

# MELiSSA Overview and Perspectives

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MELiSSA Conference, November 3-5<sup>th</sup> 2020, Gent

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# What'New since Rome 2018 ?



- The Fundamentals
- Actors
- ESA Ministerial Council 2019,
- Sciences and engineering
- Flight experiment
- Pilot Demonstration
- Technology Transfer
- Education and Communication





# The Challenge

How to select and assemble processes and technologies to reach the highest level of closure and respect safety standards ?



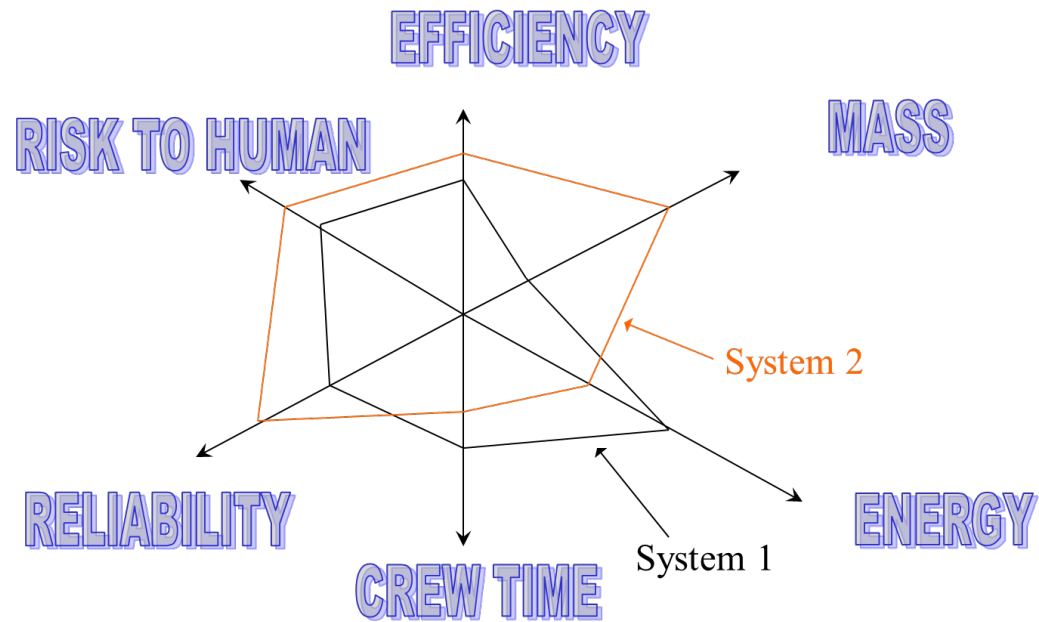
# ALISSE Criteria



Metric to evaluate and compare ECLSS:

Mono & Multi-parameters Analysis:

- Mass,
- Efficiency,
- Energy,
- Safety,
- Crew time.

