Proposal full title: Expose the Capacity of Estonian Space Research and Technology through High Quality Partnership in Europe

Proposal acronym: EstSpacE

Type of funding scheme: Coordination and support actions (Support)

Work programme topics addressed:
(if more than one, indicate their order of importance to the project)

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List of participants:

Participant no.	**Participant organisation name**	**Country**
1 (Coordinator)	Tartu Observatoorium	Estonia

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Proposal

1. Scientific and/or technical quality, relevant to the topics addressed by the call

1.1 Rationale for the project

In its White Paper on European Space Policy, the European Commission articulates the essential support that space technologies can bring to the Union's policies and objectives and also of their tremendous social, economic, and commercial potential. The White Paper recommends: (i) putting additional efforts into a variety of space infrastructures and applications, which will make unique contributions to satisfy the needs of the citizens and to respond to the Union's political objectives, (ii) consolidating the existing scientific and technical basis of space activities. It also urges a change of the governance paradigm so as to give the Union new responsibilities for driving, funding and co-ordinating activities within an extended Space Policy. The European Space Agency (ESA), Member States and their national space agencies, research centres, together with industry, all deserve the credit for having established Europe as a key player in space.[1]

Undoubtedly, space research is increasingly a key element for the European Union as it can directly contribute to the implementation of a large group of policy objectives, such as:

- *Sustainable Development*, (e.g. through information gathering in support of the Kyoto protocol monitoring and the actions resulting from the Johannesburg Summit on sustainable development).
- *Common Foreign and Security Policy* (e.g. in support of borders control, conflict prevention and crisis management).
- *Lisbon Strategy* (e.g. through better opportunities for Space related industries, improved access to space-based services such as GMES)[2]

Europe's list of achievements in space sciences and applications, largely delivered through collaboration in the European Space Agency and also through national efforts, have established the continent as a competitive actor in many public and commercial markets.[3]

The realization of the knowledge-based economy and society relies on strengthening the excellence of European research, but also on better using "untapped" high research potential which exists all over the EU.[4] In spite of Community efforts the European research and development landscape is still fragmented resulting in overlapping efforts and insufficient cooperation. This is especially true for Space research, where Europe does not fully exploit its research potential, in particular in less advanced regions remote from the European core of research and industrial development.

Seventh Framework Programme has introduced space research and technological development for the first time as a priority area in the Framework Programme. This means that prior research in this field has been conducted mostly at national level or within R&D programmes of the European Space Agency (ESA). Lack of cooperation possibilities has left several research groups without practical application possibilities for their research results, also lack of cooperation with similar research centres in Europe has left the potential of Estonian space research unutilized at European scale.

Estonia is right now concluding a framework agreement for cooperation with ESA. In a few years, Estonia could become a "European Cooperating State" (ECS). In the years following, Estonia will then have the perspective to continue to cooperate with ESA under the ECS agreement, or apply for a full ESA membership.

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[1] WHITE PAPER "Space: a new European frontier for an expanding Union An action plan for implementing the European Space policy", COM(2003) 673, Brussels, 11 November 2003

[2] Work Programme of FP7 Space Thematic Area

[3] WHITE PAPER "Space: a new European frontier for an expanding Union An action plan for implementing the European Space policy", COM(2003) 673, Brussels, 11 November 2003

[4] COM(2005) 443 final, Proposal for a COUNCIL DECISION on the Specific Programme: "Capacities" implementing the 7th Framework Programme (2007-2013) of the European Community for research, technological development and demonstration activities, Brussels, 21.9.2005

For Estonia, as for the other Eastern European states, the participation in ESA activities as an ECS will, first of all, not only strengthen Estonia's national institutional capacity, but also assist in the development of its national space industry. It will also strengthen the position of Tartu Observatory as the Estonian centre for space research and technology

Secondly, the ECS status helps to develop cooperation between the scientific and applications user communities in the ECS and in the Agency's Member States, and to ensure coherence between Member-State and ECS space activities, for example by avoiding unnecessary duplication.

One of the key challenges identified by the European Commission for implementing a successful Space policy is the need to optimize and co-ordinate the use of R&D resources to close technology gaps jeopardizing Europe's independence and worldwide competitiveness.[1]

The right sort of human capital is critical for achieving Europe's ambitions in space. But its supply is far from assured given the declining interest in scientific studies across the continent which, in the space sector, is resulting in an ageing community of scientists and a lack of young talents. There is now a serious risk of losing precious competencies and know-how. For reducing that risk mobility schemes and training opportunities for young researchers should be implemented.[2]

Current proposal has set its focus on creating the necessary conditions for utilizing the existing and emerging research potential of Estonian scientific institutes in the field of space research. The centre for space research will be built on top of the leading space related competence centres of Estonia - Tartu Observatory (TO), Institute of Technology (TUIT) and **Institute of Physics** (TUIP). We strongly believe that establishing a joint Centre of Excellence in Space research in Estonia will reinforce integration with EU's leading Space research centres and release experience and knowledge sharing in both ways. The Centre can proudly state its excellence in **theoretical and applied methods for remote sensing, space science and technology, climate change and sustainable development,** which all are highly relevant topics for international research.

To underline the existing potential of Space research, we can proudly state that research groups of Atmosphere Physics[3] (Rõõm, R. Nilson T., Kuusk A., Peterson U.), Astrophysics (Sapar, A, Kipper, T) and Cosmology (Einasto, J., Saar, E) of Tartu Observatory have received evaluation mark of Excellent To Good by international Science Evaluation, ranking on the top list amongst Estonian research groups. Institute of Theoretical Physics at Tartu University is renown for its scientists (academician E.Ergma), having Excellent rank for its scientific achievements. Institute of Physics at Tartu University in turn has overall Excellent to Good marks. Thus, it clearly underlines the potential of Space Sciences which is scattered between different organizations in Estonia, which determine to establish a single Centre of Excellence for Space Research. Single unit will definitely facilitate the further upgrade of research potential through joint activities and pooling of resources. The high quality of research demonstrated by those groups in turn renders a good potential for bi-directional experience and knowledge sharing between the Centre and European established Centres in the field, whereby beneficiaries from that is both Estonia as well as European Union.

[1] Ibid.
[2] Ibid.
[3] http://www.ekak.archimedes.ee/eval/astronomy-atmospheric-physics.htm

1.2 Concept and objectives

Explain the concept of your project. What are the main ideas that led you to propose this work?

The main objective of the project is to create the necessary conditions for utilizing the existing and emerging research potential of Estonian scientific institutes in the field of space research and increase the level of international cooperation to fully realize the potential of European Research Area within the enlarged Union.

The projects seeks to enhance the potential and research capacities of Estonian scientists in space research, space technology and remote sensing by supporting and mobilizing human and material resources and developing strategic partnerships with other research groups in Europe to guide future research efforts, supporting thus closer cooperation of Estonia with the European Space Agency (ESA) and facilitating the participation of Estonian scientists in the activities of the Seventh Framework Programme.

The project will increase the visibility and collaboration of Estonian space scientists with public, industry, enterprises and policy on national and European level. It will also improve awareness of EU space policy on the national level.

For achieving the above mentioned objectives the project has envisaged the following activities:

- Building a sustainable cooperation network to realise the existing potential and competencies of Estonian space researchers and facilitating communication between the centres having similar scientific interest.

i) An Advisory Council (AC) of 9 members, all distinguished European researchers, will be formed. The Council will advise TORC on the improvement and harmonization of its development strategy. AC members will contribute in supervising and training at TORC. The Advisory Council will include the following people:
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- Danielle de Staerke, CNES, France
- Prof. Josh Thomas, Uppsala Advanced Battery Centre, Sweden
- Dr. Bernard Pinty, EC Joint Research Centre (JRC)
- Prof. Jürgen Metzdorf, Physikalisch-Technishe Bundesanstalt (PTB), Germany
- Prof. Marku Kulmala, University of Helsinki, Finland
- Prof. Gunther Seckmeyer, Institute for Meteorology and Climatology, University of Hannover, Germany
- Dr. Roland Doerffer, GKSS, Germany
- Prof. Esko Valtaoja, University of Turku, Tuorla Observatory, Finland
- Prof. Ene Ergma, Chairman of the Estonian Space Policy working group; Speaker of the Estonian Parliament

ii) Short-term visits of 15 experienced researchers to TORC are planned. Their aim is to serve as networking meetings helping to engage TORC in more research networks and joint research activities, including FP7 projects.

iii) A constant need to expose TO success and high-level scientific results at international level will be facilitated by uniting the competences of 3 separate institutes (Tartu Observatory (TO) and its two collaborating Tartu University institutes - Institute of Technology (TUIT) and Institute of Physics (TUIP).

- Contribution to the European space and atmospheric research, through partnership in the EU research networks and improved coordination in related activities between research institutions in Estonia

i) TORC will initiate 2 project proposals to the forthcoming calls of FP7. As a result of networking activities, TORC will be included at least into two FP7 project proposals as a partner.

- Organising researchers' mobility (including twinning) between Estonia and other European Space Science centres to upgrade the human potential of Estonian space researchers and to take advantage of the knowledge and experience existing in other regions of Europe

i) During the project European and US researchers will come to TORC under short-term or long-term contracts to conduct their studies at TORC and give lecture courses to students on space-related subjects. In total 19 experienced researchers will contribute to the scientific activities of TORC. Around 30 Estonian researchers and PhD students will visit European Centres of Excellence. The list of incoming and outgoing researchers is presented in specific workpackage descriptions, including the added value of these staff exchanges.

ii) Twinning workgroups and collaboration schemes will be created with 8 different European research centres operating in similar activity areas.

- Upgrading the technological base and research equipment of TORC to increase the capacity of Estonian researchers to participate in international cooperation projects

i) The necessary equipment includes instrumentation and software to be used in remote sensing, atmospheric and astronomical research that allows TORC to improve its measurement, calibration, and data analysis results and participate in European scientific networks (e.g. GMES) and ESA space missions (e.g. Gaia).
A list of 10 instruments includes:

a) A field spectrometer FieldSpec-FR (for spectral measurements to support radiative transfer and remote sensing studies)
b) An unmanned aerial vehicle (UAV) (to carry light weight spectrometer capable for multiangular measurements over forest and coastal areas of large lakes and seas)
c) Sun radiometer (CIMEL) (for the validation of satellite retrievals of aerosol optical properties on the Baltic Sea eastern coastal region)
d) Software package HYDROLIGHT software (for computing radiance distributions and related quantities)
e) AERONET–Ocean Color (for measuring the radiance emerging from the sea)
f) Automated Brewer Ozone Spectrophotometer (for measuring spectral UV radiation and testing modelling of aerosol optical properties)
g) Ambient Particulate Monitor TEOM Series 1400a (required for calibration of spectrometers)
h) CCD camera (Andor, iKon-L, DW436-BV) (for ground-based (support) photometry of Gaia targets)
i) Parstat 2273 potentiostat/galvanostat (necessary for developing novel actuators and sensors for space technology and UAV technology)
j) Agilent 3458A Multimeter (for high-accuracy photocurrent measurements in calibration of radiometric detectors)

- Organising scientific conferences on space research/technology and disseminating scientific information as well as the results of research to promote the existing competencies of Estonian space researchers

i) TORC will be organizing medium scale conference:

- International conference in "*Advances in Space and Earth monitoring: what does it mean for society?*" (the papers will be published in special volume of an international research journal)

ii) Organisation of (international) research and development workshops (6):

- Workshop "Space technology, remote sensing, including satellite remote sensing: Prospectives and horizons"
- Workshop "Space technology and remote sensing: scientific and technology cutting edge level and possible services for society"
- International workshop "New particle generation in atmosphere" in August 2008. A complementary session will be organized for the local authorities and experts of public health and air quality monitoring
- International training course "Optical properties and types of aerosol used in atmospheric correction of satellite images over waterbodies – measurements and models"
- Regular Nordic Ozone Group Meeting in spring 2009
- Meeting on "Ground-based observations of standard/calibration stars and corresponding databases" in August 2009

iii) Organisation of 3 summer schools for young scientists and PhD students in space technology and remote sensing, physics, math, biology, chemistry and informatics:

- International summer school "Applications and operational use of remote sensing for monitoring environment and security" in July 2008 with complementary session for science teachers: *Using satellite remote sensing products for classroom teaching*
- International summer school "*Common base of knowledge in satellite communications: is it needed for business or research?":* in July 2009
- A regional (Finland, Estonia, Latvia, Lithuania) winter school "*The accessibility and usage of ESA archives and databases for astronomical and remote sensing research*" in Nov, 2008

iv) TORC staff will participate in about 15 international conferences. The list of proposed conferences is presented in WP6 description.

These activities go well in line with the objectives of the addressed call (REGPOT-2007-1) of the Capacities programme, seeking *to improve the research capacities of highest quality and/or promising centres, in the thematic priorities' domains of the FP7, by reinforcing their S&T potential, by supporting and mobilising the human and material resources, by developing strategic partnerships (including twinning) with well established research groups elsewhere in the Union, by disseminating scientific information as well as the results of research, by facilitating communication between the centres having similar scientific interest and by improving their responses to socio-economic needs of the country.*

1.3 Overview of TORC scientific competences and their correspondence to EU priorities

Tartu Observatory (TO) and collaborators from two research institutes of Tartu University - Institute of Technology (TUIT) and Institute of Physics (TUIP) form together TO Research Centre (TORC) which successfully contributes to the European and international efforts using their competence and skills in areas: theoretical and applied methods for remote sensing, space science and technology, climate change and sustainable development. These four areas are well in line with priorities of European Commission Framework Programme 7 (see Table 1.)

Table 1. Correspondence of scientific topics addressed in present proposal to FP7 priorities

General areas of research in TORC	Corresponding activity of FP7
Theoretical and applied methods for remote sensing	**ACTIVITY: 9.1. SPACE-BASED APPLICATIONS AT THE SERVICE OF EUROPEAN SOCIETY**
Foundations of space science and technology	**ACTIVITY: 9.2. STRENGTHENING THE FOUNDATIONS OF SPACE SCIENCE AND TECHNOLOGY** *Area 9.2.1: Research to support space science and exploration*
Climate change	**ACTIVITY 6.1. CLIMATE CHANGE, POLLUTION, AND RISKS** SUB-ACTIVITY 6.1.1. PRESSURES ON ENVIRONMENT AND CLIMATE ▫ *Area 6.1.1.1. The Earth System and Climate: Functioning and abrupt changes* ▫ *Area 6.1.1.2. Emissions and Pressures: Natural and anthropogenic* ▫ *Area 6.1.1.3. The Global Carbon cycle - GreenHouse Gas budgets* ▫ *Area 6.1.1.4. Future Climate* SUB-ACTIVITY 6.1.2. ENVIRONMENT AND HEALTH ▫ *Area 6.1.2.1. Health effects of exposure to environmental stressors* ▫ *Area 6.1.2.2. Integrated approaches for environment and health risk assessment*
Sustainable development	**ACTIVITY 6.2. SUSTAINABLE MANAGEMENT OF RESOURCES** SUB-ACTIVITY 6.2.1. CONSERVATION AND SUSTAINABLE MANAGEMENT OF NATURAL AND MAN-MADE RESOURCES AND BIODIVERSITY ▫ *Area 6.2.1.2. Water resources* ▫ *Area 6.2.1.3. Soil research and desertification* ▫ *Area 6.2.1.6. Integrated forest research* **ACTIVITY 6.4. EARTH OBSERVATION AND ASSESSMENT TOOLS FOR SUSTAINABLE DEVELOPMENT** SUB-ACTIVITY 6.4.1. EARTH AND OCEAN OBSERVATION SYSTEMS AND MONITORING METHODS FOR THE ENVIRONMENT AND SUSTAINABLE DEVELOPMENT ▫ *Area 6.4.1.1. Integration of European activities within GEO* ▫ *Area 6.4.1.2. Cross-cutting research activities relevant to GEO* ▫ *Area 6.4.1.3. Earth Observation activities in emerging areas*

In addition, one of the tasks of above mentioned research institutes is improving public awareness on European space and environmental science activities by transferring knowledge to younger generations through teaching and supervising at Estonian universities and providing research consultancies and technological services for local governmental agencies and private companies. Mentioned actions are

important for several areas of **FP7** work program. For example activities of ***area 6.1.1.6. Response Strategies: Adaptation, Mitigation and Policies*** include awareness raising among governmental agencies and private companies. Also tasks of area ***9.2.1 Support to research activities related to space science and exploration*** include increasing public awareness of space research and space data sharing activities.

The harmonized and coordinated efforts of the research group of TORC in space research and technology allows for more efficient use of complex instrumentation, the sharing of high level optical and technological laboratories for research and training and increases the exchange of knowledge between different scientific topics. **All research institutes have world level know-how and experience in cooperation with top scientists of their fields[1]. Pooling of such knowledge allows creation of synergies and stronger base for continuing world level research inline with EU priorities.** Yet existing infrastructure and competences in the fields of radiative transfer, atmospheric physics, astrophysics in conjunction with experimental accuracy and traceability, technological development on the borderline of material science, robotics, chemistry, computer science and electronics are insufficient for advancing Estonian space and environment related research as fast as renewed Lisbon strategy, EU Commission and ESA goals require. Existing constraints can be overcome by actions formalised in current project.

Scientific topics covered in the project

Research in above mentioned areas is done by four research groups of 3 centres. The research groups focus on following fields:

G1: remote sensing,

G2: atmospheric composition,

G3: astronomical research

G4: advanced technology

The interaction of TORC thematic groups, FP7 priority fields, the current project and several outside actors are shown in Figure 1.

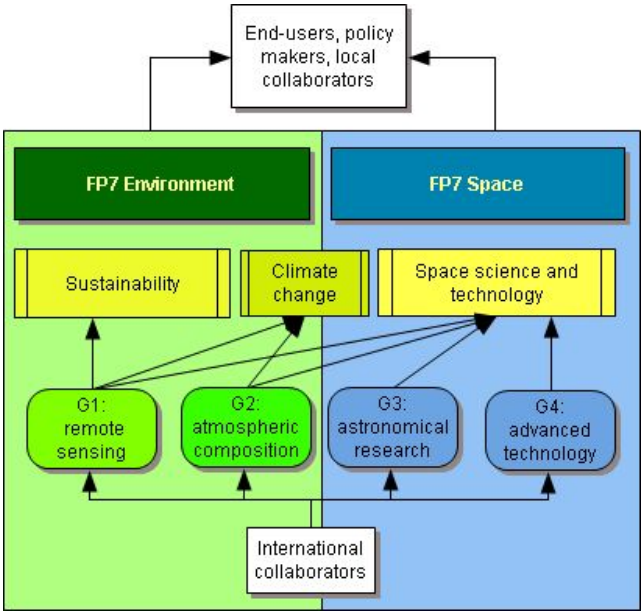

Figure 1. *Interaction of TORC and FP7 activities*

[1] See international science evaluation results http://www.ekak.archimedes.ee/eval/

As shown in Figure 1, the project integrates 4 major scientific topics. Their closer interrelations as well as the cooperation level between TO and its collaborators TUIT and TUIP relevant to the themes in FP7 are shown schematically in Figure 2.

