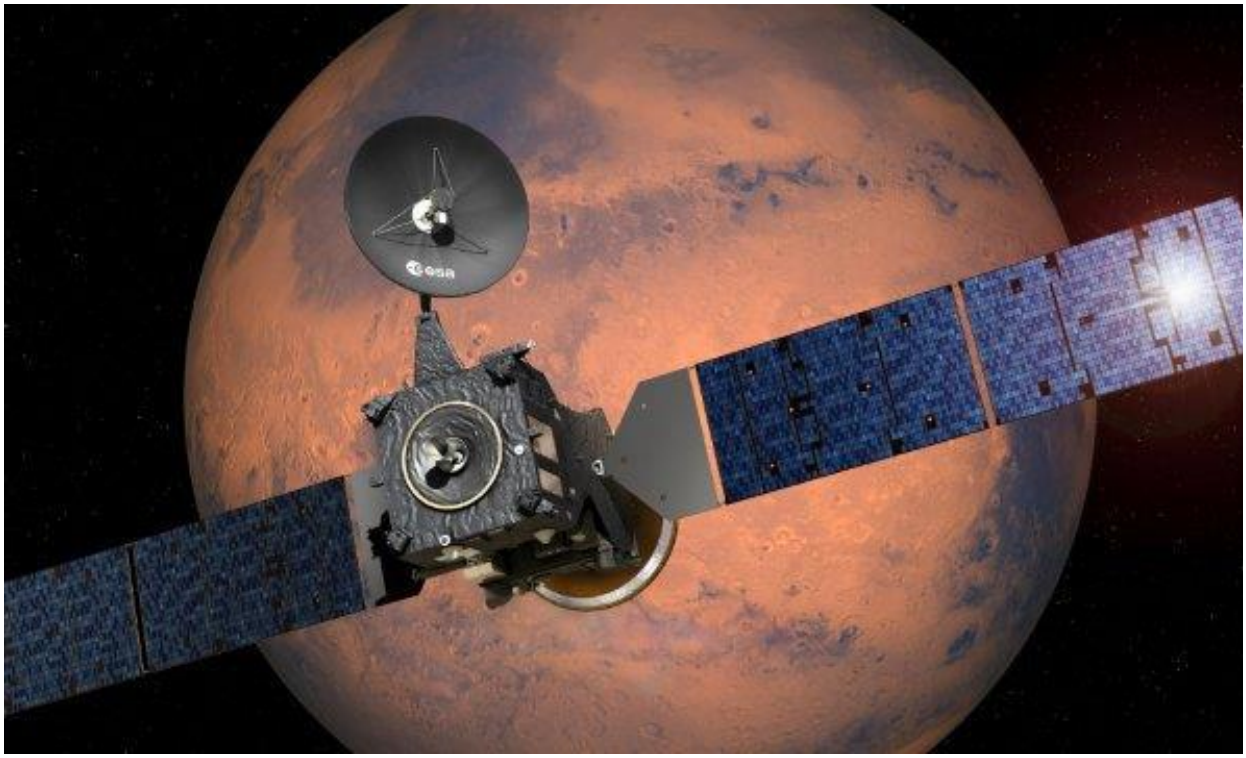
technopolis|group|

December 2016

Evaluation of the Royal Belgian Institute for Space Aeronomy - Management Summary

Management Summary



The ExoMars Trace Gas Orbiter is an ESA and Roscosmos mission to Mars

Belgium (BIRA-IASB) is leading the international team behind the NOMAD spectrometer

Evaluation of the Royal Belgian Institute for Space Aeronomy - Management Summary

Management Summary

technopolis |group| December 2016

Christien Enzing

Stijn Zegel

With cooperation of:

Anke Nooijen

Annemieke Pickles

Judith Vermeer

Michaela Gigli

Patrice Léger

Sarah Delvaux

Viola Peter

Commissioned and funded by the Belgian Science Policy Office - BELSPO

Management Summary

This evaluation

This report presents the results of the evaluation of the research activities of the Royal Belgian Institute for Space Aeronomy. In this report the abbreviation BIRA-IASB is used. It is the combination of the abbreviations of the Dutch name of the institute (Koninklijk Belgisch Instituut voor Ruimte-Aeronomie - BIRA) and the French name of the institute (Institut royal d'Aéronomie Spatiale de Belgique – IASB).

