

נספח ב' לק"ק תשתיות חלל 2014 – תכנית "ונוס"

VEN μ S:
Joint Israeli – French Micro-
Spacecraft for Earth Observation
Mission

VEN μ S

Vegetation and Environment monitoring on a New Micro Satellite

Research Announcement

Call for site proposals for VEN μ S sites over Israel

Deadline: February 25th, 2015 at 15:00

The Remote Sensing Laboratory, Ben Gurion University of the Negev – Israel

On behalf of
The Israeli Space Agency – Israel

In corporation with
Centre National d'Etudes Spatiales – France
CESBIO, Toulouse University – France

<http://www.bgu.ac.il/BIDR/research/phys/remote/03-Venus.htm>

December 23, 2014



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1 Introduction

CNES, the French space agency, and ISA, the Israel space agency, are soliciting research proposals for the use of VEN μ S Earth observation (EO) data. The purpose of this call is to select about 100 sites to be acquired by the VEN μ S mission.

The VEN μ S program is jointly developed, manufactured, and operated by CNES and ISA. It consists in two missions:

- A Scientific Mission aimed at operating a super-spectral camera for land environment monitoring.
- A Technological Mission aimed at qualifying an Israeli electric propulsion technology (IHET) and demonstrating its mission enhancement capabilities.

Only the Scientific Mission is part of this Research Announcement (RA)

VEN μ S is planned to be launched during 2016. The scientific mission is designed to last two and a half years (30 months) that will span over two vegetation cycles in both hemispheres.

VEN μ S unique features are the acquisition of high resolution (5 and 10 m), super-spectral (12 bands) images every other day with constant view angles over about 100 selected sites around the world. VEN μ S will demonstrate the combination of high temporal observation capabilities, high spectral resolution, and high spatial resolution and its relevance for scientific and applied research. The acquired knowledge and utility will be used for developing specifications of the next generation of missions dedicated to land surface monitoring.

The scientific mission is expected to terminate about 33 months after launch (so-called VM1 period). At the end of this period, the Technological Mission will begin. The altitude of the spacecraft will be lowered from 720 km to about 410 km. The orbit change will last about six months (VM2 period). The 410 km orbit will then be kept for one year, from about the 38th month to the 50th month after launch (VM3 period). Imaging operation is expected to continue also during the Technological Mission. Due to the orbit change, the swath will be reduced to about 15 km and the ground resolution will increase to about 3 m. This Research Announcement is related to the VM1 period only. Site selection for the VM3 period will be announced separately.

The selection of about 100 sites that will be imaged every two days by VEN μ S during VM1 is the subject of this Research Announcement.

Scientific mission requirements have been provided by CESBIO (Gérard. DEDIEU, French PI), Ben Gurion University of the Negev (Arnon KARNIELI, Israeli PI), and CNES (Hervé JEANJEAN and Olivier HAGOLLE).

2 Motivations

Global warming, the global population increase (9 billion people in 2050), the explosion in global food demand, the pressure on land, energy crisis, and the environmental degradation, threats to biodiversity.

All these changes and trends are challenging our understanding of the world. Dealing with them in a rational way requires efficient monitoring systems. For instance, climate change will keep modifying the environmental conditions in which grow cultivated ecosystems. We have to adapt our production systems and in the same time preserve biodiversity and the other environmental services.

Despite of the existing panoply of space sensors, appropriate measurements tools are still lacking for providing the highly dense spatially and temporally information which is required for monitoring the land surface status and changes. The current EO missions cover either the temporal variability (AVHRR, VEGETATION, MERIS, MODIS, SUOMI-VIIRS, MSG...) or the spatial variability (SPOT, Landsat...). By the end of 2017, and for the first time, the European Sentinel-2 mission will offer a global coverage with a decametric ground resolution and a revisit period of 5 days, which will be obtained with two satellites.