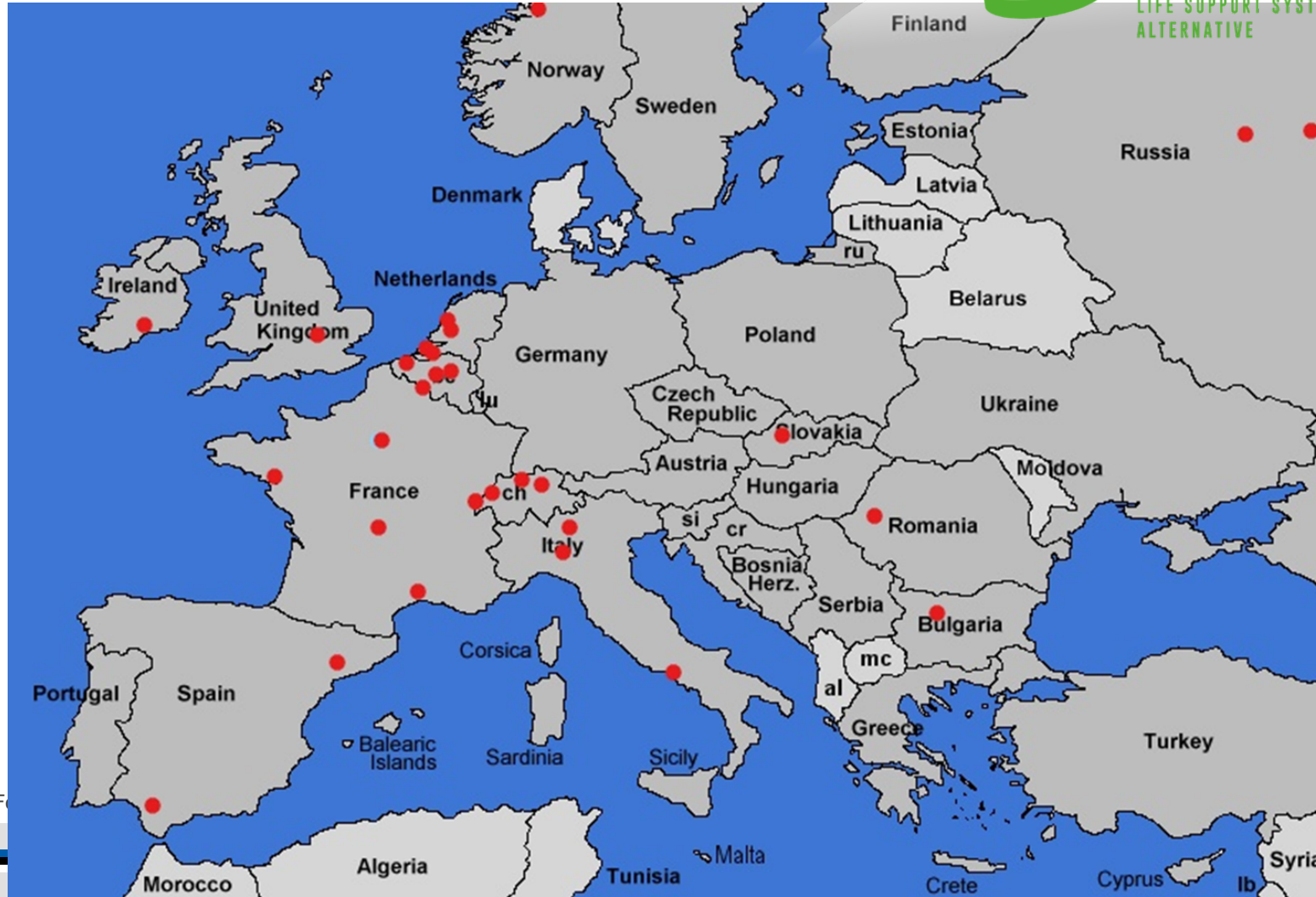


# A community

# MELISSA



MICRO-ECOLOGICAL  
LIFE SUPPORT SYSTEM  
ALTERNATIVE



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11/01/2018 | Slide 5

European Space Agency

# Motivation



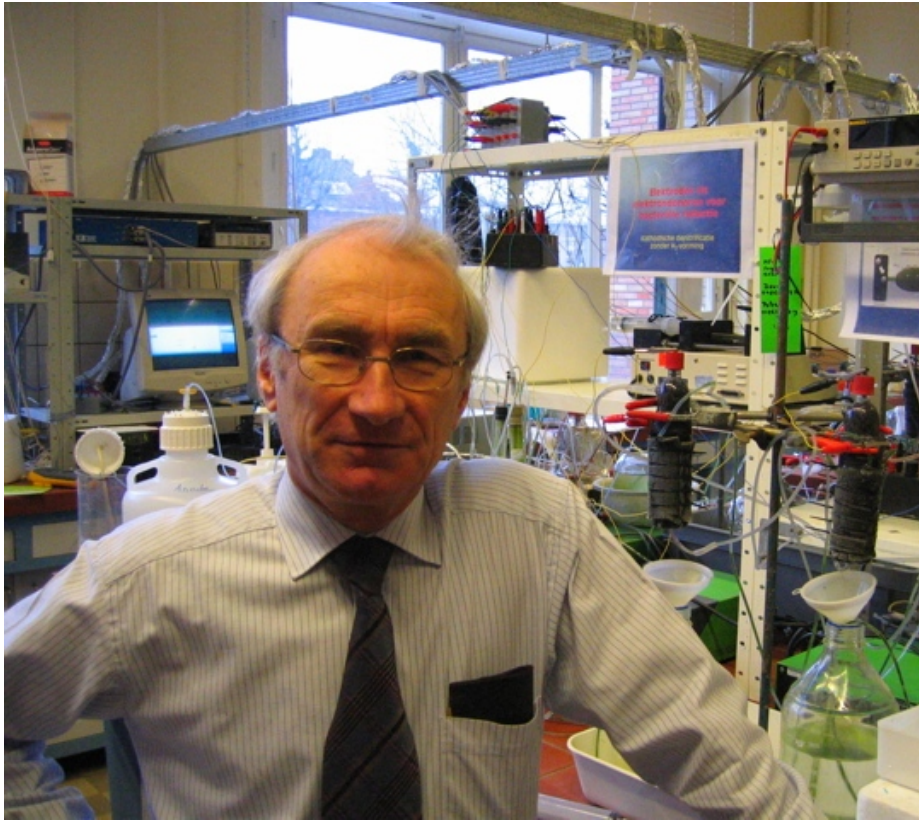
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2018 | Slide 6