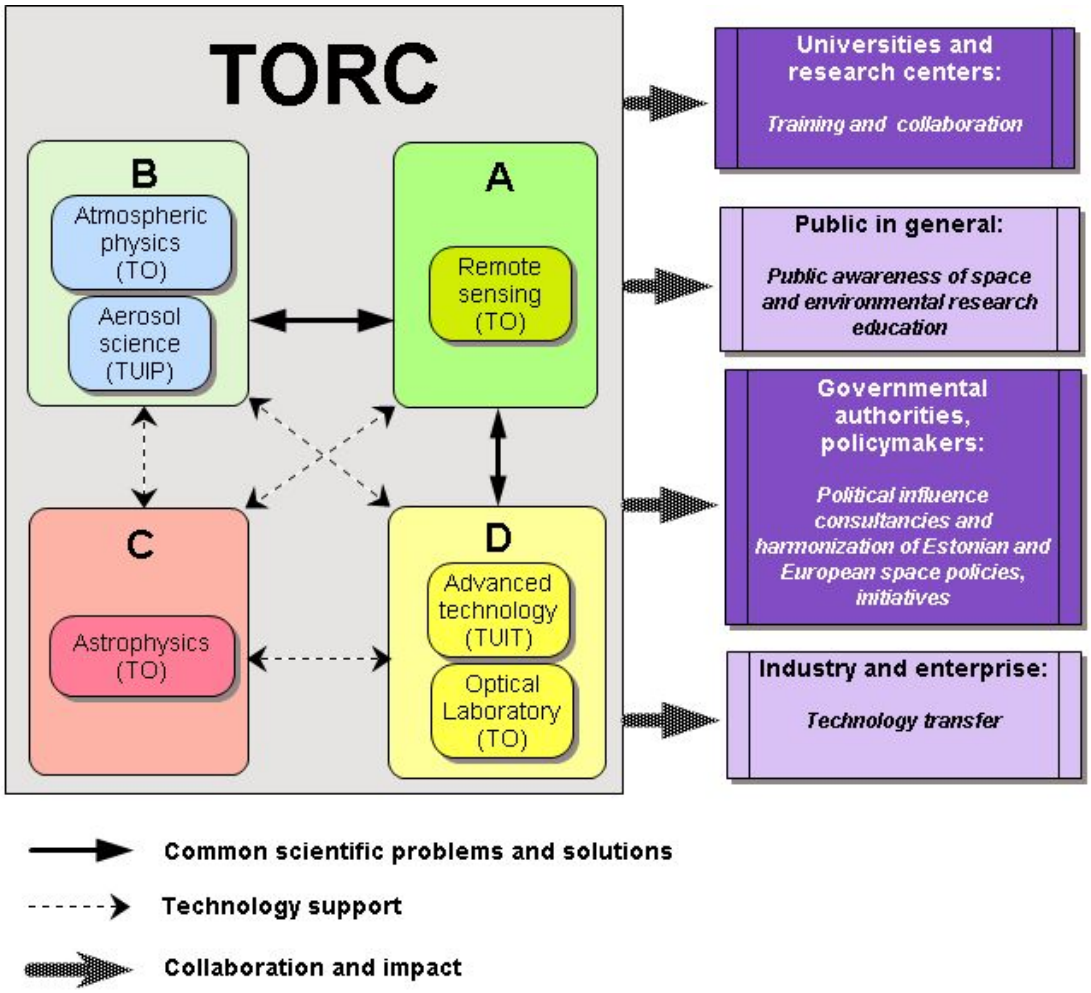

Figure 2. *TORC cooperation scheme and its impact on society*

G1: Remote sensing

Since satellites can easily cross boundaries of different countries, remote sensing can add an international dimension to monitoring programs and allow creation of international services. One of the main focuses of FP7 Space Work Programme is developing services based on remote sensing for environmental monitoring, agriculture, security etc. Several GMES services which include space and in situ component need to start already in 2008. EU Member States have to strengthen their internal co-ordination and contribute to the implementation of the necessary infrastructure and in situ data. Research and development activities for GMES shall contribute to the ongoing INSPIRE implementation in Member States. Although satellite systems provide a unique and globally available data source for such operational services, their effectiveness depends critically on close integration with ground systems, to exploit the comparative advantage of each.

With its improved spectral and radiometric resolution the European Space Agency's sensor MERIS on the ENVISAT-1 satellite is the first ocean colour sensor that is adequate for coastal remote sensing and have also capacity for land cover remote sensing. Its data are still under validation, as its expected work time last until 2010, there is need for development methods combining different other sensors to ensure continuity of data flow.

Following are the main areas TORC's researchers have contributed significantly to world science or where current international projects are conducted:

- studies of solar radiation transfer in complex geometrical structures,
- modelling vegetation reflectance based on the radiation transfer theory.
- remote sensing of forests, turbid humic coastal and inland waters
- monitoring land cover, forest and landscape dynamics from satellite images supported with numerical databases of spatial data (GIS).

TORC has long traditions in the study of **solar radiation** transfer in complex geometrical structures, such as vegetation, forest and canopies. Analytical approximate formulas developed by Prof. Ross[1] for the multiple scattering of radiation are in use in the algorithms used by NASA and other institutions to retrieve such vegetation parameters from the measurements by multispectral and multiangular satellite systems MODIS/Terra and Aqua and MISR/Terra.

TORC scientists have high experience in **modelling vegetation reflectance** based on the radiative transfer theory Dr. Kuusk[2] was the first to apply the reflectance model inversion technology to retrieve vegetation parameters (LAI, leaf chlorophyll content, etc.) in large areas covered by a Landsat TM image, that has nowadays become a widely used method.[3] Time series of these parameters by Landsat TM and SPOT images were obtained for the extent of the Eastern Baltic region (includes Estonia, Latvia and western areas of Leningrad oblast and Pskov district in Russia) from 1985 to 2006. The problems addressed consider the harvesting rates in the forests, cultivation patterns of arable land and abandonment rates of arable land in the region. Additionally, also hyperspectral images from PROBA/CHRIS[4] and Hyperion/EO1 have been used and methods tested on TO's forest test site in Järvselja[5]. Homogeneous canopy reflectance model and forest reflectance models by Nilson[6] and Kuusk are being used by several European remote sensing teams (e.g., CNES, INRA, CESBIO (France), Swedish University of Agricultural Sciences, Lund University (Sweden), Helsinki University (Finland)) to interpret and test remote sensing data.

With the help of the project described in this proposal, an important step can be taken to improve the overall quality of TORC's capability for supporting satellite remote sensing with under-atmosphere measurements and its interpretation using physically based radiative transfer models. Collaboration attracts other European groups to work with their methods and instrumentation in well established forest test site in Järvselja.

Remote sensing of turbid waters has become very important nowadays because of the increased human impact on coastal and inland waters, and capabilities of new generation of ocean colour satellites to detect properties of these complex ecosystems. New sensors are specifically adapted to the low radiances and have better spatial and spectral resolutions, needed for monitoring of aquatic environment. Monitoring of harmful algal blooms is particularly important for marine aquaculture and fisheries, as well as for tourism. Despite

[1] Ross, Juhan (1981). "The Radiation Regime and Architecture of Plant Stands". The Hague-Boston-London: Dr. W. Junk Publishers, 391 pp.

[2] Kuusk, A. and Nilson, T. (2000). "A directional multispectral forest reflectance mode". *Remote Sensing of Environment*, 72(2), 244-252.

[3] Peterson, U., Püssa, K., and Liira, J. (2004). "Issues related to delineation of forest boundaries on Landsat Thematic Mapper winter images". *International Journal of Remote Sensing*, 25(24), 5617-5628

[4] ESA Cat 1 project 3133 "Validation of the directional multispectral forest reflectance model and estimation of forest parmeters by model inversion".

[5] Järvselja area is currently a test site for the international VALERI program (Validation of Land European Remote Sensing Instruments, http://www.avignon.inra.fr/valeri/). The remote sensing group has applied to include the Järvselja forest site as a measuring site of the VENμS mission (http://smsc.cnes.fr/VENUS/GP_mission.htm) with its high spatial and spectral resolution and two-day revisit possibilities.

[6] Nilson, T. and Ross, J. (1997). "Modeling radiative transfer through forest canopies: Implications for canopy photosynthesis and remote sensing". In: H. L. Gholz, K. Nakane, and H. Shimoda (Eds.), *The Use of Remote Sensing in the Modeling of Forest Productivity*, Kluwer, Dordrecht, 23-60

great improvements in aquatic remote sensing over the last decades, the remote sensing of optically complex waters, such as lakes and the coastal zone (so called optical Case-2 waters) is still a challenge. Well-calibrated and validated physics-based approaches used thereby include atmospheric correction, and are applicable to every scene acquired of a selected waterbody, giving the opportunity to map water quality parameters independently from ground measurements. The group presently works on MERIS/Envisat (Medium Resolution Imaging spectrometer) validation for humic coastal and inland waters (Dr. Reinart[1]).

The present project will combine achievements in terrestrial remote sensing and aerosol measurements to improve atmospheric correction over coastal waters of Baltic Sea and inland waters. **Atmospheric correction of satellite and airborne** images is extremely important in the quantitative analyses and time series of remote sensed parameters of both terrestrial and aquatic environment. Here an extremely important aspect is the validation of developed models, quality of in situ measurements and operational availability of products.

Above mentioned research areas are currently priorities of **ESA**, **EU Framework Programme 7** and other **key documents** such as EC Habitat Directive (92/43/EEC) on the conservation of the natural habitats and of wild fauna and flora; INSPIRE (agreed in Nov, 2007) on establishing an infrastructure for spatial information in the Community, and EC Water Framework Directive (C.E.C., 2000) on assessment of the ecological status of European waters.

More specifically, TORC's research activities on advanced methods for remote sensing of land and water both on the bases of radiative transfer theory and practical measurements using satellite, air and ship based methods in conjunction with in situ data, are in line with **FP7** ***activity 6.3. Environmental Technologies,*** which sub-activity covers ***6.3.1 Environmental Technologies for Observation, Simulation, Prevention, Mitigation, Adaptation, Remediation and Restoration of the Natural and Man-made Environment.*** Work program emphasizes the importance of development, implementation and validation of new field, remote and proximal observation technologies capable to improve, accelerate and objectify the collection of soil data, allowing at the same time a non destructive approach. Similar targets are set for water bodies. TORC's research can contribute also to ***sub-activity 6.4.1. Earth and Ocean Observation Systems and Monitoring Methods For the Environment and Sustainable Development*** and its first three areas ***Area 6.4.1.1. Integration of European activities within GEO, Area 6.4.1.2. Cross-cutting research activities relevant to GEO, Area 6.4.1.3. Earth Observation activities in emerging areas.***

TORC's research on methods is also important for the **FP7 activity** ***9.1 Space-based applications at the service of European Society***, where primary goal of focus area *1.1 (Pre-) operational validation of GMES services and products* is development of a comprehensive Earth observation system, using space borne and in-situ techniques (land, air and sea based) for the delivery and sustainability of well defined operational services, which support the implementation and monitoring of environmental policies in the context of sustainable development. Although satellite systems provide a unique and globally available data source for such operational services, their effectiveness depends critically on close integration with terrestrial systems, to exploit the comparative advantage of each. Therefore TORC's experience and research can be used for achieving to goals of FP7 activity 9.1:

- conducting validation of GMES services and products, and
- achieving integration of ground (in-situ) and space systems into services.

G2: Atmospheric research

There is a growing public concern about the Climate Change, which is one of the main policy priorities of European Commission. Climate change means changes in atmospheric composition directly affecting many aspects of life, determining climate, air quality and atmospheric inputs to ecosystems. In turn, these changes affect the fundamental necessities for human existence: human health, food production, ecosystem health and water. All these connections are presented as extremely important topics for research in FP7 Environment

[1] ESA Cat 1 project 3180 "Testing applicability of MERIS L2 products for monitoring humic coastal and lake waters in Baltic Sea region."

theme. **The FP7 Space programme specifically points out the creation of services for atmospheric composition monitoring.**

The expertise in atmospheric research at TORC covers the modelling and measurements of atmospheric radiative transfer, research of UV radiation[1], stratospheric ozone[2] and atmospheric aerosol[3], and development of measurement methods and instrumentation[4]. The synergy of the expertise of TORC research groups enables to build and implement closure experiments for integrated investigation of microphysical, chemical and optical properties of atmospheric aerosol and the impact of atmospheric composition on atmospheric radiative transfer. It enables better assessment of regional atmospheric characteristics, required for the improvement of remote sensing algorithms and climate models. The purpose of the research is better quantification of regional and global links between air pollution, climate and climate change, which is one of the main goals of the European Environment Work programme 2007.

TORC's research in atmospheric research has significant outcomes in following areas:

- monitoring of UV radiation,
- researching aerosol and air ions.

Regular monitoring of the UV radiation in EC countries has been started less than 20 years ago. The interannual and intraseasonal variations of the available solar radiation are related to different environmental and health effects. The increasing rates of skin cancer incidents in many countries in recent decades have evoked studies to quantify UV-radiation exposures that lead to skin cancer and other harmful health effects. It was only very recently that attention focused also on potential anti-cancer effects of UV radiation and on its role in the vitamin D synthesis in human skin. Vitamin D is produced with the maximum efficiency at wavelengths around 297 nm; at the latitudes above 50^{o} there exists a period around the winter solstice when the level of short-wave ultraviolet irradiance remains below the threshold needed for vitamin D production.

Long-term datasets of the broadband solar radiation are also available for relatively few sites. Such dataset, collected at the Tartu-Tõravere Meteorological Station, belongs to the few time-series of the highest quality in Europe. At present, long term quality evaluations of UV radiation as well as of broadband solar radiation over Europe have obtained significant actuality.

Tartu Observatory has participated in the EC research project EDUCE "European Database for UV Climatology and Evaluation" and currently participates in COST 726 action "Long term changes and climatology of UV radiation over Europe" (PI Dr. Eerme). Daily UV doses at the Tartu-Tõravere Meteorological Station site have been reconstructed back to 1953 and the interannual variations and systematic changes have been studied for the UV as well as for the broadband solar radiation. The main objective of the action is to advance the understanding of UV radiation distribution under various meteorological conditions and assess UV changes over Europe[5].

[1] Eerme K., Veismann U., Lätt S. (2006). "Proxy-based reconstruction of erythemal UV doses over Estonia for 1955-2004". *Ann. Geophys.*, 24, 1767-1782, 2006

[2] Eerme K., Veismann U., Koppel R. (2002). "Estonian Total Ozone Climatology". *Ann. Geophys.* 20, 247-255, 2002

[3] Reinart, A., Kikas, Ü., Tamm, E. (2006). "Investigation of aerosol components influencing atmospheric transfer of UV radiation in Baltic Sea region". *J. Geophys. Res*., Vol. 111, No. D2, D02205, 10.1029/2005JD005786

[4] Veismann U., Eerme K., Tõnnisson T., Avaste O. (1993). Studying Atmosphere by a Method of Remote Sounding of Earth Limb from the Board of Orbital Station. In: CIS Selected Papers: Photometry, SPIE Proceedings 2161, 98-107, 1993.

[5] Kikas Ü., Reinart A., Vaht M., Veismann U. (2001). "A Case Study of the Impact of Boundary Layer Aerosol Size Distribution on the Surface UV Irradiance". *Atmospheric Environment 35 (30),* 5041-5051, 2001

The research group of aerosol and air ions in Estonia (University of Tartu, formerly led by Prof. H. Tammet[1]) is widely acknowledged in the international atmospheric research community by high-quality expertise in the development and design of DMA spectrometers for aerosol and air cluster measurements, theory of ion-induced nucleation, composition and optical properties of atmospheric aerosol.

The aerosol group is currently cooperating with an Estonian spin-off company AIREL and a US company TSI. During this project we hope to find new partners among European SME-s. The measurement range of particles has been extended to below 3 nm. Also, ground-based measurements of aerosol and air ion size distributions (in a wide size range of 3 nm to 10 nm) have been conducted during the last 5 years. In addition, the data measured by the spectral sun photometer of the AERONET[2] system are available.

Since 2007 the group is a partner of the EU Framework 6 project "Eucaari", which goal is to investigate the role of aerosol on climate and air quality. TORC's research has applications in researching effect of atmospheric aerosols on global climate. Numerous international and European programs and projects have been initiated for coordinated monitoring and research of atmospheric composition in Europe (EMEP[3] ACCENT[4] , EUSAAR[5]). With the help of the project application for joining network EUSAAR will be made.

In particular, TORC research contributes to understanding global climate change by investigation of atmospheric composition, in particular atmospheric particulate matter and ozone and assuring the continuity of solar radiation records for more than half of a century. These TORC's activities match with **FP7** ***activity 6.1 Climate Change, Pollution, and Risks***, where primary interest is to observe, analyse and model climate induced changes to atmospheric composition, greenhouse gases and to the water cycle, on soil, and the cryosphere; impacts on ecosystems, feed-back mechanisms and abrupt changes as well as the occurrence of extreme events.

Additionally TORC's research is in line with focus ***Area 6.1.1.1. The Earth System and Climate: Functioning and abrupt changes, Area 6.1.1.2. Emissions and Pressures: Natural and anthropogenic, Area 6.1.1.3. The Global Carbon cycle - GreenHouse Gas budgets*****,** and ***Area 6.1.1.4. Future Climat.*** Also current datasets and knowledge of UV and aerosols allow to contribute to environment and health related research such as described in **FP7** ***Area 6.1.2.1. Health effects of exposure to environmental stressors,*** and ***Area 6.1.2.2. Integrated approaches for environment and health risk assessment***

Furthermore, TORC's research can help preparing European space science missions, with the optimal scientific exploitation of missions' data covering radiometric and atmospheric measurements. This research is covered by **FP7 activity** ***9.2. Strengthening the foundations of Space science and technology*** and **focus area** ***9.2.1: Research to support space science and exploration***, where one target is on upstream and downstream R&D activities complementing space missions, such as the optimal preparation of scientific payloads on future space missions, and an effective scientific exploitation of their data.

G3: Astronomical research

Space studies slowly broaden the understanding of the Universe and provide synergy with ground observations for physical, life and environmental sciences

Main areas of TORC's astronomy research group are:

[1] Tammet, H., Kulmala, M. (2005). "Simulation tool for atmospheric aerosol nucleation bursts". *J. Aerosol Sci*., 36, 173-196

[2] AERONET - The AErosol RObotic NETwork program is a federation of ground-based remote sensing aerosol networks established by NASA and LOA-PHOTONS (CNRS), greatly expanded by collaborators from national agencies, institutes, universities, individual scientists, and partners. (http://aeronet.gsfc.nasa.gov)

[3] Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air pollutants in Europe, http://www.emep.int

[4] The European Network of Excellence on atmospheric Composition Change, http://www.accent-network.org

[5] - European Supersites for Atmospheric Aerosol Research is an EU-funded I3 project, http://www.eusaar.net

- cosmology,
- stellar astrophysics.

The group of cosmology participates in Planck mission via collaboration with Tuorla Observatory, Turku University, Finland in group "Large scale structure in Planck. Sunyaev/Zeldovich effect emission". ESA Planck Mission (to be launched in 2008) is a mission to map the structure of the Cosmic Microwave Background in detail. Planck will observe the Universe as it was 300 000 years after the Big Bang, will constrain cosmological models and examine the birth of large scale structure in the Universe.

TO is among the pioneers in European studies of large scale structure of the Universe[1], especially in studies of superclusters of galaxies. At present, TO compiles catalogues of superclusters of galaxies using the best presently available datasets, the 2dF Galaxy Redshift Survey, and the Sloan Digital Sky Survey, latest data releases. On the basis of supercluster catalogues, density field sky maps with supercluster information are generated which can be used to extract foreground data from Planck microwave data[2]. For that work supercluster catalogues, using data from the largest existing cosmological models, the Millennium Simulations and Hubble Volume Simulations, are generated.

The stellar astrophysics group has been involved in the preparations for the ESA Gaia mission (to be launched in 2011) since 2001 – in Gaia Data Processing and Analysis Consortium in the Coordination Unit "Astrophysical Parameters" (CU8). Based on the long-term experience in the field of peculiar emission line stars, TO's contribution has been the assessment of different photometric systems proposed for Gaia in their ability to recognize and classify stars[3]. TO's current efforts are directed at the collection of empirical spectral energy distribution data on different types of emission line objects/stars (e.g. Be stars, WR stars, HAeBe stars, T Tauri stars, symbiotic stars) to be used for Gaia on-board calibration purposes and for the elaboration of specific photometric classification algorithms for Gaia in case of these stars.

Project increases sustainability of collaboration between TORC and ESA for the preparing for European space science missions, with the optimal scientific exploitation of missions' data and with the improvement of public awareness on European space science activities**.**

These research topics support **FP7 activities in area *9.2.1: Research to support space science and exploration.***

G4: Advanced Technology and Laboratory of Optical Radiometry

Beyond development of GMES and following guidelines of INSPIRE proposal, ESA priorities include strengthening the foundations of European Space science and technology, without which it becomes impossible to develop truly autonomous and efficient applications. These topics are driven in Europe by entities and agencies at European or national level. Enhancement of scientific added value through synergies with the European Space Agency and Member States space agencies initiatives in the field of space science and exploration, space transportation and space technologies is a necessity.

Scientists of TORC centres are experts in following relevant areas:

- radiometric detectors
- conventional, piezoelectrical and EAP actuators

[1] Einasto J., Einasto M., Saar E. et al. (2006). "Luminous Superclusters: Remnants from Inflation?" *Astronomy & Astrophysics*, Vol. 459, pp L1-L4

[2] Einasto J., Einasto M., Saar E., Tago E. et al. (2007). "Supeclusters of Galaxies in the 2dF redshift Survey. I, II III". *Astronomy & Astrophysics*, Vol. 462, pp. 397-410, 811-825; Vol. 464, pp 815-826

[3] Kolka I., Eenmäe T., Hirv A., Tuvikene T. Kama M. (2005). Emission Line Stars in the Framework of Gaia. Proceedings of the Gaia Symposium "The Three-Dimensional Universe with Gaia", ESA SP-576, pp 543-547

The development of new **solutions for radiometric detectors**[1] has been one of the most prominent achievements of the Laboratory of Optical Radiometry of TO which has also long experience in participating in Russian space programmes. Radiometers, developed at TO, have been used on six different missions (Saljut, Saljut 1, Saljut 4, Saljut 6, Saljut 7, and MIR Space Station) between 1971 and 1993[2].

