

List of Publications

Academic Publications (1)

- Detrell G.: Analysis and Simulation of a Synergetic Environmental Control and Life Support System for Long Duration Spaceflight, PhD Dissertation *Universität Stuttgart* and *Universitat Politècnica de Catalunya*, ISBN 978-3-8439-2658-4, Dr. Hut Verlag, **2015**

Book Chapters (1)

- Detrell G., Helish H., Keppler J., Martin J., Henn N.: From Biofiltration to Promising Options in Gaseous Fluxes Biotreatment, Chapter 20 - Microalgae for combined air revitalization and biomass production for space applications. DOI: 10.1016/B978-0-12-819064-7.00020-0, **2020**

Journal Publications (4)

- Detrell G., Griful Ponsati E., Messerschmid E.: Reliability versus Mass Optimization of CO₂ Extraction Technologies for Long Duration Missions, DOI: 10.1016/j.asr.2016.03.024 *Advances in Space Research*. Vol. 57, Issue 11 (2337-2346), **2016**
- Detrell G., Schwinning M., Ewald R.: An international and interdisciplinary approach on learning how to design a space station, DOI: 10.1016/j.actaastro.2018.12.009, *Acta Astronautica*, **2019**
- Helisch H., Keppler J., Detrell G., Belz S., Ewald R., Fasoulas S., Heyer A.G., High density long-term cultivation of *Chlorella vulgaris* SAG 211-12 in a novel microgravity-capable membrane raceway photobioreactor for future bioregenerative life support in SPACE, DOI: 10.1016/j.lssr.2019.08.001, *Life Sciences in Space Research*, **2019**
- Detrell, G.: *Chlorella Vulgaris* Photobioreactor for Oxygen and Food Production on a Moon Base—Potential and Challenges, DOI: 10.3389/fspas.2021.700579, *frontiers in Astronomy and Space Sciences*, **2021**

Conference Papers (41)

- Belz S., Ganzer B., Detrell G., Messerschmid E.: Synergetic Hybrid Life Support System for a Mars transfer Vehicle, IAC-10-A1.6.7, 61st International Astronautical Congress, Prague, Czech Republic, **2010**
- Detrell G., Ganzer B., Messerschmid E.: Adaptation of the ELISSA Simulation Tool for Reliability Analysis, AIAA-11-5279, 41st International Conference on Environmental Systems. Portland, Oregon, USA, **2011**
- Detrell G., Ta R., Baker S., Gray K.A., Dawson E., Vigneron A., Lüthen C., Ewald R. Eriksson K.: A Next Generation Space Station, IAC-12-B3.2.2, 63rd International Astronautical Congress, Naples, Italy, **2012**
- Belz S., Bretschneider J., Helisch H., Detrell G., Keppler J., Burger W., Yesil A., Binnig M., Fasoulas S., Henn N., Kern P., Hartstein H., Matthias C.: Preparatory Activities for a Photobioreactor Spaceflight Experiment Enabling Microalgae Cultivation for Supporting Humans in Space, IAC-15-A1.7.7, 66th International Astronautical Congress, Jerusalem, Israel, **2015**
- Bretschneider J., Belz S., Helisch H., Detrell G., Keppler J., Fasoulas S., Henn N., Kern P.: Functionality and setup of the algae based ISS experiment PBR@LSR, ICES-2016-203, 46th International Conferences on Environmental Systems, Vienna, Austria, **2016**
- Detrell G., Griful Ponsati E., Messerschmid E.: ECLSS reliability analysis tool for long duration spaceflight, ICES-2016-294, 46th International Conference on Environmental System, Vienna, Austria, **2016**

