ESA R&D activities and plans

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ESTEC TEC-EES

19/5/2015 – SPINE meeting ESA HQ

ESA Programmes

- General Studies Programme (GSP)
  - *I've got an idea… Does it make sense? Does it work in principle?* mandatory programme
- Technology Research Programme (TRP)
  - *Let's develop this further… I want to see this working in the lab!* - different Service and Tech Domains; mandatory programme.
- General Support Technology Programme (GSTP)
  - *Let's build the real thing… And get it ready to be flown in space!*; optional programme
- … and ARTES, Galileo Evolutions Programme, Project programmes, SSA, maintenance and investment …

ESA ITTs

- To find ITTs:
  - http://emits.esa.int/
  - Issued and intended ITTs listed
- Tender type
  - C Competitive (may be restricted)
  - DN Direct negotiation
- Special Provisions may limit to underspent countries

Running activities on spacecraft plasma interactions

- Environment modelling
- Instrument developments
- Effects simulation tools
- Data analysis

Some relevant activities in TEC-EES

- JUICE charging analysis tools (JCAT)
- 3D Modelling of Internal Charging (3DMICS)
- IEM implementation in SPENVIS
- Compact Hot Plasma Monitor (HOPE-M)
- CIRSOS
- SPENVIS-NG
- SPIS-DUST

Running activities

- Hellenic Evolution of Radiation data processing and Modelling of the Environment in Space (HERMES)
- Micro-particle impact detection by plasma effects
- SOSMAG magnetometer
- Giove radiation environment data exploitationEnergetic Neutral Atom Imaging for Space Environment Monitoring
- Interoperability between Space Environment Simulation Tools

Planned activities

3-D ENERGETIC ELECTRON SPECTROMETER – phases C1/C2/D

Prog: GSTP

DN: QinetiQ (B)

To complete the development of the novel 3-d directional electron spectrometer (3DEES) designed in phase A/B. Directional measurements, when used together with basic physical principles of the radiation belts, can be used to construct a full map of the radiation belts. Phase C1 will perform enabling developments foreseen in phase A/B and complete the instrument detailed design….

Planned activities

DATA EXPLOITATION OF NEW GALILEO ENVIRONMENTAL MONITORING UNITS (EMUS)

Program ref.: TRP , Tender Type: C(3) Tender Status: INTENDED

Special Prov.:
B+DK+F+D+I+NL+E+S+CH+GB+IRL+A+N+FIN+POR+GR+LUX+CZ+RO+PL

To create the processing chain to generate physical parameters from the raw EMU data including calibration arising from modelling and cross-calibration. This shall allow rapid access to the data for Galileo operations and build up a database for validation of specifications and modelling. Improve the statistics and functionality of the current Medium Earth Orbit (MEO) models.....

Planned activities

RADIATION BELT MODEL DEVELOPMENT AND VALIDATION - EXPRO PLUS

Program ref.: TRP Tender Type: C Tender Status: INTENDED

Special Prov.:
B+DK+F+D+I+NL+E+S+CH+GB+IRL+A+N+FIN+POR+GR+LUX+CZ+RO+PL

Several new radiation belt models have been recently released, including the NASA AP-9/AE-9 models. ..... During this activity, all new models will be subjected to a detailed validation exercise against in-situ datasets including but not limited to ESA and other European spacecraft and other radiation environment models. .....

Planned activities

MODEL AND EXPERIMENTAL VALIDATION OF SPACECRAFT-THRUSTER INTERACTIONS (EROSION) FOR ELECTRIC PROPULSION THRUSTERS PLUMES

Program ref.: TRP Tender Type: C(2) Tender Status: TO BE RE-ISSUED

Special Prov.:
B+DK+F+D+I+NL+E+S+CH+GB+IRL+A+N+FIN+POR+GR+LUX+CZ+RO +PL

This study has the following goals: To identify and master the key physical processes ….To propose models ……..· To implement these electron models in SPIS …. To experimentally validate on-ground those models using a typical EP thruster used on Telecom platform. …..to perform system applications including erosion analyses….