Presently, the main task of the laboratory at TO is to respond to the critical needs of the Remote Sensing community in Estonia for accurate radiometric calibration of optical sensors. Nowadays, the calibrations are traceable to the spectral irradiance scale maintained at the National Institute of Standards and Technology of the USA (NIST). **Project enables harmonization of the measurement data obtained in TORC and in different locations in EU through established measurement traceability to one of the European metrology institutes.**

One of the major research of TORC **the combining of conventional and EAP actuators** and ensuring the smart design of different kinds of actuators and sensors is conducted in collaboration with the Intelligent Materials and Systems Lab at the Institute of Technology at Tartu University (Dr. Aabloo[3], Dr. Kruusmaa). Sometimes actuators made from EAP are called artificial muscles. Possible applications of EAP materials are flapping actuators, solar sails deployment, deployable antennas, driving control surfaces, suspension of instrumentarium, robotic soft manipulators and grippers, active loads, smart skins for vehicles and devices[4], etc. Recently there have been discussions about possibility to construct EAP based docking systems, shock-free deployment systems. The laboratory works in close collaboration with local UAV[5] producer company Eli Military Solutions. UAVs can carry scientific and measurement equipment to perform activities necessary for the TORC activities. The research centre aims to present a high level academic structure with more research conducted towards technological problems. **During this project we hope to find new partners among European SME-s and encourage local SME-s participate in EU FP7 projects. But also add advanced technological support for TORC activities in remote sensing, miniaturised sensing systems and wireless network technology.**

In conclusion, TORC's advanced technologies research group focuses on developing new technologies and exploiting innovative materials and methods which permit building devices, different and in many ways superior to conventional machines/instruments and possibly useable for space applications. Such research fits well into the **FP7 activity** ***9.2. Strengthening the foundations of Space science and technology***. The **area** ***9.2.1: Research to support space science and exploration*** is supporting upstream research aimed at improving the capability to access planets surfaces, to move, to select and collect and finally return samples to Earth. Research on EAP and UAV can lead to advanced solutions for fulfilling latter objectives.

[1] (1) Noorma, M, P. Kärhä, A. Lamminpää, S. Nevas, and E. Ikonen (2005). "Characterization of GaAsP trap detector for radiometric measurements in ultraviolet wavelength range," *Rev. Sci. Instrum*. 76, 033110, (2)Lamminpää, A. M. Noorma, T. Hyyppä, F. Manoocheri, P. Kärhä, and E. Ikonen (2006) "Characterization of Germanium Detectors for Applications of Spectral Irradiance Measurements," *Meas. Sci. and Technol*. 17, 908-912

[2] Veismann, U. (1995). "Calibration of the radiometers for remote sensing of the Earth's atmophere from space", *Metrologia*, 32, 671-674

[3] Punning, Andres, Anton, Mart, Kruusmaa, Maarja, Aabloo, Alvo (2005). An Engineering Approach to Reduced Power Consumption of IPMC (Ion-Polymer Metal Composite) Actuators. In: Proceedings: 12th International Conference on Advanced Robotics (ICAR2005); Seattle, USA; 18.-20.07.2005. New York: IEEE, 2005, 856 - 863

[4] Punning, A., Kruusmaa, M., Aabloo, A. (2007). Surface resistance experiments with IPMC sensors and actuators. Sensors and Actuators A: Physical, 133(1), 200 - 209

[5] http://www.eli.ee

1.4 Contribution to the co-ordination of high quality research

Indicate how the area addressed by your project will benefit from the co-ordination (including networking) that you propose.

Competence and skills of **Tartu Observatory** and its collaborators from Tartu University Institute of Technology and Institute of Physics allow contribution to the European R&D efforts in the following areas:

1) understanding global climate change by investigation of atmospheric composition - atmospheric particulate matter and ozone; assuring the continuity of solar radiation records for more than half of a century;
2) developing methods for remote sensing of land and water both on the bases of radiative transfer theory and practical measurements using satellite, air and ship opportunities in conjunction with in situ data;
3) Developing electroactive polymers (EAP) for space applications. Possible applications of EAP materials are flapping actuators, solar sails deployment, deployable antennas, driving control surfaces, suspension of instrumentarium, robotic soft manipulators and grippers, active loads, smart skins for vehicles and devices.

The harmonized and coordinated efforts of the research group of TORC in space research and technology allows for more efficient use of complex instrumentation, the sharing of high level optical and technological laboratories for research and training and increases the mobilization of knowledge between different scientific topics. **All research institutes have world level know-how and experience in cooperation with top scientists of their fields.** Pooling of such knowledge allows creation of synergies and stronger base for continuing world level research inline with EU priorities. Yet existing infrastructure and competences in the fields of radiative transfer, atmospheric physics, astrophysics in conjunction with experimental accuracy and traceability, technological development on the borderline of material science, robotics, chemistry, computer science and electronics are insufficient for advancing Estonian space and environment related research as fast as renewed Lisbon strategy, EU Commission and ESA goals require. Existing constraints can be overcome by actions formalised in current project.

Through collaborations with TUIT new technological methods for practical application and solutions could be invented. Also TUIT will have additional outreach of its research in the field of novel actuators and their applications in enhancement of technical capability for airborne measurements. Optical laboratory will provide the possibility for technical measurement support and will make it possible to standardize and harmonize data on local and international level.

Besides research topics specific for each theme, there are common problems in measurements of spectral optical radiation with high accuracy in astronomy, atmospheric physics and optical remote sensing. The studies of Earth atmosphere gives links and knowledge for theories of stellar atmosphere, including the Sun. Studies about processes in stars, particularly the Sun, has direct influence to the environment of the Earth and about the Global Change as well. We share expertise in management, processing and systematization of large scale ground and space based spectroscopic and photometric databases and mathematical methods for developing algorithms. Specialty in measuring weak optical signature is equally important for astronomical measurements and quality can be assured only by high quality calibrations performed in optical laboratory. Integration of aerosol research and remote sensing of Earth surface gives desirable combinations needed for atmospheric correction processes in regions where atmospheric properties varies greatly – coastal zones.

Integrating activities of Tartu Observatory, Tartu University Institute of Technology and Institute of Physics under TORC allows efficient use of complex instrumentation, share high level optical and technological laboratories for research and training, increases exchange of knowledge between different scientific topics. The background of the academic staff in the fields of radioactive transfer, atmospheric physics, astrophysics in conjunction with experimental accuracy and traceability, technological development on the borderline of material science, robotics, chemistry, computer science and electronics permits research activities which support EU and ESA space and environmental actions. Integration of use in maximum extent possible, existing capacities, both on national and European level, share common service and avoid duplications in local level.

Integrated international training encourages and attracts students starting their studies and research in the demanding field of space science and technology which requires knowledge in several fields of science, especially in physics and mathematics.

Extension of the competence of the research staff in cutting edge fields improves awareness on European Space policy and applications in local scales. It also provides multidisciplinary consultancies and public services to SME and therefore opportunities for developing/providing GMES services.

Contribution of proposed coordination to the scientific topics addressed by the project:

1. Estonian study sites/measurement systems for atmospheric aerosol can serve as reference point on the eastern border of EU on the coast of the Baltic Sea. The sites/measurement systems are well located to determine the effects of air and water pollution from eastern regions, outside the EU.
2. Models developed at TO were originally targeted at (sub) boreal forests but they can be applied, due to their physically-based nature, to other vegetation types on global scale. As a result global models for vegetation parameters are improved.
3. Combination of aerosol experimental and theoretical studies with remote sensing methods will help to improve atmospheric correction which is now the main restricting factor for effective application of remote sensing method for optically complex Baltic Sea waters.
4. With the fast advance and miniaturization of measurement technology it will be possible to satisfy the validation requirements of physically-based models imposed by the advancing remote sensing technology for example in determining the nadir and/or hemispherical spectral reflectance, complete spectral and angular signatures.
5. Provides possibilities for validation and calibration satellite, air borne and ship-based remote sensing data with experience in modelling radiation transfer through atmosphere, water and vegetation in combination for better understanding of global processes in atmosphere, land cover changes in remote regions and wetlands but also large inland waterbodies, which are difficult to sample by common sampling strategies.
6. Adds additional competence in high performance computing, low-noise detector technology used remote sensing but also in multi-wavelength astronomical observations and as test for theoretical astrophysics.
7. Improves local users access to substantial volume of Earth Observation data and opens long –lasting time series of incident solar radiation measured by Tartu Observatory and Estonian Hydro-Meteorological Institute for analyzes in conjunction of other similar series and in respect of the theory and observation of Solar processes.

TORC's researchers aim to take a leading role in the above mentioned areas, complementing thus European R&D efforts with specific know-how and experience.

Through the promotional, educational and dissemination activities of this project, Estonian industry, especially the SMEs, will have an opportunity to benefit from the know-how and cooperation partnerships of TORC. As a result, Estonian enterprises will be more competitive and able to more actively participate in European space projects.

Current project foresees high level networking activities targeted towards a wider utilization of the scientific competence of TORC at European level. Twinning workgroups will be formalised with the following European research centres:

- Stockholm University, Sweden (Dr. S. Kratzer)
- Helsiniki University, Finland (Prof. Kulmala)
- Tuorla Observatory, Finland (Dr. Heinamäki and Dr. Nurmi)
- Helsinki University of Technology, Finland (Prof. Ikonen)

Knowledge transfer and further cooperation to formulate joint R&D projects is further conducted through long term cooperation agreements with the following research centres:

- Institute of Geophysics, Polish Academy of Sciences
- Institute of Meteorology and Climatology, University of Hannover, Germany
- Finnish Meteorological Institute, Finland
- ING and Instituto de Astrofisica de Canarias, Tenerife, Spain
- Observatoire de Paris-Meudon, France
- Astronomical Institute, Utrecht University, Netherlands
- Finnish Environmental Institute, Finland
- EC Joint Research Centre (JRC)
- Physikalisch-Technishe Bundesanstalt (PTB), Germany
- Johannes Gutenberg-Universität Mainz, Germany
- GKSS, Germany

Two research networks will be established (1) Tuorla Observatory (Finland) preparations for the ESA space mission Planck and (2) Observatoire de Paris-Meudon, France for the ESA space mission Gaia.

The current project aims to pool together Estonian competence in space related research activities making Estonia a more attractive partner for large international cooperation projects and solid contributor to ESA objectives.

The project will facilitate active participation of TORC staff, co-workers and PhD students in the following international scientific networks:

- Nordic Network 'Physically-based remote sensing of forests'
- Nordic Network "Aquatic remote sensing – from research toward operational services'
- AERONET-OC network
- EUSAAR network
- COST action on Coordination of spectral UV measurements in Europe
- Planck and Gaia (2011-2020) missions
- Nordic Ozone Group
- The EC-ESA joint GMES initiative

Detailed research activities, their correspondence to EU Framework Programme and the added value to specific science fields are presented in point **1.2 Overview of TORC scientific competences and their correspondence to EU priorities** (see pages 8-15).

1.5 Quality and effectiveness of the support mechanisms, and associated work plan

A detailed work plan should be presented, broken down into work packages[1] (WPs) which should follow the logical phases of the implementation of the project, and include consortium management and assessment of progress and results. (Please note that your overall approach to management will be described later, in section 2).

1.5.1 Overall strategy

The overall strategy of the current proposal is through international and local cooperation **(1) establish a wider integration of Estonian space related research competence in Tartu Observatory Research Centre (TORC) with European well established research centres, (2) foster the contribution of Estonian scientists towards the fulfilment of EU Space Policy and ESA objectives, (3) expand the participation of Estonian researchers in international R&D projects and EU priority initiative such as GMES**. Four types of actions are required in order to achieve this goal:

- Establishing sustainable partnerships for joint RTD projects
- improving research potential through knowledge transfer, training and complementary education of staff
- improving research potential by upgrading research equipment
- increasing visibility of Estonia in European space and environmental research community and business related to these topics.

The project is organised into 6 core work-packages (out of total seven WPs), which aim to cover logical steps in reaching the above mentioned project objectives (Figure 3).

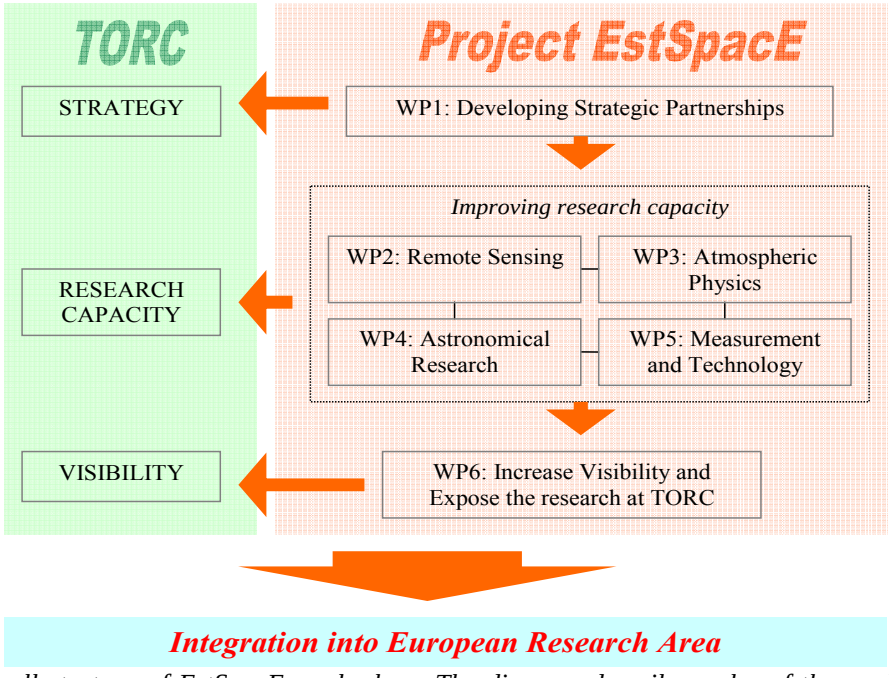

Figure 3. *Overall strategy of EstSpacE work plan. The diagram describes roles of the workpackages for achievement of the project objectives (see section 1.1).*

[1] A work package is a major sub-division of the proposed project with a verifiable end-point - normally a deliverable or a milestone in the overall project.

- **Workpackage integration**

WP1 "Developing strategic partnerships" is designed to guide and support the integration of Estonian space research into European Research Area. WP1 will establish an Advisory Council, which will be the source of expertise knowledge for accelerating the integration and will support strengthening contacts for conducting knowledge transfer initiatives, study and consultancy visits to EU research centres.

Integration into scientific networks allows also to invite researches from EU research centres with complementary competence to the scientific areas of TORC. Yet such networking is not sufficient for increasing integration and visibility of Estonian researchers as current integration is constrained by research capacity.

WP1 will conduct and sustain the necessary capacity building and networking activities. The project has identified key scientific areas (Figure 2), were capacity building and networking will be targeted, specific workpackages (WP2, WP3, WP4, WP5) are structured for each scientific area, according to their internal needs:

- **WP2 "Improving research capacity of staff and equipment in remote sensing"**
- **WP3 "Improving research capacity of staff and equipment in atmospheric physics"**
- **WP4 "Improving research capacity of staff and equipment in astronomical research"**
- **WP5 "Harmonization of measurements and enhancement of technological capability"**

Specific activities within each WP (2-5) focus on the improvement of human resources and upgrading research equipment. For these purposes foreign researchers and experts are invited for longer periods to take part of TORC research activities and facilitate knowledge transfer. Short term visits of Estonian scientists and PhD students are also foreseen to similar European research centres to establish cooperation networks, share and gain new knowledge in the specific scientific fields. Within WP2, WP3 and WP4 research equipment in specified scientific areas will be upgraded to take full benefit of existing human resources, participate in international cooperation projects and on the same time train young scientists and research staff.

A separate workpackage (WP5) is foreseen to support the human and instrumental resources for harmonization of measurements and enhancement of technological capability in key scientific areas, providing thus input for WP2; WP3 and WP4.

Recruiting 12 incoming researchers for 6-24 month in four scientific topics covered in project allows to extend TORC's research in new directions of space research according to GMES initiative, ESA and EU goals. Enlargement of scientific knowledge capacity is supported in the project by acquiring of new and modern research equipment, which contributes significantly both to current and future extended research activities and applications.

Experience and know-how gained by networking and study visits (WP1) and increased research capacity (WP2-5) are sufficient base for starting to increase the visibility of Estonian space research, which will be targeted within WP6 **"Increase visibility and expose research centre at international, European, regional and national level". In WP6, there will be organized** several international conferences, workshops and summer schools, and other public events to disseminate project results and promote space research.

- **Timing of the WPs and components (Gantt chart)**

Activity	M01-06	M07-12	M13-18	M19-24	M25-30	M31-36
WP 1 Development of Strategic Partnerships						
Task 1.1. Establishment of an Advisory Council						
Task 1.2. Development of strategic partnerships through short-term visit						
Task 1.3 Preparation of new project proposals						
• **WP2-WP5 Improving research capacity of staff and equipment in:** • **Remote sensing (WP2)** • **Atmospheric physics (WP3)** • **Astronomical research (WP4)** • **Harmonization of measurements and enhancement of technological capability (WP5)**						
Task 2.5.1. Recruiting researcher with complementary competence						
Task 2.5.2. Acquisition of research equipment						
Task 2.5.3. Capacity building by training and transfer of knowledge						
Task 2.5.4. Open-up the Space Research centre by networking and twinning workgroup						
Task 2.5.5. Promotion activities						
WP6 Increase visibility and expose research centre at international, European, regional and national level						
Activity	M01-06	M07-12	M13-18	M19-24	M25-30	M31-36
Task 6.1 Organizing RTD Workshops						
Task 6.2 Organizing international summer schools for PhD students						
Task 6.3 Organise scientific conference to promote the research centre						
Task 6.4 Promote and develop research centre visibility by active participation in international research and technology conferences and workshops.						
Task 6.5 Dissemination and promotion						
WP7 Management						

1.5.2 Vision of work packages

WP1 Developing strategic partnerships

On the bases of outstanding researchers an Advisory Council (see WP1, Table 1.1) will be established. Members are chosen from different scientific areas and they are excellent in their research topic and experienced in organizing international research initiatives. Advisory Council is crucial in strengthening and expanding existing networks in order to foster integration to European research area and accelerate knowledge transfer in complementary areas. More specifically, Advisory Council develops strategic guidelines for balanced progress of research topics in TORC, helps to organize visits of outstanding experts into TORC, helps in contacting relevant European Research centres, prepare longer visits, prepare multiple new joint research activities and proposals for financing, members of council will participate in supervision of young searchers.

WP2 Improving research capacity of staff and equipment in remote sensing

The present workpackage uses the existing high level academic staff of TORC and previous research contacts as the basis for two networks: one for forest remote sensing and one for coastal and inland water remote sensing. Partnerships founded in WP1 allow organising short time visits of 7 experienced foreign researches to TORC and sending TORC researchers to the European Excellence Centres in Italy, Germany and France. Attention is drawn to building a more experienced scientific environment in the Baltic Sea region (Baltic States, Finland and Sweden) and ensuring the full application of research potential generated and improved during training sessions at both Estonian and European Excellent Centres. Institutes and contact person are listed in Table 2 (Annex I) but also members of Advisory Council (Table 1.1) will be involved.

For extending competence towards cutting-edge research two experienced researchers will start work in TORC and develop new application for forest and water remote sensing especially needed for further GMES core and downstream services. As workgroups about water remote sensing are small in Estonia and Sweden, we plan to create twinning workgroup with Stockholm University to shear expensive field equipment and human resources.

Acquiring, developing and upgrading scientific instrumentation is necessary for fostering incorporation of TORC into existing international research networks. With the help of the project described in this proposal, an important step can be taken to improve the overall quality of TORC's capability for supporting satellite remote sensing with under-atmosphere measurements and its interpretation using physically based radiative transfer models.

WP3 Improving research capacity of staff and equipment in atmospheric physics

Into this WP are integrated researchers from two groups, working with radiation transfer in atmosphere and more specifically particles in atmosphere. Competence in modelling aerosol optical properties is increased by recruiting one researcher for two years, and additionally provide training in European excellent centres for researchers and four doctoral students. Activities in WP3 will update the potential of TORC for ground–based measurements of atmospheric composition and solar radiation, update the data collection, transfer and presentation system. The group is already widely acknowledged in the international atmospheric research community by high-quality expertise in the development and design of DMA spectrometers for aerosol and air cluster measurements. During the project it is expected to find new partners among European SME-s. The integration of aerosol research and remote sensing of Earth surface gives desirable combinations needed for atmospheric correction processes in regions where atmospheric properties varies greatly – coastal zones and inland waters. Better contribution to the European networking EUSAAR and COST actions for Coordination of spectral UV measurements.