- Belz S., Bretschneider J., Detrell G., Helisch H., Keppler J., Nathanson E., Fasoulas S., Ewald R., Henn N., Kern P., Hartstein H., Adrian, A.: Microalgae cultivation in space for future exploration missions: Results of the preparatory activities for a spaceflight experiment on the International Space Station, IAC-16-A1.6.4, 67th International Astronautical Congress, Guadalajara, Mexico, **2016**
- Belz S., Keppler J., Helisch H., Bretschneider J., Detrell G.: Innovative biological and physico-chemical recycling of CO₂ in human spaceflight, ICES-2017-147, 47th International Conference on Environmental Systems, Charleston, USA, **2017**
- Detrell G., Belz S.: ELISSA – a comprehensive software package for ECLSS technology selection, modelling and simulation for human spaceflight missions, ICES-2017-190, 47th International Conference on Environmental Systems, Charleston, South Carolina, USA, **2017**
- Keppler J., Helisch H., Belz S., Bretschneider J., Detrell G., Henn N., Fasoulas S., Ewald R., Angerer O., Adrian A.: From breadboard to protoflight model - the ongoing development of the algae based ISS experiment PBR@LSR, ICES-2017-180, 47th International Conference on Environmental Systems, Charleston, USA, **2017**
- Belz S., Helisch H., Keppler J., Detrell G., Martin J., Ewald R., Henn N., Adrian A.; Hartstein H., Angerer, O.: Microalgae cultivation in space for future exploration missions: Results of the breadboard activities for a long-term photobioreactor spaceflight experiment on the International Space Station, IAC-17-A1.7.6, 68th International Astronautical Congress, Adelaide, Australia, **2017**
- Detrell G., Belz S., Bretschneider J., Ewald R., Fasoulas S.: A Hybrid Life Support System for a Moon Base, IAC-17-A5.1, 68th International Astronautical Congress, Adelaide, Australia, **2017**
- Schwinning M., Detrell G., Ewald R.: Conceptual design of a manned platform in the Martian system, IAC-17-A5.2, 68th International Astronautical Congress. Adelaide, Australia, **2017**
- Detrell G., Schwinning M., Ewald R.: An international and interdisciplinary approach on learning how to design a space station, IAC-17-E1.3, 68th International Astronautical Congress. Adelaide, Australia, **2017**
- Pardo Spiess M.J., Cowley A., Belz S., Lehner B., Hauslage J., Detrell G.: C.R.O.P.[®] Demonstrator for Human Space Exploration: Experiment Analysis and System Model Development, IAC-17-A1.IP, 68th International Astronautical Congress. Adelaide, Australia, **2017**
- Keppler J., Belz S., Detrell G., Helisch H., Martin J., Henn N., Fasoulas S., Ewald R., Angerer O., Hartstein, H., The final configuration of the algae-based ISS experiment PBR@LSR, ICES-2018-141, 48th International Conference on Environmental Systems, Albuquerque, USA, **2018**
- Detrell G., Keppler J., Helisch H., Fasoulas S., LSS hands-on research opportunities for students at the University of Stuttgart, ICES-2018-144, 48th International Conference on Environmental Systems, Albuquerque, USA, **2018**
- Detrell G., Belz S., Bretschneider J., Kittang Jost A., Mejdell Jakobsen Ø., Design of a test platform for algae cultivation research at different gravitation levels, ICES-2018-145, 48th International Conference on Environmental Systems, Albuquerque, USA, **2018**
- Helisch H., Belz S., Keppler J., Detrell G., Henn N., Fasoulas S., Ewald R., Angerer O., Non-axenic microalgae cultivation in space – Challenges for the membrane µgPBR of the ISS experiment PBR@LSR, ICES-2018-186, 48th International Conference on Environmental Systems, Albuquerque, USA, **2018**
- Keppler J., Detrell G., Helisch H., Belz S., Martin J., Henn N., Ewald R., Fasoulas S., Hartstein H., Angerer O.: Microalgae cultivation in space for future exploration missions: a summary of the development progress of the spaceflight experiment PBR@LSR on the international space station ISS, IAC-18-A1.7.4, 69th International Astronautical Congress, Bremen, Germany, **2018**
- Detrell G., Keppler J., Helisch H., Martin J., Belz S., Henn N., Ewald R., Fasoulas S., Hartstein H., Angerer O.: PBR@LSR experiment – ready to fly, IAC-18-A1.7.6, 69th International Astronautical Congress, Bremen, Germany, **2018**

