ESA Council at Ministerial level – Space19+ (Seville, 27-28 November 2019)

Presentation of the Programmes to the Belgian actors

Belgian Science Policy Office

Royal Library of Belgium, Brussels
30 September 2019
Introduction

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WHERE ARE WE

• CM-ESA Luxemburg: Dec. 2014
  – Limited topics: access to space, space exploration and ESA evolution

  – Full ministerial: BE commitment for programmes for the period 2017-2021

• CM-ESA Seville: Nov. 2019
  – Full ministerial: BE commitment for programmes for the period 2020-2024
• CM-ESA in preparation: PB’s, 7 CWG....
• Draft Resolutions
  – The five dimensions of Space 4.0
    ➢ inform, innovate, interact, inspire + infrastructure
  – Level of resources for the Agency’s mandatory activities 2020-2024
    ➢ Science Programme, Basic Activities
  – CSG 2020-2024 + Renewal
  – ESA Optional Programmes
• Belgian level
  – Open and transparent debate with the space associations (VRI, BAG, WE): 3 meetings with 3 representatives of each association + Cabinet Wilmès as observer
Science and Exploration
- The Science Programme

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• Mandatory Programme
• Contributions according to relative GDP
• “Backbone” of ESA: provides long-term stability
  – Scientific excellence
  – Cutting-edge technologies and innovation
• Driven bottom-up by the scientific community
  – Calls
  – Competition
  – Peer review
• Payloads are mostly funded by national programmes
  – For BE: PRODEX
• Shows what Europe can do together in science and technology
• Provides a framework for additional national programmes
Solar System

Astrophysics

Fundamental physics
Planned activities for 2020-2024

• Operations in orbit
  XMM, CLUSTER, INTEGRAL, MARS EXPRESS, GAIA, BEPI COLOMBO, SOLAR ORBITER, CHEOPS
  EXOMARS/TGO, EXOMARS/2020, PROBA-3
  HST, SOHO, HINODE, IRIS, JWST

• Development
  EUCLID, JUICE, PLATO, ARIEL, ATHENA, LISA
  COMET INTERCEPTOR, M5 (ENVISION or SPICA or THESEUS)
  JWST, SMILE, EINSTEIN PROBE, XRISE, MMX, WFIRST

• Future calls
  S, M, L missions
  New Missions of Opportunity

• Basic activities
  Technology development
  Science management support
  Programme contingency
Budget request

The Science Programme loses buying power continuously since the mid-90ties:

Figure 6. ESA’s Scientific Programme in Comparison to Member State’s GDP and the Agency’s Large (L, red) and Medium Mission (M, blue) Launches.
Budget request

• Proposal of ESA for Space19+: increase of 20% from 2020 onwards in 5 steps, plus inflation compensation

<table>
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<tr>
<th>Year</th>
<th>2020</th>
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(MEUR, current e.c.)

• To do what? → New content proposed in the Programme:
  – Aligning the development of LISA and ATHENA by clever phasing of the developments and providing payload support to the Member States
  – Developing an additional M mission with NASA to Uranus and Neptune
  – Adding a recurrent F(ast) mission line to the Science Programme
  – Providing payload support to the Member States for all missions during phases A/B
Belgian priorities

- Mandatory Programme → we have very little impact on activities; our georeturn is above 1

- Newly proposed activities: F(ast) missions and payload support during phases A/B

- 10 % increase may be affordable (incl. inflation)

- Unanimity required → Belgium will not block but general support for 20 % is unlikely
Science and Exploration -
Human Spaceflight, Microgravity and Exploration

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Main priorities for Space19+

• Maintain recurrent capacities in the production of the ESM for Orion
• Maintain planned production of IBDMs for Gateway
• Support Science In Space (SciSpacE)
Science and Exploration

Scientific Support (PRODEX)

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**PROgramme for the Development of scientific EXperiments**

- Provide funds through ESA for **payload**
  - hardware and software development
  - operations (incl. cal/val)
  - data exploitation

- Cooperation among **scientific institutes/universities** and between those (in the driving seat) and **industry**

- **Implementation:**
  - ESA selects the projects
  - BELSPO determines the level of financial support
  - ESA issues the contracts with institutes and industry
  - Joint follow-up by ESA and BELSPO

- Guaranteed **georeturn** of one
4 main areas:

✓ Space Sciences (~ Science Programme)
✓ Life and Physical Sciences (~ ISS Programmes)
✓ Earth Observation (~ EO Programmes)
✓ Space Exploration (~ Robotic Exploration Programmes)
Some successful past and ongoing Belgian PRODEX projects:

✓ Extreme Ultraviolet Imager (EUI) on SOLAR ORBITER

✓ ArtemISS: study the potential of algae for bioregenerative life support in space: the first photobioreactor in space

✓ Development of the APEX hyperspectral imager for EO cal/val activities over Belgium

✓ NOMAD spectrometer on EXOMARS/TGO

Some planned Belgian PRODEX projects for 2020-2023:

- ASIC development for the photosensors of the LISA mission, and gravitational wavefront modeling of inspiraling black holes

- Dexterous locomotion in microgravity

- Retrieval algorithm improvement and data processors update for HCHO and SO$_2$ on SENTINEL-5P

- Science Operations Centre for the LaRa instrument on EXOMARS 2020
Budgetary erosion: constant budget (18-19 M/y)
increase of salary costs above inflation
overcosts in hardware dev. projects
more BE payload participations selected
risk for budget decrease in the future

→ Future evolution:
  ✓ significant savings needed in the period 2020-2023
  ✓ priority for ESA missions/projects
  ✓ priority for developments (pre-launch)
  ✓ new limitations for data exploitation (post-launch):
    number of FTE’s and duration
Applications
- Telecommunications and Integrated Applications

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ARTES evolution for CMIN19:
A matrix with Generic and Strategic Programmatic Lines (GPL/SPL)

To integrate in BE strategy to generate a BE ecosystem around a given theme?!
ARTES 4.0

Generic Programmatic Lines (GPLs)

**FP = Future Preparation** (ARTES entry ticket)
for knowledge building, preparatory studies, standardisation
according to an ESA workplan

**CC = Core Competitiveness**
BE usual strong a la carte use

**BASS = Space Solution Center** (including BICS)
& Business Applications (formerly IAP)
& network of Brokers, Ambassadors, Investors

**PP = Partner Projects** (formerly PPP)
BE occasional use as sub
• **Advanced Technology (AT)** = ESA initiated activities according to an ESA workplan to promote farther away from the market studies and developments

• **Competitiveness & Growth (C&G)** = Industry initiated activities following their own strategic roadmap, must be rather close to market, aiming at a commercial product. Different co-funding levels for Design or Technology Development or Product Phases
**Business Applications & Space Solution center:**

- **Product development:** Business Application of SpaceTechnos (BA) to Non-Space sector
- **Company development:** current ESA Business InCubators (BIC) & space techno spin in/off
- **Networking:** Technology brokers & Ambassadors (TEAM network) & private investment funds & financial institutions (Investor Network)

**SocioEconomic Benefits**
- Revenue
- Exports
- Investment Leverage
- Addressable Market
- Jobs
- Innovation
- R&D uplift
- Extent of value chain
- Value creation
- Societal benefits
• New dev & funding request for existing PPs at CMIN19
New proposed PPPs at CMIN19

- SAGA (SPL 4S)
  
  BE interest???
  See industry workshop 30/09

- Iris satcom Global Solution (SPL 4S)
  
  BE interest on BASS side???
  See industry workshop 02/10

- HYDRON (SPL Scylight)

- SUNRISE Phase 2 (SPL 5G)

- NOVACOM 1 (GPL PP)
ARTES 4.0
Strategic Programmatic Lines (SPLs)

- **4S (Secure Systems for Safety and Security):** Secure Satcom for key infrastructures or in support to crisis management, maritime safety, border control and other security domains; in agreement with policies/regulations/specifications under authority of institutional/public bodies.

- **Scylight – Optical Comms:** optical communication technologies in space are expected to achieve major impacts on the satcom sector in the next decade (high levels of transmission rates, data security and resilience).

- **Space for 5G:** new generation of communications is key to support the Digital Transformation with integration of satellite with terrestrial telecom networks.
Transversal synergies for 4S SPL

4S ESA\ARTES Programme: Sophie.Pireaux@belspo.be

Other related activities outside ARTES followed by BELSPO Dir Space

- ESA ITTs via GSTP programme for C-SOC & SCCoE: Hendrik.Verbeelen@belspo.be

- ESA ESEC infrastructure: Agnes.Grandjean@belspo.be

- Transversal (cyber)security matters: David.Cox@belspo.be

- EU H2020, EU Parliament Preparatory Action: Danielle.Coosemans@belspo.be

- EU Space Regulation Drafting, including new Govsatcom Programme: Julien.Beclard@belspo.be
Applications
-
Earth Observation

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Future-EO

• Backbone programme of ESA EO
• Width variety of activities:
  – Different kind of opportunities for BE players
  – In the past a distribution of BE players in the different blocks
• Previous envelopes: BE over returned