Planned activities

IMPROVED MODELLING OF ELECTRICAL THRUSTER INDUCED PLASMA PLUME INTERACTIONS - EXPRO PLUS

Program ref.: TRP Tender Type: C(2) Tender Status: INTENDED

Special Prov.:
B+DK+F+D+I+NL+E+S+CH+GB+IRL+A+N+FIN+POR+GR+LUX+CZ+RO+PL

The objective is to improve the algorithms in the Spacecraft Plasma Interaction System that can be used to model the interaction of electrical engines with a spacecraft. In particular the details of the collection of the plume plasma by the interconnectors on solar array will be more accurately modelled.....

Planned activities

ELECTRICALLY CONDUCTIVE BLACK PRIMER (PTRP) - EXPRO PLUS

Program ref.: TRP Tender Type: C(1) Tender Status: INTENDED

Special Prov.:
B+DK+F+D+I+NL+E+S+CH+GB+IRL+A+N+FIN+POR+GR+LUX+CZ+RO+PL

Currently in the aviation and spacecraft industry, aluminium surfaces need to be treated for corrosion protection, or are coated with primers for subsequent painting or structural bonding. It is possible to combine properties so that primers have the function of corrosion protection as well as bonding……

Planned activities

IMPROVED MODELING OF SHORT AND LONG TERM CHARACTERISTICS OF IONOSPHERIC DISTURBANCES DURING ACTIVE YEARS OF THE SOLAR CYCLE - EXPRO PLUS

Program ref.: TRP Tender Type: C(3) ISSUED

Special Prov.:
B+DK+F+D+I+NL+E+S+CH+GB+IRL+A+N+FIN+POR+GR+LUX+CZ+RO+PL

This activity has the objective of developing ionospheric models and adapt existing ones based on experimental data measured in activities during active periods of the solar cycle (e.g. MONITOR) able to: - reproduce the effects of the ionosphere in equatorial regions (temporal/spatial gradients and ionospheric scintillations) - reproduce small-scale effects such as TIDs or depletions and other disturbances - understand better the effects of geomagnetic storms in the ionosphere …..

Planned activities

Title: 3-D IONOSPHERIC TEC MODELLING - T710-401GN

Program ref.: TRP Tender Type: C(3) Tender Status: INTENDED

Special Prov.:
A+B+CH+CZ+D+DK+E+F+FIN+GB+GR+I+IRL+LUX+N+NL+PL+POR+RO+S

Taking into account the results from an exploratory study completed in 2010 ("GNSS contribution to next-generation global ionospheric modelling"), the present activity aims at identifying a suitable algorithm for generating 3-D TEC maps based on processing data in near-real time (several minutes to a few hours)….

Planned activities

P2-SWE-VII - MAGNETOMETER FOR SOLAR MONITORING MISSIONS

Program ref.: SSA Period 2 - SWE Tender Type: C Tender Status: INTENDED

Special Prov.: A+B+CH+CZ+D+DK+FIN+GB+I+LUX+N+PL+RO+S

This activity will carry out Phase C/D development of a magnetometer that can be used in hosted payload missions for SWE monitoring…. Service Oriented Spacecraft Magnetometer Set (SOSMAG) under phase A/B development in an on-going GSTP is a suitable candidate for this activity, but also other options will be considered….

Also there are generic ITTs

- OPEN CALL FOR PROPOSAL FOR ARTES (no.XX)
- GSTP-6 ELEMENT 2: PERMANENT OPEN ANNOUNCEMENT OF OPPORTUNITY (AO) FOR MARKET-ORIENTED ACTIVITIES
- PECS (PROGRAMME FOR EUROPEAN COOPERATING STATES)
    - SLOVAKIA
    - BULGARIA
    - HUNGARY
- ROMANIAN INDUSTRY INCENTIVE SCHEME

Future ideas for R&D

SPINE meetings and direct contacts are used to gather information

- Problems to be solved
- Gaps in our capabilities
- New techniques

However

- It may take some time to become an R&D activity
- It helps if an ESA project is supporting us
- There needs to be a good reason for direct negotiation