BIRA-IASB is one of the ten Federal Scientific Institutes (FSIs) of BELSPO. BELSPO organises evaluations of the scientific research of each of the FSIs, to support the institutes in the development and determination of their research strategy. The Technopolis Group was contracted by BELSPO to perform this evaluation.

The evaluation is based on the results of desk study, interviews with BIRA-IASB's staff and external stakeholders, case studies, benchmark, bibliometric analysis, a peer review by an independent panel of experts and a Self-Assessment Report written by BIRA-IASB.

Context of the Federal Scientific Institutes

Belgium is a federal state with three regions (Flanders, Wallonia, Brussels-Capital) and three communities (French-, Flemish- and German-speaking). BELSPO is responsible for coordinating science policy at the federal level. Among BELSPO's tasks are the design and implementation of research programmes and networks and the supports of ten Federal Scientific Institutes (FSIs).

The FSIs of BELSPO have a two-fold mission:

- Performing research: performing fundamental and applied research.
- Delivering scientific public services (including museum activities, collection conservation and policy support).

The FSIs receive structural funding from BELSPO, which consists of a general dotation and funding for part of FSIs personnel. The current Federal Government (established in October 2014) has announced and already implemented serious changes in the Belgian federal science policy. Four main changes are related to or will have an impact on the FSIs: serious budget cuts for FSIs (~10-15% on structural funding) and 20% budget cuts on BELSPO's research funding schemes, but the budget for space research remains unaffected; integration of BELSPO, currently a separate administration, into another government department; an increase in the autonomy of the FSIs and the creation of a Belgian Space Agency.

Since the FSIs are part of the federal government, they should follow the rules for federal organisations. As most rules are designed for government administrations and not for scientific institutes, the administrative burden is relatively high for FSIs. Also, FSI can only access regional sources of research funding (FWO, IWT, FNRS) through collaboration with universities; neither can they recruit PhD students independent on universities. Since recently FSI's financial autonomy has severely decreased due to government measures that

apply to all Belgian federal organisations. The most important measure is that FSIs are - in theory - not entitled to transfer surpluses from one fiscal year to the next; the surplus is stored in a reserve fund.

FSIs are also subject to rules regarding the recruitment of staff (both in selection procedures which involve a federal recruitment agency and/or BELSPO, and in linguistic constraints). Scientific staff are employed as either statutory civil servants or hired contractually. The procedure for nominating statutory civil servants is managed by BELSPO, whereas the FSIs can hire contractual staff directly.

Within the last couple of years, FSIs have been asked to modernise and optimise their management, their organisation and their services, to being integrated in the Belgian, European and international research area, to contribute to the international radiance of Belgium and to link with other federated entities. In addition, a commercial logic is little by little introduced in the FSIs, stimulating them to have economic impact and to increase the financed part of their budget. However, regulation does not determine whether the services provided by the FSIs to external partners are free or need to be paid for. Although the government announced changes that will increase the FSIs autonomy again, these changes have not been implemented yet.

History, mandate and tasks of BIRA-IASB

In 1964, with the detachment of the 'aeronomy service' from the Royal Institute for Meteorology (RMI, another Space FSI) the Royal Belgian Institute for Space Aeronomy (BIRA-IASB) became a federal scientific institute. Since the beginning, BIRA-IASB's activities include the study of space itself. In the early nineties, BIRA-IASB became actively involved in several ESA Science missions and started building space instruments for the study of the planetary atmospheres, magnetosphere, and heliosphere. With these space missions the institute increased its international focus, gaining also international recognition. Building on this new position, the number of research topics expanded to the many currently covered by the institute.

BIRA-IASB's principal mandate is to acquire scientific and technological expertise, and to disseminate information, in the field of space aeronomy. This implies research and service tasks, as well as partnership with the business world. To perform these tasks, it is necessary to acquire data from space missions, rockets, balloons and all related means. This knowledge concerns the physics and chemistry of the atmospheres of planets and comets and of the interplanetary space, as well as the impact of the sun on the Earth atmosphere, in particular in the context of global changes and space weather.

The institute has formulated sevens tasks, specifying the different types of activities and responsibilities including providing advice to governments. For the mission and the seven tasks, it is explicitly stated that they should - amongst others - contribute to providing appropriate answers to the questions that the civil society in general and human beings in particular have, based on interest in the Earth's atmosphere and its development in the short and long run.

