to the maximum possible, that these technologies are then implemented and exploited in the Czech Republic. The collaboration or teaming of academia with Czech industry is a very important factor, especially in the middle-low TRL, in this process. For this purpose projects that encourage this collaboration, in the respect of their roles, should be encouraged.

1.6.1.3 SME

In the Czech Republic there are several technologies that are sufficiently advanced to be applicable relatively easily to space programmes or applications. However, only the companies with the determination and motivation to overcome the initial hurdles will be able to move the space arena. Among the reasons are strict project management, standards and documentation requirements, the very restricted profit margins that ESA contracts allow (maximum 8%), as well as the relatively small contribution of the Czech Republic towards ESA. The size of the Czech contribution to the ESA budget, the general trend, and specific recent practical experience, point to the realisation that the space business in the Czech Republic must focus on innovative SME. Specific measures to support SME and their innovative behaviour should be devised possibly through TIP or OP PI. These measures should also contemplate IPR and patent registration support.

1.6.1.4 General Approach

At this stage, since the recent accession to ESA, high TRL should have the higher priority to achieve products, applications and services that are used in ESA missions without disregarding low TRL technologies.

It is impossible to be exhaustive at this stage for low TRL technologies. On the other hand for high TRL, taking into account the capabilities in the Czech Republic discussed elsewhere in this document, and their access to high TRL contained in its existing products, opportunities or niches in the areas below should be supported commensurate with the Czech resources available for space.

Flight Hardware

Mechanisms and its related areas are an essential part of any satellite where Czech industry has a high level of preparedness, in fact, it is already supplying high quality mechanical parts to several European space products. Design and development capabilities in this area also exist.

Electronics and its related areas play a fundamental role in any sensor, instrument and satellite and where again there are already Czech suppliers also with capabilities of design and development.

Devices and components: the Czech Republic already has several device and component manufacturers, with Czech designs or licenses. Where appropriate, the development or qualification for space of these devices or components should be supported.

Payload or satellite sub-systems: in this area there are also high TRL capabilities.

Sensors or scientific instruments: this area should be encouraged fostering the collaboration between academia and industry and leading to the acquisition of knowledge and experience in space project management, development, constraints, quality assurance and others beyond the value or economic benefit of the particular sensor or instrument.

Software (ground or space)

Data processing for satellite data: in this area there are not only very good development capabilities but there are also good opportunities;

Ground segment: electrical ground support equipment (EGSE); antenna/telescope control; telemetry, telecommand and control (TT&C), spacecraft control systems, and other ground segment support systems;

On-board: especially that related to payload software;

Embedded software: used in many satellite sub-systems;

Data and satellite applications: this is an area with proven capabilities that could also lead to fast developments. In the area of Earth observation it could lead to extend the portfolio and quality of offered services about the state of Earth's environment and to effective data collection, data management and maintenance

Services

Support to the development of services for navigation and Earth observation in the form of demonstrations and validation would play an important role in fostering the use of these services and by exposing a wider community to space applications.

There are other areas with middle-high TRL technologies that should be supported in preparation of mid-term opportunities. Of special mention are those associated with launchers where there are capabilities regarding cryogenic sub-systems and propulsive or explosive materials.

As previously mentioned low TRL technologies are essential to maintain a constant flow of innovation however this area is fraught with risk. To ensure that the most promising technologies survive and develop to attain high TRL it would be advisable

to use funding competitive processes. For this purpose the ESA's Technology Research Programme, when compatible with the specified technology requirements, as well as the national programmes of TACR and GACR, should be used.

1.6.1.5 National Space Programme

The main tool for the Czech Republic to influence, develop and participate in space must be through its membership of the European Space Agency where all European space-related research and developments are carried out leading to systems that are then commercialised and exploited by other European organisations.

For the Czech Republic the *geo-return* used in ESA programmes is especially important as it guarantees the return on Czech contributions made to ESA back to the Czech Republic – even when Czech industry may by less competitive vis-à-vis the rest of Europe. On the other hand to complement the participation in ESA activities a National Space Programme with a clear strategy is necessary.

The National Space Programme should also fund student satellites projects to attract and motivate the young generation to start a career in science and engineering involving young students in these student satellites projects. These small student satellites would engage them with hands-on experience even during their studies. The low cost of these nano-satellites or more complex international student projects organised and managed by ESA could provide suitable opportunities. This could be done with modest funds and would also raise the awareness due to the high profile of these space activities.

An amount of €1.5-2 million per year is proposed as the budget for a National Space Programme that should include the costs of the supporting structure, the educational and training activities (including student satellites) and specific technology or scientific space activities.

1.6.1.6 Legal Framework

The current legal framework may need to be improved to support the full range of activities necessary to achieve the objectives of the Czech Republic in the field of space. The current approach is not clear from the institutional point of view and does not allow for a balanced participation of the scientific and industrial communities, respecting their roles and missions, typical of space related activities.

The best solution, that would allow for the exploitation of the potential of space activities, would be to setup a structure that would allow the pertinent ministries (MEYS, MT, MTI, ME and possibly Defence and others) to jointly exploit this potential and fund the multi-disciplinary, cross-sectional area of space.