→ Continuation of BE support to the programme
Earth Watch (1/2)

• ALTIUS: BE priority
  – BE PI
  – BE Industrial Prime
  – International collaborations

• PROBA-VE extension
  – Maximise the potential of the mission
    • Extend the operations (till the technical limits)
    • Experimental: expand the mission with additional sensors and demonstrate new space technology
Earth Watch (2/2)

• **InCubed+**
  – Strong resemblance with other ESA programmes (GSTP, ARTES,…)
  – But BE participation in InCubed+ enables the engagement of ESA EO team

• **Global Development Assistance (GDA):**
  – Return on investment (contributions to the joint initiative of ESA and Investment Banks via Trust Funds)

• **TRUTHS:** UK interest

• **ARTIC:** Swedish interest
Copernicus Space Component-4 (CSC-4)

- 6 HPCM

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<td>Copernicus Imaging Microwave Radiometer</td>
<td>Altimetry Mission</td>
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- BE potential
- Strong international collaborations
- Return on investment (potential EU contribution)
European Global Navigation Satellite System

• Composed of:
  – EGNOS (European Geostationary Navigation Overlay Service) is already operational
  – GALILEO is still being deployed:
    • 26 satellites already in orbit (4 IOV and 22 FOC)
    • 4 more satellites will be launched between end 2020 and mid-2021
    • The full system (30 satellites and ground segment) should be fully operational in 2021 but Galileo Initial Services are provided since December 2016
BE position navigation

- The deployment, operation and evolution of the EGNSS programmes are now funded from EU budget but it is important to secure R&D activities in Navigation to foster Belgian industry in succeeding in the highly competitive and rapidly-evolving global market for Satellite Navigation, and more broadly Positioning Navigation Timing (PNT) technologies and services.
- Two programmatic lines are targeted: Navisp and GSTP
Enabling and Support

Technology

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Technology Programmes

• The technology programmes at ESA remain at the core of BE priorities
• GSP & TRP -> DPTD
• GSTP -> GSTP
  – 3 “framework activities”
    • Element 1: prepare and de-risk & Building Blocks
    • Element 3: Technology Flight Opportunities Studies
  – Element 2 “MAKE” (see AO9834)
    • 3 segments (Market, Company Strategy, National)
    • Different entry points (Pre-outline, Outline, Full)
Enabling and Support
- Space Transportation

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Space Transportation

• Today's priority is to secure the end of Ariane-5 and Vega exploitation and to prepare the transitions to the new family of European launchers with Ariane-6 and Vega-C, and their common motor P120C, in a highly competitive global market situation.
Space Transportation

• Space 19+ focus on:
  – Mandatory programme:
    • CSG Launch Range Continuation Period 2020-2024 and Renewal
  – Exploitation programme:
    • Ariane-6 Transition Programme Step-2
    • LEAP:
      – Ariane-5 Supplementary 2020 to completion
      – Ariane-6 2020-2022
      – Vega / Vega-C Transition Accompaniment 2020-2022
Space Transportation

- Development programmes:
  - Ariane-6, Vega-C and P120C competitiveness improvements
    - Ariane-6 Competitiveness Improvements
    - Ariane-6 Future Upper Stage System Preparation
    - Vega Competitiveness Improvements
    - Vega Evolution Preparation
  - Future Launchers Preparatory Programme (FLPP)
    - Studies, Demonstrators and Advanced technology core Element
    - Prometheus Element
    - Themis / Reusability Element
  - Space Rider
  - Commercial Space Transportation Services and Support
Space Transportation

• In addition to the Space19+ programme proposal, Participating States subscriptions to cover the non-covered parts of the following on-going programmes will be open for subscription:
  – Ariane-6 and P120C Elements of the Ariane and Vega development programme
  – LEAP Ariane-5 Classical and MCO
  – Ariane-6 Transition Programme Step-1
Space Transportation

• BE position:
  – Large investments at CM-ESA 2014
  – Limited budget at Space19+

• Exploitation Programmes
  – Commitments for Ariane-5 Supplementary and Ariane-6 Transition

• Development Programmes
  – New technologies to maintain the skills acquired by Belgian industry in strategic areas such as propulsion, avionic,...
Space Safety and Security
- Space Safety

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Belgian priorities

First priority: the Core Programme: maintaining and expanding our past investments in Space Weather:

- Space Weather Services Coordination Centre (SSCC)
- Expert Service Centres on Solar Monitoring and Space Radiation
- Space Weather Data Centre
- PROBA-2 operations
- Development of new applications and services (future EU funding!)
- Physics-based model development of the Sun-Earth connection
- Small hosted payload developments

Second priority: contribution to the EUVI instrument on the L5 mission and TBD contribution to the HERA mission
Space Safety and Security
-
Cyber Resilience

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Varia
- STEREO

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National programme supporting scientific research in Earth Observation
KEY ASPECTS

• 34 years of continuous RS programmes by the Belgian Science Policy Office in // with technology developments.