Location

BIRA-IASB is located at the site of the Uccle Plateau in two different buildings, the main building and the Atelier.

BIRA-IASB has indicated that the available space for their staff is insufficient, furthermore the available facilities are not where BIRA-IASB would like them to be. This has made that some facilities such as library and engineering-electronics service have decreased and others are not supported (first aid room, cafeteria, meetings rooms). Lack of security is a main concern. The quality of the buildings is poor; many improvements (such as climate control, electricity capacity, bearing capacity of floors) should be made. The Atelier building (engineering workshop) is out of date and in need for renovation. This has been scheduled but also postponed many times. This has a negative impact on the working conditions and puts up barriers for BIRA-IASB's' staff in performing their tasks adequately. BIRA-IASB lacks the autonomy to manage its buildings.

Internal governance structure and management

The overall governance structure of BIRA-IASB is rather complex with many committees, councils, Jury and Directions. There are close links between the management of the institute and the external management of the group of FSIs. This is the same situation for all FSIs within BELSPO and a situation which is now under discussion and aimed at more autonomy for the FSIs.

The reorganisation process that started after the appointment of the new director in 2011, and that has resulted in a new structure, has recently been ratified by a Ministerial Decree. The new structure is aimed at achieving excellent research in the field of space aeronomy. The institute is now organised in four scientific departments. These departments are themselves organised in three to four smaller research groups. In this structure the scientific services (which was a separate division before 2011) have been integrated into the research divisions. The institutes' staff considers the new structure an improvement; there is much more clarity on tasks and responsibilities.

The internal organisation seems to be fit for the mission of the institute. The structure is clear and optimal from a management perspective, allowing a flexible and fast decision making process. The research divisions consist of a number of subdivisions; some of them are very small (three, four persons). From a management point of view, it is not evident that such small entities are efficient as they ask for relatively more managerial activities than larger teams.

The institute is run very well and the management seems able to motivate the staff. Competences and involvement of the staff in the projects and overall life of the institute seem encouraged by the management.

The technical and administrative staff appears efficient. Technical and administrative staff is organised within one support department. This appears to work well for the institute although the scientific staff is in high need for more specialised project and administrative support services.

Mechanical and electrical engineering support is closely tied to the research activities within the departments meaning that they do not pursue independent projects. This strategy is adequate, but it also implies that there are clear limits to the engineering tasks that can be taken up internally at BIRA-IASB. The evaluation showed that the engineering is overstretched; they have an overload of work.

The employee survey held in 2014 showed that several internal management issues should be improved. An internal task force has formulated an action plan to address the problems that were identified. Actions to improve internal communication have been implemented by BIRA-IASB's Outreach and Communication Unit. While BIRA-IASB employees are now relatively satisfied with the up/down communication, this does not apply for the communication between the departments although activities have been organised to increase meetings and knowledge dissemination between the departments.

Human resources

In 2015, BIRA-IASB had a staff of 136 persons consisting of 83 scientists, 32 scientific support staff and 21 non-scientific support staff. Most of the scientific staff has a PhD degree.

About two-third of the staff has a non-permanent position (contractual), so the ratio of temporary to permanent funding for personnel is high and this represents a significant threat of losing perennial expertise and know-how within the technical and scientific staff should there be a decline in third-party funding, in particular from the long-term space programs to which the institute participates.

The number of employees increased from 123 in 2009 to 136 in 2015, with the statutory staff showing more stable figures than the contractual staff. The capacity of the engineering department has not increased in a similar way as that of the research divisions. It still has the same size as twenty years ago.

Statutory personnel are the nuclei for further growth, as they are the responsible managers in projects and there is a limit to what can be managed. The allocation of new scientific statutory positions is thus important for implementing BIRA-IASB' research strategy. By recruiting persons with a specific expertise BIRA-IASB's can ensure that its scientific quality remains at an internationally competitive level.

BIRA-IASB is not rewarded for its success in terms of acquisition of external funding for new projects in terms of an increase in statutory personnel. Added to that are the rules of the Federal Government for all federal administrations and institutes, that BIRA-IASB should follow in its human resource management. These restrictions in recruitment clearly contradict the position of BIRA-IASB as an internationally recognised research institution that should look internationally for the best staff with the possibility of giving them a permanent position.