Ultimately ESA R&D is there to serve European public, industry and science (and represented by communities like SPINE)

THE END

1. Title: SECOND CALL FOR OUTLINE PROPOSALS UNDER THE PROGRAMME FOR EUROPEAN COOPERATING STATES (PECS) IN HUNGARY
2. AO Number: 1-7925
3. Program ref.: PECS Hungary
4. Tender Type: C
5. Tender Status: ISSUED
6. The European Space Agency (ESA) and the Hungarian Ministry of National Development invite you to submit an Outline Proposal in theframe of PECS. The subject of the present Call is exclusively for: a) Flight Hardware activities related to ESA's missions, in theform of payloads or its sub-systems, or satellite-platform technologies and sensors, or to generic technologies with potential for re-use (the start TRL shall be at least 3 and the target TRL shall be at least 6); b) Research and Development activities (including technology demonstrations, industrial processes and their qualification/certification) leading to products (hardware or software) orto generic technologies with potential for re-use (the start TRL1 shall be at least 2 and the target TRL 5 or below); c) Preparatory activities (e.g. feasibility studies, technology assessments, user requirements or market surveys) and ESA mission related services to support national competitiveness in ESA programmes (optional and mandatory) to which Poland subscribes; d) Space-based applications, products and services making use of space infrastructure that is already existing or scheduled for operation in the near term, (the start TRL1 shall be at least 4).

PECS etc

AO8224 FIRST CALL FOR OUTLINE PROPOSALS UNDER THE PLAN FOR EUROPEAN COOPERATING STATES (PECS) IN SLOVAKIA

- Tender Type: C
- …Flight Hardware ….Research and Development activities …. Space applications, products and services …. Preparatory …. Awareness and education activities..

1-8268 FIRST CALL FOR OUTLINE PROPOSALS UNDER THE PROGRAMME FOR EUROPEAN COOPERATING STATES (PECS) IN BULGARIA

- …..

1-7925 SECOND CALL FOR OUTLINE PROPOSALS UNDER THE PROGRAMME FOR EUROPEAN COOPERATING STATES (PECS) IN HUNGARY

- ….

1-8153 ANNOUNCEMENT OF OPPORTUNITY - 3ND CALL FOR OUTLINE PROPOSALS UNDER THE ROMANIAN INDUSTRY INCENTIVE SCHEME

- …

1. Title: ANNOUNCEMENT OF OPPORTUNITY - 3ND CALL FOR OUTLINE PROPOSALS UNDER THE ROMANIAN INDUSTRY INCENTIVE SCHEME
2. AO Number: 1-8153
3. Program ref.: NMS - Romania
4. Tender Type: C
5. Tender Status: ISSUED
6. Price Range: KEURO
7. The European Space Agency (ESA) hereby invites you to submit an outline proposal in the frame of the Announcement of Opportunity for Outline Proposals under the Romanian Industry Incentive Scheme. The present Announcement of Opportunity (AO) is addressed only toRomanian companies (including SME) or academic and research organizations. The present AO is part of the Romanian Industry Incentive Scheme aiming at supporting the participation of Romania in ESA mandatory activities (especially the Scientific Programme) and in ESA optional programmes that Romania subscribes to. The subject of the present AO is exclusively for: a)Flight Hardware activitieswith preference for those related to satellite platform technologies and sensors or to generic technologies with potential for re-use(the start TRL shall be at least 3 and the target TRL1 shall be at least 5); b)Research and Development activities (including technology demonstrations, industrial processes and their qualification/certification) leading to products (hardware or software) orto generic technologies with potential for re-use (the start TRL1 shall be at least 2 and the target TRL 5 or below); c)Preparatory activities (e.g. feasibility studies, technology assessments, user requirements or market surveys) and ESA mission related services tosupport national competitiveness in ESA programmes (optional and mandatory) to which Romania subscribes; d)Space-based applications, products and services making use of space infrastructure that is already existing or scheduled for operation in the near term, (the start TRL1 shall be at least 4). Note:education and awareness activities shall not be considered in the present call.