However, this revisit period might not be sufficient to accurately monitor vegetation cycle in very cloudy areas or during cloudy seasons^{1,2} nor to capture rapid phenomena such as vegetation growth in spring. By 2016, the VEN μ S mission will offer a revisit period of 2 days and a 10 m ground resolution. These features will allow the scientists monitoring the spatial and temporal variability of vegetation functioning with an unprecedented time sampling, thus allowing them new insights in land surface functioning. It is expected that this will lead, for instance, to major improvements of the process models and to the definition of new indicators for enhanced environmental policies, making them ready for operational uses with Sentinel-2 and other EO missions.

After the race for resolution, the next step will be the daily revisit with decametric resolution and systematic coverage!

3 General conditions for the submission of a proposal

Participation is open to any organization provided that the leading partner, named Co-PI, belongs to a non-profit organization, such as educational institutions, research institutes, government institutions, and nongovernmental organization (NGO). Partners associated to the proposal under the Co-PI responsibility can belong to any type of organization.

The use of data is limited to peaceful purposes, scientific research, R&D activities, on a non-commercial basis.

¹http://www.cesbio.ups-tlse.fr/multitemp/wp-content/uploads/2014/11/02_Take5_nov14_Hagolle.pdf

²http://www.cesbio.ups-tlse.fr/multitemp/wp-content/uploads/2014/11/16_Take5_nov14_Verhegghen.pdf

Proposals for this VEN μ S Research Announcement are submitted in a one-stage procedure. Applicants may submit their proposal any time before February 25th, 2015 at 15:00. The proposals will be evaluated during the first quarter of 2015.

The advantages of responding to this call and being selected as a Co-PI are:

1. **Funds for several Israeli Co-PIs, who respond to this “Call for site proposals”, is planned to be available. A separate call for research proposals will be announced by ISA during 2015.**
2. **Co-PIs who respond to this call will be included among the VEN μ S' users.**
3. **The Co-PIs will be given the first priority for the delivery of the VEN μ S' products, three months ahead of other (not Co-PI) users.**

4 Data products

Product Level	Temporal characteristics	Content	Ground resolution
Level 0	Single date and single angle acquisition	Basic archived product	5.3 m
Level 1	Single date and single angle acquisition	Top of the atmosphere reflectance, map projection	5.3 m
Level 2	Single date and single angle acquisition	Surface reflectance, map projected, NDVI, LAI, Chlorophyll, fAPAR, etc.	10 m
Level 3	10 days time composite of a single date and single angle acquisition	Surface reflectance, map projected, NDVI, LAI, Chlorophyll, fAPAR, etc.	10 m

5 Eligible topics

Although VEN μ S is primarily designed for vegetation studies, all subjects are welcome (land, cryosphere, coastal and inland water bodies, atmosphere, etc.).

Scientific and applied research proposals may, for example, address one or several of the following topics;

- Monitoring and analysis of ecosystems functioning under the influence of environmental factors (climate, topography, soils etc.) and of human activities
- Land-cover and land-use mapping, change detection, including frequent updating and near real time classification, for instance for agriculture applications
- Biodiversity and more generally environmental studies
- Studies in the field of agriculture: crop types mapping, monitoring of crop growth conditions, agri-environmental policies, precision farming, assessment of policy impacts
- Development and validation of natural and cultivated ecosystem functioning models: vegetation phenology, surface energy budget, biogeochemical fluxes and budget (CO₂, H₂O, N₂O, CH₄ ...), vegetation growth simulation, biomass and yield estimates, soil-vegetation-atmosphere exchanges ...
- Modeling of snow cover, snow melt, glacier flow
- Monitoring of water turbidity and analysis of the driving factors (river flow and tides in estuaries for instance)
- Water management issues, diffuse pollutions assessment

Proposals may also deal with CAL/VAL, pre-processing, and processing algorithms, such as:

- Validation of VEN μ S data products
- Improvement of VEN μ S products, for example algorithms for atmospheric correction, cloud screening, time compositing
- Development of new products (L1, L2, L3, and higher level products)
- Retrieval of land surface biophysical variables
- Combination of VEN μ S data with other satellite (e.g. radar, thermal infrared, ...) data
- Development of remote sensing data assimilation techniques within process models;
- Definition and test of theoretical and practical methods for scale transfer, i.e. up and downscaling;
- Assessment, validation, improvement of pre-processing algorithms (e.g. atmospheric effects correction, cloud masking, time composite, biophysical variables) and products derived from the data of high, medium and low spatial resolution sensors, and especially Sentinel-2.