Funding

BIRA-IASB has an annual budget of almost €14m (2014). BELSPO's structural funding (general dotation) constitutes 10% of BIRA-IASB's overall income and another 29% of its income is the BELSPO staff envelope (which is forwarded by BELSPO directly to the responsible federal service that pays the salaries of civil servants). The other 61% of BIRA-

IASB's income is from projects that are funded by national and international funding organisations and their programmes. The past years the institute has been very successful in acquiring project-based research funding. This income has almost doubled since 2009. The most important research funders are ESA, BELSPO and the EU. Over the period 2009-2014, the institute's results have been more than positive, with a small budget overrun in 2011.

The downward trend in investments is a reason for concern. There is a growing dependency on project funding for investments in instruments and technical facilities. In addition, investments made by some of the projects have the condition that the infrastructure stays the property of the funder. Also, further growth of the external budget compared to the base budget leads to too large distortion of the relation between statutory staff and contractual staff.

While the current circumstances in terms of HRM and financial management (due to the status of the FSIs as civil service institute) are unfit to run a research institute. These restrictions in recruitment clearly contradict the position of BIRA-IASB as an internationally recognised research institution that should look internationally for the best staff with the possibility of a permanent position.

Knowledge dissemination and visibility

By installing an Outreach and Communication service unit, BIRA-IASB has shown serious efforts to enlarge its visibility in the outside world. The external interviewees are satisfied with the current communication tools, such as website and bi-annual report. However, their day-to-day contacts with partners at BIRA-IASB are their most important source of information on the institute.

BIRA-IASB staff has the opinion that the current level of visibility should be raised. The lack of a clear communication strategy might have contributed to this invisibility.

Also, there is a sparsity of regular science seminars/meetings, a weakness that holds for the entire BIRA-IASB organisation.

Research strategy

The scientific strategy of BIRA-IASB is well in place, providing strategic direction, while not preventing to make use of opportunities when they arise. BIRA-IASB's Strategy Plan for the period 2016-2020 holds a mission and vision and sets four strategic research priorities. In addition, strategic goals are set for the supporting services (Engineering and IT), for providing expertise and education, creating jobs and a market position for industry, human resource management, safety and security, communication and outreach. Each strategic priority is elaborated in several operational priorities with for each priority a set of performance indicators.

Compared to the old plan is Climate Change is now a new core issue and scientific services and application-oriented research are explicitly mentioned as a priority. The priorities are rather closely related to the research priorities set by ESA (as important funding organisation) and they are in line with the interests of the space industry.

BIRA-IASB with its 83 scientific staff and 32 scientific-support staff (situation end of 2015) is organised in four divisions, that each are subdivided in three to four subdivisions, has a rather fine-grid organisational model that also reflects its wide range of research issues. The scientific activities of sub divisions have a strong foundation in the general strategy of BIRA-IASB and can clearly be linked to the institute's strategic objectives. However, some activities are very small. This leads to the question – also raised within BIRA-IASB – on focus and critical mass. Added to that is the high dependency on external funding which makes that some projects might be positioned at the boarders of BIRA-IASBs strategic plan, weakening it at the same time.

Research performance

BIRA-IASB is a flagship of Belgian research. It is internationally well recognised and makes important contributions to atmospheric and space science nationally and internationally. The institute combines knowledge and know-how of instruments with models and data-analysis to produce new scientific insights. In this way BIRA-IASB generates high-quality science and high-quality scientific services across all departments and research areas.

Key competences mentioned are: space data assimilation and the use of modelling techniques, space physics, multi spacecraft methods, plasma sphere, ionospheric flows, polar aura, tropospheric chemistry and UV radiation. The high-level research achievements have been facilitated by and performed in combination with the in-house development of prototypes of instruments for space mission.

The period 2005-2015 showed a steady increase in publications in peer-reviewed, high impact journals with an average annual growth rate of 6.4%. BIRA-IASB researchers were publishing predominantly in absolutely top quality journals. The Top-3 journals BIRA-IASB researchers have published in are: Atmospheric Chemistry and Physics, Atmospheric Measurement Techniques and the Journal of Geophysical Research: Atmospheres.

A benchmarking analysis (with medium accuracy) comparing BIRA-IASB's performance with DTU Space (DK) and IRAP (FR) for the period 2008-2012 shows that BIRA-IASB is positioned between DTU and IRAP in terms of number of publications and of citations, but is much closer to DTU Space, than to IRAP (who scores as highest). In terms of citations per publication and in terms of non-cited literature, BIRA-IASB was behind the benchmarks.