- Detrell G., Keppler J., Helisch H., Fasoulas S.: Getting students closer to university research – Life Support System training at the University of Stuttgart, IAC-18-E1.3.8, 69th International Astronautical Congress, Bremen, Germany, **2018**
- Detrell G., Helisch H., Keppler J., Martin J., Henn N., Fasoulas S., Ewald R., Angerer O., Adrian, A.: PBR@LSR: The Algae-based Photobioreactor Experiment at the ISS -Configuration and Operations, ICES2019-95, 49th International Conference on Environmental Systems, Boston, USA, **2019**
- Detrell G., Ewald R.: LSS design tool for the Space Station Design Workshop at the Institute of Space Systems - University of Stuttgart, ICES2019-96, 49th International Conference on Environmental Systems, Boston, USA, **2019**
- Martin J., Keppler J., Detrell G., Helisch H., Ewald R., Fasoulas S.: Microalgae-based Photobioreactors for a Life Support System of a Lunar Base, ICES2019-92, 49th International Conference on Environmental Systems, Boston, USA, **2019**
- Detrell G., Helisch H., Keppler J., Martin J., Henn N., Angerer O., Peters S., Ewald R., Fasoulas S.: PBR@LSR: The algae-based photobioreactor experiment at the ISS – Operations Phase, IAC-19-A1.7.3, 70th International Astronautical Congress, Washington D.C., United States, **2019**
- Martin J., Detrell G, Ewald R., Fasoulas S.: Scalable Microalgae-based Life Support System, IAC-19-A1.8.5, 70th International Astronautical Congress, Washington D.C., United States, **2019**
- Detrell G., Helisch H., Keppler J., Martin J., Henn N., Ewald R., Fasoulas S., Angerer O., Peters S.: PBR@LSR: the Algae-based Photobioreactor Experiment at the ISS - Operations and Results, ICES2020-25, International Conference on Environmental Systems, **2020**
- Martin J., Dannenberg A., Detrell G, Ewald R., Fasoulas S.: Noninvasive process control of a microalgae-based system for automated treatment of polluted agricultural ground water transferred from the development of a biological Life Support Systems, ICES2020-21, International Conference on Environmental Systems, **2020**
- Keppler J., Detrell G., Fasoulas S.: Hands-on Seminar on Electrolysis and Fuel Cells for Life Support System Applications for Students at the University of Stuttgart, ICES2020-48, International Conference on Environmental Systems, **2020**
- Detrell G., Microalgae-based Hybrid Life Support System from Simulations to Flight Experiment, ICES-2021-185, 50th International Conference on Environmental Systems, online congress, **2021**
- Detrell G., Muñoz, Banchs-Piqué M. Anglada G., Hartlieb, P., Sureda M., Nüwa, a self-sustainable city state on Mars–development concept, urban design and life support, ICES-2021-255, 50th International Conference on Environmental Systems, online congress, **2021**
- Martin J., Dannenberg A., Detrell G., Fasoulas S., Ewald, R., Development of a harvesting-unit for an automated photobioreactor system, ICES2021-105, 50th International Conference on Environmental Systems, online congress, **2021**
- Martin, J., Dannenberg A., Detrell G., Fasoulas, S. Ewald, R., Energy reduction by using direct sunlight for a microalgae photobioreactor for a Mars habitat, ICES-2021-107, , 50th International Conference on Environmental Systems, online congress, **2021**
- Detrell G., Martin J., Vogel M., Oxygen and food production using a microalgae photobioreactor for a Lunar base, IAC-2021-A1.7.3. 72nd International Astronautical Congress, Dubai, United Arab Emirates, **2021**