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# Experience



# A Consolidated Strategy

- Working Group with ESA National Delegation,
- Review of European ECLSS Know-how,
- A study over 18 Months,
- A consolidated Roadmap,
- A public document available on [MELiSSAfoundation.org](http://MELiSSAfoundation.org)
- A clear industrial support



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ESA/PB-HME(2019)30  
Att: Report  
Paris, 30 April 2019  
(English only)

**EUROPEAN SPACE AGENCY**  
**HUMAN SPACEFLIGHT, MICROGRAVITY AND EXPLORATION**  
**PROGRAMME BOARD**

**Life Support System Working Group Report**

## **Summary**

Following the decision of the Director of Human and Robotic Exploration to establish a Working Group with representatives of PB-HME Delegations and chaired by ESA, the working group met 6 times to determine the way forward for Life Support Systems (LSS) in Europe in the context of E3P Period 2. Short, medium and long term exploration scenarios and corresponding LSS requirements were reviewed in order to define the LSS elements that could support these scenarios and requirements. At the same time, a comprehensive list of all currently ongoing LSS related European activities was established and analysed, and was taken into account in the ESA Technology Harmonisation Roadmap presented to IPC in January 2019 (ESA/IPC (2019) 9).

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## MELISSA Industrial Actors – Position Paper

The European space industries involved in the Micro-Ecological Life Support System Alternative (MELISSA) would like to express their strong support to the on-going Program.

MELISSA now encompasses key technological and scientific activities, including **PFPU, Artemiss, WTUB, WC-MEC, Urinis, Biorat, GWRU and WQA.**

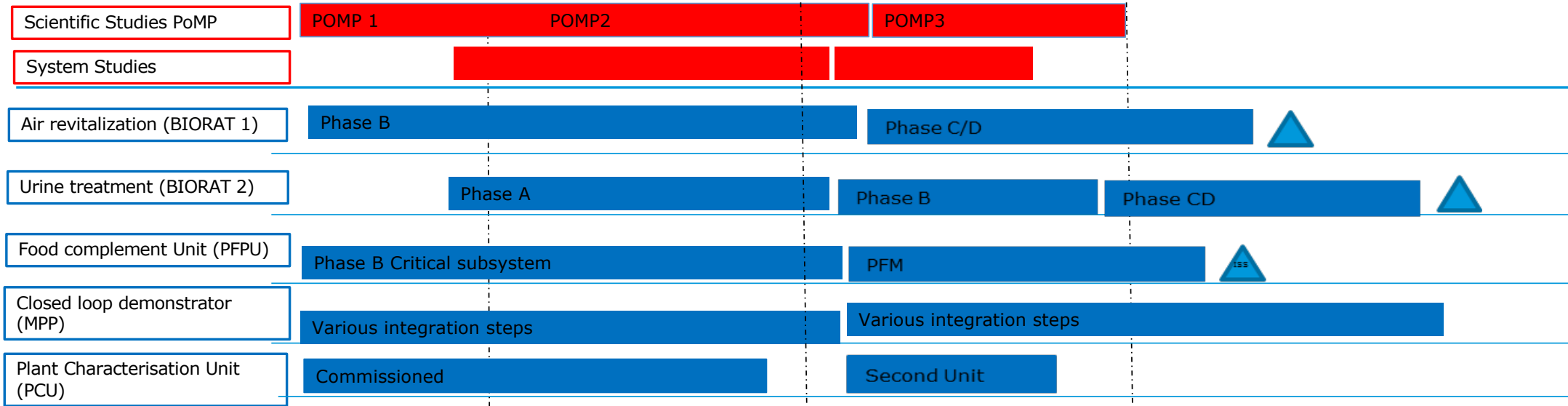
We stress specifically the importance of the ongoing preparation of space missions, in continuity of the on-going activities mentioned above and the new ones such as Phases Separation Units, all of the described in the Annex.