BIRA-IASB was rather successful in its applications to BELSPO research programs. Not only did the institute perform best compared to the other two Space Institutes (RIBM and ROB), it also performed above average in terms of the programs' overall success rates.

The scientific services provided by BIRA-IASB are well in balance with the science task of BIRA-IASB. However, this high quality of services can only be retained if the quality of the research also stays at the present high level.

Impacts on economy and society

BIRA-IASB provides a wide range of public services. One special and free service that is hosted at BIRA-IASB is the Support to Aviation Control Service (SACS). Others are the space weather service, the satellite fall warning system, natural disaster crises management, UV

warning system, the support to national policymakers in developing protocols and complying with international agreements.

BIRA-IASB staff is looking for users of specific outputs of their research and service projects, such as data on emissions. BIRA-IASB has tried to strengthen the links with public policy makers, especially for the development of climate related services, but this has not worked.

Cooperation with industry is a strong point of BIRA-IASB. Companies are partners in projects and this cooperation in projects is the channel through which results of research projects can be valorised by industry. BIRA-IASB considers the industry as a good partner and *vice versa* the importance of BIRA-IASB for industry is clearly confirmed by industry. This is an important rewarding impact for Belgium.

Obstacles for commercialisation and valorisation mentioned by BIRA-IASB employees vary from 'valorisation is not encoraged by the top management', to 'no time' and 'no competences to interact with business community'. BIRA-IASB has no specific policy on making research results profitable for industry. Nevertheless, it provides some very small commercial service to industry.

National positioning

BIRA-IASB's aim is to build strategic collaborations with Belgian universities: BIRA-IASB staff gives courses at various universities to get more structural collaboration, to get PhD students work at BIRA-IASB and for recruitment. BIRA-IASB works together with almost all universities in Belgium (except for Hasselt and Mons) and most often with the Université de Liège, the University of Leuven, the Université Libre de Bruxelles and the Ghent University.

The link of BIRA-IASB with the other two Space FSIs (RMIB and ROB) has always been rather close, not only because their research domains are related. The cooperation with the other Space institutes in Uccle (RMIB and ROB) is well developed on the operational level where common needs are identified. They share facilities and the same uncertainties concerning their near future. On the research level, it seems adequate, but the level of cooperation between the three institutes is still rather low, when considering the number of co-publications in the period 2005-2015: out of the grand total of BIRA-IASB publications, about 3% are also credited to the collaborative STCE-project and even lower to ROB or RMIB.

Collaboration between the three FSIs is stimulated through the common BELSPO funded Solar-Terrestrial Centre of Excellence project (STCE). Analysis of cooperation in STCE shows that it is still rather virtual: there are only 'vertical projects' and no horizontal projects that involve teams from all three institutes. The chosen structure does not suit the collaboration aims behind the project. STCE is less a 'Centre' and more a platform for researchers who share similar interests.

International positioning

BIRA-IASB staff works rather systematically with various international research institutes and this is the result of a dedicated strategy. All research related activities take place in international cooperative projects. This includes especially research projects, development of instruments and components data exchange and analyse and software development. Top

international cooperating institutions (co-authors in peer-reviewed publications) are located in France, US, Germany, UK and the Netherlands.

BIRA-IASB has a good reputation as partner and consortium leader in international research cooperation projects. In large project consortia, BIRA-IASB often takes the lead. In those cases where BIRA-IASB has not the role as project coordinator, it is often one of the leading organisations in the project consortium. BIRA-IASB researchers are considered as professional, reliable, reliable, also in times of staff changes and they are easy and pleasant persons to work with.

At the international level BIRA-IASB is well-connected. BIRA-IASB participates in many international committees which contributes to their impact on various policies (in space and other areas).

Recommendations

The external circumstances in which BIRA-IASB must operate is far from optimal. The following steps need to be taken by the Federal Belgian Government to improve this situation.

- Appoint a full power director as soon as possible, seriously considering the excellent performance of the present director ad-interim.
- Take swift decisions on the future situation in Belgium (Belgian Space Agency/position of FSIs in the Belgian science system) to end the long-term insecurity the institute is in.
- Provide more autonomy to the federal scientific institutes to create more flexibility in human resource management and financial management, as well as in property management (suited to a research institute of international standing).
- Keep up the budget of BIRA-IASB for investments in new equipment and instruments.
- Refrain from further budget cuts to keep the institute at the present international level of competitiveness.