1.6.2 European Space Agency (ESA)

To ensure a wider and deeper consultation of all Czech entities, the review of the status of the participation of the Czech Republic in ESA space activities and the definition of its priorities, social and economic impacts and resources, it will be necessary to start this process at least 1 year before any planned ESA Council at ministerial level. **Error! Reference source not found.**Figure 6 shows the current plan for ESA Councils at ministerial level that take place, in general, every three years.

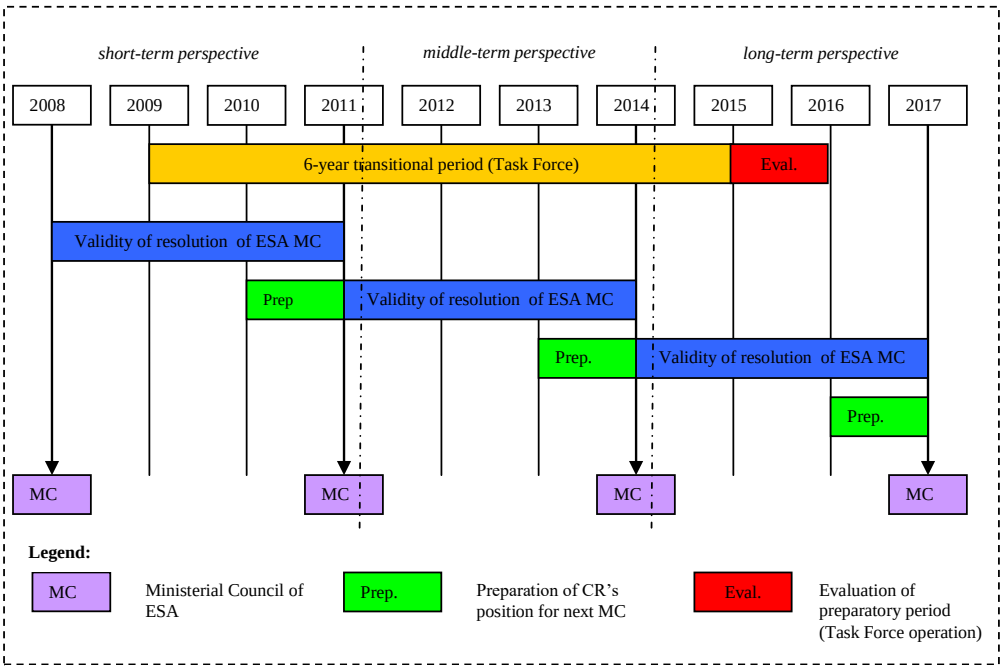


Figure 16 – Milestones for ESA programmes from 2008 to 2017

1.6.2.1 Scientific Programmes

Space Science

The Space Science is part of the mandatory activities of ESA where Czech scientists already participate in some missions with some sub-systems at instrument level (software and hardware).

It should be noted that ESA's Space Science Programme funds only the platform (satellite), its launch, and operations. The scientific instruments on-board each of the Space Science satellites are funded nationally by the Member states involved except in the case of single instrument satellites as is the case of XMM, Herschel-Plank or Gaia.

To ensure an active and increased participation in this programme it will be important to support these developments using PRODEX and National resources while ensuring that there is also an industrial component that will retain the experience acquired. When the industrial component is predominant, the Czech Industry Incentive Scheme could also be used if compatible with the resources available.

Regarding the processing and analysis of scientific data this should also be supported through PRODEX or National resources. Czech scientists should also be encouraged to submit scientific proposals for the future science missions with the aim of becoming Principal Investigators of scientific instruments.

Programme for the Development of Scientific Experiments (PRODEX)

The Czech Republic has subscribed €0.1 million per year for the period until 2014 (e.c. 2008) to this optional programme.

This programme is an ESA optional programme and the current subscription in PRODEX of €0.1 million per year will soon be too small to support a effective participation of academia supported by industry. The subscription should be increased to € 0.2-0.3 million per year.

European Programme for Life and Physical Sciences (ELIPS)

The Czech Republic has subscribed €2.77 million in this optional programme for the period 2008 – 2012 which is 0.7% of the overall programme budget of €395 million (all in e.c. 2008).

The amount subscribed in ELIPS is high and is constrained by the use of the European Columbus laboratory in ISS. This is also a scientific and technological area with the smallest "return-on-investment". For this reason the subscription should be decreased, possibly to around € 1.5 million, while increasing the subscription to PRODEX and GSTP that allow for a bigger flexibility while allowing for the same type of experiments.

1.6.2.2 Technology R&D

ESA manages several technology R&D programmes to guarantee that the necessary technologies are mature enough in due time. These programmes may fall under the mandatory activities of ESA or are optional programmes.

Mandatory Programmes

In the mandatory activities of ESA regarding technology, namely the Technology Research Programme (TRP), Science Core Technology Programme (CTP), Innovation Triangular Initiative (ITI), General Studies Programme (GSP) and European Component Initiative, Czech industry and academia has not been a very active player mainly due to lack of awareness of the web-based procurement tools of ESA and its technology work-plans. It is important to address this deficit as soon as possible by publicising the information in the websites of the relevant Governmental authorities and other special actions.