# Approved Activities 2019-2022



## FUNDED ACTIVITIES



## New Activities



## Decisions of ESA Ministerial Council

- All Activities are approved and maintained
- Contribution is increased of 13%
- All involved countries are maintaining the effort,
- Low TRL activities are financed via TRP,
- All activities are now in implementation phase,



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# Phase 1 : R&D

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# Main Decisions/Results



- To start a deterministic determination of the metabolic pathway of the waste compartment,
- MEC Demonstration to transform VFA to CO<sub>2</sub>,
- Urine Nitrification is demonstrated with reasonable efficiency,
- To Develop a unique facility for Plant Characterisation (PacMan),
- Study of the Gas/Liquid Mixing/Separation AND Solid/Liquid separation in Reduced gravity,
- Consolidate the modelling from a stoichiometry to a metabolic network (OSCAR),
- To consolidate and deploy ALISSE metrics,





## Phase 2: Flight Precursors

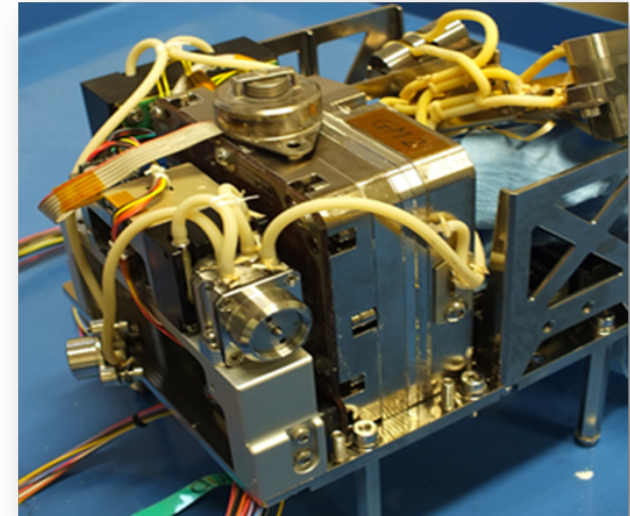
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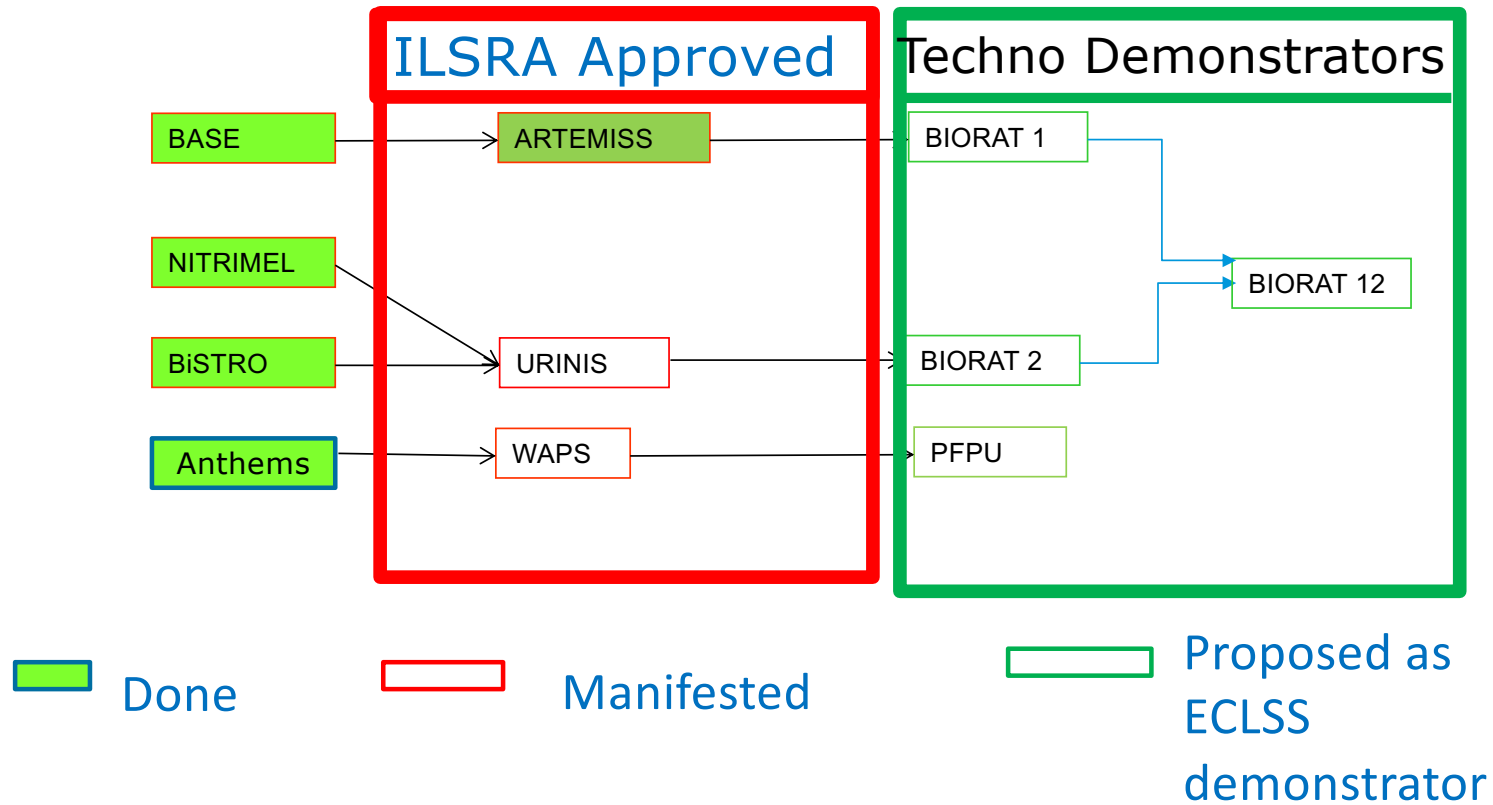
# Achieved Flight Experiments