Please note that the radiometric quality (i.e. signal to noise ratio) might be not sufficient for demanding water colour studies, such as phytoplankton monitoring. However, the quality should be sufficient for studying sediments in coastal zones, estuaries, and inland waters.

6 Data Distribution

6.1 Data Policy

For this RA, the data will be provided free of charge through the Internet to the Co-PIs who agree to the following.

Access to VEN μ S Scientific Mission data will be as follows:

- 3.1.1. VEN μ S Scientific Mission data are the property of CNES and are subject to the French and European Intellectual Property laws. The use of data is limited to peaceful, scientific R&D activities, on a non-commercial basis.
- 3.1.2. CNES has the responsibility to make the Scientific Mission data available free of charge, in a standard data format after calibration and validation, to the two main French and Israeli Principal Investigators (PIs), together with the selected Co-PIs from other countries. The aforementioned will be given the first priority for delivery of level 1 to 3 data.
- 3.1.3. Final results of the analysis of the Scientific Mission data will be made available to the scientific community through publication in appropriate journals or other established channels as soon as practicable and consistent with good scientific practice. In the event such reports or publications are copyrighted, CNES and ISA shall have a royalty-free right under the copyright to reproduce, distribute, and use such copyrighted work for their own purposes. Publications shall include a suitable acknowledgement of the services afforded by CNES and ISA.
- 3.1.4. All raw Scientific Mission data obtained from the VEN μ S Scientific Mission will be archived in an appropriate CNES and ISA center for at least 10 years after completion of the VEN μ S Scientific Mission, unless otherwise agreed by CNES and ISA.
- 3.1.5. The Co-PI of a selected proposal is authorized to provide copies of the data to its partners listed in their proposal.
- 3.1.6. The Co-PI and their partners are not allowed to redistribute or to sell the data.

CNES and ISA shall not be liable for data loss, deterioration in data quality, or delay of data supply resulting from problems of VEN μ S or ground facilities, or for not providing VEN μ S data due to bad weather or matters beyond CNES and ISA control.

7 Funding

Funds for several Israeli Co-PIs, who respond to this "Call for site proposals", is planned to be available. A separate call for research proposal will be announced by ISA during 2015.

8 Benefits and Responsibilities of PIs

8.1 Benefits

CNES and ISA will make their best effort to acquire, process, and deliver the data to the Co-PIs of the selected sites. The Co-PIs will have the first priority for the delivery of levels 1 to 3 data, three months ahead of other (not Co-PI) users.

8.2 Responsibilities

The selected scientific Co-PIs working over the study sites will provide two intermediate reports (launch +15 months, and launch + 30) and a final report (launch + 3.5 years) on the results obtained with VEN μ S to the main French and Israeli PIs. Publications in peer-reviewed journals may substitute to reports. The Co-PIs will send to CNES and ISA a copy of any published article dealing with VEN μ S data.

It is expected that at least two international workshops (or symposiums) will be jointly organized by the CNES and ISA in order to present and share the results.

The Co-PIs will also be encouraged to participate in the kick-off meeting that will be held within six months after the launch of VEN μ S.

The Co-PIs will send to CNES and ISA a copy of any published article dealing with VEN μ S data.

9 Proposal Submission

9.1 General Conditions

Proposals for this VEN μ S Research Announcement are submitted in a one-stage procedure.

Application form is available hereafter and can also be downloaded on the VEN μ S web site:

For Israeli sites: <http://www.bgu.ac.il/BIDR/research/phys/remote/03-Venus.htm>

For non-Israeli sites: <http://www.theia-land.fr/venusRA>

The proposal should be type-written in French or in English, Arial font, size of 11 points.