1. Title: SSA-P2 SWE-II SPACE WEATHER SERVICE DEVELOPMENTS
2. AO Number: 1-8135
3. Program ref.: SSA Period 2 - SWE
4. Tender Type: C
5. Tender Status: COMPLETED
6. Special Prov.: A+B+CH+CZ+D+DK+FIN+GB+I+LUX+N+PL+RO+S+E
7. Space Weather Service Developments (multi-ESC, cross domains). Activity Code: P2-SWE-103: This activity will constitute an initialset of developments aimed towards further extending the SWE precursor network towards both fully meeting the user requirements for existing precursor services as set out in the SWE CRD and extending the scope of the precursor service network to additional domainsnot addressed during the Preparatory Programme. This activity will particularly focus on developments which are cross-domain, requiring input from two or more ESCs, and domains of significant strategic interest which are not yet mature enough to require the establishment of a dedicated ESC during Period 2, but for which this could be foreseen at a later stage.

1. Title: P2-SWE-III - SSA/SWE DATA CENTRE OPERATIONS AND MAINTENANCE
2. Status: ISSUED

3. Special Prov.: A+B+CH+CZ+D+DK+FIN+GB+I+LUX+N+PL+RO+S+E
4. Tender Type: C

5. Activity Code: P2-SWE-201 This activity aims at ensuring the operations, standard maintenance and evolutive maintenance of the SWE Data Centre in Redu.

1. Title: OPEN CALL FOR PROPOSAL FOR ARTES 20 (INTEGRATED APPLICATIONS PROMOTION PROGRAMME)
2. Status: ISSUED
3. Prog. Ref.: IAP/ARTES 20
4. Special Prov.: B+F+D+I+NL+E+CH+GB+IRL+A+N+FIN+POR+GR+LUX+CZ+DK+RO+PL
5. Tender Type: C
6. The overall goal of the ARTES Element 20 programme can be summarised as "the development of operational services for a wide range of users through the combination of different systems". To achieve this, the following objectives have been defined: Promotion of space applications to a wider range of users, especially those who are not aware of the benefits that space technologies can bring to them; Development of new operational services for these users, involving a broader participation by actors on both the demand and supply sides; Utilisation of at least two existing and different space assets (such as Satellite Communications, Earth Observation, Satellite Navigation, Human Spaceflight technologies and others), leading to a better exploitation of existing space capacity and know-how together with a better understanding of how they should evolve to meet user requirements; Cross-fertilisation across disciplines (e.g. impact of Climate on Health, on Energy, on Transport, etc...) together with the development of a consistent approach across Integrated Applications initiatives, to maximise their efficient and cost- effective implementation. ARTES 20 operates via a 'Call for Proposals' which is always open. Partners respond with proposals as they find it opportune. The activities proposed in response to this 'Call for Proposals' must be relevant to above mentioned ARTES 20 programme objectives. Although not a competitive tender action, the ARTES 20 Call for Proposals is published on EMITS in order to achieve a higher degree of visibility. The closing date that will be mentioned upon issue of the Call for Proposals is established solely for technical reasons connected with EMITS and can be disregarded.

Planned activities

1. Title: ARTES 5.2: TELECOM - TECHNOLOGY CALL FOR PROPOSALS
2. Status: ISSUED
3.
4. Prog. Ref.: ARTES 5.2
5. Special Prov.:
   B+DK+F+D+I+NL+E+S+CH+IRL+GB+A+N+FIN+POR+GR+CDN+LUX+RO
6. Tender Type: C
7. ARTES 5.2 is the ESA Telecom - Technology programme for development of new technologies and techniques for satellite telecommunication. ARTES 5.2 operates with a 'Call for Proposals' which is always open. Industry responds with proposals as they find it opportune. The activities proposed in response to this 'Call for Proposals' must be relevant for the space segment or ground segment of a satellite telecommunications system. The content of an ARTES 5.2 contract shall address the introduction of new technologies and techniques in the initial stages of the development of a product and shall exclude qualification in case of a product for space and industrialisation in case of a product for ground. The product shall have a clear market potential. Essential characteristics of this programme are the proactive role of the Bidder in defining and proposing projects oriented to sustainable products (equipment, software, systems) in the wide area of satellite telecommunications and the sharing of funding by ESA and industry/businesses for the development of the new technology to be used in the products. Although not a competitive tender action, the ARTES 5.2 Call for Proposals is published among these in order to achieve a higher degree of visibility. NOTE: The closing date above had to be established solely for technical reasons connected with EMITS and ought to be ignored.