• Current programme: STEREO III (Support to the Exploitation and Research in Earth Observation)

| 2014-2021 |
| — A yearly call for proposals |
| — 55 ongoing research projects |
| — 49 Belgian research groups |
| — 33 International partners (on the basis of fund matching) |

Quality – innovation - visibility of research - international collaboration – Introduction of RS in new areas
BELGIUM: SMALL IN SIZE...

....BUT RICH IN REMOTE SENSING RESEARCH LABS ALL OVER THE COUNTRY
THE 3 PILLARS OF STEREO

• Financing of various types of research projects with room for PhDs
• Project Steering Committees

• Support of cal/val sites
• Data purchase
• RS Community days
• Website eo.belspo.be

• Newsletter
• Support/organisation of events (visibility)
• Education
THEMATIC PRIORITIES

- Both global and local
  - Terrestrial and aquatic environments
  - Interaction between land cover and climate change
  - Epidemiology
  - Security and risk management
RESEARCH SUPPORT: FINANCING OF RESEARCH PROJECTS

- Based on call for proposals (fixed date and open)
- Project types:
  - Application projects
  - Exploration projects (focus on innovation)
  - Thematic network projects (multidisciplinary)
  - Shared cost projects
DEVELOPMENT OF APPLICATIONS

- Collaborations (knowledge transfer) between research institutions, public administrations (Wallonia and Flanders)
- And with private companies
- Non-scientific organisations in the driver’s seat
- Private companies cannot obtain funding by the STERE0 III programme
Industrial Potato monitoring for the Belgian potato sector. Potato prices are estimated early in the growing season and yield prediction are therefore crucial.

Potato crop monitoring with the use of RS data

https://watchitgrow.be/en
Request from SES VANDERHAVE

This project aims at applying the UAVs potential for the quantitative assessment of a specific plant trait (disease resistance against Powdery Mildew ‘PM’) within breeding trial plots.
SUPPORTING SCIENTIFIC OUTREACH

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- Newsletter with jobs, events, webstories, …
- Subscribe via eo.belspo.be
Special attention to exhibitors: BE big companies + SMEs

Bid book BRUSSELS

International Geoscience & Remote Sensing Symposium - IGARSS 2021
12 - 16 July 2021
NEXT STEPS

• Evaluation of the STEREO III programme by an external company (already done for STEREO II) with recommendations on how to improve the programme.

• Implementation of a new programme ideally without gap.

• STEREO IV will more focus on link between research and industry

• Use of Copernicus and Sentinel data

• STEREO IV budget is part of the financial envelope to be defined in the framework of the Space19+ preparation
Varia
-
Education

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Education 6-18 years

- European Space Education Resource Office (ESERO)
  - [www.eserobelgium.be](http://www.eserobelgium.be)
  - Inform the teachers in your environment!
Education >18 years

• ESA Academy ([https://www.esa.int/Education/ESA_Academy](https://www.esa.int/Education/ESA_Academy))
  – Hands on space projects:
    • CubeSats - Fly Your Satellite!
    • European Student Earth Orbiter
    • Drop Your Thesis!
    • Fly A Rocket!
    • Fly Your Thesis!
    • Orbit Your Thesis!
    • Spin Your Thesis!
    • Spin Your Thesis! Human Edition
    • REXUS/BEXUS rocket & balloon experiments
Education: >18 years

• ESA Academy (https://www.esa.int/Education/ESA_Academy)
  – Training and learning programme
    • Four-five day training sessions in:
      – Space engineering
      – Space sciences
      – Space medicine
      – Space law
      – Spacecraft operations and communication
      – Project and risk management
      – Product & quality insurance
      – Space debris
      – Technology transfer and innovation
      – Mission planning
      – ...
Education: >18 years

• Traineeships at ESA:
  – ESA YGT programme
    • https://www.esa.int/About_Us/Careers_at_ESA/Graduates_Young_Graduate_Trainees
  – National Trainee Programme
    • https://www.belspo.be/belspo/space/Training_ESA_nl.stm
Education: >18 years

• Summer internships in BE companies?
  – 1 or 2 months
  – 60-40 % funding industry-Belspo
  – Dedicated delivery
Wrap up

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THANK YOU
The Space Department of BELSPO

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