- Longue March (1987)
- MESSAGE 1 (ISS) 2002,
- MESSAGE 2 (ISS) 2003,
- MOBILIZATION (ISS) 2004,
- BASE A (ISS) 2006,
- BASE B&C (ISS) 2008,
- NITRIMEL (Foton) 2014,
- MELONDEAU/BISTRO (ISS), 2015,
- ArtEMISS/Arthrospira B (ISS) 2017-2018,
- ANTHEMSx 3 : (2017-2018)





# The Flight hardware Development Logic



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# Phase 3: Ground Demonstration

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# MELiSSA Pilot Plant



- Efforts are maintained, COVID did not help,
- Integration of Nitrification + Photo-bioreactor + Crew Compartment on Gas and Liquid phase, is in progress and will end in 2021.
- Full demonstration of :
  - $\text{CO}_2 + \text{Urine} = \text{Oxygen} + \text{Proteins}$
- Higher Plant Compartment in refurbishment for future integration,



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# Phase 4: Terrestrial Applications

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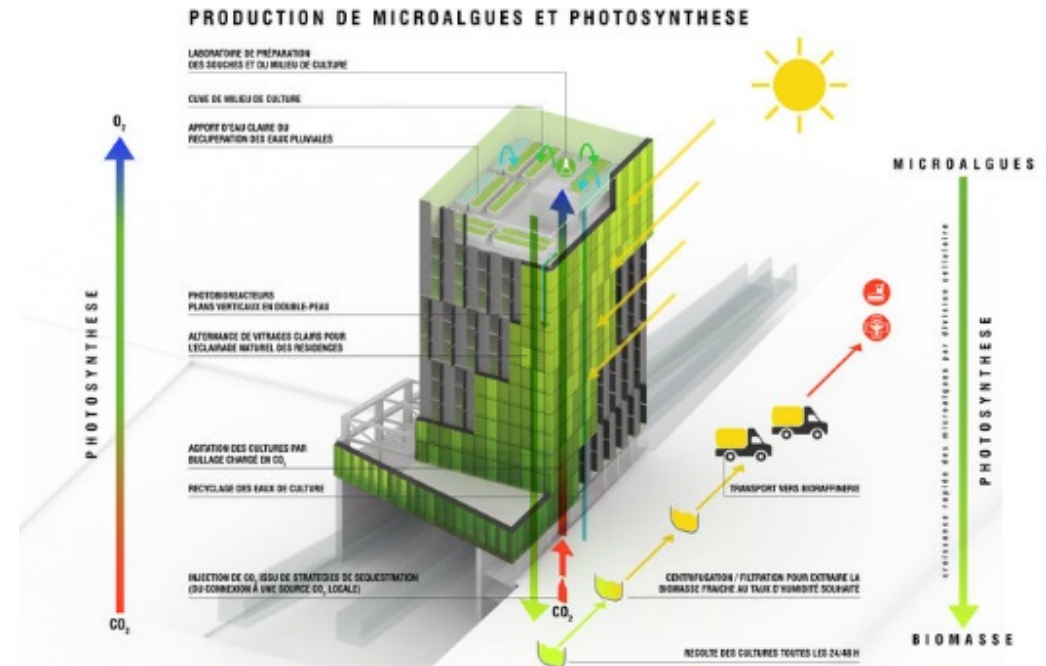