Each page should be numbered in the lower middle and the name of the applicant should appear on top of the page, in the middle.

File format should be Adobe PDF (preferred), Free Office (DDT), MS Word (DOC), or Rich Text File (RTF).

The location of the site(s) proposed should be described using the provided Excel file (XLS).

Proposals must be submitted by e-mail using the template available on the web site to:

For Israeli sites: venus@post.bgu.ac.il

Note: each proposal will have to be submitted also to the Ministry of Science, Technology and Space / Israel Space Agency. The e-mail address will be announced separately.

For non-Israeli sites: venusRA@cnes.fr

Applicants may submit proposals any time before February 25th, 2015 at 15:00. The core of the proposals, that is the description of the proposed work and facilities, should **not** exceed 5 pages.

9.2 Where to ask for further information

For more information contact

Sites in Israel: venus@post.bgu.ac.il

General and/or global information venusRA@cnes.fr

10 Selection of Proposals

10.1 Evaluation and Selection Procedures

Proposals will be first checked for technical consistency and feasibility. Then, they will be reviewed and evaluated by experts of the Scientific Committee assigned by CNES and ISA based on the evaluation criteria. Final decisions on acceptance of proposals will be made by CNES and ISA, taking into account the overall balance of the different proposals and their satellite resource requirements as well as their scientific merits. Co-PIs will be notified of proposal acceptance by mid-2015.

10.2 Evaluation criteria

- Technical feasibility of acquiring VEN μ S images other the requested site(s) within the research period.
- Overall scientific, technical, or social merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.
- Relevance of the proposal to demonstrate the usefulness of VEN μ S high resolution, multi-spectral and frequent revisit capabilities.
- Relevance for the development of science and applications at the landscape, river basin, or regional scales.
- Applicant's existing capabilities, related experience, dedicated ground facilities and techniques for achieving the proposal objectives.

- If the subject requires it, availability of *in-situ* data for the validation of products.
- Ability to bring together multidisciplinary teams on the same site, combination of different applications and partners.

10.3 Follow-on action

After applicants are notified of selection as a Co-PI, they are required to observe the terms and conditions of the projects including, but not limited to, data distribution and publications of results. CNES and ISA will send an agreement form to the selected Co-PIs later. Co-PIs should follow the procedures therein.

11 Cancellation and Postponement of RA

CNES and ISA reserve the right to cancel this RA upon notice delivered by CNES and ISA. CNES and ISA assume no liability for cancelling the RA, for postponing the RA schedule, or for anyone's failure to receive actual notice of cancellation.

VEN μ S Research Announcement Proposal

Proposal Title:

Acronym:

Principal Applicant:

Name, first name:

Official title:

Organization:

Department:

Address:

Country:

E-mail:

Telephone:

Facsimile:

Co-applicants:

Name	Organization	E-mail

Research Category (check one)

- Validation of VEN μ S data products
- Improvement of VEN μ S products (algorithms for atmospheric correction, cloud screening, time compositing...)
- Development of new products
- Scientific research
- Applied research

Date and Signature of the principal applicant:

Suggested content and length of the proposal

1) Cover page (1 page with the above information)

2) Proposal (4 to 5 pages):

2.1 Objectives, expected results, and benefits/contribution to VEN μ S

2.2 Project description, including justification for the required VEN μ S data

2.3 Ground experiment(s), in situ measurements

3) Data Requirements: one page per requested site, see next page

The proposal should be type-written in French or English, Arial font, size of 11 points.
Each page should be numbered in the lower middle and the name of the applicant should appear on top of the page, in the middle.

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Data Requirements: If several sites are requested, please provide the information for every site. You are kindly requested to use the available Excel (.xls) or Free/Libre Office (.ods) files to provide this information, one file per site. A Kmz file can also be provided.