WP4 Improving research capacity of staff and equipment in astronomical research

TORC groups of cosmology and group of stellar astrophysics will improve their capacity for ground-based support investigations for ESA space programs and for preparing European space science missions. These activities will ensure optimal scientific exploitation of missions' data and the improvement of the public awareness on European space science activities. With four incoming researchers the competence in the field of acquisition of ground-based calibration data, data processing, and analysis/interpretation of space data will increase.

Two research networks will be established (1) Tuorla Observatory (Finland) preparations for the ESA space mission Planck and (2) Observatoire de Paris-Meudon, France for the ESA space mission Gaia. A new large format CCD camera for reflector telescope at TORC will be purchased and used by researchers from TORC and partners of proposed network.

WP5 Harmonization of measurements and enhancement of technological capability

Joint efforts of TO optical laboratory and TUIT intelligent materials laboratory are directed to complement academic staff of TORC with researchers having background in advanced technology and technology transfer. This WP will support activities to increase research capacity of staff by recruiting four researchers and provide complementary training for research staff and doctoral students. Laboratory equipment will be upgraded and new optical standards will be acquired, which enables better parameterization of Electro-Active Polymer (EAP) actuators, advanced technological support for TORC activities in remote sensing, miniaturising sensing systems and wireless network technology, harmonization of the measurement data with other European institutes and establishment of the measurements traceability to the leading labs in EU via established twinning workgroup.

During this project we hope to find new partners among European SME-s and encourage local SME-s participate in EU FP7 projects for technology transfer.

WP6 Increase visibility and expose research centre at international, European, regional and national level

Actions at national level include promotion and awareness rising of European Space Policy, EU space initiatives and ESA activities. Relevance of these initiatives and activities from the viewpoint of Estonian socio-economic needs is explained through dissemination activities to policy makers, industry, SMEs, and general public including governmental authorities, science teachers and students. Summer schools and research meetings encourage Estonian and international researchers, doctoral students with educational background in math, chemistry, physics, biology and engineering for deeper cooperation with each other and with society.

Within WP6 Estonian space researchers will also take part of several international conferences introducing their scientific achievements, but also increased potential and cooperation possibilities raised from present project. Special webpage will be created, targeted papers in high rank scientific and public journals will be published, TORC posters and leaflets prepared.

A special attention will be made to cooperate with enterprises in industry areas:

- Antennas design and production
- Machined high precision metal components
- Products for wireless communication
- Development environmental monitoring techniques
- Digital maps and positioning
- Spectral analyses systems
- Signal processing and coding
- Electronical appliances design and manufacturing

WP7 Management

This work package is preoccupied with the co-ordination of the activities of the project, monitoring of the reporting activity, including financial supervision, evaluation, and the realisation of the proposed communication activity using all adequate means for these purposes.

The main objectives of the work package are:

- To co-ordinate the project activities using efficient tools of communication and active involvement of project coordinator in the everyday activities of WP leaders, monitor progress and ensure timely release of the deliverables.
- To ensure that the project makes efficient use of its resources and to ensure technically high quality and accuracy in delivering the project results.

The objectives will be achieved by establishing an appropriate organisational structure of management hierarchy, actionable communication lines and mutual commitment.

The Management team will supervise the whole range of activities of the project, guaranteeing timely delivery of the work results, completion to envisaged milestones and intermediating communication to European Commission. They will also be responsible for reporting activities.

Table 1.5 a: Work package list

Work package No[1]	Work package title	Type of activity[2]	Lead partic no.[3]	Lead partic. short name	Person-months[4]	Start month[5]	End month
1	**Developing strategic partnerships**	SUPP	1	TO	8	1	36
2	**Improving research capacity of staff and equipment in remote sensing**	SUPP	1	TO	10	1	36
3	**Improving research capacity of staff and equipment in atmospheric physics**	SUPP	1	TO	10	1	36
4	**Improving research capacity of staff and equipment in astronomical research**	SUPP	1	TO	10	1	36
5	**Harmonization of measurements and enhancement of technical capability**	SUPP	1	TO	10	1	36
6	**Increase visibility and expose research centre at international, European, regional and national level**	SUPP	1	TO	10	1	36
7	**Management**	MGT	1	TO	18	1	36
	TOTAL				**76**		

1 Workpackage number: WP 1 – WP n.

2 Please indicate one activity per work package:
SUPP = Support activities; TRA = Training; MGT = Management of the consortium.

3 Number of the participant leading the work in this work package.

4 The total number of person-months allocated to each work package.

5 Measured in months from the project start date (month 1).

Table 1.5 b: Deliverables List

Del. no.[1]	Deliverable name	WP no.	Nature[2]	Dissemi-nation level[3]	Delivery date[4] (proj. month)
D.1.1	Annual report on the suggestions of the Council on the Research Strategy of TORC,	1	R	PU	12;24;36
D.1.2	Reports on networking visits including suggestions on the development of existing or emerging research potential in Estonia.	1	R	PU	12;24;36
D.1.3	Two proposals for the FP7 Space or Environment Work Programmes project	1	R	RE	24;36
D.2.1	Annual report on the activities of incoming researchers.	2	R	PU	12;24;36
D.2.2	Report on purchased equipment.	2	R	PU	12
D.2.3	Annual report on capacity building by training and transfer of knowledge.	2	R	PU	12;24;36
D.2.4	Annual report on participation in international networks.	2	R	PU	12;24;36
D.2.5	Report on promotional activities	2	R	PU	12;24;36
D.3.1	Annual report on the activities of incoming researchers.	3	R	PU	12;24;36
D.3.2	Report on purchased equipment.	3	R	PU	12
D.3.3	Annual report on capacity building by training and transfer of knowledge.	3	R	PU	12;24;36
D.3.4	Annual report on participation in international networks.	3	R	PU	12;24;36
D.3.5	Report on promotional activities	3	R	PU	12;24;36

[1] Deliverable numbers in order of delivery dates. Please use the numbering convention <WP number>.<number of deliverable within that WP>. For example, deliverable 4.2 would be the second deliverable from work package 4.

[2] Please indicate the nature of the deliverable using one of the following codes:
R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

[3] Please indicate the dissemination level using one of the following codes:
PU = Public
PP = Restricted to other programme participants (including the Commission Services).
RE = Restricted to a group specified by the consortium (including the Commission Services).
CO = Confidential, only for members of the consortium (including the Commission Services).

[4] Measured in months from the project start date (month 1).

D.4.1	Annual report on the activities of incoming researchers.	4	R	PU	12;24;36
D.4.2	Report on purchased equipment.	4	R	PU	12
D.4.3	Annual report on capacity building by training and transfer of knowledge.	4	R	PU	12;24;36
D.4.4	Annual report on participation in international networks.	4	R	PU	12;24;36
D.4.5	Report on promotional activities	4	R	PU	12;24;36
D.5.1	Annual report on the activities of incoming researchers.	5	R	PU	12;24;36
D.5.2	Report on purchased equipment.	5	R	PU	12
D.5.3	Annual report on capacity building by training and transfer of knowledge.	5	R	PU	12;24;36
D.5.4	Annual report on participation in international networks.	5	R	PU	12;24;36
D.5.5	Report on promotional activities	5	R	PU	12;24;36
D.6.1	Report on summer schools together with student presentations.	6	R	PU	12;24;36
D.6.2	Annual report on research and training workshops	6	R	PU	12;24;30
D.6.3	Conference report	6	R	PU	36
D.6.4	Report on industry and enterprise targeted information events	6	R	PU	36
D.7.1	D7.1. Project meetings (incl minutes): Month	7	R	PU	12;24;36
D.7.2	Periodic Progress Reports and final report;	7	R	PU	6; 12; 18; 24; 30;36
D.7.3	Project public website	7	R	PU	3

Table 1.5.c: Work package description

Work package No.	1	**Start date or starting event:**				Month 1	
Work package title	Development of Strategic Partnerships						
Activity type	SUPP						
Participant No.	1						
Participant short name	TO						
Person-months per participant	8						

Objectives
The objective of the current workpackage is to establish sustainable cooperation networks between Tartu Observatory and the leading research institutions in the other Member States with clear focus on strengthening the capacity of TORC in space research.

Description of work (tasks, role of participant)
The objectives of the WP 1 will be achieved through the following activities:

- establishment of an Advisory Council;
- development of the strategic partnerships through short-term visits of experienced research leaders from the other Member States;
- preparation of two R&D project proposals under the Seventh Framework Programme (FP7) or to the other funding schemes.

The activities are broken down into three tasks.

Task 1.1. *Establishment of an Advisory Council for the harmonisation of the research objectives within the networks.*

On the bases of visiting research leaders (Task 1.2) as well as existing international contacts, an Advisory Council will be formed (Table 1.1). The Council will advise TORC on harmonisation of the strategic collaboration by means of partners and topics most relevant for better integration into the European Research Area. The Council will hold regular web-meetings and extended annual meetings to discuss the need to adjust collaboration schemes of the scientific topics and/or decide over the excellence needed to better participate on the European, regional and national level. It is planned to have 15 short visits for Advisory Council members into TORC. The scientists have been pre-selected for the invitation and have preliminarily confirmed their acceptance.

Table 1.1 Proposed list of participants for the Advisory Council.

NAME	*INSTITUTION*	*COMPETENCE*
Danielle de Staerke	CNES (Centre National d'Etudes Spatiales), Toulouse, France	CNES Scientist. Director of educational and public affairs. Expert on programs related to oceanographic satellites.
Prof. Josh Thomas	Uppsala Advanced Battery Center, Sweden	Leading one of the outstanding research groups in polymer battery area in the world.
Dr. Bernard Pinty	Global Vegetation Monitoring (GVM) Unit Institute for Environment and Sustainability (IES) EC Joint Research Centre (JRC)	Advisor of the STARS (Science and Technology for Applied Remote Sensing) sector. Multiangular& multispectral remote sensing data; coupled surface-atmosphere geophysical system.
Prof. Jürgen Metzdorf	Physikalisch-Technishe Bundesanstalt (PTB), retired	Management of activities on development of national standards for optical radiometry and

		photometry in Germany.
Prof. Marku Kulmala	University of Helsinki, Finland	One of the European leading scientists in atmospheric aerosol research. Topics: aerosol-cloud-climate interactions; Coordinator of numerous European networking activities and research projects.
Prof. Gunther Seckmeyer,	Institute for Meteorology and Climatology, University of Hannover	Expert on studies of radiative transfer and UV radiation.
Dr. Roland Doerffer	GKSS, Inst. For Coastal Research, Dept. Optical Remote Sensing, Germany	Leading algorithms development for MERIS/Envisat (ESA) Case 2 products.
Prof. Esko Valtaoja	University of Turku, Tuorla Observatory, Finland	Expert in large scale structure in Planck missions, Sunyaev-Zeldovich effect emission.
Prof. Ene Ergma	Chairman of the Estonian Space Policy working group; Speaker of the Parliament of Estonia	Leading astronomer, advisor on political aspects of space research.

Task 1.2. *Development of strategic partnerships through short-term visits of experienced research leaders from a number of EU research centres.*

One of the main targets of this project is to increase the visibility and expose our research centre to the European research community. As a result of the proposed activates, TORC can be involved in more research networks and joint research activities, including FP7 projects. 15 networking visits of experienced researchers are planned in this proposal. Details of the visits are described in field-specific work packages, WP2-WP5. The scientists are selected mainly on the bases of their competence in participation and management of EU cooperation and networking projects in the field of research close to the activities of TORC. During the visits, possible joint research activities will be formulated. The experts will help TORC identifying the factors restricting TORC from fully contributing to the fulfilment of the objectives of the European Space and Environmental Policies. The scientists have been pre-selected for the invitation and have preliminarily confirmed their acceptance.

Task 1.3 *Preparation of new project proposals.*

At least two R&D proposals will be submitted by Tartu Observatory to the forthcoming calls of FP7 (Space or Environment themes). Consortiums will be formed in collaboration with the participants of the established networks, described in Task 1.2. The proposals will address one of the common research priorities, defined by the Advisory Council (Task 1.1). During the preparation phase of the proposal, the visiting scientists (within the activities of Task 1.2) will discuss the proposal and contribute to the coordination of joint activities in order to achieve the most efficient solutions.

For new cooperation activities, other sources of financing will also be considered. Through the Advisory Council, wider range of information will be available about the financing opportunities in different Member States. Short-term visits to the prospective partners of research networks will be carried out. The preliminary destinations are described in the corresponding tasks of work packages WP2-WP5. However, it is not possible to completely finalise the list of the visits at this stage of the proposal, as the final selection depends on the new knowledge generated through this project and on the suggestions by the Advisory Council.

Deliverables (brief description and month of delivery)

- D1.1. Annual report on the suggestions of the Council on the Research Strategy of TORC. Month 12;24;

36

- D1.2. Reports on networking visits including suggestions on the development of existing or emerging research potential in Estonia. Month 12;24;35
- D1.3. Two proposals for the FP7 Space or Environment Work Programmes project. Month 3.

Milestones

- M1.1. Advisory Council formally established. Month 2
- M1.2 FP7 proposal ideas formulated. Month 18
- M1.3 1 FP7 proposal prepared. Month 24

Work package No.	2	**Start date or starting event:**				Month 1		
Work package title	Improving research capacity of staff and equipment in remote sensing							
Activity type	SUPP							
Participant No.	1							
Participant short name	TO							
Person-months per participant	10							

Objectives
Increase research capacity of staff and upgrade research equipment in remote sensing group of TORC research centre and to promote the existing competence at international and national conferences and seminars.

Description of work
Improvement of research capacity in remote sensing theory and applications is achieved through four tasks:

Task 2.1. *Recruiting researcher with complementary competence*

One experienced searcher into land-cover remote sensing group will be recruited and one for short time work to complement our water remote sensing methods with extended use of various sources (satellites, airborne). According to results from local collaborating institutions (listed in WP1) and Advisory Council suggestions develop principles for analyses systems and publications.

Table 2.1 Incoming researchers and their competence

NAME	*COMPETENCE*	*EXPECTED IMPACT*	*Duration (month)*
Dr. Miina Rautiainen	Remote sensing of boreal forests (mainly conifer forests), in the studies of leaf and needle amount of forests which limits productivity of forests.	Background in biology complements the experience of optical remote sensing studies at TORC. Relate Remote sensing to biological processes: productivity, carbon cycle, light and nutrients competition.	12
*Dr. Mati Kahru Scripps Institution of Oceanography, University of California, San Diego, USA, (6 month)	Co-authors of the NASA standard chlorophyll algorithm remote sensing software at Wimsoft,	Monitoring algal blooms: New techniques for detecting large-scale environmental change Methods for combination of different data sources into product; Management of large image archives	3

*recruiting nationals having left the country

Task 2.2. *Acquisition of research equipment*

Upgrading TORC's infrastructural base to facilitate the participation of TORC in international research networks and take full benefit of existing human resources. Scientific instrumentation is used as well as base in training doctoral students in accordance to suggestions of strategy-groups. The following equipment will be purchased:

- **An unmanned aerial vehicle (UAV)** (from Eli Military Solutions) is an aircraft with no onboard pilot. UAVs can be remote controlled or fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems, it carries light weight spectrometer capable for multiangular measurements over forest and coastal areas of large lakes and seas.

- **A field spectrometer covering the spectral range from 0.3 to 2.5 µm for ground based spectral**

measurements FieldSpec-FR (350-2500 nm). A field portable high quality spectrometer for visible-shortwave NIR spectral domain for spectral measurements to support radiative transfer and remote sensing studies. Most of Earth observing satellites measure in this spectral region. At present, TO has spectrometers with silicon-based sensors (350-1050 nm). This instrument will be used to support airborne and satellite measurements with ground truth data.

- **Sun radiometer (CIMEL):** The exiting station of Aerosol Robotic Network (AERONET) in TO, will be complemented with new radiometer installed on offshore platform on Baltic Sea eastern coast suitable for the validation of satellite retrievals of aerosol optical properties on coastal region. Its speciality is capability of measuring the radiance emerging from the sea—the 'water-leaving radiance'— with modified sun photometer and therefore provide support for Baltic Operational Oceanographic System (BOOS) where Estonia is member, in cooperation with Swedish and Finnish members also to EuroGOOS.

- Purchase **software package Hydrolight (Sequoia Scientific, Inc),** which is commonly used by high level water remote sensing groups elsewhere, but still not available in Estonian and Swedish groups. This is radiative transfer numerical model computes radiance distributions and related quantities (irradiances, reflectance, diffuse attenuation functions, etc.) in the water will be used in conjunction with of atmospheric code and in situ measurements above water (AERONET-OC) as well as independent measurements in field. It can serve as data analysis tool system design tool, predictive tool and teaching tool as well for research staff and doctoral students.

Task 2.3. *Capacity building by training and transfer of knowledge*
Incoming researchers will regularly participate on the seminars together with staff for mutual exchange of knowledge. They will participate as lecturers on workshop named in WP6 (Task 6.1 event, 1 and 5).

- Organising research staff visits to the neighbouring space research centres to teach (Dr. Kuusk, Dr. Nilson). Complementary training and sharing of expertise at specific research topics for strengthening collaborations for 2 researchers leading scientific projects in TORC (Table 1, Annex I)).
- Short visits of high experienced researchers to TORC (Table 2 Annex I) for providing lessons, training courses and seminars, visits will be organised according to timing of events in WP 6 (task 6.2, 1 and Task 6.3) so that participation in summer school, conferences and meetings is possible. During visits planning for new FP 7 applications
- Sending out 3 doctoral students for training.

Host organizations and the expected impact from the visit is outlined in Table 1 in Annex I

Task 2.4. *Open-up the Space Research centre by networking and twinning workgroup*
Short time visits for preparations of networks are included into WP1:

- Preparations for next application Nordic Network 'Physically-based remote sensing of forests' (Dr. T. Nilson)
- Preparations of Nordic network "Aquatic remote sensing – from research toward operational services (PI A. Reinart and S. Kratzer)
- Incorporation into AERONET-OC network (PI Dr. Zibordi).
- Develop twinning workgroup with Stockholm University (Dr. S. Kratzer) for efficient use of existing instruments and man power. Such an activity would also serve as good example for partnership at a European level.

List of the person/workgroups with whom collaboration will be strengthened and elaborated on the bases of short visits, and networking in remote sensing topics is presented in Table 2 in Annex I

Task 2.5. ***Promotion activities***

- Promoting and exposing research centre at scientific conferences (WP6, Task 6.4, 1,2,4-8).
- Promoting results of research and development activities by active participation at high-level scientific

conferences by our researches and visitors (WP6, Task 6.4, Rows 1,2,4-8).
- Presentation of research centre and scientific know-how by visitors during visits (Task 2.3, 2.4).

Deliverables (brief description and month of delivery)

D.2.1 Annual report on the activities of incoming researchers. The report will reflect an overview of their work in TORC and the measurable results of their research and training activities. Month 12;24;35
D.2.2 Report on purchased equipment. Month 12
D.2.3 Annual report on capacity building by training and transfer of knowledge. Month 12;24;35
D.2.4 Annual report on participation in international networks. Month 12;24;35
D.2.5 Report on promotional activities. Month 12;24;35

Milestones

M.2.1 Public procurements finished and pre-contracts signed for purchasing equipment, Month 6
M.2.2 Cooperation agreements signed with incoming researchers for the first year. Month 4
M.2.3 Cooperation agreements signed with incoming researchers for the second year. Month 14
M.2.4 Cooperation agreements signed with incoming researchers for the third year. Month 26
M.2.5 Contract on twinning workgroup between Stockholm University and TORC. Month 3
M.2.6 Proposal for Nordic Network 'Physically-based remote sensing of forests' (Dr. T. Nilson). Month 10
M.2.7 Incorporation into AERONET-OC network. Month 24

Work package No.	3	**Start date or starting event:**	Month 1
Work package title	Improving research capacity of staff and equipment in atmospheric research		
Activity type	SUPP		
Participant No.	1		
Participant short name	TO		
Person-months per participant	10		

Objectives
Increase research capacity of staff and modernize research equipment in atmospheric research group

Description of work

Task 3.1. *Recruiting of researchers with complementary competence*

The objective is to enhance the competence in radiation transfer and aerosol modelling; update the potential of TORC for ground–based measurements of atmospheric composition and solar radiation, update the data collection, data transfer and data presentation system, provide users and network partners with the reliable online measurement data.

