

# Call for Abstracts

## MELISSA Conference

### 3-4-5 November, 2020

## FULLY VIRTUAL

The 2020 edition of MELISSA Conference is the European platform dedicated to closed life support system. It is the place to share and exchange about fundamental and applied research for Space and Earth applications. All the respective communities: air, water, waste recycling, food production and preparation, modelling, control, safety, circular systems, education and societal impact,... are represented.

The Conference will highlight and foster the collaboration between researchers, engineers, experts, private and public organisations.

#### **CALL FOR ABSTRACTS**

*Technical papers and posters* addressing the topics of the Conference are welcome.

The abstract must be in English language with a maximum length of 500 (without blanks) words and **must contain:**

1. Title of the work
2. A brief summary of the content that will be addressed in the paper with an indication of the selected topics
3. An indication of main hypothesis on which the work is based, of the followed methodology and of the used sources
4. A presentation of the main results of the paper and of their added value with respect to the substantive knowledge of the addressed matter and / or of literature on it
5. First name, last name, phone numbers, e-mail address and company of the author/s
6. Preferred presentation option: oral presentation or poster.

Eleven main topics will be discussed:

1. [Organic wastes processing and refinery](#)
2. [Urine treatment](#)
3. [Water recycling \(grey water and condensate\)](#)
4. [Edible biomass production](#)
5. [Food quality, processing and human nutrition](#)
6. [Physical, chemical and microbial contaminants](#)
7. [Modelling and system design](#)
8. [Flight experiments and space technology demonstrators](#)
9. [Ground demonstration and analogue testing](#)
10. [Terrestrial applications](#)
11. [Societal impacts and education](#)

## **Session topics**

### **1. Organic wastes processing and refinery**

Review and characterization of processes and technologies enabling to transform organic wastes (i.e. biological, physical, chemical transformations) into relevant resources for photosynthetic processes, crew metabolic needs (i.e. oxygen, water) and mission consumables (e.g. nitrogen).

*Keywords: waste collector, waste preparation, waste degradation, waste separation, carbon dioxide purification, reverse microbial fuel cells, microbial degradation, wet oxidation, fiber degradation, space environment effects (modified gravity, radiation, vacuum, etc..).*

### **2. Urine treatment**

Review and characterization of processes and technologies enabling to transform Urine (i.e. biological physical, chemical transformations) into relevant resources for photosynthetic processes, crew metabolic needs (i.e. oxygen, water) and mission consumables (e.g. nitrogen).

*Keywords: collector, stabilisation, nitrification, denitrification, electro dialysis, filtration, electrolysis, anammox, space environment effects (modified gravity, radiation, vacuum, etc..).*

### **3. Water recycling (grey water and condensate)**

Review and characterization of processes and technologies enabling to transform grey water and condensate (i.e. biological, physical, chemical transformations) into relevant resources for photosynthetic processes, crew metabolic needs (i.e. oxygen, water)

*Keywords: grey water collector, condensers, storage and buffering, biocide, antimicrobial surfaces, electrodialysis, membrane filtration, electrolysis, water quality monitoring, space environment effects (modified gravity, radiation, vacuum, etc..).*

### **4. Edible biomass production**

Review and characterization of processes and technologies enabling to produce edible biomass (i.e. higher plants, microorganisms) from relevant resources (i.e. CO<sub>2</sub>, VFAs, N-sources)

*Keywords: bioreactors, lighting systems, biomass characterization, biomass quality, greenhouse, hydroponics, aeroponics, plant physiology, stress and pathogen detection/control, space environment effects (modified gravity, radiation, vacuum, etc..).*

### **5. Food quality, processing and human nutrition**

Review and characterization of raw material quality, processes and technologies enabling to transform edible biomass (i.e. higher plants, microorganisms) into food products and recipes within the nutritional requirements.

*Keywords: food processing, food safety and quality, food storage, diet, recipes, food management systems, nutrigenomics, prebiotics, probiotics.*

### **6. Physical, chemical and microbial contaminants**

Review and characterization of risks and hazards for the crew, bioprocesses, and materials, related to physical, chemical and microbial contaminants in closed systems.

*Keywords: Pathogens, phages, virus, SMACs, modelling, risks assessment, risk management, human toxicology, emerging pollutants, radiation effects (space environment).*

### **7. Modelling and system design**

Characterization, model elaboration, simulations, testing and control of regenerative processes at sub-system and system levels, leading up to closed life support system.

*Keywords: system engineering, stoichiometry, mass-balances, ALISSE criteria, control design, simulations tools, CFD modelling, concurrent engineering, knowledge management.*

## **8. Flight experiments and space technology demonstrators**

Flight experiment (at payloads and system level) and associated flight hardware development for data collection, process demonstrations, control validation, ECLS H/W development and overall operations.

*Keywords: ARTEMIS, URINIS, MELONDEAU, WAPS, ACLS, MODULES, PFPU, space greenhouse, cold plasma, water recovery unit, ANITA2, hardware development.*

## **9. Ground demonstration and analogue testing**

Development and tests of life support processes and systems using ground facilities and terrestrial analogues.

*Keywords: technology validation, operation testing, crew psychology, field testing remote monitoring and control, MELISSA Pilot Plant, Concordia, EDEN, LUNA, BIOS, FIPES.*

## **10. Terrestrial applications**

Spin-in and spin-off of life support developments.