General Support Technology Programme (GSTP)

The Czech Republic has subscribed €3.23 million for the period 2009 – 2013 which is 0.5% of the overall optional programme envelope of €650 million (all in e.c. 2008).

GSTP is of very high interest to industry and academia and due to its confirmation support mechanism for single activities (and guaranteeing a geo-return of 100%) it allows Czech priorities to be addressed. The subscription level should be increased to around € 6-7 million for the next subscription period 2014-2019.

1.6.2.3 Earth Observation Technology R&D Programmes

Earth Observation Envelope Programme (EOEP)

The Czech Republic has joined the already running EOEP-3 optional programme and has subscribed €2.6 million for the period 2008 – 2010 which is 0.17% of the overall programme budget of €1490 million (all in e.c. 2006).

The subscription level (€2.6 million) of EOEP should be maintained if not increased for the next subscription period to ensure a Czech participation from the beginning of the definition of future Earth Observation missions to participation in instrument

development. This would ensure a participation in the formation of the consortia that carry out the development of the future missions.

1.6.2.4 Earth Observation Application Development Programmes

Meteosat Third Generation (MTG)

For the period 2009-2020 the Czech Republic has subscribed €2.24 million which is 0.26% of the overall programme envelope of €860 million (all in e.c. 2008).

This programme with a long subscription period (2009-2020) offers the opportunity for Czech industry to develop products for the next generation of operational meteorological satellites that will then be procured by EUMETSAT via ESA and it will lead to benefits in the Czech Republic. If appropriate and possible at the ESA Council 2011, an increase of the subscription could be considered.

Global Monitoring for Environment and Security Space Component (GSC)

The Czech Republic has subscribed €1.76 million for the period 2009 – 2018 which is 0.2% of the overall optional programme envelope of €856.6 million (all in e.c. 2008).

This programme offers the opportunity for Czech industry to develop products that will then be procured by the EU possibly via ESA, leading to a fallout in the Czech Republic. Due to its long subscription period (2009-2018) it will not be up for subscription soon however, if appropriate and possible at the ESA Council 2011, an increase of the subscription should be considered if it increases the leverage to access EU funding.

Both MTG and GMES are opportunities for the Czech industry to establish itself as supplier to large space integrators. The MTG programme is especially attractive due to higher numbers of satellites to be built (this includes MTG satellites ordered by EUMETSAT. For this reason it may be beneficial and is recommended to raise the Czech contribution to MTG programme if funds are available and, of course, other participating states agree. This could make the Czech Republic an indispensible partner of the programme thus securing key procurements. The GMES programme still offers the chance to join the consortia developing Sentinels 4 and 5 while it is already too late for Sentinels 1 – 3.

1.6.2.5 Navigation Technology R&D Programmes

European GNSS Evolution Programme (EGEP)

The Czech Republic has subscribed €0.48 million for the period 2009 – 2011 which is 0.64% of the overall optional programme envelope of €75 million (all in e.c. 2006).

EGEP is a programme that could ensure the participation of Czech industry in the future generation of Galileo. For this reason the subscription to the next subscription period, that could take the form of a new programme e.g. *European GNSS Supp. Programme Extension*, should be increased to around €1 million.

1.6.2.6 Telecommunication Technology R&D Programmes

The Telecommunication optional programme is the *Advanced Research in Telecommunications Systems (ARTES)* and is divided in elements that can be subscribed separately.

ARTES 3-4

For the period 2009 – 2013 the Czech Republic has subscribed €1.7 million for the Element 3-4 of ARTES which is 0.43% of €400 million of the overall optional programme-element envelope (all in e.c. 2008).

ARTES 3-4 is geared towards "close-to-market" technological activities that require matching funds from industry. Its effectiveness should be evaluated at the end of the subscription period to assess if these opportunities are being taken up by industry. In the negative case ARTES 5, that allows for 100% (or 75%) funding of telecommunication technology R&D, should be subscribed instead. In any case ARTES 5 should also be subscribed by a similar amount. The possibility to decrease the subscribed amount to subscribe ARTES 5 with at least an equal amount should be investigated as soon as possible.

ARTES 5

The *ARTES Element 5: "ESA Telecom – Technology"* has been initiated to ensure the long-term readiness of the industry to respond to coming commercial or institutional opportunities by focusing the ARTES 5 activities on technological innovation in equipment and systems for satellite communication. The space, ground and user segments are supported in the programme as well as overall system related activities.

The ARTES 5 supports the early steps up to and including the step where the subject of the development has been built into a configuration representative of the final product and critical performances have been verified by test. The formal qualification and industrialisation are not part of the programme. The ARTES 3-4 Element is ideally suited for a continuation of an ARTES 5 development to complete the step required to have a product ready for commercial exploitation.

The ARTES 5 programme element is split into two sub-elements. The "Competitive Workplan Activities" sub-element 5.1 is 100% funded by ESA. The workplan contains objectives and descriptions of the individual activities and it is updated yearly by ESA on the basis of a Call for Ideas open to industry, universities, research organisations, national space agencies and ESA itself. The "Non-competitive Industry Initiated Activities" sub-element 5.2 is funded to a maximum level of 75% by ESA. ESA may fund up to 100% for work carried out by universities and research organisations when such institutions are sub-contractors and if this funding does not exceed 30% of the total cost of the activity. The activities are defined by industry and submitted in response to an Open Call for Proposals. When industry presents a proposal in this sub-element a plan is required for continuing the development to a product ready for commercial exploitation.