The incoming researcher will specify the measurement, data acquisition and quality assurance system, discuss and agree the structure with the TORC researchers, create and lead the development team, provide training courses for students in visual programming and computer-controlled measurements, communicate with the international network partners for harmonising the measurements, participate in atmospheric research and remote sensing. The incoming visitor will take advantage of the expertise existing in the TORC on extension of the size range of the aerosol and cluster ion electric mobility spectrometers. Inter-calibration of instruments, joint atmospheric measurements and justification of data acquisition procedures are foreseen.

Table 3.1. Incoming researcher for 16 months

NAME	COMPETENCE	*EXPECTED IMPACT*
* Aivo Reinart Engineer in high tech laser company Radiant Dyes, Germany. Defense of PhD Sept, 2007,	Modelling of radiation transfer and aerosol optical properties, excellent knowledge on electronics, all levels of programming and newest process control technologies.	High experimental and academic skill, will add competence in modelling, measurements and data acquisition.

*recruiting nationals having left the country

Task 3.2. *Acquisition of research equipment*

The objective is to introduce in TORC the spectral UV radiation measurements, and extend the measurement range of aerosol particles below 3 nm, for creation a link between aerosol and solar radiation measurements to perform the cutting edge research on new particle formation and aerosol impact in UV spectral region. Provide and prepare facilities for permanent measurements of aerosol and cluster ion size distributions, provide resources for calibration and inter-calibration of the aerosol and radiation spectrometers.

The following instruments will be purchased:

- *Brewer spectrophotometer* - The Automated Brewer Ozone Spectrophotometer (collectively referred to as the "Brewer") is a widely recognized instrument for surface UV radiation measurements. It is installed at the ground-level UV-radiation and atmospheric total ozone network in over 40 countries, unfortunately not in Estonia. Absence of the instrument prohibits participation in the UV research projects. At present time the major interest of using the Brewer's is related to the research of spectral

UV radiation and aerosol optical properties. It will update the collaboration and research potential of TORC in the above mentioned areas. The Brewer spectrometer allows reliable measurement of UV irradiance between 290-305 nm which is crucial from the point of view of health effects as well as those to the artificial materials and cultivated plants.

- *Ambient Particulate Monitor* - TEOM Series 1400a (USA firma Rupprecht & Patashnick). The instrument will enable the aerosol measurements with an independent method, complementing the optical and electrical spectrometers, currently available in TO. The instrument will improve the quality assurance of aerosol data, and closure experiments for investigation of aerosol microphysical, chemical and radiative properties which are required for linking of regional and global air quality models and improvement of remote sensing algorithms. The measurements with the TEOM will provide a research-based knowledge, required for introduction in Estonia of the targeted EU particulate matter standards (PM2.5). Purchasing of the Brewer spectrometer and TEOM will be required also for realization of the full potential of the incoming researchers.

Task 3.3. *Capacity building by training and transfer of knowledge*

The objective is to improve training of the TORC staff and doctoral students in the complex field of atmospheric research, and transfer the expertise available in TORC to the European researchers through exchange visits, joint activities and conference presentations. The activities will comprise of:

- Sending 4 doctoral students to European research institutions
- Organising exchange and research staff visits to the neighbouring space research centres to learn about new methods and techniques.
- Organizing visits of high level researchers to TORC for providing lessons, training courses and seminars
  - A lecture and training course will be offered by a leading European scientist on atmospheric UV radiation Prof. J. Krzyscin (Geophysical Institute of Polish Academy of Sciences) on application of advanced statistical methods in atmospheric research
- Organising workshops and seminars.
  - The workshops to be organised are listed in WP6 as 6.1.3 and 6.1.4.
    The timing of short time visits of European researchers to TORC will be adjusted to the timing of organised workshops, training events and conferences.
- Participation in the conferences, network meetings, calibration and joint research activities
- Creating twinning workgroup with Prof. Kulmala group in Helsiniki University

Visits to European research centres will enhance the knowledge and skills of doctoral students on broad variety of methods for Earth systems research. The students will participate in measurement campaigns, and offer the aerosol and air ion measurement data to hosting partners. The visits will prepare students for future collaboration in European aerosol research networks.

List of organisations were the training visits will be conducted and with whom collaboration will be strengthened and elaborated on the bases of short visits, two-way exchange and/or networking **in atmospheric research topics** is presented in Table 3 in Annex I

Task 3.4. *participation in international networks*
The objective is to contribute and take advantage of the European networking

- Apply for association to the EUSAAR network
- Participate in the EUSAAR networking activities:

i) Standardisation of measurement protocols, intercomparisons and quality assurance for measurements of physical properties of aerosols; Standardisation of data protocols
ii) Harmonization and validation of current measurements of particle optical, physical and chemical properties
iii) Extending the aerosol measurement range below 3 nm

- Participate in the forthcoming COST action on Coordination of spectral UV measurements in Europe, directed to the establishment and adoption of common QC/QA procedures and also to

study of the possibilities for wider use of the simple and cheap diode array/CCD spectrometers.
- Maintain the AERONET measurements in TORC for providing data on aerosol optical characteristics. Exploit the AERONET public domain facilities for research.

Task 3.5. *Dissemination and promotion activities*
- workshops 6.1.3, 6.1.4,
- research conference 6.3.1,
- presentations in network meetings, presentation in scientific conferences, e.g. 6.4.10, 6.4.11
- workshop and consultation meetings for the national authorities and experts

Deliverables (brief description and month of delivery)

D.3.1 Annual report on the activities of incoming researchers. The report will reflect an overview of their work in TORC and the measurable results of their research and training activities. Month 12;24;35
D.3.2 Report on purchased equipment. Month 12
D.3.3 Annual report on capacity building by training and transfer of knowledge. Month 12;24;35
D.3.4 Annual report on participation in international networks. Month 12;24;35
D.3.5 Report on promotional activities. Month 12;24;35

Milestones

M.3.1 Public procurements finished and pre-contracts signed for purchasing equipment, Month 6
M.3.2 Cooperation agreements signed with incoming researchers for the first year. Month 4
M.3.3 Cooperation agreements signed with incoming researchers for the second year. Month 14
M.3.4 Cooperation agreements signed with incoming researchers for the third year. Month 26
M.3.5 Workshop for local air quality and environmental health authorities. Month 18

Work package No.	4	**Start date or starting event:**				Month 1	
Work package title	Improving research capacity of staff and equipment in astronomical research						
Activity type	SUPP						
Participant No.	1						
Participant short name	TO						
Person-months per participant	10						

Objectives
Increase research capacity of staff and modernize research equipment in astronomical research group

Description of work
The objectives of the WP4 will be achieved through four main tasks, additionally project results will be promoted on scientific meetings and seminars, but also on special activities for public in large.

Task 4.1. *Recruiting researchers with complementary competence*

Table 4.1. Incoming researchers for longer period - additional competence and sustainability of research and technology development in **astronomical research.**

NAME	COMPETENCE	ADDED BENEFIT	Duration (month)
*Dr. Gert Hütsi Post-doc in University College London, UK,	Outstanding specialist in Cosmic Background Radiation.	Cosmic Background Radiation will be explored by the Planck satellite	12
*Taavi Tuvikene Defence of PhD 2008, Vrije Universiteit Brussels, Belgium	Specialist in photometry of stellar objects	Pre-launch and follow-up photometry of stellar objects to be studied with the Gaia satellite	12

*recruiting nationals having left the country

Task 4.2. *Acquisition of research equipment*

- *Upgrading TORC's infrastructural base to facilitate the creation of and participation in research networks.* Acquiring, developing and upgrading the scientific instrumentation base necessary to train doctoral students in accordance to suggestions of strategy-groups.

New large format CCD camera (Andor, iKon-L, DW436-BV) for ground-based (support) photometry of Gaia targets: High quality photometric data for selected classes of Gaia objects (mostly emission line stars) should be collected before the launch of the mission as well as during its functioning in the orbit, in order to provide solid reference for classification purposes. The camera will be used together with the 60 cm reflector telescope at TO. The presently existing CCD camera with small number of pixels (1024 x 1024) and with rather primitive thermoelectric cooling system is not able to support this task. The observational data collected by the new camera would be used both by researchers from TORC and by visitors in the framework of the present project.

Task 4.3. *Capacity building by training and transfer of knowledge*

- Research staff visits are organized to the neighbouring space research centres to learn about new methods and techniques. Two visits (cosmology group) are planned to Tuorla Observatory, University of Turku, Finland (5 months in sum), and two visits (stellar astrophysics group) to Observatoire de Paris-Meudon, France (5 months in sum). The contact persons and expected impact are described in Table 4 Annex I.
- Visits of high level researchers to TORC will be organized for providing lessons, training courses

and seminars, the timing will be set according to events in WP 6 so that people could participate at conferences and meetings. One workshop (Task 6.1.) and one summer school (Task 6.2.) will be organised in this research topic.
- Short time visits for collaboration are included in WP1, the partners listed at Task 1.2.
- Active participation in preparation of specific summer school (WP6, Task 6.1 event 3), and conference (WP6, Task 6.3)

List of contact persons for collaboration in cosmology and stellar astrophysics is presented in Table 4 in Annex I

Task 4.4. *Open-up the Space Research centre by networking and twinning workgroups*

International networking partners are listed in Table 4 Annex I. The collaboration about Planck mission will result in the formation of the twinning workgroup with Tuorla Observatory, University of Turku, Finland. This will include the organization of two Tartu-Tuorla workshops (participants also from other workgroups) on the data reduction problems.

Task 4.5. *Dissemination and promotion*
At TO, the NGO "Stellaarium" (founded in 1997) promotes the education of schoolchildren and grown-up people in the field of astronomy and remote sensing. We plan to disseminate the results and experiences obtained during the present project using the activities of "Stellaarium".

Deliverables (brief description and month of delivery)

D.4.1 Annual report on the activities of incoming researchers. The report will reflect an overview of their work in TORC and the measurable results of their research and training activities. Month 12;24;35
D.4.2 Report on purchased equipment. Month 12
D.4.3 Annual report on capacity building by training and transfer of knowledge. Month 12;24;35
D.4.4 Annual report on participation in international networks. Month 12;24;35
D.4.5 Report on promotional activities. Month 12;24;35

Milestones

M.4.1 Public procurements finished and pre-contracts signed for purchasing equipment, Month 6
M.4.2 Cooperation agreements signed with incoming researchers for the first year. Month 4
M.4.3 Cooperation agreements signed with incoming researchers for the second year. Month 14
M.4.4 Cooperation agreements signed with incoming researchers for the third year. Month 26
M.4.5. The network with France, and Spain established. Month 8
M.4.6. The twinning workgroup with Tuorla Observatory established. Month 12

Work package No.	5	**Start date or starting event:**				Month 1	
Work package title	Harmonization of measurements and enhancement of technological capability.						
Activity type	SUPP						
Participant No.	1						
Participant short name	TO						
Person-months per participant	10						

Objectives

Increase research capacity of staff and upgrade laboratory equipment. Harmonization of the radiometric and photometric measurements in Remote Sensing (WP2), Atmospheric Physics (WP3), and Astronomical Research (WP4) within EU through established traceability of calibration of the radiometric standards to the European scales.

Description of work

The objectives of the WP 5 will be achieved through:

- complementing academic staff of TORC with researchers with background in advanced technology and technology transfer;
- acquisition and upgrade of the laboratory equipment and standards, vital for the establishment of the measurements traceability to the leading labs in EU, and for parameterization of Electro-Active Polymer (EAP) actuators;
- provision of complementary training for research staff and doctoral students;
- promotion of cooperation on the European level by building-up networks and twinning workgroups.

These actions are broken down into four tasks.

Task 5.1. *Recruiting researcher with complementary competence*

Recruitment of four researchers (three of them at postdoctoral level) has been planned. Their competences and added benefits to the project are listed in Table 5.1. Preliminary month of arrival from the start of the project and the proposed duration of their visits are given in the last column of the table.

Table 5.1. List of incoming researchers

NAME	*COMPETENCE*	*ADDED BENEFIT*	Duration (month)
*Meelis Mait Sildoja Planned defence of PhD in 2009, Helsinki University of Technology.	Advanced studies of optical metrology and calibration services for industrial applications in Finland.	Modelling of spectral responsivity of UV detectors for applications in solar UV measurements. Experience in participation in EU projects on harmonization of optical measurements.	12
*Anti Liivat Planned PhD defence May 2007 in Uppsala University. Institute of Materials Chemistry, Angström Lab, Prof. Josh Thomas workgroup.	Ion conducting polymer materials and different ion conducting mechanism.	New design and syntheses novel ionic conducting electro-active polymer materials. Active participation in teaching. Contribution in close collaboration with Prof. Josh Thomas workgroup in Uppsala University	1/12

Dr. Daniel Brandell, Currently postdoc in Virgina Tech, US. Originally from Uppsala, Sweden.	Materials chemistry and implementation of new technologies.	High scientific merits and management skills. We offer him outstanding opportunity to realise potential for development our research centre. Development of close collaboration and twinning research and develop projects with Prof. Josh Thomas workgroup in Uppsala University.	4

*a repatriating scientist

Task 5.2. *Acquisition of research equipment*

We plan to purchase following equipment, what currently is not available at our research centre, but highly necessary for centre development

Agilent 3458A Multimeter for high-accuracy photocurrent measurements in calibration of radiometric detectors. The instrument, best for this application, is used for this purpose in most of the National Measurement Institutes in Europe, acquisition of the same instrument is important for the harmonization and comparability of the calibrations.

Parstat 2273 from Princeton Applied Research for experiments requiring potential/current control and recording at a large potential range. These experiments are a part of development of EAP based actuators for equipment of airborne measurements. The potentiostat is the most accurate and the best in the long term stability available in market.

Task 5.3. *Capacity building by training and transfer of knowledge*

Short-term visits of TORC research staff have been planned to European Centres of Excellence. The persons, destinations and added benefits to the project are listed in Table 5 Annex I. Preliminary month of departure from the start of the project and the proposed duration of their visits are given in the last column of the table. Incoming researchers and visiting scientist will make presentations and lessons to train staff of TORC, using new and upgraded instrumentation. They participate actively in preparations of WP6 conferences, summer schools and workshops.

Task 5.4. *Open-up the Space Research centre by networking and twinning workgroups*

Twinning workgroup will be established with Metrology Research Institute, Helsinki University of Technology for establishment of the measurements traceability and research for new solutions for radiometric detectors. Work can be organized on the bases of short visits using existing collaborations.

Additionally new contacts will be established with excellence centres listed in Table 5 of Annex I

Task 5.5. *Dissemination and promotion*
Dissemination and promotion is divided into following activities:

- Promoting and exposing research centre at five scientific conferences (WP6, Task 6.4, Rows 8, 9, 12-14).
- Promoting results of research and development activities by active participation at high-level scientific conferences by our researches and visitors (WP6, Task 6.4, Rows 8, 9, 12-14).
- Presentation of research centre and scientific know-how by visitors during short-term visits (Task 5.3, Table 5 Annex I) to the European Centres of Excellence.

Deliverables (brief description and month of delivery)

D.5.1 Annual report on the activities of incoming researchers. The report will reflect an overview of their work in TORC and the measurable results of their research and training activities. Month 12;24;35
D.5.2 Report on purchased equipment. Month 12
D.5.3 Annual report on capacity building by training and transfer of knowledge. Month 12;24;35
D.5.4 Annual report on participation in international networks. Month 12;24;35
D.5.5 Report on promotional activities. Month 12;24;35

Milestones

M.5.1 Public procurements finished and pre-contracts signed for purchasing equipment. Month 6
M.5.2 Cooperation agreements signed with incoming researchers for the first year. Month 4
M.5.3 Cooperation agreements signed with incoming researchers for the second year. Month 14
M.5.4 Cooperation agreements signed with incoming researchers for the third year. Month 26

Work package No.	6	**Start date or starting event:**				Month 1	
Work package title	Increase visibility and expose research centre at international, European, regional and national level						
Activity type	TRA						
Participant No.	1						
Participant short name	TO						
Person-months per participant	10						

Objectives

Achieve a higher visibility of Estonian space related research competences and activities of the research centre at international, European, regional and national level

Description of work

- Organizing workshops and summer schools trainings for researchers and doctoral students of close-to-space topics to raise the overall interest in space sciences and technology using the competence of local high level academic staff, collaborating high lever research staff and members of Advisory Council.
- Active participation in workshops and informational days, organized by EC and governmental organizations for enhancement policy makers.
- Organising scientific conferences on space research and technology with the participation of international and Estonian enterprises. Publications in international research journals.
- Participation in international conferences and workshops.

Task 6.1 Organizing RTD Workshops

These workshops will introduce and expose our research centre to European and regional scientific community. By inviting leaders of specific research areas as key speakers at these workshops we will strengthen and establish contacts leading to mutual scientific and development research networks, also exposing our research centre as a research and development unit what has specific know-how and scientific excellence in areas complementing and not available in current European RTD community.

1. Workshop “Space technology, remote sensing, including satellite remote sensing: Prospectives and horizons”, about 20 international participants in 6th months from project start. The workshop will bring together international leaders in remote sensing area, including representatives from European space agency and other interested partners. Workshop will put down roadmap and perspectives for remote sensing development, including important perspectives for Estonian research centre.

2. Workshop “Space technology and remote sensing: scientific and technology cutting edge level and possible services for society”; about 20 international participants. The workshop will bring together leading scientists and technology developers to discuss current status of science and technology, but the major focus will be in possible applications and services from current technology. Representatives from related industry and policy makers will be invited. The workshop will take place in 18th month from project start.

3. Nordic Ozone Group Meeting in 25 month with 35-40 participants from Finland, Sweden, Norway, Denmark, Iceland, Poland and Estonia. New results in the ozone and UV research obtained by researches of the listed countries will be presented.

4. International workshop “New particle generation in atmosphere”, in 8th month, 40 – 50 participants, (doctoral students; researchers in atmospheric nucleation, air ions, clusters and ultrafine aerosols). The workshop will discuss the latest results in measurements, instrumentation development, modelling and climate impacts of ultrafine particles. The

workshop will be a sequent step for association to the EUSAAR network which is established during project. A complementary session will organized for the local authorities and experts of public health and air quality monitoring.

5. International training course "Optical properties and types of aerosol used in atmospheric correction of satellite images over waterbodies – measurements and models"; 20 participants from Baltic and Nordic region - introduces latest results derived from AERONET- OC network which station is established during project. 21th month.

6. Meeting of Gaia mission DPAC CU8 members "Ground-based observations of standard/calibration stars and corresponding databases" in 13th month, 20- 30 participants from France , Italy, Germany, Lithuania, Estonia. This meeting will summarize the results of performed so far ground-based observations and give guidelines for the next periods.

Task 6.2 Organizing international summer schools for PhD students

To involve young scientists and PhD students in remote sensing, space technology and astronomical databases, and we will organize specific summer and winter schools. We will call PhD students from European universities, regional universities and local universities. These events will give young scientists broader overview of the research area, training in specific areas, but also possibility to make common short research projects in international teams. The summer schools will be as follows:

1. International summer school "Applications and operational use of remote sensing for monitoring environment and security", 6^{th} month, about 30-40 participants. The event should encourage young researchers and doctoral students in math, physic, biology and chemistry relate their science to space research. Introduce participants to lectures who are from European excellent centres of space research. Complementary session for science teachers: *Using satellite remote sensing products for classroom teaching.*

2. Summer school "*Common base of knowledge in satellite communications: is it needed for business or research?", 18^{th} month*. 30-40 participants including local industry and enterprises, invited lectures from Excellence Centres (*SatNEx).* The summer school should initiate research collaborations with industry in broadcasting, broadband, and mobile satellite communications. Introduce forms of space communication and space exploitation.

3. A regional (Finland, Estonia, Latvia, Lithuania) winter school "*The accessibility and usage of ESA archives and databases for astronomical and remote sensing research*" 10^{th} month, about 30-40 participants. Lectures are invited speakers from collaborating institutes and ESA, CNES, VILSPA. Training for intelligent and comprehensive usage of existing and future space databases to enhance contribution to the space science and exploration.

Task 6.3: Organise scientific conference to promote the research centre

The task is to organize medium scale scientific conference to promote established research centre in scientific regions and for SMEs. The conference in "Advances in Space and Earth monitoring: what does it mean for society?" will expose to European community the outcome of current project, so we plan the event at last project year, month 30. Participants number ~100. The papers will be published in special volume of international research journal.

Task 6.4: Promote and develop research centre visibility by active participation in international research and technology conferences and workshops.