1. Title: PROTOTYPE COMPACT WIDE ANGLE CORONAGRAPH
2. AO Number: 1-8180
3. Program ref.: GSTP Period 6 E1 PRJ
4. Tender Type: C
5. Tender Status: COMPLETED
6. Special Prov.: B+D+GB
7. In a coronagraph, a small disk in the field of view of a telescope is used to obscure the bright Sun, allowing its outer "atmosphere" - the Corona - to be seen, as during an eclipse. From space, coronal plasma emissions are very clear out to several solar radii (Rs) from the Sun's surface because of the lack of atmospheric scattering. Large-scale eruptions of plasma from energetic events on the Sun are easily monitored and measured. The coronagraphs on SOHO and STEREO have become vital elements for space weather forecasting. However, scientific instruments like those are large and their resolution exceeds what is required for user-oriented space weather services. Similarly, the proposed Proba-3 polarizing spectroscopic coronagraph, for high-resolution images of the inner corona down to 0.02 Rs from the limb, is a radically different instrument from that required for SSA, with an emphasis on diffraction and straylight effects removal. This activity will design a coronagraph with appropriate field of view, resolution and timing as defined inspace weather system studies (1 Mpixel images, FOV to 20 Rs and image cadence 5 minutes). Strong emphasis will be placed on limiting the mass and volume compared to the existing generation of scientific instruments. A wide angle requirement is necessary to enableestimation of plasma cloud extent and velocity. Pre-development, prototyping and testing of key technologies and elements, including optics and electronics will be undertaken to validate the design and reduce development risk. Stray-light rejection will be optimized so that Earth directed halo CMEs can be detected on a routine basis. The instrument will be deployable on a dedicated small satellite or as a secondary payload on a larger platform. Accommodation constraints (interfaces, data rate, power, mass, thermal, stability pointing requirements, etc.) will be analysed. Phase C/D planning and costing will also be performed.

Planned activities

1. HIGHLY MINIATURISED ASIC RADIATION DETECTOR - EXPRO PLUS
2. Program ref.: TRP Tender Type: C(1) Tender Status: INTENDED
3. Special Prov.:
   B+DK+F+D+I+NL+E+S+CH+GB+IRL+A+N+FIN+POR+GR+LUX+CZ+RO+PL
4. This activity will develop a highly miniaturised personal radiation detector prototype based on ASIC particle detectors, with appropriate tailored processing to derive biological end-points and with converters to allow tailored responses to neutrons, protons, and ions. Particle detectors are being developed on single ASICs that include detecting element and processing electronics, dramatically reducing size compared with "traditional" dosimeters and detectors. This should allow low power, low voltage devices that would be extensively deployed around the astronaut body, in EVA suits, and throughout habitats, dramatically improving the knowledge of individual and area radiation exposures. The chip can also be easily co-located with samples and experiments. In this activity a prototype for a highly miniaturised

1. Title: FIRST CALL FOR OUTLINE PROPOSALS UNDER THE PROGRAMME FOR EUROPEAN COOPERATING STATES (PECS) IN BULGARIA
2. Revision: 4
3. AO Number: 1-8268
4. Program ref.: PECS Bulgaria
5. Tender Type: C
6. Tender Status: ISSUED
7. Price Range: No Range
8. Budget Ref.: E/0908-10 - PECS Bulgaria
9. Special Prov.: BG
10. Establishment: ESTEC
11. Directorate: Directorate of Ind, Proc. & Legal Aff.
12. Department: Industrial Policy Department
13. Division: IPL-PTS
14. Contract Officer: Dearey, Niamh