Subscription to the ARTES 5 Element would ensure an easier participation of Czech entities in the earlier stages of development of telecommunication satellite equipment that would then be supported by ARTES 3-4. It is recommended that this programme element is subscribed as soon as possible. The relative ratio of subscription in ARTES 5 to ARTES 3-4 should be 1 to 2.

1.6.2.7 Telecommunications Application Development Programmes

ARTES 10 Iris

The Czech Republic has subscribed €4.14 million for the period 2009 – 2011 which is 11.83% of the overall optional programme-element envelope of €35 million (all in e.c. 2008) – by far the largest Czech contribution to an optional programme both in

terms of absolute amount of money and share of the subscription. Assuming that the same percentage of the total programme is maintained for the following phase, the subscription could cost in excess of €19 million with an equivalent amount being invested by industry.

The subscription to ARTES 10 Iris phase II.1 for the period 2009-2011 is the highest of all ESA optional programmes € 4.14 million).Since the subscription to the following phase II.2 would entail a very high amount, with matching funds from industry, it will be necessary to evaluate whether a) industry is prepared to fund to a similar amount phase II.2 while ensuring that the intellectual property rights (IPR), manufacture and exploitation of the products and services developed will remain in the Czech Republic, b) the necessary resources will be available to the Czech State with no detriment to the participation in other programmes. If the benefits will not remain in the Czech (namely IPR, manufacture and exploitation) it is advisable to decrease substantially (at least by a factor of 2-4) the subscription to phase II.2 and keeping the same subscription amount (€ 4 million).

ARTES 20

The Czech Republic has subscribed €0.17 million for the period 2009 – 2013 (Phase 1) which is 0.21% of the overall optional programme-element envelope of €80 million (all in e.c. 2008).

The ARTES 20 (IAP) may lead to some integrated systems of interest to the Czech Republic that will be defined in this programme. The next phase (Phase 2) of this programme with application development of integrated systems should be subscribed only if there are applications of clear interest to the Czech Republic. This should be decided at the ESA Council of 2011. It should be noted that the envelope of Phase 2 may be three times higher than the current envelope. In any case the subscription to the following phase should, in principle, be of the same level (0.21%).

1.6.2.8 Launchers and Human Exploration Technology R&D Programmes

Future Launchers Preparatory Programme (FLPP)

The Czech Republic has subscribed €0.5 million for the SDT element (Systems, Demonstrators and Technology) for the period 2009 – 2012 which makes 0.42% of the overall element budget of €120 million (all in e.c. 2008). The Czech Republic has not subscribed for IXV element (Intermediate eXperimental Vehicle for re-entry) since the consortia of companies built around IXV development has already been established which makes it difficult for Czech companies to participate in the programme.

There is some promise that FLPP could exploit Czech existing know-how in cryogenic pumps, turbo-compressors and others. In the case that this promise is fulfilled the next period of FLPP (2013-2016) should be subscribed as well as the follow-up programme concerning the NGL (successor to Ariane 5). In these cases the subscription level for FLPP should be of a similar percentage (0.42%) and the subscription level for the NGL at 0.21% to 0.4% depending on the resources available.

European Transportation and Human Exploration Preparatory Activities Programme (ETHE)

The Czech Republic has subscribed €0.19 million for the period 2009 – 2012 which is 0.21% of the overall optional programme budget of €90 million (all in e.c. 2008).

At this point in time it is not clear if the subscription to ETHE will lead to any interesting activity with potential future benefits in the Czech Republic. The successor to this programme could require high levels of subscription. It is proposed to examine the status at the end of the subscription period and to evaluate if it is worthwhile continuing subscribing to the programme or leave this optional programme.

1.6.2.9 Security of the Earth

The *Space Situational Awareness Preparatory Programme (SSA)* objective is to support the European independent utilisation of and access to space for research or services, through providing timely and quality data, information, services and knowledge regarding the environment, the threats and the sustainable exploitation of the outer space.

For this purpose, the SSA objectives are carried out in successive programmatic steps with a view to achieve a full operational capability over a framework of ten years since 2008. ESA is responsible for the technical definition and the developments of the European SSA system up to the operational stage. The operational stage is expected to be taken over by the EU.

The high-level users' needs for the European SSA system are especially to support safe and secured operation of space assets and related services, to support risk management (on orbit and during re-entry) and liability assessment, to assess the status and basic characteristics of space objects (both man-made and natural), detect non-compliance with applicable international treaties and recommendations, and to enable the allocation of responsibility for space objects to launching state or organization, and support confidence building measures (identification of owner and/or operator).

The SSA Preparatory Programme comprises four elements: the core element, the space weather activities, the pre-development and bread boarding of critical subsystems of the radar, and the pilot data centres. The core element activities pursue the objective of supporting the definition of the governance, of developing an appropriate data policy and of specifying the data centres that need to be established within the SSA system. It also includes the specification and architectural design of a space surveillance system that will monitor man-made objects in Earth-bound orbits including space debris.