1	Applicant's name	
2	Short site Name (8 characters)	
3	Country of the site	
4	Latitude of the center of the area of interest (in decimal degrees, + for northern latitude)	
5	Longitude of the center of the area of interest (in decimal degrees, + for longitude East of Greenwich)	
6	Site length along the along track direction (that is one or two images)	
7	Name of the nearest town within the site (blank if none)	
8	Beginning of the requested period(s) of observation (if different from continuous observation during mission VM1 phase of 2,5 years) Year/Month/Day : YY/MM/DD	
9	Year 1	
10	Year 2	
11	Year 3	
12	End of the requested period(s) of observation (if different from continuous observation during mission VM1 phase of 2,5 years) Year/Month/Day : YY/MM/DD	
13	Year 1	
14	Year 2	
15	Year 3	
16	Do you wish your area of interest to be acquired every 2 nd day under different view angles (YES/NO)	
17	<i>If you answered "YES" to 13:</i> If you are not able to give the angles, please comment (e.g. forward, nadir, backward, and approximate values of the angles)	
18	Which Level of product will you preferably use: L1, L2, L3 ? (all three levels will be available for every site)	
Additional comments and information		

Conventions and units of the latitude and longitude of the center of the area of interest

Latitude and longitude of the center of the site in decimal degrees, with the following convention: "+" for northern latitude (0-90°N) and "-" for southern latitude (0-90°S), and "-" for longitude west of Greenwich (0-180°W) and "+" for longitude East of Greenwich (0-180°E).

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For instance, with this convention:

- the coordinates of the *Inaccessible Island* (37°18'11.62" S / 12°40'36.18" W) are Latitude = - 37.303228 and Longitude = - 12.676717
- the coordinates of the *City of Carcassonne* (43°12'22.08" N / 2°21'50.81 E) are Latitude = + 43.206133 and Longitude = + 2.364114

It is recalled that a standard site is an area on the Earth covered by one to two along track contiguous images. The minimum size of a site is 27x27 km², the maximum size being 27x54 km² at nadir. A site can also be observed with different view angles, for example nadir, forward and backward viewing from the same orbit and/or from different orbits at high latitudes.

The site will be observed every two days, with similar viewing angles, during these periods, unless a different requirement is given.

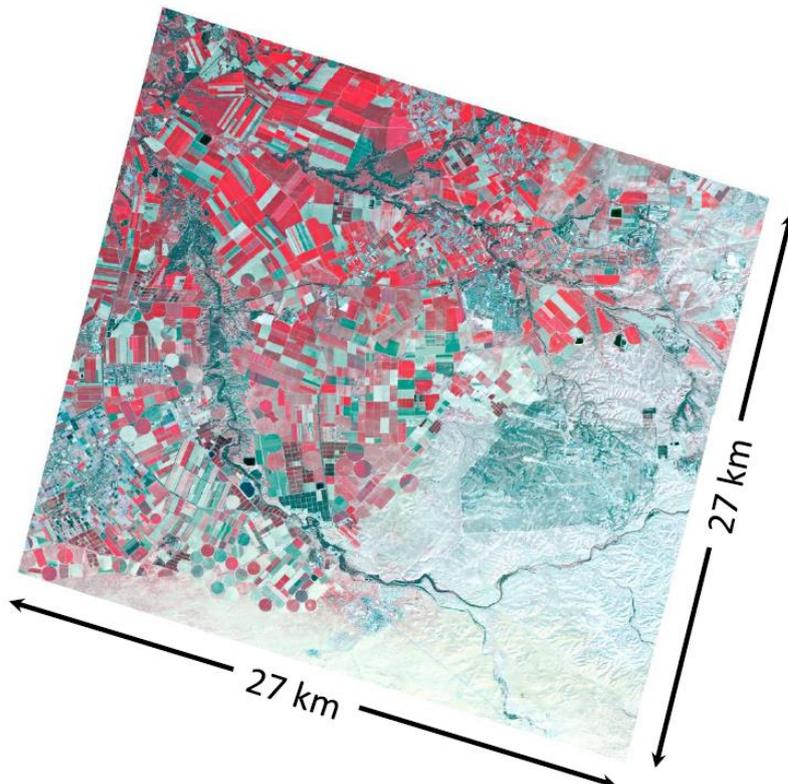
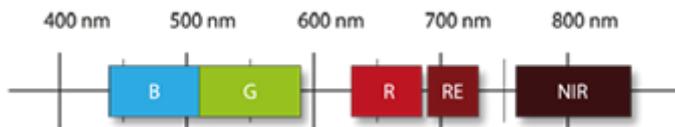
14 APPENDIX C: Your research site in high resolution