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# Biofacades Paris XTU



# Hydrohm

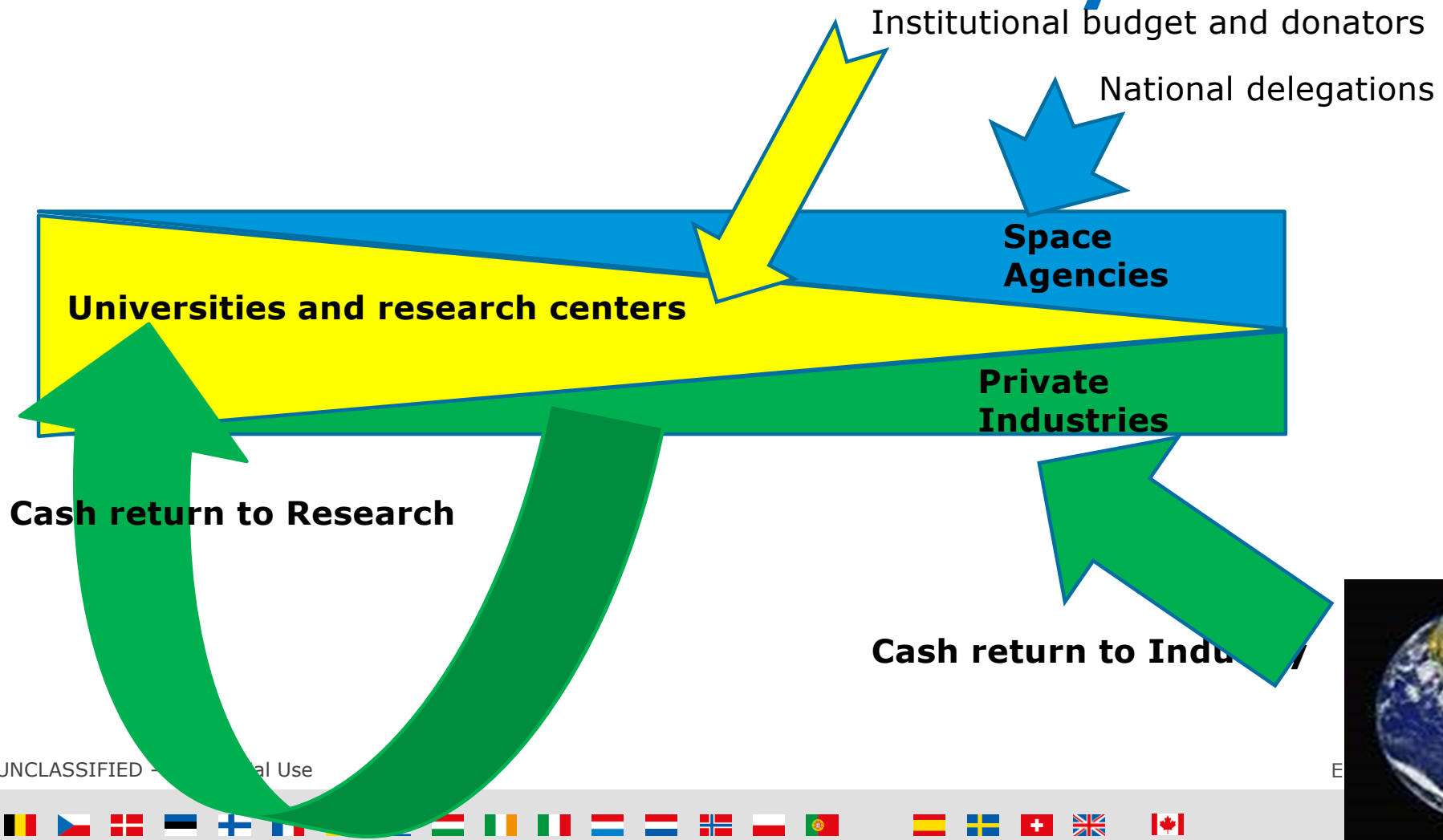


The 6<sup>th</sup> MELiSSA Spin-off company,

- Initiated by U Gent, and a MELiSSA PhD (Dr Jolien De Paepe),
- Hydrohm will bring electrification to the water sector by development and commercialization of innovative water treatment solutions
- Technology based on 2 pillars:
  - electricity: renewable, inexpensive and steerable input,
  - no added chemicals: no residues/waste streams
- Goal: higher local water efficiency and sustainability



# Additional Financial Pathways



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# Phase 5: Education & Communication

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## Education & Communication

- MELiSSA project is committed to support Education