Besides the events we organize, it is constant need to report our success and scientific results among RTD society in Europe. Therefore our co-workers and PhD students will actively participate in international conferences, symposiums and workshops. There are two major objectives to achieve:
1. Promote or know-how and competence as complementary to current European RTD know-how;

2. Create new contacts and collaborations.

Large-scale regular conferences where we plan to participate are listed below, but smaller workshops and meetings can not be listed, as mainly they are not so regular

1. ISPMRS- International Symposium of Physical measurements and signature in remote Sensing (annually)
2. Resent Advances in Quantitative Remote Sensing, RAQRS (2009).
3. International Symposium on Remote Sensing of Environment – regular after each second year (2009)
4. Ocean Optics - regular after each second year (2008)
5. ESA Envisat Symposium – regular after second year (2009)
6. IGARSS- International Geosciences and Remote Sensing Symposium- regular each year
7. Workshops organized in the framework EARSeL Symposium Geoinformation in Europe (annually)
8. Conferences organized by the International Society for optical Engineering (SPIE Europe) according to various topics: Optical Meteorology, Remote Sensing, Optics/Photonics in Security & Defence; (annually)
9. NEWRAD: International Conference on New Developments and Applications in Optical Radiometry -- (regular after three year) (2008)
10. European Aerosol Conference – (annually)
11. European Geosciences Union General Assembly – (annually)
12. EAPAD – Electroactive polymers and actuators, San Diego, (annually)
13. ISPE11 – International Symposium on Polymer Electrolytes, Portugal 2008, 2010
14. 5th, 6th, and 7th World Congress on Biomimetic, Artificial Muscles and Nano-Bio, (annually).
15. IAU (International Astronomical Union) 27th General Assembly, August 2009, Rio de Janeiro, Brazil.

Task 6.5: Dissemination and promotion

Specific activities are planned to disseminate and promote our research centre and know-how at regional and European level in industry and policy makers.

- Two industry and enterprise targeted information days will be organised in Tallinn (10th month) and Riga (31 month) respectively.
- Active participation in workshops and informational days, organized by EC and governmental organizations for enhancement policy makers.
- Creating project website with interactive options for collaborators for joining web meetings and conferences.
- Publishing an Observatory leaflet

Deliverables (brief description and month of delivery)

- D.6.1 Annual report on summer schools together with student presentations. Month 10; 14, 22
- D.6.2 Annual report on research and training workshops. Month 12; 24, 30
- D.6.3 Conference Report. Month 36
- D.6.4 Report on industry and enterprise targeted information events. Month 32

Milestones

- M.6.1 Workshop "Space technology, remote sensing, including satellite remote sensing: Prospectives and horizons". Month 6.
- M.6.2 International summer school "Applications and operational use of remote sensing for monitoring environment and security". Month 6
- M.6.3 International workshop "New particle generation in atmosphere". Month 8
- M.6.4 A regional (Finland, Estonia, Latvia, Lithuania) winter school "*The accessibility and usage of ESA archives and databases for astronomical and remote sensing research*". Month 10

- M.6.5 Industry and enterprise targeted information day in Tallinn. Month 10
- M6.6 Meeting "Ground-based observations of standard/calibration stars and corresponding databases". Month 13
- M.6.7 Workshop on "Space technology and remote sensing: scientific and technology cutting edge level and possible services for society". Month 18.
- M.6.8 Summer school "*Common base of knowledge in satellite communications: is it needed for business or research?"*. Month 18
- M.6.9 International training course "Optical properties and types of aerosol used in atmospheric correction of satellite images over waterbodies – measurements and models". Month 21
- M.6.10 Nordic Ozone Group Meeting. Month 25
- M.6.11 Conference "Advances in Space and Earth monitoring: what does it mean for society?" Month 30
- M.6.12 Industry and enterprise targeted information day in Riga. Month 31

Work package No.	7	**Start date or starting event:**				Month 1	
Work package title	Project management						
Activity type	MGT						
Participant No.	1						
Participant short name	TO						
Person-months per participant	18						

Objectives :

The project management workpackage is responsible for the co-ordination of the project in both administrative and technical terms aiming towards achieving effective operation of the project as well as timely delivery of quality results. Specific management structures and techniques have been devised to support the following objectives:

• Establishment of appropriate project relations with and reporting to the Commission.
• Organisation and running of Project Meetings and achieving common understanding within the project.
• Setting up services for electronic documentation storage.
• Establishment of appropriate review procedures within the project.
• Production of high quality technical documentation.
• Establishment of an efficient system of electronic communication.

Description of work:

- Establishing actionable communication both telematic as well as interpersonal, quality standards, guiding principles for organization of activities within the project and mutual commitment.
- Organisation of a kick-off meeting, intermediary meetings and mid-term assessment of project progress
- General contract administration including consortium agreement
- Financial administration and liaison with the Commission
- Solution of possible conflicts and misunderstandings and overcoming encountered problems throughout the project period
- Production of management reports and integrated cost statements
- Instruction and supervision of WP participants for efficient reporting of the progress of their activities
- Compilation of joint intermediate and final reports
- Coordination of auditing of both general project accounting and financial transactions made at the partners
- Internal Management and project public website
- Developing an action plan for future R&D cooperation project

Deliverables

D7.1. Project meetings (incl minutes). Month 12;24; 36
D7.2. Periodic Progress Reports and final report. Month 6; 12; 18; 24; 30;36
D7.3. Project public website. Month 3

Milestones

M7.1. Successful review meetings. Months 13, 26; 35
M7.2. Successful achievement of project goals. Month 30

Table 1.5 d: Summary of staff effort

A summary of the staff effort is useful for the evaluators. Please indicate in the table the number of person months over the whole duration of the planned work, for each work package, for each participant. Identify the work-package leader for each WP by showing the relevant person-month figure in bold.

Participant no.	Participant short name	WP1	WP2	WP3	WP4	WP5	WP6	WP7	Total person months
1	**TO**	8	10	10	10	10	10	18	76
Total		8	10	10	10	10	10	18	76

Table 1.5 e: List of milestones

Milestones are control points where decisions are needed with regard to the next stage of the project. For example, a milestone may occur when a major result has been achieved, if its successful attainment is required for the next phase of work. Another example would be a point when the consortium must decide which of several technologies to adopt for further development.

Milestone number	Milestone name	Work package(s) involved	Expected date [1]	Means of verification[2]
M1.1	Advisory Council	1	2	Council formally established
M1.2	FP7 proposal ideas formulated	1	18	List of formulated ideas presented to Steering Committee
M1.3	FP7 proposal prepared	1	24	Proposals ready to be submitted to the EC
M2.1	Public procurements finished and pre-contracts signed for purchasing equipment	2	6	Pre-contracts signed
M2.2	Cooperation agreements signed with incoming researchers for the first year	2	4	Cooperation agreements signed
M2.3	Cooperation agreements signed with incoming researchers for the second year	2	14	Cooperation agreements signed
M2.4	Cooperation agreements signed with incoming researchers for the third year	2	26	Cooperation agreements signed
M2.5	Contract on twinning workgroup between Stockholm University and TORC	2	3	Contract signed

[1] Measured in months from the project start date (month 1).

[2] Show how you will confirm that the milestone has been attained. Refer to indicators if appropriate. For example: a laboratory prototype completed and running flawlessly; software released and validated by a user group; field survey complete and data quality validated.

M2.6	Proposal for Nordic Network 'Physically-based remote sensing of forests' (Dr. T. Nilson)	2	10	Proposal submitted
M2.7	Incorporation into AERONET-OC network	2	24	Membership established
M3.1	Public procurements finished and pre-contracts signed for purchasing equipment	3	6	Pre-contracts signed
M3.2	Cooperation agreements signed with incoming researchers for the first year	3	4	Cooperation agreements signed
M3.3	Cooperation agreements signed with incoming researchers for the second year	3	14	Cooperation agreements signed
M3.4	Cooperation agreements signed with incoming researchers for the third year	3	26	Cooperation agreements signed
M3.5	Workshop for local air quality and environmental health authorities	3	18	Workshop organised, report presented
M4.1	Public procurements finished and pre-contracts signed for purchasing equipment	4	4	Pre-contracts signed
M4.2	Cooperation agreements signed with incoming researchers for the first year	4	6	Cooperation agreements signed
M4.3	Cooperation agreements signed with incoming researchers for the second year	4	14	Cooperation agreements signed
M4.4	Cooperation agreements signed with incoming researchers for the third year	4	26	Cooperation agreements signed
M4.5	The twinning workgroup with Tuorla Observatory established	4	12	Working group formulated
M4.6	The network with France, and Spain established	4	8	Network connections established
M5.1	Public procurements finished and pre-contracts signed for purchasing equipment	5	6	Pre-contracts signed
M5.3	Cooperation agreements signed with incoming researchers for the first year	5	4	Cooperation agreements signed
M5.4	Cooperation agreements signed with incoming researchers for the second year	5	14	Cooperation agreements signed
	Cooperation agreements signed with incoming researchers for the third year	5	26	Cooperation agreements signed
M6.1	Workshop on "Space technology, remote sensing, including satellite remote sensing: Prospectives and horizons"	6	6	Workshop organised, report presented
M6.2	International summer school "Applications and operational use of remote sensing for monitoring environment and security"	6	6	Summer school organised, report presented
M6.3	International workshop "New particle generation in atmosphere"	6	8	Workshop organised, report presented
M6.4	A regional (Finland, Estonia, Latvia, Lithuania) winter school "*The accessibility and usage of ESA archives and databases for astronomical and remote sensing research*"	6	10	Winter school organised, report presented
M6.5	Industry and enterprise targeted information day in Tallinn	6	10	Information day organised, report

				presented
M6.6	Meeting "Ground-based observations of standard/calibration stars and corresponding databases"	6	13	Minutes of the meeting presented
M6.7	Workshop on "Space technology and remote sensing: scientific and technology cutting edge level and possible services for society"	6	18	Workshop organised, report presented
M6.8	Summer school "*Common base of knowledge in satellite communications: is it needed for business or research?"*	6	18	Summer school organised, report presented
M6.9	International training course "Optical properties and types of aerosol used in atmospheric correction of satellite images over waterbodies – measurements and models"	6	21	Training course held, report presented
M6.10	Nordic Ozone Group Meeting	6	25	Meeting held, minutes presented
M6.11	The conference in "Advances in Space and Earth monitoring: what does it mean for society?"	6	30	Conference held, minutes presented
M6.12	Industry and enterprise targeted information day in Riga	6	31	Information day held, report presented
M7.1	Successful review meetings	7	13, 26, 35	Review meetings attended
M7.2	Successful achievement of project goals	7	30	Project final report presented

2. Implementation

2.1 Management structure and procedures

Describe the organisational structure and decision-making mechanisms of the project. Show how they are matched to the complexity and scale of the project.

2.1.1. Management structure

The project will be managed by **the Steering Committee**, which involves the representatives of the Scientific Council of Tartu Observatory. Steering Committee gathers physically twice a year, to monitor the progress of the project and assess strategic orientation and value of the directions carried out on the everyday basis. On a daily basis, the Steering Committee will meet in the form of telephone conferences, e-mail communications, and use of intranet. Project Manager is responsible for documenting the meetings.

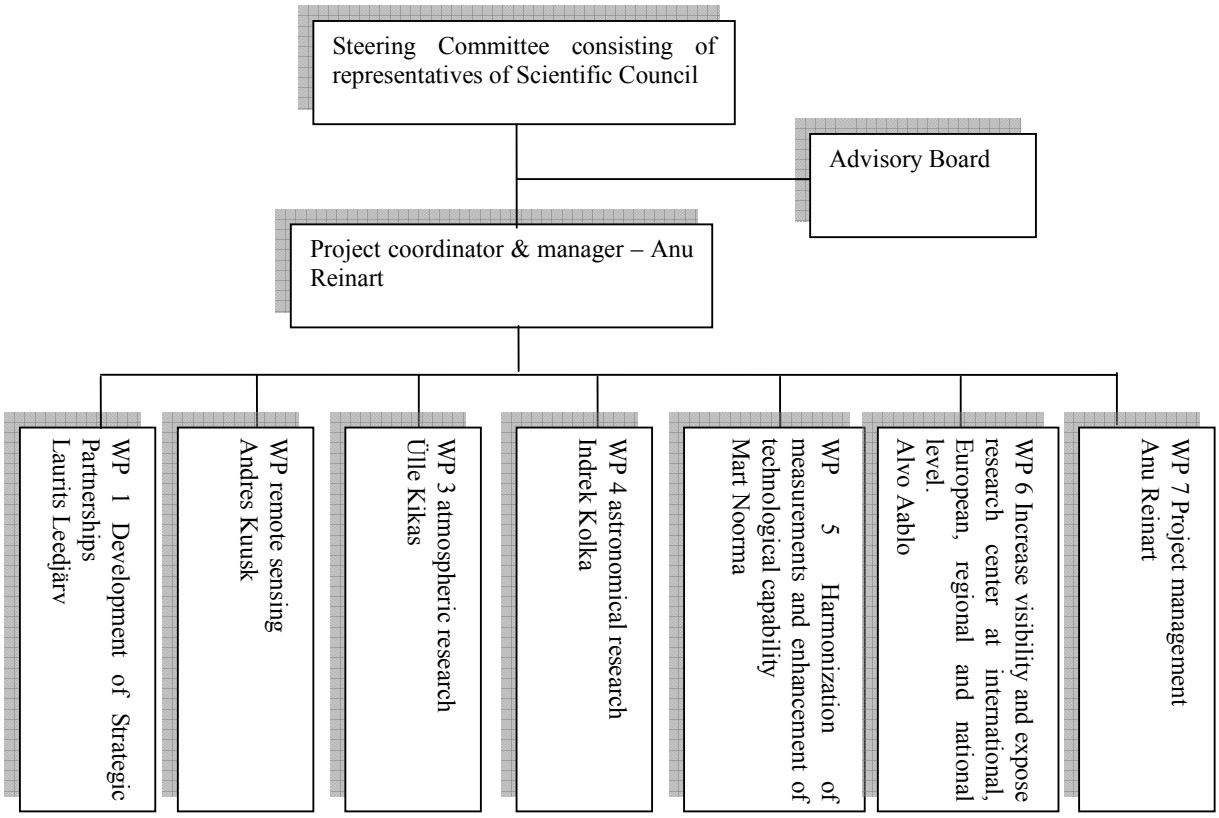

Figure 4. *Management structure of the Centre*

The main responsibilities of the Steering Committee are:

- Adopting strategic decisions on project management, to achieve consensus on project issues. The issues dealt with the Steering Committee cover mostly strategic planning, financial, scientific planning and control matters as well as dissemination aspects.
- Assessment of the performance of the Project Managers and posing recommendations or prescriptions to improve the operative management. Supervision of the objectives to be met.

- Discussing tactical questions if these have important influence on project's success, and assessment of the performance of the work package leaders.

Except for funding, the decisions of the **Steering Committee** are taken with simple majority votes, though the objective is unanimity. All decisions concerning funding (division between tasks or work-packages etc) are taken with 2/3 majority votes. Majority principle is applied in order to maintain flexibility and promptness in adopting the decisions.

Advisory Board will be established to engage the leading researchers and visiting professors into one single group, which will provide input into strategic planning of the Centre's long term activities and maintain daily contact with all the professors and visitors, which will be invited to the Centre. The role of Advisory Board is to assess the long term research directions, which render good potential, and influence the development of competencies within the Centre to follow those global R&D directions. The Advisory Board is meant to serve as a continuing link between local and international leading professors, which is also conductive to the emergence of long-term collaborative R&D projects in the future.

The Project Manager (financial and administrative co-ordinator, Anu Reinart) subordinates and is obliged to report directly to the Steering Committee. The Project Manager is also responsible for communicating with the European Commission. The Project Manager will be responsible for financial and administrative co-ordination of the project including project planning, cost statements, budgetary overviews, progress reports and milestone reports.

The **leaders** of the **work packages** will be responsible for detailed implementation of the work packages. **Work package leaders** perform operative management on the level of their work-package. They are responsible for convening the meetings with Project Manager and respond to Steering Group if latter requires more detailed information. Work package leaders communicate with Project manager on day-to-day basis. By the time of deliverable the Work Package leader has to present the report on the deliverable to Project Manager. After each deliverable and report the cost claims are observed by Manager and assessed their conformity with the foreseen budget. The Project Manager has the responsibility to report the costs of the project to the European Commission.

2.1.2. Quality Assurance and Monitoring of Progress

The project will apply an internal reviewing procedure to guarantee the quality of its results. Each WP leader will be responsible for the quality of the results – especially the deliverables of its WP, which will be presented to Steer Committee. They will be asked to review quality of deliverables and to contribute with additional useful aspects. The activities of the project are interlinked, therefore special attention will be paid on timely delivery of the intermediate results, not compromising on the quality. In order to achieve this, short time buffers are planned for each milestone, to be able to cope with deviations should they occur.

Each partner will report project progress to the Project Manager on a three-monthly basis. This will cover technical progress, results, deliverables and compliance with the work plan. Progress of the task will be reported in terms of percentage of completion and estimated time to completion, deviations from agreed time scales and corrective actions. The Project Manager will summarize overall project progress, updating planning charts and manpower records.

Project Manager will organize preparation and distribution of these reports, as well as brief six-monthly reports, and intermediate and final assessment reports. Every 6 months, Project Manager will prepare a consolidated budget overview of the project status using cost assessment information received from the partners. This will be compared with initial budget planning. **The 6-monthly reports will be communicated to the Project Officer in DG Research responsible for the supervision of the project progress. This will ensure transparency in the implementation of the project.**

2.1.3. Conflict Resolution

In essence, there is relatively low chance for conflicts, as the present project is proposed by single entity with far evolved management structure and decision taking schemes. However, if interpersonal or inter-work-package conflicts will arise, they will be resolved in dialogue, and preferably amicably. If an agreement cannot be reached at a WP level, then the Project coordinator will mediate. If that is not satisfactory, then the Project Steering Committee will take a decision, and if necessary will ask for the authorization of the EC.

Should pertinent conflicts arise, the issues will be discussed in the Steering Board and relevant decisions taken. Decisions on redistribution of budgets, deviations from important milestones etc will require communication with Steering Board and when voted, 2/3 of votes are necessary for decision taking. Other decisions will be taken by simple majority, although unanimous decision will be an objective.

2.1.4. Risk management

Due to the fact that the project is coordinated by a single legal body, not international consortium, the risks associated with the project implementation are accordingly lower. Still, there are some risks (low to medium), which we highlight and address those risks by contingency measures.

The following table provides insight to possible risks associated with the execution of the project and contingency plan for each scenario.

Nature of risk	Level of risk	Contingency plan to address risks
Any of the professors working in TORC will decide to leave the project and TORC	Medium	Each professor in the project will involve a staff of senior researchers into the work-package management and implementation, they will guarantee continuity of activities and communication with international professors.
Due to unforeseen circumstances some of the key people invited to TORC will not be able to fulfil their obligations	medium	For long-time contract then open call will be announced in scientific community, with clear specifications for specialist needed. Advisory Board will support continuous interaction with leading scientists. Commitment letters have been negotiated.
Major deviations from the plan will happen	Low	3-monthly monitoring scheme will be applied, 6-monthly reporting to EC will be foreseen, thus interventional measures can be applied immediately

2.2 Individual participants

For each participant in the proposed project, provide a brief description of the organisation, the main tasks they have been attributed, and the previous experience relevant to those tasks. Provide also a short profile of the staff members who will be undertaking the work.
(Maximum length for 2.2: one page per participant)

Tartu Observatory (TO) was founded in 1947 in the framework of the Estonian Academy of Sciences as an Institute of Physics, Mathematics and Mechanics and it continued the work of the historical Tartu Observatory (established in 1811). It became quickly one of the partners of the Soviet Union space projects. Developing, testing and implementing methods for calibration optical sensors were started in 1970. Two models of space borne radiometers for measuring atmospheric radiation at the Earth's limb radiance profiles have been designed in TO and used aboard in Russian orbital stations "Saljut" and "MIR" (from 1971 to 1993).

The break-up of the Soviet Union in the 1990-s put TO into a difficult situation as long-lasting collaboration channels closed down and funding schemes were ended. As a result, the number of researchers decreased, financial resources became limited and internal connections between local workgroups diminished; but most importantly – access to scientific challenges was blocked for several years.

Nowadays, the basic financing introduced in 2005 has opened broader prospects for research institutions. Research budget for 2006 again increased to some extent in Estonia and in TO. Most of the finances for research are nevertheless coming from the target financed projects (according to the three thematic research fields at TO and two at Tartu University). Additionally, the Estonian Science Foundation has given out several grants (altogether 11 running grants at TO). The Ministry of Environment is contributing in the development of monitoring methods and Enterprise Estonia is supporting collaboration between TO and Estonian enterprises.