The SSA programme started in 2008 without Czech participation. For its strategic it is, however, deemed important to get involved in the programme at the earliest possible occasion. The successful Czech participation in the programme may build on the Czech expertise in related scientific disciplines astronomy and Earth observation.

1.6.2.10 International Space Station Exploitation Programme

The *European Participation in the International Space Station Exploitation Programme (ISS Exploitation)* provides for the legal and financial framework as well the means for fulfilling the obligations and responsibilities accruing to the ESA in the

framework of the Space Station Agreements (i.e. IGA and ESA/NASA MOU) during the ISS operations and utilisation phase.

The ISS Exploitation programme is intended to cover the operations/maintenance of the elements developed in the past ISS Development programme and of other European contributions to the space station orbital facility developed in other self-standing programmes. The payloads and experiments to perform the actual utilisation are not covered by this programme.

The ESA ISS Exploitation Programme involves a number of system elements and related functions including all European developed items, which are part of the integrated space station, as well as their maintenance. The flight element includes Automated Transfer Vehicles (ATVs), Columbus laboratory, Node 2 and 3, Cupola, European Robotic Arm and many other facilities of the ISS. Ground elements include Columbus and ATV control centres, cargo integration, ground communication systems, user support and operations centres (USOCs), and crew training and medical facilities.

The ISS development is close to completion and the benefits of a Czech participation in the programme are questionable. The prime reason is that in the next ten years the focus of the programme will be on the maintenance, operational activities and procurement of services, ATVs and its subsystems. For virtually all of these procurements significant past expertise is essential which cripples opportunities for the Czech industry. However, the Czech participation in the next period of the programme may be requested by other ESA member states for solidarity reasons. This request should be avoided and only considered if (and only if) the Czech utilization of the ISS considerably increases and becomes significant which is not expected.

1.6.3 European Union (EU)

In the context of Article 189 of the Lisbon Treaty[5] and considering the possible scenarios of cooperation between the EU and ESA and the approach that will be used, it will be important for the Czech Republic to ensure that a) space in small States like the Czech Republic is protected; b) space, and especially space technology R&D, is a tool for development that contributes to the closing of the structural gaps between EU Member States and c) that space is not a "normal" market due to its strategic role and multi-annual nature. These considerations will be fundamental in the negotiations regarding funding of space activities and procurement of space systems.

It is important to recall that the industrial policy of these two organisations is substantially different. For the EU the industrial policy is primarily focused on *competitiveness and avoiding distortion of the markets* while for ESA is mostly aimed at *developing and safeguarding European industrial capabilities*.

It will be important for the Czech Republic to ensure that its interests, that are the same as of all EU small Member States, are protected regarding space technology R&D since it plays an important role in the development of its economy.

[5] CONSOLIDATED VERSION OF THE TREATY ON THE FUNCTIONING OF THE EUROPEAN UNION, Official Journal of the European Union, C 115/49, 9 May 2008, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2008:115:0047:0199:EN:PDF

1.6.3.1 Framework Programme

The Czech Republic belongs to a group of less successful countries in the 7th Framework Programme SPACE. On one hand, there are not too many projects proposed by Czech applicants and on the other hand the overall rate of successful applications is below average.

Compared to other instruments (ESA, national funds) the 7th Framework Programme is one of the most difficult to succeed with successful proposals. Also the EU cannot support all fields of space and has to focus its SPACE funding instruments as a priority for the EU as whole, which can be limiting in terms of topics offered for participants. In this context a better coordination of activities and especially the definition of roles, for example with the EU delegating the funds for space technology R&D to ESA (even from a small part of the structural funds) will be necessary.

1.6.4 EUMETSAT

The European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) supports Satellite Application Facilities (SAFs) that are specialised development and processing centres within the EUMETSAT applications ground segment. Using specialised expertise in Member States, they complement the production of standard meteorological products derived from satellite data at EUMETSAT's central facilities and distribute user software packages. Each SAF is lead by a national meterological service. There are currently eight SAF.

SAFs are funded nationally and may offer an opportunity to the Czech Republic to participate in the development of such a facility leading to additional applications and products. The possibility to develop in the Czech Republic a SAF covering applications not yet contemplated in the existing SAF should be investigated since it may bring national benefits.

1.6.5 National

1.6.5.1 Supporting Structure

With the new status of the Czech Republic as a member of ESA a representation, wider than that provided by the Czech Space Office (CSO), of all competent governmental authorities in all the activities regarding space is necessary.

The next ESA Council at ministerial level, where new programmes will be open for subscription by Member States, is expected to take place at the end of 2011 (see **Error! Reference source not found. Error! Reference source not found.**Figure 6). For this purpose it will be necessary to start, at the end of 2010, the preparation through a thorough review and assessment of the status of Czech space activities and to identify priorities and resources.

This review and assessment task will have to be performed before any new supporting structure is possible to establish (e.g. a National Space Agency) with an institutional setting different from that of the CSO.

The preparation for the 2011 ESA Council at the ministerial level needs to be lead by a Steering Committee with a clear mandate to act on behalf of the Czech government and representing all institutional competent authorities. The Steering Committee will lead this preparation process and be assisted by the experience and human resources

of the CSO that will act as its secretariat carrying out its decisions. For this purpose the Steering Committee should as soon as possible steer the activities of the CSO.