- Grass M., Maheswaran T., Detrell G., The space station design workshop goes digital - opportunities and challenges during pandemic-times, SSEA-2022-148, 4th Symposium on Space Educational Activities (SSEA), Barcelona, Spain, **2022**
- Detrell G. Wenzel S., Bosch Bruguera M., Maheswaran T., Grass M., Martin J., Vogel M., From Soyuz-docking manoeuvres to microalgae cultivation: hands-on training for Master's students, SSEA-2022-179, 4th Symposium on Space Educational Activities (SSEA), Barcelona, Spain, **2022**
- Detrell G., Martin J., Microalgae for Oxygen and food production on the Lunar or Martian surface - Impact of In-Situ Resources Utilization, ICES-2022-48, 51st International Conference on Environmental Systems, St. Paul, Minnesota, USA, **2022**
- Martin J., Detrell G., Development of an automated photobioreactor test system, ICES-2022-68, 51st International Conference on Environmental Systems, St. Paul, Minnesota, USA, **2022**
- Bosch Brugera M., Lopez Bermudez J.S., Detrell G., Ewald R., Development of a Virtual Reality space docking simulator for research and training - A case application in the space analogue SIRIUS-21, IAC-22-B3.5, 73rd International Astronautical Congress, Paris, France, **2022**
- Detrell G., Maheswaran T., The Stuttgart Space Station Design Workshop – Current Status, IAC-22-E1-EPB-11, 73rd International Astronautical Congress, Paris, France, **2022**

Presentations and Posters (16)

- Detrell G., Belz S., Schwinning M.: PBR@Moon: Research on Algae Photobioreactors for a Moon Base, Poster, 5th European Lunar Symposium, Münster, Germany, **2017**
- Schwinning, M., Detrell G., Belz S., Ewald R.: The Stuttgart Space Station Design Workshop – Conceptual Designs of a lunar exploration architecture, Poster, 5th European Lunar Symposium, Münster, Germany, **2017**
- Belz S., Helisch H., Keppler J., Detrell G., Fasoulas S., Ewald R., Henn N.: Photobioreactor Technology for Microalgae Cultivation to Support Humans in Space with Oxygen and Edible Biomass, Presentation, 51st ESLAB Symposium: “Extreme Habitable Worlds”. ESTEC, Noordwijk, Netherlands, **2017**.
- Detrell G.: Lebenserhaltungssysteme: Überleben im Weltall, 22nd Bad Honnefer Winterseminar, Bad Honnef, Germany, **2018**
- Detrell G., Keppler J., Helisch H., Belz S., Henn N., Hartstein H., Angerer O.: PBR@LSR – A Hybrid Life Support System Experiment and Technology Demonstrator at the ISS, Presentation, AgroSpace-MELISSA Workshop Rome, Italy, **2018**
- Detrell G., Keppler J., Helisch H., Belz S., Henn N., Hartstein H., Angerer O., Ewald R., Fasoulas S.: PBR@LSR: A Hybrid Life Support System Experiment at the ISS, 42nd COSPAR Scientific Assembly, F4.2-0015-18, Pasadena, USA, **2018**
- Detrell G., Keppler J., Belz S.: ELISSA: A Life Support System (LSS) technology selection, modelling and simulation tool for human spaceflight missions, 42nd COSPAR Scientific Assembly, F4.3-0005-18, Pasadena, USA, **2018**
- Helisch H., Keppler J., Martin J., Detrell G., Ewald R., Fasoulas S., Heyer, A.G.: Advanced biotechnological life support systems – Development of microalgae cultivation processes for space applications, Presentation, 11. Bundesalgenstammtisch, Karlsruhe, Germany, **2018**
- Martin J., Detrell G., Ewald R., Fasoulas S.: Lightning system for microalgae cultivation on the Moon and possible applications on Earth, Poster, 11. Bundesalgenstammtisch, Karlsruhe, Germany, **2018**