At the moment TO includes three different departments conducting research and teaching in a wide range of fields ranging from astrophysics, cosmology, astronomy, robotic technology (in relation to space and remote methods) and remote sensing to atmospheric physics, being the leading institute in Estonia on these topics.

1. Department of Astrophysics:

- Stellar physics (head of the working group is T. Kipper) – research areas are for instance "Late-type stars", "Symbiotic stars and related objects" etc.
- Theoretical astrophysics (head of the working group is Arved-Ervin Sapar) – research areas are for instance "Formation of chemical peculiarities due to diffusion and drift processes in the atmospheres of CP stars" etc.
- Telescopes (head of the working group is E. Ruusalepp)

2. Department of Cosmology:

- Physics of galaxies (head of the working group is J. Vennik) – research areas are for instance "Double galaxies", "Kinematics of High Velocity hydrogen Clouds (HVC's) in the outskirts of our Galaxy" etc.
- Cosmology (head of the working group is J. Einasto) – research areas are for instance "High-resolution numerical modelling of large scale structures in the Universe" etc.

3. Department of Atmospheric Physics:

- Sensing of vegetation (head of the working group is A. Kuusk) – research areas are for instance "Development of the remote sensing methods for investigation of optically multicomponental waters in Estonia" etc.

- Sensing of atmosphere (head of the working group is K. Eerme) – research areas are for instance "Estonian radiation climatology" etc.

Tartu Observatory is the figurehead of Estonian cosmological research. The observatory enjoys a long tradition of studying galaxies and theoretically modelling the structure of the universe and its formation. It is Estonia's main research centre for astronomy and atmospheric physics, with fundamental research focusing on physics of galaxies, stellar physics and remote sensing of the Earth's atmosphere and ground surface. Furthermore, TO played a vital role in catapulting the career of Jaan Einasto, one of the most famous and eminent Estonian astrophysicists and one of the discoverers of 'Dark Matter' and of the cellular structure of the Universe.

TO group of sensing of vegetation belongs to the Estonian Centre of Excellence for Basic and Applied Ecology. Their participation in the EU 6th framework programme extends to 2 projects:

1) HYRESSA (2006-2008) - HYperspectral REmote Sensing in Europe specific Support Actions (Estonian co-ordinator M. Mõttus, 8200 EUR) and
2) EUCAARI - European Integrated project on Aerosol Cloud Climate and Air Quality interactions (Estonian co-ordinator U. Hõrrak, 60000 EUR).

Besides the former, TO working groups have participated in other EU FP5 and FP6 projects, namely via:

- Crop Reflectance Operational Models for Agriculture CROMA (2001-2002)
- Mediterranean oak forests (MOST, 1994-1996)
- Remote Sensing for the Environment (RESE, 1997-2002)

A number of TO priorities are included in a list of target financed projects for 2007 referring to TO high-level competence in respective fields of research (more or less the same amount is expected for the coming years):

- Optical remote sensing of the environment in Estonia and Baltic region (PI Dr. Kuusk, 160000 EUR)
- Structure, chemical composition and evolution of stars (PI. Dr. Kipper, 201000 EUR)
- Evolution of the structure in the Universe from the deep past until the present (PI. Dr. Einasto, 160000 EUR)
- Silent devices: materials and control systems (PI Dr. Aablo, 32000 EUR)
- EURON network grant "EAP applications in robotics" (2007-2009) (Estonian coordinator Dr Aablo, 1 million EUR)

Besides the above mentioned, TO team members are PI-s for two ESA Cat-1 projects: PROBA/CHRIS hyperspectral data for forest studies (Dr. Kuusk) and MERIS/Envisat products over case 2 waters (Dr. Reinart).

Involved key personnel at Tartu Observatory

Anu Reinart, PhD, specialist in remote sensing and aquatic optics, application of remote sensing methods on large lakes and coastal waters. She has worked in Uppsala University department of Limnology as a EU Marie Curie Fellow and under contracts with the Swedish National Space Board. She is currently participating in MERIS/Envisat calibration and validation activities and is one of the organizers of the Nordic Network for Aquatic Remote Sensing. Dr. Reinart is the Estonian coordinator in GMES Advisory Council.

Tiit Nilson, DSc, specialist in quantitative remote sensing (forests) and biogeophysics, development of the radiative transfer-based reflectance models for vegetation. He is teaching courses (including doctoral level) and supervising PhD students in remote sensing and quantitative remote sensing in Estonian Universities.
Dr. Nilson is PI of several international and Estonian research projects (RESE, CROMA).

Andres Kuusk, DSc, specialist in quantitative optical remote sensing of vegetation canopies, radiative transfer of shortwave radiation in vegetation canopies, developing of canopy reflectance models, atmospheric correction of remote sensing data, estimation of vegetation parameters by the inversion of reflectance models. He is member of the editorial board of the Agricultural and Forest Meteorology, PI of the national project Optical Remote Sensing of Environment in Estonia and Baltic Region and ESA Cat-1 PROBA/CHRIS.

Kalju Eerme, PhD, specialist in ultraviolet (UV) radiation and atmospheric ozone, reconstruction of UV doses for past, effect of UV on human health. Dr. Eerme is the Head of the coordination group of UV radiation, ozone and aerosol research in Estonia and the Estonian representative in the COST 726 action. He is the Secretary of the Estonian Geophysical Committee.

Ülle Kikas, PhD, researcher in the Institute of Physics of Tartu University. An expert in the field of aerosol physics and atmospheric aerosols, microphysical and optical characteristics, radiative effects of atmospheric aerosol. Prof. Kikas is the coordinator of the ACCENT and MINERVA projects, country coordinator of the world wide science education program GLOBE. She has established collaboration with the Estonian Ministry of Education and Colorado University, USA for educational outreach and validation of CloudSat data.

Laurits Leedjärv, PhD, astronomer, specialist in spectroscopy and photometry of symbiotic and other interacting binary stars. Prof. Leedjärv is Director of Tartu Observatory, Vice-chairman of the Estonian Space Policy working group and member of the European High-Level Space Policy Group, thereby coordinating space research activities in Estonia and in Europe.

Indrek Kolka, PhD, astronomer, specialist in spectral and photometric investigations of single and binary stars with emission lines in spectra, IAU member, member to the ESA Gaia mission DPAC Coordination Unit (CU8) in the framework of work packages on hot stars and emission line stars, supervisor of BSc, MSc and PhD theses in astronomy at Tartu University.

Uno Veismann, PhD, in astrophysics, expert in optical radiometry and photometry, astronomical technics and space research. Principal investigator in projects about remote sensing of Earth atmosphere from Russian orbital stations Salyut 4, Salyut 6, Salyut 7 and Mir using the teleradiometers Micron and FAZA. Supervisor of PhD courses in Tartu University.

Mart Noorma, PhD, expert in optical radiometry and photometry, Research Fellow at the University of Tartu, Estonia. Dr. Noorma has worked for Helsinki University of Technology (Finland) and National Institute of Standards and Technology (USA), where he has participated in development of the national standards in radiometry and photometry for Finland and the USA.

Alvo Aabloo, PhD, specialist in polymer materials and robotics, professor in polymer materials technology at the Institute of Technology, Tartu University. His research areas include ion conducting polymers, electroactive polymers and their applications in robotics. Prof. Aabloo is currently member of COST network MOLSIMU (Molecular simulations) and ESF project STIPOMAT (Stimuli responsive materials).

2.3 Sub-contracting

In general, subcontracting is kept to minimum within the project. Only cost related to website and internal management system and expenses for PMB meetings will be subcontracted.

All the subcontracting activities will be done in accordance with the rules stipulated in the "Guide to Financial Issues relating to Indirect Actions of the Seventh framework Programme", meaning that for both cases the subcontract will be awarded to the bid offering best value for money (best price-quality ratio). For both cases a minimum of three competitive quotes will be included. Subcontracting will be performed respecting all transparency requirements and compliant with national legislation.

2.4 Resources to be committed

In addition to the costs indicated in part A3 of the proposal, and the staff effort shown in section 1.3 above, please indicate any other major costs (e.g. equipment).

Table 2. Detailed project budget

	WP1	WP2	WP3	WP4	WP5	WP6	WP7
Person months rate	3 000	3 000	3 000	3 000	3 000	3 000	3 000
Total Person months for management	0,5	0,5	0,5	0,5	0,5	0,5	15,0
Total Person Months for activities	8,0	10,0	10,0	10,0	10,0	10,0	
Cost for Advicory Council (travel+accommodation)							
number of trips	15,0						
cost per one trip	1 000,0						
Total cost	15 000,0						
Cost of networking visits (travel + accommodation)							
number of trips	15,0						
cost per one trip	1 000,0						
Total cost	15 000,0						
Cost of recruiting researchers (accommodation+salaries)							
Number of researchers		8	4	6	4		
number of person month spent		22,5	18	28	28		
Cost per resercher per 1 month		4 000	4 000	4 000	4 000		
Total cost		90 000	72 000	112 000	112 000		
Travel cost for incoming researchers							
Number of trips		14	4	6	3		
Cost per one trip		1 000	1 000	1 000	1 000		
Total cost		14 000	4 000	6 000	3 000		
Cost for outgoing researchers (travel + accommodation)							
Number of researchers		5	4	4	4		
number of person month spent		5,0	4	4	4		
Cost per resercher per 1 month		2 500	2 000	2 500	2 500		
Total cost		12 500	8 000	10 000	10 000		
Number of trips		5	4	4	5		
Cost per one trip		600	600	600	600		
Travel cost for outgoing reserchers		3 000	2 400	2 400	3 000		
Equipment							
Cost of equipment		86 000	120 000	50 000	52 000		
Travel to conferences, workshops							
Number						15	
Cost of travel (including conference fees)						1200	
Total cost						18000	
Cost of workshops;conferences; summer schools							
Number						12	
Cost of events						62000	
Travel to review meetings							
Number							3
cost of travel to review meetings							2000
Total travel cost							6000
Subcontracting							
Subcontracting Website + internal manageme							4000
Subcontracting expenses for Steering Committee meeting							3000
Direct costs							
Cost of Flyers, brochures						2000	
Audit costs							
nr							3
cost of certificate							500
Management costs							
Management personnel	**Travel**	**Total Direct**	**Subcontracting**	**Audit**	**Total subcontracting**	**Total indirect**	**Total management**
54000	6000	60000	7000	1500	8500	4200	72700
Support Cost							
Support personnel	**Travel**	**Other cost**	**Total Direct**	**subcontracting**	**Total subcontracting**	**Total indirect**	**Total support**
174000	85 800,0	798 500	1058300	0	0	74081	1132381
TOTAL budget (support + management)	**1205081**						

Table 3. A3.2 Form

Proposal Submission Forms

EUROPEAN COMMISSION

7th Framework Programme on Research, Technological Development

A3.2: Budget

			Estimated budget (whole duration of the project)									
Participant Nr	Organisation Short Name	Organisation country	RTD	Demonstration	Training	Coordination	Support	Management	Other	Total	Total receipts	Requested EU contributions
1	TO	0	0	0	0	0	1132381	72700	0	1205081	0	1205081
		Total	0	0	0	0	1132381	72700	0	1205081	0	1205081

Table 4. Cost of organized events

No.	Cost article	Cost (EUR)	Comments
1.	Workshop "Space technology, remote sensing, including satellite remote sensing: Prospectives and horizons"	1500	20 international participants
2.	Workshop "Space technology and remote sensing: scientific and technology cutting edge level and possible services for society"	1500	20 international participants
3.	Nordic Ozone Group Meeting	3000	35-40 participants
4.	International workshop "New particle generation in atmosphere"	5000	40 – 50 participants
5.	International training course "Optical properties and types of aerosol used in atmospheric correction of satellite images over waterbodies – measurements and models"	4000	20 participants
6.	Meeting of Gaia mission DPAC CU8 members "Ground-based observations of standard/calibration stars and corresponding databases"	1500	20- 30 participants
7.	International summer school "Applications and operational use of remote sensing for monitoring environment and security"	6000	30-40 participants
8.	Summer school "*Develop a common base of knowledge in satellite communications"*	3000	30-40 participants
9.	A regional (Finland, Estonia, Latvia, Lithuania) summer school "*The accessibility and usage of ESA archives and databases for astronomical and remote sensing research*"	3000	30-40 participants
10.	Conference in "Space technology and remote sensing"	30000	~100 participants
11.	Industry and enterprise targeted information day in Tallinn	1500	30 participants
12.	Industry and enterprise targeted information day in Riga	2000	30 participants
TOTAL		**62000**	

Table 5. Cost of equipment

No.	Article	Cost (EUR)
1.	A field spectrometer covering the spectral range from 0.3 to 2.5 μm for ground based spectral measurements (FieldSpec)	47 000
2.	UAV copter	6 000
3.	Sun radiometer	25 000
4.	Hydrolight software	8 000
5.	Automated Brewer Ozone Spectrophotometer	100000
6.	Ambient Particulate Monitor - TEOM Series 1400a	20000
7.	CCD camera (Andor, iKon-L, DW436-BV) for ground-based (support) photometry of Gaia targets	50 000
8.	Agilent 3458A Multimeter	10000
9.	Parstat 2273 from Princeton Applied Research	42000
Total		**308000**

As of January 1, 2006 there were altogether 60 people in the main staff of the Observatory, 37 of them on the position of researchers and 8 as engineers. The current project builds its activities on the four main scientific areas of Tartu Observatory, meaning that most of the personnel working in Tartu Observatory will be engaged into the project activities complementing as additional contribution to the personnel cost foreseen in the budget.

The following table presents the financial resources of Tartu Observatory during the period of 2004-2007. These resources will be combined with the grant requested from the Commission for EstSpace project building a centre of excellence for Estonian space research. The funds of TO will support the implementation of the project, through the existing funds of TO researchers and PhD students will be involved in the project.

Table 6. Tartu Observatory budget 2007-2007

TO's Budget 2004-2007 (in EUR)				
SOURCE	**2004**	**2005**	**2006**	**2007**
Target-financed projects	460639,0	456357,8	507859,4	575655,0
Basic financing	-	77539,9	89968,1	93955,3
ESF grants	97699,7	88869,0	138274,8	132907,3
Infrastructure	170479,2	195527,2	231437,7	231437,7
Investments (renovation)	35143,8	48178,9	46709,3	37060,7
National programme	-	6607,0	6607,0	4472,8
Contracts	-	43450,5	124408,9	Not yet known
TOTAL	***763961,7***	***916530,4***	***1145265,2***	***1075488,8***

3. Impact

3.1 Expected impacts listed in the work programme

Describe how your project will contribute towards the expected impacts listed in the work programme in relation to the topic or topics in question. Mention the steps that will be needed to bring about these impacts. Explain why this contribution requires a European (rather than a national or local) approach. Indicate how account is taken of other national or international research activities. Mention any assumptions and external factors that may determine whether the impacts will be achieved.

Until now, European countries have been pursuing their national goals while also benefiting from a European dimension derived from pooling most of their efforts within the framework of the European Space Agency (ESA). Also previous Framework Programmes have not offered substantial international cooperation possibilities to utilize the existing scientific competence developing concrete applications matching the current industry needs. Estonian space research has also being suffering due to lack of specific research equipment to take part of international scientific research project.

The aim of the current project is to touch the latter problem, i.e. by upgrading the infrastructural and human resource bases of Tartu Observatory in order to transform it into Estonian Space Research and Technology Centre able to contribute fully and assertively to R&D and innovation in Europe.

The longer-time perspective of TORC thereby is to provide (international) training and twinning possibilities to its research staff and students, improve significantly TORC's instrumentation base – both to engage in active networking activities and ensure sustainable cooperation in scientific workgroups at European levels; participate actively in the activities of FP7 and in the European Space Agency (as a European Cooperating State/ECS) by better integrating the Estonian space related research activities into the frameworks, including input into building out the EC-ESA joint initiative GMES; help TORC to establish better direct relations with technology applications developers and producers offering Estonian space scientists an incentive to obtain good practical experience and know-how to be later disseminated and shared at European level.

3.1.1 Upgrading the RTD capacity

Interaction with national and international initiatives

The scientific and technological objectives of the EU R&D FP7 "Capacities" sub-programme include the promotion of the coherent development of research policies putting a greater emphasis on the co-ordination of national and regional research policies through a specific support scheme for trans-national policy cooperation initiatives by Member States and regions. This will reinforce the implementation of the open method of co-ordination (OMC) to research policies and foster concerted or joint initiatives between groups of countries and regions in areas involving a strong transnational dimension.[1] Issues of common interest and concerted bottom-up initiatives and actions undertaken by several countries and regions, involving where appropriate other stakeholders (including industry, European organisations and civil society organisations), include space research and technology as an innovative sector of international cooperation.

Throughout this project, TORC will systematically focus on acquiring new knowledge and experiences about the implementation of the latest technological achievements in space technology, also relating to the search for services adaptable to the benefit of European citizens and their sustainable environment (e.g. in interpreting remote sensing data – of land, boreal forests, water/turbid waters; observing climate-vegetation

[1] Proposal for a Council Decision on the Specific Programme: "Capacities" implementing the 7th Framework Programme (2007-2013) of the European Community for research, technological development and demonstration activities; Brussels, 21.9.2005, COM(2005) 443 final.

interactions, the levels of UV-radiation; measuring aerosol and air clusters/air ions; conducting ground-based support investigations for EU and ESA space programmes; developing novel actuators and sensors for space technology and UAV technology), and exchange of know-how with regional and European partners.

Thus, great emphasis is put on upgrading the existent technological basis of TORC, which will enable the institution to engage more actively in networking activities (e.g. via research exchange and twinning, sending and receiving of doctoral student and post docs), substantiating the new as well as already existent partnerships and taking an active part in the development of European space science and technology agenda and policy documents.

The necessary instrumentation, used for networking activities, includes among others resources to upgrade remote sensing landcover studies. A FieldSpec-FR spectrometer will replace a spectrometer with silicon-based sensors, thus allowing measuring the spectres at a much smaller scale. An AERONET–Ocean Color provides TORC with additional capabilities to measure the radiance emerging from the sea. Special HYDROLIGHT software will increase TORC's analytical capabilities and is necessary for computing radiance distributions and related quantities.

Atmospheric research level at TORC will be improved by obtaining 2 instruments:
- an Automated Brewer Ozone Spectrophotometer that measures spectral UV radiation and tests modelling of aerosol optical properties. It has been installed in over 40 countries belonging to the ground-level UV-radiation and atmospheric total ozone network. By the purchase, Estonia can become a new member of the European network that aims to define radiation-human health effects as well as those between UV radiation-artificial materials and cultivated plants.
- an Ambient Particulate Monitor TEOM Series 1400a is extremely important for TORC be able to better calibrate its spectrometers.

Astronomic research at TORC will be substantiated by acquiring a new and more accurate CCD camera to be used together with a 60 cm reflector telescope at TO. This will enable TORC and its visiting scientists to collect high quality photometric data for selected classes of Gaia objects (mostly emission line stars) before the launch of the mission (in 2011)[1] as well as during its functioning in the orbit, (until 2020).

The TORC Technology & Optical laboratory will purchase a Parstat 2273 potentiostat/galvanostat which in necessary for developing novel actuators and sensors for space technology and UAV technology. The Equipment is especially relevant for successful research activities of Johann Citerin and Anti Liivat.

Formation of a high level Advisory Council brings together highly accredited international space scientists devising the development agenda for TORC - substantiating sustainable reciprocal collaborations and ensuring an improved integration of the results of Estonian scientific society into European community through the better understanding of common European Space Policy. The members of Advisory Council represent TORC cooperation with the following universities and research centres in Europe:

- Uppsala Advanced Battery Center, Sweden
- Centre National d'Etudes Spatiales (CNES), Toulouse, France
- Global Vegetation Monitoring (GVM) Unit, Institute for Environment and Sustainability (IES), EC Joint Research Centre (JRC), Italy
- Physikalisch-Technishe Bundesanstalt (PTB), Germany
- University of Helsinki, Finland
- University of Turku, Tuorla Observatory, Finland
- Johannes Gutenberg-Universität Mainz, Fachbereich Physik, Mathematik und Informatik, Institut für Physik der Atmosphäre, Germany

[1] Gaia is an ambitious mission to chart a three-dimensional map of our Galaxy, the Milky Way, in the process revealing the composition, formation and evolution of the Galaxy. http://gaia.esa.int/science-e/www/area/index.cfm?fareaid=26

Altogether, TORC will engage 9 acknowledged European scientists into its Advisory Council who will all be sharing their knowledge on various scientific fields with TORC staff in the format of short time visits to TORC for consultancies, some of them also coming to give lecture sessions at TORC.