  - BELSPO : “ MELiSSA is a very good tool for Education !”
- POMP Programme (phase 3)
- MASTER Lectures in : TUBerlin, TUDelft, AgroParis, EPFL, CentraleSupElec, IPSA, KTH, ..
- Publications List on : [MELiSSAfoundation.org](http://MELiSSAfoundation.org),
- Technical Notes on : [MELiSSAfoundation.org](http://MELiSSAfoundation.org),
  
- AstroPlants initiative ([Astroplant.io](http://Astroplant.io))

# ASTROPLANT

ABOUT

TEAM

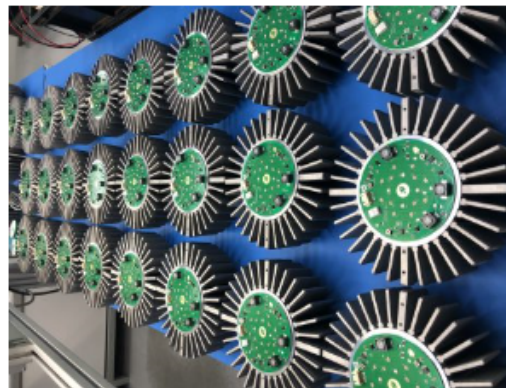
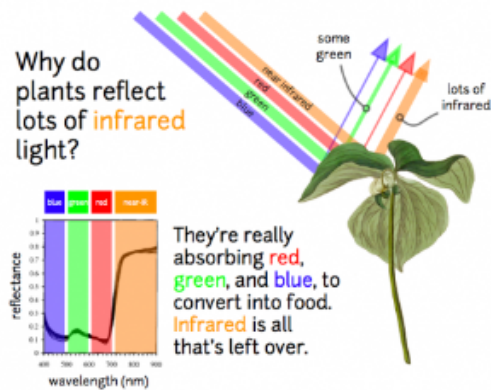
FEATURES

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If you are interested in purchasing a kit, please email [thieme@astroplant.io](mailto:thieme@astroplant.io).

[VIEW ASTROPLANT KIT](#)



## Quick update June 2019

hi community, so much to do, so little time. Story of AstroPlant. Well, our community is a priority (like the...