- Fasoulas S., Ewald R., Detrell G., Helisch H., Keppler J., Martin J.: Future Life Support Systems, Poster, United Nations / Germany High Level Forum: The Way Forward after UNISPACE50+ and on Space 2030, Bonn, Germany, **2018**
- Detrell G., Keppler J., Helisch, H., Martin J., Ewald R., Fasoulas S.: Photobioreactor Technology for Microalgae Cultivation to Support Humans in Space, Space Travel: Adaptive Research and Technologies from Biological and Chemical Engineering, Houston, USA, **2018**
- Martin J., Detrell G., Ewald R., Fasoulas S., Automatisierung von Photobioreaktoren zur Grundwasseraufbereitung, 12. DECHEMA Bundesalgenstammtisch, Universität Kiel, **2019**
- Helisch, H. Schließung von Stoffkreisläufen - Technologietransfer zwischen Weltraum und Erde zur Einsparung von Ressourcen (Vortrag). 12. DECHEMA Bundesalgenstammtisch, Universität Kiel, **2019**
- Martin J., Detrell G., Ewald R., Fasoulas S., Technologietransfer: Photobioreaktoren zur Grundwasseraufbereitung, DLR INNOspace, Bonn, **2019**
- Detrell, G., Microalgae: from oxygen and food production in Space to groundwater processing on Earth, MELISSA Congress, O_15, Digital Congress, **2020**
- Detrell, G., Microalgae for space applications: from microgravity to partial gravity scenarios, 43rd COSPAR Scientific Assembly, F4.1-0001-21, Digital Congress, **2021**

Public Outreach Presentations (40)

- Bad Honnefer Winterseminar „Weltraum Exploration & Kolonisation“, Überleben im Weltall, **2018**
- Startevent PAPELL, Algen auf der Raumstation, **2018**
- Von Böblingen in den Weltraum, ein kleiner Schritt, **2018**
- Raumfahrt aus Leidenschaft, Algen auf der Raumstation, **2019**
- Spaceport Norway, From Life Support Systems for Space to Improved Resource Utilization on Earth, **2019**
- Tag der Wissenschaft Universität Stuttgart, Algen auf der Raumstation, **2019**
- SpaceUp Stuttgart, Algae in Space?, <https://youtu.be/NZxpuSpjdWI>, **2019**
- Centre Cívic Vil·la Urània, 50 anys de l'arribada a la lluna, **2019**
- Volkshochschule Backnang & Kulturkreis Weissach am Tal, Überleben im Weltall, **2019**
- TEDxEixample, Let's learn from Mars, <https://youtu.be/NvuZJ5qCKLk>, **2020**
- HLRS, Nüwa, Design of a sustainable city on Mars, **2020**
- Culinary Institute of Barcelona, Survival in space: Air, Food and Water, **2021**
- Haus der Astronomie, Überleben auf dem Mars, <https://youtu.be/Lo-MJYn69yc>, **2021**
- SONet Talks, Surviving in Space, <https://youtu.be/6holJmF4cWI>, **2021**
- WIA-Europe #Women4Space, Surviving on Mars, https://youtu.be/Gx6JC_CHVXs, **2021**
- Col·legi Montserrat – Barcelona, Per què anem a l'espai?, **2021**
- Girl's Day at IRS, Astronautinnen und Lebenserhaltungssysteme, **2021**
- Fibracat TV, STEM Arreu, <https://youtu.be/p3m1bKUKbwk>, **2021**
- Inspired Workshop, Photobioreactor Technology for Microalgae Cultivation, **2021**
- House of Switzerland, Rethinking Living: the future of food and the food of the future, **2021**
- Next frontiers, <https://www.next-frontiers.de/de/2021/nachhaltig-bauen-auf-dem-mars-mit-dr-gisela-detrell-karlheinz-steinmueller/>, **2021**
- Science Slam Stuttgart, Leben auf dem Mars?, **2021**
- School of Talents, Surviving in Space, **2021**
- EETAC - Setmana de la ciència, Sobreviure a Mart, <https://youtu.be/fcfBY-kwPpk>, **2021**
- St. Peters School Barcelona, Surviving on Mars, **2021**
- STEM Women Congress, Sobrevivir en Marte, <https://youtu.be/ad0zSJI3TiY>, **2021**