To address new challenges in Europe and modernise TORC's technical infrastructure, the project encourages equally the Estonian participation in specific international working groups and resorts to attract students to study and work more on the research topics focused on space and advanced technology. The project seeks to conclude several researchers' exchange contracts bringing in additional competence to stimulate the application of TORC scientific results in a wider European context, at the same time encouraging the Estonian staff "to go out", thereby putting a greater emphasis on knowledge sharing.

A number of 25 incoming **experienced researchers and post doc researchers** will be included into the project and recruited to work for TORC. With some of the mentioned researchers collaboration will be strengthened via short time visits, two-way exchanges and/or networking (17 of them). Another group of scientists will come to TORC for a longer period of 1-2 years (8 people). A list of partner universities and research centres includes:

- Evry University, France
- Centre de Recherches d'Avignon (INRA Avignon), France
- Uppsala University Institute of Materials Chemistry, Sweden
- Stockholm University, Department of Systems Ecology, Sweden
- Helsinki University of Technology, Finland
- Vrije Universiteit Brussels, Belgium
- ING and Instituto de Astrofisica de Canarias, Tenerife, Spain
- JRC / SAI / Marine Environment Unit, Ispra, Italy
- University College London, UK
- Virginia Polytechnic Institute and State University, USA
- The Finnish Environment Institute (SYKE), Finland
- Forschungszentrum Geesthacht GmbH (GKSS), Heidelberg, Germany
- Max-Planck-Institut für Astronomie, Germany
- Institute of Meteorology and Climatology, University of Hannover, Germany
- Brockmann Consult, Germany (company providing innovative developments for geodata processing, custom software development, scientific consulting, and environmental informatics)
- Radiant Dyes, Germany (a high tech laser company)
- Institute of Geophysics, Polish Academy of Sciences, Department of the Physics of the Atmosphere, Poland
- Geography and Environment Department, Boston University, USA
- Scripps Institution of Oceanography, University of California, San Diego, USA

Different work groups at TORC will organise short-time visits to neighbouring research centres (France, Finland, Sweden), several students will be enabled to study abroad in cooperating centres of excellence for several months. The remote sensing group at TO will arrange a PhD student courses in quantitative remote sensing and its applications by inviting students from Estonia, Finland and Latvia to participate in it.

Besides concentrating on research activities, in order to evaluate technologies and get support in integrating different smart material technologies, **TORC involves certain technology application developers and producers** - companies that have extensive knowledge in aerospace and space technology. E.g. TORC Technology & Optical laboratory has contacts with CRISA - a Spanish aerospace applications developer and manufacturer, and with an Estonian UAV producer enterprise - Eli Military Solutions.

3.1.2 Better integration of the selected research team in the European Research Area as a whole

The EU FP7 "Capacities" programme REGPOT call seeks to unlock the research potential in the EU's convergence and outermost regions under which Estonia can be categorised. Consequently, one of the main

impacts of the project will be the **formation of a Space Centre of Excellence** integrating and complementing TO's high academic competence in remote sensing, atmospheric physics and astronomy with advanced technologies and informatics which represent the key components in global and European space research and technology.

The development of TORC human resource potential and the integration of its research staff into the European Research Area help to **expose the achievements of the Estonian research area and culture to the ERA - extend the impact of TORC** as an Estonian research and education centre to neighbouring countries in the region.

Closer collaboration with and in various European scientific networks improving the availability of scientific data collected in Estonia and the effective use of specific and expensive instrumentation for multifunctional purposes (scientifically in research activities as well as for training and education in physics, chemistry, infotechnology, biology, astronomy) - thus raising the status of Estonian space research in the ERA.

Strengthening TORC workgroups with regular networks and partnerships helps to devise **a better strategy for international collaboration**. Several objectives are set in this respect: extension of the existing Nordic Network 'Physically-based remote sensing of forests' to other European counties; developing common workgroups in water remote sensing with Finland, Latvia, and Sweden, a twinning workgroup with Stockholm University (Dr. Kratzer); creating a network of Estonian, Swedish, Finnish and German scientists for aquatic remote sensing, especially for turbid waters of the Nordic countries; applying for association to the EUSAAR network in atmospheric science).

Interaction with ESA

Tartu Observatory´s long term priority is to become one of the main contributors into the framework agreement for cooperation with ESA, and in the future, into the ECS agreement.

The impact on TORC related to the ESA is exposed in two spheres:

- **Participation in the ESA with the perspective for Estonia to conclude a framework agreement with ESA** (a step closer to obtaining a "European Cooperating State" status) helps to develop cooperation between the scientific and applications user communities in Estonia, EU and ESA Member States, and to ensure coherence between activities by avoiding unnecessary duplication[1].
  E.g. via the project, TORC astronomy workgroup will develop its space research competence by adding new areas of ground-based support investigations for ESA space research activities, by enhancing the capabilities of TORC staff and PhD students to use the ESA archives and databases in their research projects and by training the experienced TORC staff for teaching and consulting SMEs in Estonia for the possible partnership with ESA.

- **Full participation in the EC-ESA joint initiative Global Monitoring for Environment and Security (GMES)** – the most complex and ambitious Earth-observation programme to date.
  For Estonia, it means contributing to the two main objectives of GMES:
  a) Independent access to geo-spatial information for policy- and decision-makers in order to advance European and national agendas related to environment and security policies.
  b) Federation of European contributions to the international Global Earth Observation System of Systems (GEOSS).

  Estonia fulfils the tasks by providing regular Earth surveillance time series data and operational services; in the early stages, aiding in conducting land monitoring, ocean monitoring and emergency management activities later complemented with other services to be deployed in the 2008-2020 period of the GMES

[1] http://www.eurosfaire.prd.fr/7pc/doc/1124272137_eurab_05_015_wg2_final_report_en.pdf

Space Component programme; together with SMEs, planning, drafting and proposing GMES-based services, providing input into the INSPIRE - Infrastructure for Spatial Information in Europe initiative.[1]

This responds to the recommended by the European Commission within the framework of WHITE PAPER "Space: a new European frontier for an expanding Union An action plan for implementing the European Space policy" to bring together various GMES stakeholders across Europe.

3.1.3 Improvement of TORC participation in international R&D projects

As a result of the project, TORC as a promising frontrunner of Estonian space research and technology will be capable of participating more effectively in various European networks and consortia, gain a maximum benefit from the resources available in Estonia and Europe and make its own input into their renewal, multiplication and improvement.

One concrete milestone of the success of the REGPOT project, listed among the EU R&D top priorities[2], is a number of new FP7 cooperation initiatives/projects where TO will act as a partner and/or a coordinator. Minimum 2 FP7 projects are envisaged and prepared during the project.

As an additional benefit, Estonia as the ERA member will be able to raise its attractiveness as a future ESA Member State participating in the ESA missions. A good start has already been made with the EC-ESA joint GMES initiative.

3.1.4 Better regional research capacity to improve economic and social cohesion

Estonia's long-term economic development oriented towards increasing the role of knowledge-based economy coincides with the fact that the EU market has become a home market for local enterprises and that both enterprises and research institutions are able to participate in European cooperation networks.

The current project supports the Estonian state vision towards knowledge based economy by strengthening collaborative relationships between research institutes and enterprises (SMEs) and improved competitiveness of the Estonian SMEs in the sector of space technology and applications.[3]

The realization of the project gives a further step forward towards achieving the objectives of European Research Area (ERA)[4] by joining cross-border R&D efforts in designing proprietary technology and industrial applications in such a strategic field as space research is. By commercialization of the RTD results further **contribution to Lisbon and Barcelona objectives for increasing competitiveness of the European economy** is provided.

Another goal of ERA is the **reduced duplication in research activities** by ensuring complementarities of competences, i.e. including Space as one of FP7 priorities, and ensuring a situation where collective outputs of the EU are greater than the sum of the outputs of each member state.[5]

[1] ESA 2005 ANNUAL REPORT, http://www.esa.int/esapub/annuals/annual05/ESA_AR2005.pdf
[2] Ibid., pp 22.
[3] "Teadmistepõhise Eesti arengukava aastateks 2007-2013 (TE II)" [Strategy for knowledge-based Estonia 207-2013], http://www.hm.ee/index.php?popup=download&id=4808 (2006).
[4] Regarding duplication of EU resources see: "The Financial Perspective for Framework Programme 7 and Criteria for the Selection of Topics for the Work Programmes Recommendations, 10 May 2005, http://europa.eu.int/comm/research/era/index_en.html
[5] http://www.eurosfaire.prd.fr/7pc/doc/1124272137_eurab_05_015_wg2_final_report_en.pdf

3.2 Spreading excellence, exploiting results, disseminating knowledge

Outline how you intend to achieve these benefits through engagement with stakeholders outside the network, and the public at large.

The project constitutes a viable capacity building activity for TORC, addressing many of the urgent necessities confronted currently by the research centre (poor level of sustainable networking; lack of reach to international R&D networks, much due to insufficient instrumentations base; lack of attraction for young researchers; low visibility of TO in the EU/ERA etc.). The REGPOT project attempts to balance the previous problem situations by making great contributions to the development of Tartu Observatory and raising its international visibility.

Dissemination activities are well emphasised during the whole project. It is a vertical activity within almost each workpackage plus horizontally performed by WP1 and WP6. WP1 concentrates more on networking activities of the potential Centre of Excellence, WP6 is more about internationalisation of the RTD results and enhancing the scientific understanding of the general public.

Through the dissemination processes, the know-how and expertise of TORC scientists and researchers will be on the one hand transferred to the Estonian public, policymakers and representatives of industry, especially to SMEs. In relation to SMEs, more cooperation channels are hoped to be opened to ensure direct application of the results of TORC space research and technology activities and developing-devising companies' industrial solutions.

On the other hand, the progress of TORC helps to build and strengthen the structure of the European Research Area "in the EU convergence and outermost regions" and increase the Estonian input into it. In reference to the ESA, TORC activities are seen mainly through GMES which is one of the principal issues for Estonia; also in reference to ESA-EU cooperation - after signing the framework agreement between Estonia and ESA. Consorted actions within the EC-ESA GMES initiative also emphasise the need for TORC to cooperate further with Estonian SMEs – in the preparation of necessary GMES services, including giving consultations to Estonian SMEs.

Special attempts will be made to bring the goals of the Estonian Space Centre of Excellence to a wider public, mainly by distributing information materials, managing a public outreach section on the Observatory Website and providing it with a link to several video conference material, organising workshops on space, atmosphere and remote sensing for Estonian business people and policy decision-makers, organising atmospheric and astronomic observations for students, etc.

Increasing the attractiveness of space research among students to take up scientific careers will be a continuous activity within the project, addressing thus a key problem identified by the European Commission in the space sector - ageing community of scientists and a lack of young talents. For that purpose several summer schools will be organized.

Besides, international proliferation of the RTD results will be encouraged through networking with other European Space Centres of Excellence (especially in the region) as well as via networking activities together with the space science research community in Estonia.

A whole range of activities is entirely designed to inform the RTD community, both academic and industrial, internationally as well as nationally about the research results provided by each working group at TORC (remote sensing, atmospheric composition, astronomy, space technology). To reinforce the impact of these results, but also the conditions for favourable RTD performance, necessary steps will be taken also on policy level by awareness raising activities (seminars, consultations) for the national executive and administrative personnel in ministries.

Dissemination in core workpackages amongst the RTD community is executed by means of:

- exchange of research personnel and twinning projects with regional/European research centres

- international courses organised by TORC;
- participation in several international conferences;
- publications in international literature;
- presentations of RTD results to industry;
- establishing and operating an international Advisory Council;
- personal communication.

Significant attention is paid on disseminating the results (i) in the region (e.g. Baltic States, Eastern-European countries), keeping in mind relatively similar socio-economic situation and institutional setting, but also strategic aspirations of these countries, including towards the ESA; (ii) dissemination towards the EU Member States which will be conducted to substantiate the existing contacts, widen TORC's networking scope and potential, open up new cooperation channels and intermediate partners into future projects.

Links will be established with representatives of **European Space Technology Platform (ESTP)**[1], which integrates all the key players in space related research and specially industry representatives aiming at fostering collaborative research and sharing of knowledge, and create long-term competitive partnerships. Visit to ESTP annual meeting will be planned to make a presentation on the prospective Estonian Centre of Excellence in Space Research and cooperation possibilities will be discussed.

[1] http://www.estp-space.eu/

4. Ethical Issues

Describe any ethical issues that may arise in their proposal. In particular, you should explain the benefit and burden of their experiments and the effects it may have on the research subject.

TO hereby confirms that the current project is not contradicting any of the ethical principles as embodied in the decisions of FP7 and specific programme.

- The research activities developed by the implementation of this project do not destroy human embryos, including for the procurement of stem cells

- The proposal doesn't raise specific ethical issues like clinical trials, use of human tissues and in particular foetal and/or embryonic tissues, use of animals and in particular non-human primates or genetically modified animals.

- For implementing the project we will not collect and use unnecessary personal data.

- Implementation of the project will need no prior approval from any national or international ethical committee.

Table 7. Ethical issues table

	YES	PAGE
Informed Consent		
• Does the proposal involve children?		
• Does the proposal involve patients or persons not able to give consent?		
• Does the proposal involve adult healthy volunteers?		
• Does the proposal involve Human Genetic Material?		
• Does the proposal involve Human biological samples?		
• Does the proposal involve Human data collection?		
Research on Human embryo/foetus		
• Does the proposal involve Human Embryos?		
• Does the proposal involve Human Foetal Tissue / Cells?		
• Does the proposal involve Human Embryonic Stem Cells?		
Privacy		
• Does the proposal involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)		
• Does the proposal involve tracking the location or observation of people?		
Research on Animals		
• Does the proposal involve research on animals?		
• Are those animals transgenic small laboratory animals?		

• Are those animals transgenic farm animals?		
• Are those animals cloning farm animals?		
• Are those animals non-human primates?		
Research Involving Developing Countries		
• Use of local resources (genetic, animal, plant etc)		
• Benefit to local community (capacity building i.e. access to healthcare, education etc)		
Dual Use		
• Research having potential military / terrorist application		
I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	YES	

- **Consideration of gender aspects**

The Applicant and Management will seek to promote the participation of women throughout the project. TO will ensure that there will be no gender discrimination in the allocation of the requested funds.

Women will be encouraged to take an active role in the project management and support activities. The project manager is Mrs. Anu Reinart.

Annex I – Overview of organizations with whom collaboration will be strengthened and elaborated on the bases of short visits and networking in WP2-WP5

Table 1 Preliminary plans of TORC researchers' visits to European Centres of Excellence in WP2 (remote sensing)

NAME	DESTINATION	EXPECTED IMPACT
Dr. Anu Reinart Senior researcher	JRC/SAI/Marine Environment Unit. Ispra, Italy	Complementary training for operating automated measurements using new sun photometer in AERONET-OC Development partnerships
Dr. Matti Mõttus Researcher	Global Vegetation Monitoring (GVM) Unit Institute for Environment and Sustainability (IES) EC Joint Research Centre (JRC) (contact Dr. B. Pinty)	Complementary training on retrieving bio-physical parameters from remote sensed data on global scale. Development of partnerships
Kristi Valdemets Doctoral student	Vrije Universitetet Amsterdam, The Netherlands (contact Dr. S.Peters)	Training in modelling and applications in water remote sensing, methods for elaboration of downstream services
Krista Alikas Doctoral student	GKSS, Inst. For Coastal Research, Dept. Optical Remote Sensing, Germany (contact Dr. R. Doerffer)	Training in MERIS processing using regional processors
Joel Kuusk Doctoral student	Finnish Geodetic Institute (contact Dr. J. Peltoniemi)	Training in field spectrogoniometry of natural objects using portable instrumentation for surface BRF measurements.

Table 2. List of the person/workgroups with whom collaboration will be strengthened and elaborated on the bases of short visits, and networking in remote sensing topics

NAME/ INSTITUTION	*COMPETENCE*	*EXPECTED IMPACT*
Dr. Frederic Baret INRA Avignon, France	Leading remote sensing scientists in Europe; leader of the VALERI program.	Better integrate and use the Järvselja test site in European Earth observing studies, develop newest methods for the ground-based validation of satellite-derived vegetation products
Dr. Ranga Myneni Boston University Geography and Environment Department	Remote Sensing of Vegetation; Climate-Vegetation Interactions;	Adds competence on Radiative Transfer in Atmospheres and Vegetation; Modeling of Land Surface Processes in Climate Models.
Timo Pyhälahti Finnish Environmental Institute(SYKE), Finland	Senior expert in remote sensing and monitoring system integration of water quality parameters.	Both in situ measurements and modelling systems for water and atmospheric optics for measurement correction and data interpretation.

	Coordinator of satellite data processing and archiving.	Strategy of downstream services for end-users GIS based applications for end users, strategy development for INSPIRE implementations
Dr. Giuseppe Zibordi JRC/SAI/Marine Environment Unit. Ispra, Italy	Expert on automated measurements of Ocean color data, initiator of AERONET-OC	Installation, training and data analyses related to AERONET-OC activities, competence on development of automated systems for monitoring
Dr. Susanne Kratzer Stockholm University Department of Systems Ecology, Sweden	Oceanographer Member of MERIS cal/val team,	Elaboration of twinning workgroup for remote sensing of the Northern Baltic regions
Dr. Pauline Stenberg Helsinki University, Department of Forest Ecology	development and validation of satellite-derived biophysical products	application of physically-based models to boreal and sub-arctic regions, validation of models in these regions

Table 3. List of the person/workgroups which/whom collaboration will be strengthened and elaborated on the bases of short visits, two-way exchange and/or networking in atmospheric research topics

NAME/ INSTITUTION	*COMPETENCE*	*EXPECTED IMPACT*
Prof. Janusz Krziscin Institute of Geophysics Polish Academy of Sciences Department of the Physics of the Atmosphere	Leading scientist in Europe about atmospheric ozone and ultraviolet radiation; leaders of the current COST 726 action	Adds competence in solar UV radiation and advanced statistical data analysis methods Seminars and lectures courses
Prof. Günther Seckmeyer, Institute of Meteorology and Climatology, University of Hannover, Germany	European leading scientists in UV research; coordinator of the EC EDUCE project (EVK2-CT-1999-00028)	Adds on UV and Ozone Depletion. Seminars and lecture courses
* Dr. Rigel Kivi Arctic Research Center, Finnish Meteorological Institute	Specialist of stratospheric ozone depletion, polar stratospheric clouds and stratospheric dynamical processes.	Improvement of understanding of the stratosphere – troposphere interactions in Nordic regions. Seminars and lecture courses

*recruiting nationals having left the country

Table 4. List of contact persons for collaboration in cosmology and stellar astrophysics

NAME/ INSTITUTION	*COMPETENCE*	*EXPECTED IMPACT*
Dr. Daniel J. Lennon Head of Astronomy, ING, Canary Islands, Spain	Outstanding specialist in ground-based calibration of stellar data, in analysis of space data	Improved capacity of TO in ground-based spectroscopic support of space missions
Dr. Romano L. M. Corradi INT/JKT telescope	Outstanding specialist in the access and usage of data archives	Effective usage of complex ground-based and space-born data archives

manager, ING and Instituto de Astrofisica de Canarias, Tenerife, Spain	High ranking expertise in investigations of faint objects with emission lines	
Dr. Yves Fremat Observatoire de Paris-Meudon, France	Work package leader of Gaia Coordination Unit 8 "Astrophysical Parameters" (part of the DPAC)	Expertize on spectro-photometric modelling for Gaia extended stellar parametrization
Dr. Pekka Heinamäki Tuorla Observatory	Member of Planck Science team, working group "Large scale structure in Planck"	Expert in Sunyaev-Zeldovich effect emission. Competence on data analysis for Planck mission
Dr. Pasi Nurmi Tuorla Observatory	Member of Planck Science team, working group "Large scale structure in Planck"	Expert in large scale structures. Competence on data analysis for Planck mission

Table 5. Preliminary schedule of TORC researchers' visits to European Centres of Excellence in WP5

NAME	DESTINATION	EXPECTED IMPACT
Silver Lätt, PhD student	Physical-Meteorological Observatory at Davos, Switzerland	Training on characterization and development of spectral instrumentation for UV radiation monitoring.
Ilmar Ansko, PhD student	Metrology Research Institute, Helsinki University of Tech.	Training on Quality Assurance of photometric measurements for national metrological system
Mart Noorma, researcher	European Space Research and Tech. Centre (ESTEC), Netherlands	Training on Quality Assurance and standardization in development of space and ground-based instrumentation