High spatial resolution images, originated from RapidEye in 5 spectral bands and 5 m resolution can be used for demonstrating some of the VEN μ S spatial and spectral capabilities.

RapidEye images of research sites within the VEN μ S orbits and accessibility area over Israel will be provided upon request by the Remote Sensing Laboratory of Jacob Blaustein Institutes for Desert Research, Ben Gurion University.

Please send a cover letter and a shape file to venus@post.ac.il.

RE Band #	Name	Spectral Range (nm)
1	Blue	440 – 510
2	Green	520 – 590
3	Red	630 – 685
4	Red-Edge	690 – 730
5	Near Infrared	Near Infrared 760 – 850



Demonstration of a VEN μ S scene (WS_IMG_10). False color composite at 5 m spatial resolution.



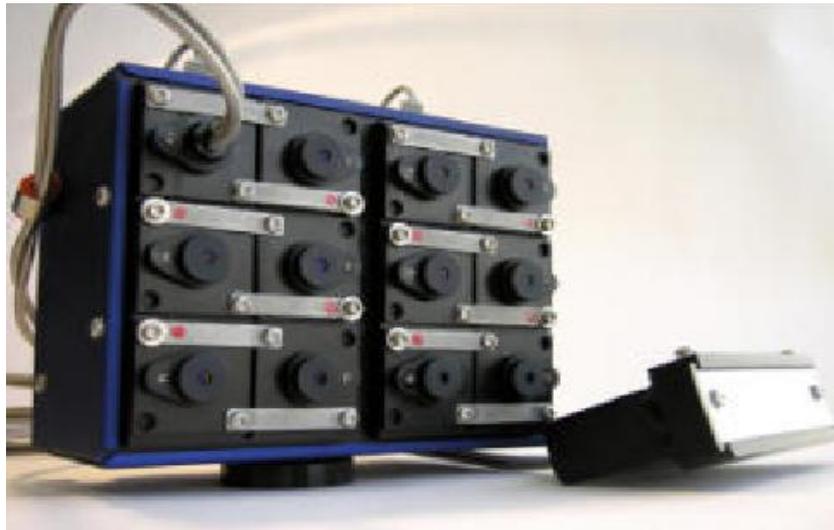
Demonstration of a research site (Sayeret Shaked Park). False color composite at 5 m spatial resolution.

15 APPENDIX D: Multi-spectral camera with VEN μ S bands

The Remote Sensing Laboratory of Jacob Blaustein Institutes for Desert Research, Ben Gurion University, has purchased a multi-spectral camera with 11 of the VEN μ S bands. The 12th band that originally is the duplication of the 638 nm band, has turned to be an Incident Light Sensor.

The laboratory invites collaborative studies that aimed at preparing the VEN μ S mission. The table presents comparison between the VEN μ S and the Mini-MCA12 camera bands. This camera can be operated from the ground and from an UAV, or a light aircraft.

For discussing these opportunities, contact karnieli@bgu.ac.il



Mini-MCA12 camera equipped with Incident Light Sensor

VEN μ S			Mini-MCA12		
Band #	Center	Width	Band #	Center	Width
1	420	40	1	420	25
2	443	40	2	440	25
3	490	40	3	490	25
4	555	40	4	550	25
5	638	40	5	ILS	25
6	638	40	6	640	25
7	672	30	7	670	25
8	702	24	8	700	25
9	742	16	9	740	25
10	782	16	10	780	25
11	865	40	11	860	25
12	910	20	12	910	25