For purposes of consultation a Council of Stakeholders (e.g. industry, academia, funding agencies) could be established to provide a forum *???????????? this would be a tough one for the committe to interpret* .... for the Steering Committee to expose results and proposals in preparation of the next Ministerial Council in a wider setting.

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The Steering Committee should also logically act as the Preparatory Committee for the establishment of a National Space Agency. The National Space Agency can be established either as a governmental cross-sectional body or as a non-profit organisation reporting and answering to the Steering Committee.

The Steering Committee could be in a first iteration, be composed of representatives of the Ministries of Education, Youth and Sports, Transport, Industry and Trade, Environment, Foreign Affairs and possibly Defence and others.

The supporting structure should act as executive and secretariat of the Steering Committee and by (most tasks are already covered by the CSO) performing the following tasks *inter alia*:

- acquire, collect and process all information relevant for space activities and providing a comprehensive source of information on all space activities in the Czech Republic;
- operate as liaison with industry and academia *(not likely in a thousand years)* regarding their field of expertise and maintaining a detailed database for this purpose;
- support the representation or represent the Czech Republic in ESA, EU (regarding space), EUMETSAT, European Space Policy Institute, European Southern Observatory, UN-COPUOS and other international organisations or initiatives relevant to space activities;
- represent or support the representation of the Czech Republic in the International Astronautic Federation and regularly participate in the International Astronautic Congresses (IAC) taking the opportunity to showcase Czech activities to a wider international audience including other space agencies and leading academics;
- maintain updated information on policy and international agreements regarding space;
- carry out or support awareness activities in academia, industry,?????????????????!!!!!!!!!!!!!!! not CSO – please the general public and policy/decision makers;
- manage its own allocated budget;
- manage or support the management of the budget of the National Programme;
- support educational and training activities by:
    - Building and maintaining the network of contact points in academia, relevant to space, including updated information on courses and their content;
    - Organize or support the organisation of the competitions for specialisation or training courses;
    - Identify, in direct contact with industry and Industrial

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Associations training actions in specific technologies of interest to industry and support them;
- Maintain a list of objective indicators regarding education and training to allow a regular assessment of the education and training programme;

The supporting structure should have a specific budget to support its activities.

1.6.5.2 Human resources, Training and Education

There is an important gap in the training of professionals to support Czech space industry that will need to be addressed. This gap may have an adverse impact on the performance of Czech industry and its growth. It is essential to support qualified professionals in raising their qualifications to keep them "current" in space activities (courses, programs, training, and grants).

The MEYS should as soon as possible stimulate the careers of university graduates in areas of applied research, innovation and in knowledge-demanding fields. It should as well announce from 2013 all new calls promoting short and long term fellowships of researchers at European and international institutions.

More targeted schemes are possible to implement with specific cooperation agreements with ESA like the Spanish, Portuguese and Greek Trainee schemes. These latter schemes allow for more targeted training where the needs of the Czech Republic are addressed first through a consultation with its industry and then through a request to ESA for training vacancies in the areas of interest.

This scheme must be funded nationally and a specific cooperation agreement between the national funding organisation and ESA is necessary. A Czech Trainee Scheme would help create engineers and scientists to quickly acquire experience in specific fields necessary to Czech industry.

1.6.5.3 Awareness

The interest in science and technology must be awakened and supported in order to create a favourable environment (e.g. promote attractive learning activities, create and support new ones, expand on current study branches and programs, and the like).

Dissemination of information among industry about opportunities in space business with focus on ESA activities should also be part of awareness actions using conferences, workshops, web information portals and other media channels.

More attention should be also be paid to raising awareness among decision makers about ongoing issues and needs in the space sector. Space activities need clear long-term planning and commitment. For this reason, systematic information must be available to decision makers, not only in the form of regular briefings or reports, but also in the form of magazines, leaflets and parliamentary bulletins.

The Council for Research, Development and Innovations should improve the popularization of R&D and Innovation by setting up an internet portal with up-to-date information.

MEYS should continue to support activities demonstrating the utilization of research and its application for the benefits of the society and in cooperation with CzechTrade its presentation abroad. *Tiger can't change its spots!!!!!!!!!!!! NO way.* On top of whole range of existing activities it should focus on the unsatisfactory interest of young people to engage in R& D and Innovation.

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1.6.5.4 Other Supporting Measures

Priorities for applied research approved by the National Policy for Research, Development and Innovations 2009-2015 will become a basis for the activities of TACR. The priorities are currently as follows: Biologic and ecologic aspect of sustainable development, Molecular biology and biotechnology, Energy resources, Material research, Competitive engineering, Information society, Security and defence, and Priorities of Czech society development. If still possible, it would be advantageous to Czech industry and academia to include a transversal priority for space.

Starting from 2012 TACR should announce new calls aimed at a new set of priorities closely related to society needs and knowledge-based economy. The emphasis should be given to relations with basic research and innovative process. New projects should be financed from 2013. MEYS shall stimulate researchers to create knowledge leading to innovation and to cooperate with industry.