*Keywords: Commercial applications, spin-off companies, closed habitats, water recycling, smart cities, circular economy, industrial ecology, extreme environments, resource recovery and reuse.*

## **11. Societal impacts and education**

Closed Life Support systems as providing models and tools to understand ecologies and ecosystems, and rethink contemporary aspects of human relationships to living beings and systems.

*Keywords: Citizen science, solar system exploration, ecology, ecosystems, anthropology, recycling, models, artificial vs. natural ecosystems, controlled environments, public perception, acceptability, history of science and technics, Science Technology Engineering and Math (STEM) activities.*

## **CHALLENGES FOR THE MELISSA CONFERENCE 2020**

In order to make this conference more concrete and effective, a list of project challenges is proposed. The authors are invited to consider these challenges during their abstract elaboration

### **Phase 1: Basic R&D**

- Characterization and mechanistic modelling of a complex microbial community;
- Characterization of Energy/Exergy balance at process and Loop level;
- Degradation and valorization of plants fibers, tissues and bio-plastics;
- Characterization and Modelling of Higher plants;
- Technologies to convert VFA to CO<sub>2</sub>;
- Reduction of organic carbon content of Urine;
- Understanding and characterization of the Na, Mg, P, S, K, Ca cycles;
- Processes to produce food with realistic ALISSE criteria;
- Food preparation: Step Processes from harvested biomass to recipes;
- Elaboration of a loop metabolome;
- Impact of exogenous products, how to prioritize?

### **Phase 2: Preliminary Flight experiment**

- Study Hoagland solution and/or urine chemical behavior under temperature gradients in weightlessness;
- Study a novel technique for transfer water (and nutrients) to a plant root system in weightlessness conditions.
- Analyse the effects of space radiation on MELISSA micro-organisms and higher plants;
- Study methods and effects for extracting and/or injecting CO<sub>2</sub> in liquids in weightlessness conditions;
- Study an energy-efficient process for removing humidity from air in weightlessness;
- Study the physical behavior of a fixed-bed reactor in weightlessness conditions, taking into account all the three phases (gaseous, liquid and solid) present in the system;
- Modelling effects of beyond LEO radiations on MELISSA processes?

### **Phase 3: Terrestrial Demonstrators**

- Gas Separation technologies (e.g. CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, H<sub>2</sub>, CH<sub>4</sub>, VFA, ...);
- Technologies for specific ions extraction from water streams;
- Dynamic simulator and Loop control strategy;
- Biomass harvesting technology to an edible product (e.g. Limnospira);
- On-line elemental chemical analysers (e.g. Hoagland, Zarrouk, Winogradsky, ...);
- ALISSE optimised demonstrators for water recovery from grey and yellow waters;
- Energy balances of pilot/demonstrator/isolation facilities.

### **Phase 4: Terrestrial Applications and Technology Transfer**

- How to progress from the existing technology demonstrators to circular system demonstrators?
- How to progress from the 4 existing spin-offs to the world leader industries?
- How to deploy technology and knowledge from our existing circular spots to Europe?

### **Phase 5: Education & Communication**

- How to place MELISSA at the level of its ambition?
- From PhD co-funding to a European Master program;
- How to enlarge European motivation, from school to retirement home?
- Societal impact of Closed Life support system activities.

## **SELECTION PROCESS**

**Abstracts submission deadline is 1<sup>st</sup> of June 2020. Only abstracts authorized for publication on MELISSA foundation site will be accepted.**

The abstracts will be evaluated by the Scientific Committee based on the following criteria and those described on page 5:

1. Approved for oral presentation: the paper will be presented (by means of a Power Point within a slot of about 15/20 minutes) during the Conference, the presentation (PDF) will be uploaded on the official website of the event.
2. Approved for poster presentation: the posters (to be provided by the author) will be affixed and they will be visible during the whole duration of the Conference. Poster dimension must be: 70cm Width x 100cm Height.
3. The paper shall preferably concern a proposed challenge.

The outcome of the selection process will be communicated to the authors by e-mail at the latest on August 15<sup>th</sup> 2020.

### **Final steps**

The final Conference program will be issued on September 1<sup>st</sup> 2020.

Authors whom abstracts have been approved must send their presentation (PDF) and/or poster (PDF) within October 19<sup>th</sup> 2020 to the following e-mail address: [team@iddup.be](mailto:team@iddup.be)

The **file name** must include the name of the speaker.

The **cover page** of the presentation must include: Title, Subtitle, Author/s, Company.

The presentation/poster can contain graphs, tables and images.

### **Additional Information**

For more information, please contact: [info@melissafoundation.org](mailto:info@melissafoundation.org)

## **REGISTRATION**

Registration is mandatory for and will be confirmed upon payment.  
Payment receipt will be sent to you together with your registration confirmation.

### ***Information about fees***

Fees include:

- Unlimited access to the Conference
- 1 copy of the Conference proceedings

**NEW PRICE : 150 € (3 DAYS)**

### ***Important notes***

Registrations will close on **27/10/2020** Closure of Business.

### ***Cancellation policy***

Full refunding for cancellations (requested to [finance@melissafoundation.org](mailto:finance@melissafoundation.org)) before 27/10/2020 18.00 local time.

No refunding after this deadline.

### ***Contact***

For any enquiry, please send an email to [info@melissafoundation.org](mailto:info@melissafoundation.org)



### **Organizing Committee**

Benedikt Sas - University of Ghent, Belgium  
Korneel Rabaey - University of Ghent, Belgium  
Christophe Lasseur - European Space Agency, The Netherlands  
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Ramon Ganigue - University of Ghent, Belgium  
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Korneel Rabaye - Ghent University, Belgium  
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