Recommendations for the BIRA-IASB management concerning internal governance structure and management.

- The research organisation in departments and sub divisions holds some very small research groups.

  A thorough assessment of the small groups' activities should be made with respect to their critical size and in the light of selecting the most promising and successful ones, and by that keep room for new initiatives.

  - When they can be kernels for renewal of the research portfolio they could be nurtured to growth.
  - When they are synergistic with other groups they should be candidate for merge.

  - When they are remnants of successes in the past or are unsuccessful in their growth ambition they should be considered for termination.

- Although the research topics of these small groups should be listed in the institute's organisational structure to retain their visibility, the management of their budget and personnel should be subsumed under the respective department, so that the overall impact on the institute's management is minimal.

- Active participation in, and discussions during scientific seminars, including interdisciplinary seminars are major assets in the progress of science. A research organisation with such a breadth of scientific topics and projects (110) should definitely use this potential on a weekly basis with participation from all departments. So:

  - promote scientific information exchange between groups (e.g. weekly internal seminars);

  - organise more structural staff meetings at departments and group level, and

  - promote informal interaction.

Recommendations for the BIRA-IASB management concerning <u>funding and human resources</u>

- The budget for strategic investments for the institute's infrastructure (IT, machinery, etc.) and for replacement or renewal of instrumentation should be increased or at least kept at the present level.

- The institute should refrain from further growth at the present level of base funding in order not to create a further imbalance between statutory and contractual staff.

Recommendations for the BIRA-IASB management concerning <u>knowledge dissemination, outreach and visibility</u>

- The BIRA-IASB management should develop a clear strategy on prioritising their outreach activities. The institute has recognised various needs for outreach activities and has a functioning outreach and communication group, but the overall objectives of these activities are somewhat diffuse which may prevent the optimal use of the scarce resources available for this kind of activities.

- The institute should maintain the present balance between pure science and scientific services, but it should better highlight these services as an integral component and asset in their strategy. The visibility of the services of the institute should be increased through a more coherent presentation ("service portfolio") and a somewhat more aggressive branding.

- For communication to the outside world, and specifically the general public, a clear communication strategy should be developed with goals at different levels (communication about the institute, communication about space sciences, communication about science in general) and for well-defined target audiences (general

public, stakeholders and policy makers, scientific community). Depending on the topic, different cooperation partners should be involved, e.g. the other space FSIs, BELSPO, etc.

Recommendations for the BIRA-IASB management concerning research strategy

- The institute should further develop their strategy on its development program for novel experimental, analytical and/or simulation techniques in space physical sciences:
  - as specialized contributor in large mission consortia;
  - as prime developer of unique instrument technologies with capacity of becoming principal investigator; and
  - as lead investigator of small (medium) bilateral/multilateral space missions,

  and decide on priorities balancing the size of the department/BIRA-IASB and the opportunities at hand.
- The institute should regularly consider the portfolio of activities to further increase focus while not diminishing the attention for renewal of the research portfolio on the longer term.
- The institute should develop a general philosophy for the use and development of models (also in light of external developments).
- Also for the instrument side of the research such a philosophy is needed (a balance between strategy and opportunity).

Recommendations for the BIRA-IASB management concerning research and scientific services

- The scientific services provided by BIRA-IASB are well in balance with the science task of BIRA-IASB. The high quality of services can only be retained if the quality of the research also stays at the present high level. BIRA-IASB therefore should not feel pressured to go further into services for non-scientific reasons.

Recommendations for the BIRA-IASB management concerning national and international positioning

- Lift the cooperation with universities at the national level to a more strategic level.
- Strengthen the efforts to establish collaborations and formal agreements with universities (by establishing this as a management objective) to increase the number of PhD and MSc students in the institute.
- Become more active in organising exchange visits of foreign scientists visiting BIRA-IASB, and encourage the BIRA-IASB staff to spend time abroad. This will also help to intensify the international collaborations.

technopolis |group| The Netherlands
Spuistraat 283
1012 VR Amsterdam
The Netherlands
T +31 20 535 2244
F +31 20 428 9656
E info.nl@technopolis-group.com
www.technopolis-group.com

belspo