There is a strong need to support the National Secretariat (NS) for GMES with a position dedicated to SMEs to motivate their involvement in GMES and also to advice on proposals writing. For big national institutions another specialist is needed to analyze services coming from GMES, which can be potentially beneficial for their daily needs.

Regarding Galileo, the Czech Republic should support the participation of Czech entities in the development of applications and services for EGNOSS and Galileo, primarily its use in traffic navigation, safety, energy, geodesy, agriculture, environment and preservation and defence. In particular the following activities concerning satellite navigation and communication systems are of interest of the Czech administration:

- strategy of the use of GNNS systems in individual sectors of the national industry;
- determination of demand for certain applications such as safety, dependability, accuracy, resistance against interference, privacy protection, cost and progress in certification and support of the standardized process;
- corresponding mapping (cartographic) foundations for GNNS systems;
- pilot verification of technical standard proposals in laboratories an; in trial operations,
- use of the GNSS system as a key component in telematic solutions for transport in all relevant types of traffic for the increase of the economics, ecologic and safety of transport.

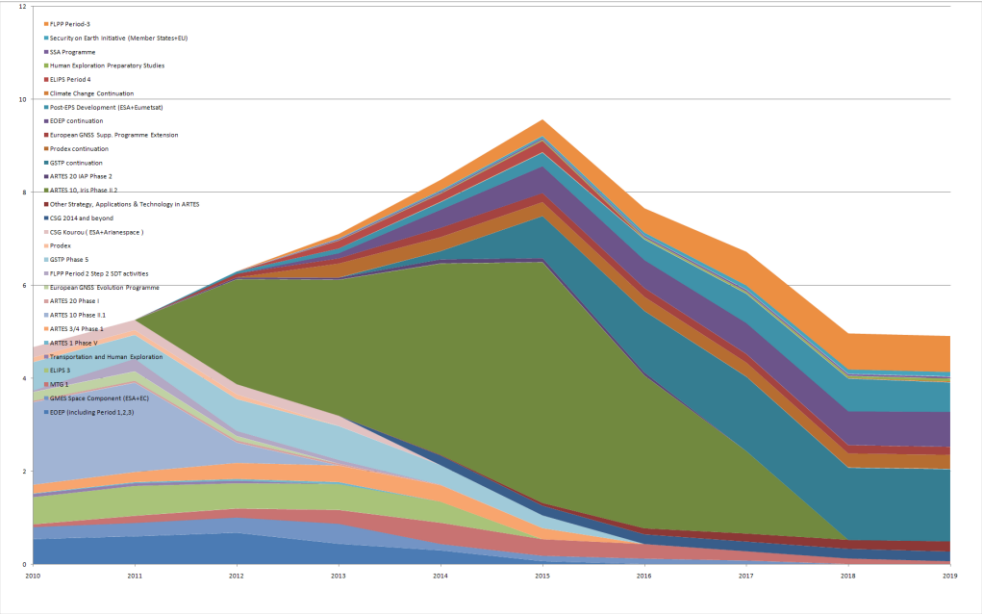
1.7 Financial implications

To be discussed at the meeting
Scenarios

Argument not to decrease the funding: If the government decreases the funding level it basically says that ESA membership was failure, innovation goes to hell, CZ is not targeting high-tech bla bla bla…

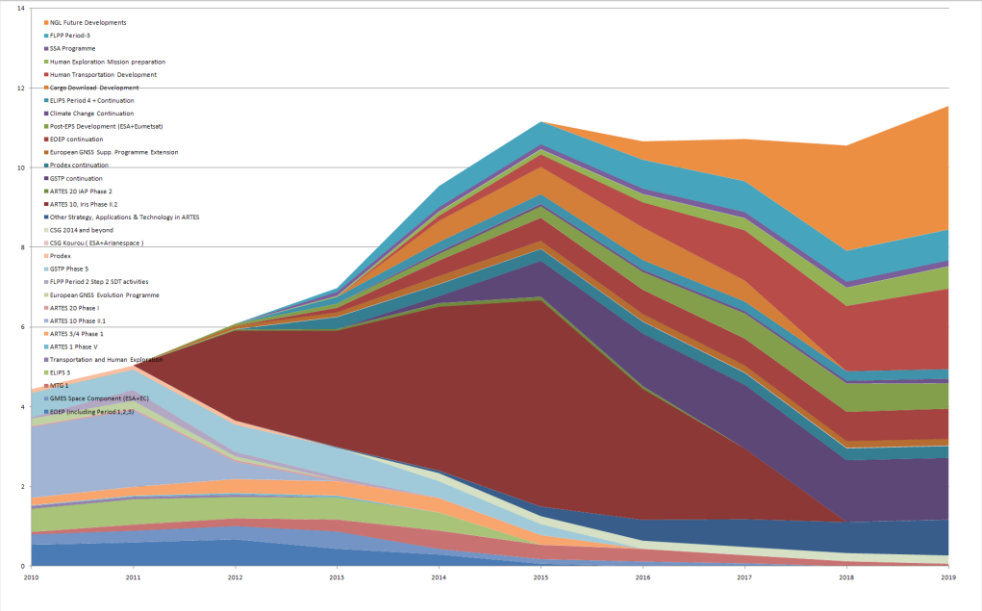
SCENARIO 1 –BASIC SCENARIO

- No increase of the support of ESA Member States with respect to their commitments taken at C/M 08.
- The European Union will pursue the primary objectives of the European Space Policy, without further fostering the European role in the space international arena (e.g., security and exploration).