1 year ago



**Frontiers Research Topic:**  
**Bioregenerative Life-Support Systems for  
Crewed Missions to the Moon and Mars**

**Topic Editors:**

**Cyprien Verseux**

Center of Applied Space Technology and Microgravity,  
University of Bremen, Germany



**Jean-Pierre Paul de Vera**

German Aerospace Center, Helmholtz Association of German  
Research Centers (HZ), Germany



**Natalie Leys**

Belgian Nuclear Research Centre, Belgium

**Topic Coordinator:**

**Lucie Poulet**

NASA - Kennedy Space Center , USA



**Submission Deadlines**

**Abstract: 15<sup>th</sup> January 2021** (not mandatory)

**Manuscript: 26<sup>th</sup> April 2021**

**Read more / submit your abstract:**

<https://frontiers.in/Ng4H>

## Year/Issue

2020

[Issue 2/2020](#)

[Issue 1/2020](#)

2019

[Issue 2/2019](#)

[Issue 1/2019](#)

2018

[Issue 2/2018](#)

[Issue 1/2018](#)

2017

[Issue 2/2017](#)

[Issue 1/2017](#)

2016

[Issue 2/2016](#)

[Issue 1/2016](#)

2015



## AIMS AND SCOPE

The online edition of the scientific journal Ecological Engineering and Environment Protection issued by and discussions, new developments, presents international and national institutions, releases book reviews, The journal is the official edition of the National Society of Ecological Engineering and Environment Protec

*It is an Open Access Journal type – full-text access to all articles is provided. Annually two numbers a*

A broad outline of the journal's scope includes following rubrics: "Man and Biosphere", "Microorganism Bioautomatics", "Ecological and Sustainable Agriculture", "Forest Biology and Forest Engineering", "New Dev on a certain ecological problem important for the country or on a significant scientific achievement.

The rubrics are directed by members of the international editorial board, leading specialists in the areas covered by the journa

## PUBLICATION ETHICS

The Editorial Board of the journal possess the responsibility to determine which of submitted research manuscript should Board are governed by journal policy and are limited by the legal requirements that will then be in force regarding libel, copyright

The Editor-in-Chief shall take reasonable steps to identify and prevent the publication of papers where research misconduct

The reviewers are required to evaluate the manuscript based on the submitted content in confidential manner. The review submitted research work is original and has not been published elsewhere in any language. Applicable copyright laws and conver send by e-mail a relevant [DECLARATION](#).

Finally the Editor-in-Chief will always publish corrections, clarifications, retractions and apologies when needed.

## SUBMISSION

The manuscripts have to be prepared according to the Instructions to the authors ([http://ecoleng.org/EEEP\\_Instructions.pdf](http://ecoleng.org/EEEP_Instructions.pdf))

The fee is required for manuscript processing and publishing, and the charge is 25 Euro per approved manuscript. After subm

We remind that all authors need to have real contribution to the research presented in the manuscript. The authors should

## PEER-REVIEW PROCESS

The Editor follows a quick evaluation method in order to substantially reduce the time for prepress and publishing. After initi can be increased. The reviewers are chosen from a referee board according to their expertise. The submitted papers will be blind r

Reviewers are asked to evaluate the manuscript originality, methodology, contribution to the field, quality of the abstract, re or may require a revision for style and/or content. Reviewers should return the review comments within 30 days after receiving th

# Status of my 2018 Dream List



- Clear, Harmonized and Robust European Strategy: **In Progress**
- High quality of the Scientific and Engineering approach: **Maintained**
- Multidisciplinary exchanges, (e.g human physiology): **Too limited**
- Easier and Faster Access to Space: **Too limited**
- Easier and Stable financial source: **Effort to be maintained**
- Economical : Terrestrial spin-in/Spin-out: **Effort to be maintained**
- Societal:
  - Education: **Good !**
  - Citizen participation, and support: **Can be better !**



## The 2020 Conference

- Unfortunately Virtual,
- Co-organised by University, IDDUP and ESA,
- More than 200 registrations,
- Really International,
- Good representation of Academic, Industry and terrestrial Actors,
- Use the QUIZZ and check your MELiSSA Know-How !
- We will welcomed your feedback



## Conclusion



- MELiSSA is doing well, thank You !
- We are now visible and part of the developments Actors on Earth and in Space
- We will maintain this dual strategy,
- During these 3 days, you will have a good summary of the project progresses,
- We do need to thank you for your all your efforts, in this difficult period, and we count on your understanding
- We wish you a fruitful conference !