- Nethunting, Diálogos de Futuro, <https://youtu.be/sG5PUxeQ2CI>, **2021**
- Economía circular, Nüwa: Economía Circular en la Primera Ciudad Sostenible de Marte, <https://youtu.be/6REYOWHLPYU>, **2022**
- Inner Wheel - Distrikt 86 Reutlingen Tübingen, Überleben auf dem Mars, **2022**
- Institut Torrent del Alous - Rubí, Sobreviure a Mart, **2022**
- Institut Escola Sant Jordi - Navàs, Sobreviure a Mart, **2022**
- UPC, talk to Bachelor Students, Working on Life Support Systems, **2022**
- Science Slam Event blackbox|55 live, **2022**
- Tag der Wissenschaft, Überleben auf dem Mars, **2022**
- Science Slam beim Stuttgarter Wissenschaftsfestival, **2022**
- Raumfahrt als Leidenschaft, Marstadt Nüwa, **2022**
- EASN Key note speaker, Surviving on Mars, **2022**
- NewSpaceEconomy congress, Networking & Speaker's corner, **2022**
- Haus der Astronomie Heidelberg, Wie wäre es eigentlich, auf dem Mars zu leben?, **2022**
- Planetarium Laupheim, Überleben auf dem Mars, **2023**

Three most relevant Publications

- **Detrell G., Helisch H., Keppler J., Martin J., Henn N.: From Biofiltration to Promising Options in Gaseous Fluxes Biotreatment, Chapter 20 - Microalgae for combined air revitalization and biomass production for space applications. DOI: 10.1016/B978-0-12-819064-7.00020-0, 2020**
This book chapter summarizes my research over the last 5 years, within the Life Support Systems group at *Universität Stuttgart*. It provides an overview of the research concept on using microalga-based components for space applications. It first provides an overview of the rationale and need of such a system in future missions, including a comprehensive literature research on experiments in the field. Biological and technical challenges are identified. Some of the technical challenges of such a component are common in the design of any space system, for example the need of miniaturization in terms of mass, volume and energy demands. Finally, the International Space Station experiment PBR@LSR is presented as an example of the development of flight hardware.
- **Detrell G., Schwinning M., Ewald R.: An international and interdisciplinary approach on learning how to design a space station, DOI: 10.1016/j.actaastro.2018.12.009, Acta Astronautica, 2019**
This paper published on *Acta Astronautica* summarizes the educational aspects of the *Space Station Design Workshop* I co-chaired in 2017. This paper explains the methodology and its evolution over the past 25 years of the *Space Station Design Workshop*. This workshop is an international and interdisciplinary 1-week event, targeted toward undergraduate and graduate students. Participants are divided into two teams and with a guided process developed and improved over the years are challenged to design a space station. The paper goes into details on the teaching approach used: from team organization to schedule and required resources. It summarizes the edition from 2017, not only by providing the results of the teams, but also feedback from the participants.
- **Detrell G., Belz S., Bretschneider J., Kittang Jost A., Mejdell Jakobsen Ø., Design of a test platform for algae cultivation research at different gravitation levels, ICES-2018-145, 48th International Conference on Environmental Systems, Albuquerque, USA, 2018**
This peer-reviewed-paper was presented at the *International Conference on Environmental Systems*, which is the largest conference in the field of Environmental Control and Life Support Systems (ECLSS) worldwide. The paper presents the work carried out within an international cooperation (TIME SCALE project, EU funded), with the goal to conceive a testing platform to allow Life Support System's technology testing at different gravitational levels, based on the experience of the European EMCS. In particular this paper describes the design of an algae cultivation module, allowing both fundamental biological research on microalgae and applied research on photobioreactor technologies. This paper is a good example of an international cooperation project I have participated in and of the 15 peer-reviewed papers I have published in this well-known congress, since 2016, many specifically on microalgae-based-systems but also on ECLSS analysis.