SCENARIO 2 – SUPPORT TO SELECTED FIELDS OF ACTIVITIES

- Additional funding is assumed to come from the European Union new Financial Perspectives starting as of 2014.
- Also Member States are assumed to increase their contribution to ESA from 2014



List of Acronyms

ARTES - Advanced Research in Telecommunications Systems (ESA optional programme)

ARTES 3-4 – Element 3-4 of the ARTES programme

ARTES 5 - Element 5 of the ARTES programme

ARTES 10 Iris – Element 10 of the ARTES programme

ARTES 20 IAP – Element 20 of the ARTES programme – Integrated Applications Promotion

ATM – Air Traffic Management

ATV – Automated Transfer Vehicle (ESA)

CEATS - Central European Air Traffic Services

CENIA - Czech Environmental Information Agency

CERN – European Organization for Nuclear Research

CIIS – Czech Industry Incentive Scheme (ESA transitional and mandatory programme)

COPUOS - Committee on the Peaceful Uses of Outer Space

CSA – Czech Space Alliance

CSO – Czech Space Office

CTP – Science Core Technology Programme (ESA mandatory programme)

DSLP - Dual Segmented Langmuir Probe

e.c. XXXX – economic conditions of year XXXX

EC – European Commission

ECI – European Component Initiative (ESA optional programme)

EDA – European Defence Agency (Agency of the EU)

EGEP - European GNSS Evolution Programme (ESA optional programme)

EGNOS – European Geostationary Navigation Overlay Service

ELIPS - European Programme for Life and Physical Sciences (ESA optional programme)

EO – Earth Observation

EOEP – Earth Observation Envelope Programme (ESA optional programme)

ESA – European Space Agency

ESAC – European Space Astronomy Centre (ESA establishment)

ESO - European Southern Observatory

ESOC – European Space Operations Centre (ESA establishment)

ESRIN – Centre for Earth Observation (ESA establishment)

ESTEC – European Space Research and Technology Centre (ESA establishment)

ETHE - European Transportation and Human Exploration Preparatory Activities Programme (ESA optional programme)

EU – European Union

EUMETSAT – European Organisation for the Exploitation of Meteorological Satellites

EUROCONTROL - European Organisation for the Safety of Air Navigation

EUSC – European Union Satellite Centre

FLPP – Future Launchers Preparatory Programme (ESA optional programme)

GACR - Grant Agency of the Czech Republic

GDP – Gross Domestic Product

GEOSS - Global Earth Observation System of Systems

GMES – Global Monitoring Environment and Security (ESA optional programme in cooperation with the EU)

GNI – Gross National Income

GNSS – Global Navigation Satellite System

GSA - European GNSS Supervisory Authority

GSC - GMES Space Component Programme (ESA optional programme)

GSP – General Studies Programme (ESA mandatory programme)

GSTP – General Support Technology Programme (ESA optional programme)

IAP - Integrated Applications Promotion (ESA programme)

IPR – Intellectual Property Rights

ISS – International Space Station

ITAR – International Traffic in Arms Regulation

ITI – Innovation Triangle Initiative (ESA mandatory programme)

ITSO – International Telecommunication Satellite Organisation

JWST – James Webb Space Telescope (ESA)

ME – Ministry of Environment (MZP In Czech)

METoP – EUMETSAT Polar System (EPS)

MEYS – Ministry of Education, Youth and Sports (MSMT in Czech)

MSG – Meteosat Second Generation (EUMETSAT satellite class and was an ESA optional programme)

MT – Ministry of Transport (MD in Czech)

MTG – Meteosat Third Generation (ESA optional programme that will become an EUMETSAT satellite class)

MTI – Ministry of Trade and Industry (MPO in Czech)

NATO - North Atlantic Treaty Organization

NGL - Next Generation Launcher (possible future ESA optional programme for the successor of Ariane 5)

NS - National Secretariat for GMES

OECD – Organisation for Economic Co-operation and Development

PB – Programme Board (ESA)

PECS – Programme for European Cooperating States (ESA optional programme for ESA non-Member States)

PRODEX – Programme for the Development of Scientific Experiments (ESA optional programme)

R&D – Research and Development

RD&I – Research, Development and Innovation

SAF – Satellite Application Facility of EUMETSAT

SDT – System, Demonstrators and Technology (component of ESA's FLPP programme)

SGEO – Small Geostationary Telecommunication Satellite (ESA optional programme, ARTES 8)

SME – Small or Medium Enterprises

SMOS – Soil Moisture and Ocean Salinity (ESA mission in EOEP programme)

SPS - Science for Peace and Security

SSA – Space Situational Awareness programme (ESA optional programme)

TACR – Technology Agency of the Czech Republic

TIP - XXX XXX Programme???

TPMU - Thermal Plasma Measurement Unit

TRL – Technology Readiness Level

TRP – Basic Technology and Research Programme (ESA mandatory programme)

UN – United Nations

VLT – Very Large Telescope (ESO)