

2016-04-18

# Living computers, Mars simulations and DIY Starships: Advancing cross-disciplinary and cross-cultural collaboration

Vermeulen, ACJ

<http://hdl.handle.net/10026.1/5068>

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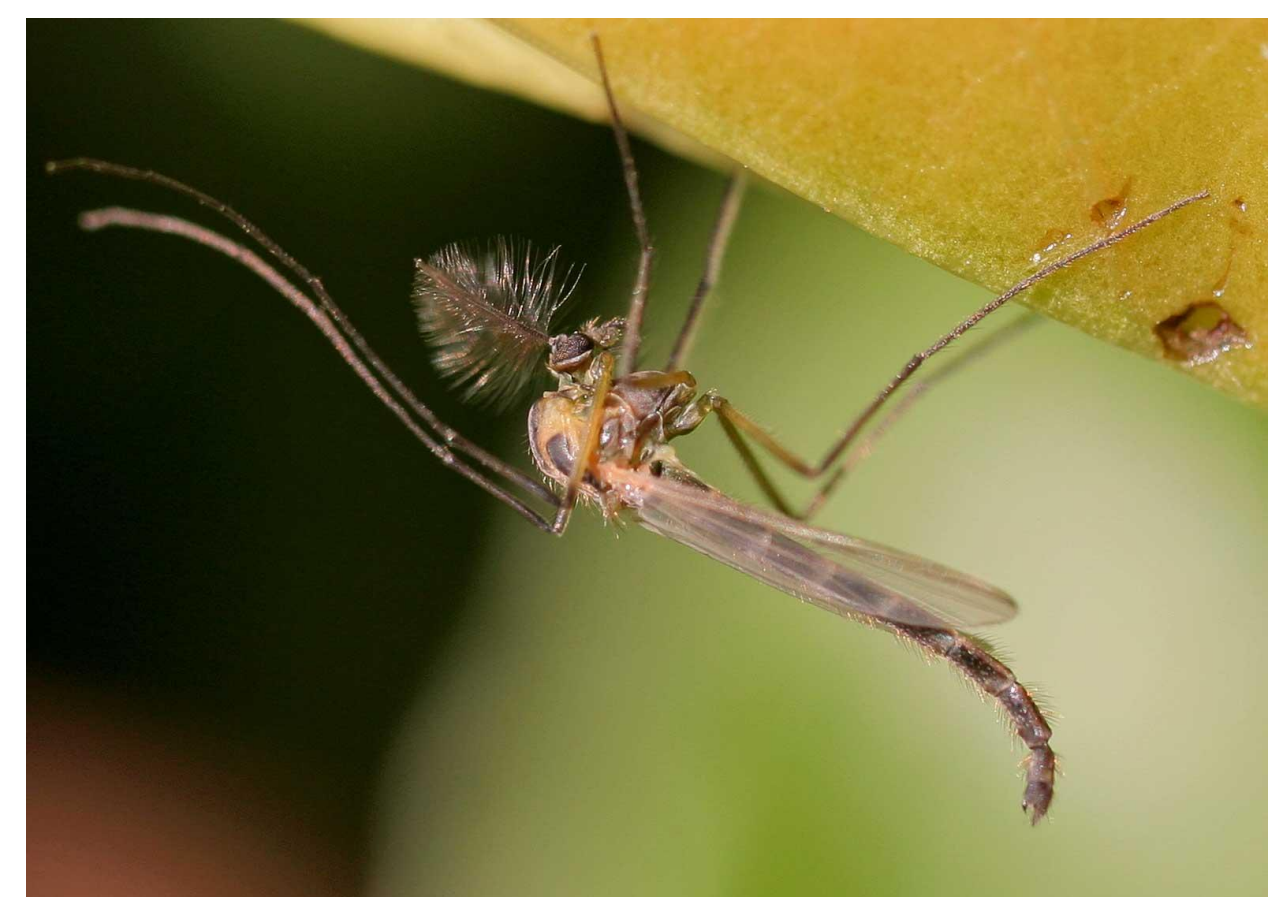
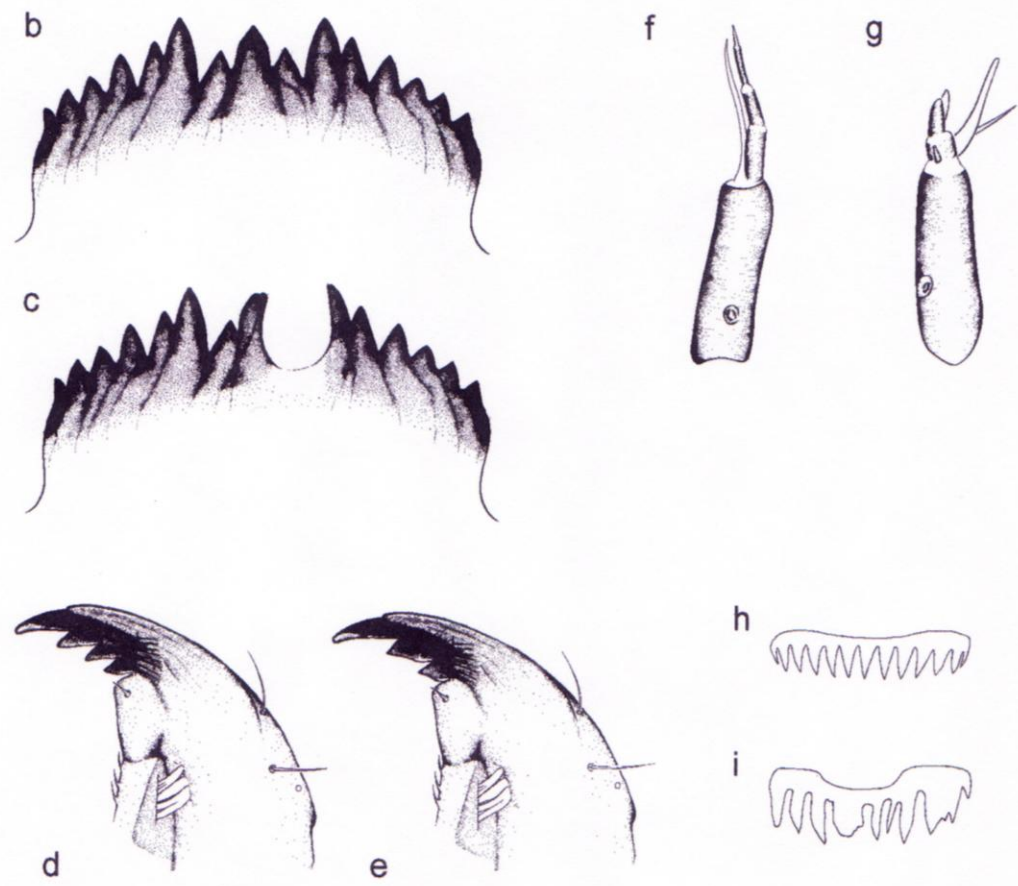
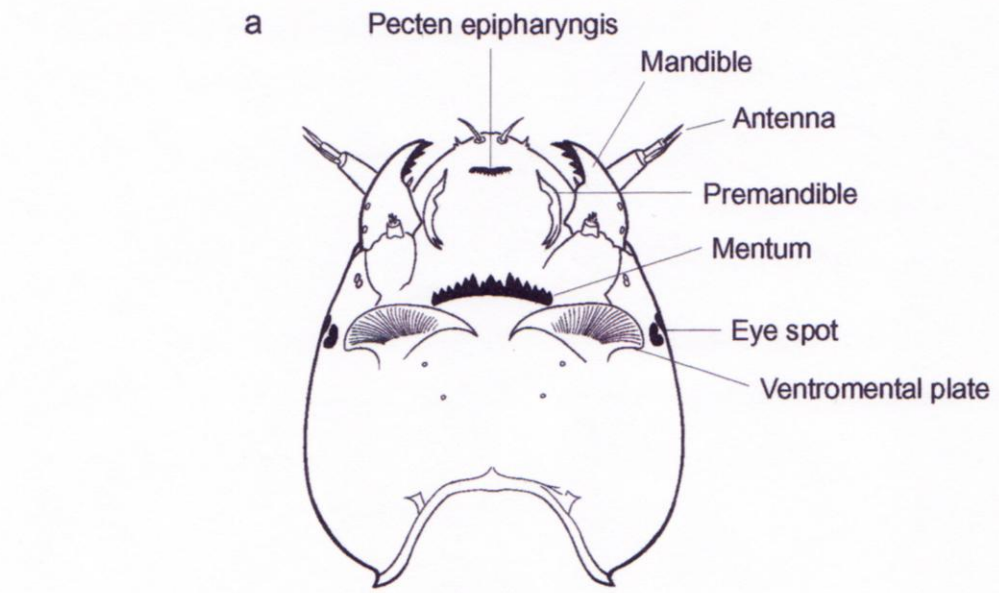
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# LIVING COMPUTERS, MARS SIMULATIONS AND DIY STARSHIPS

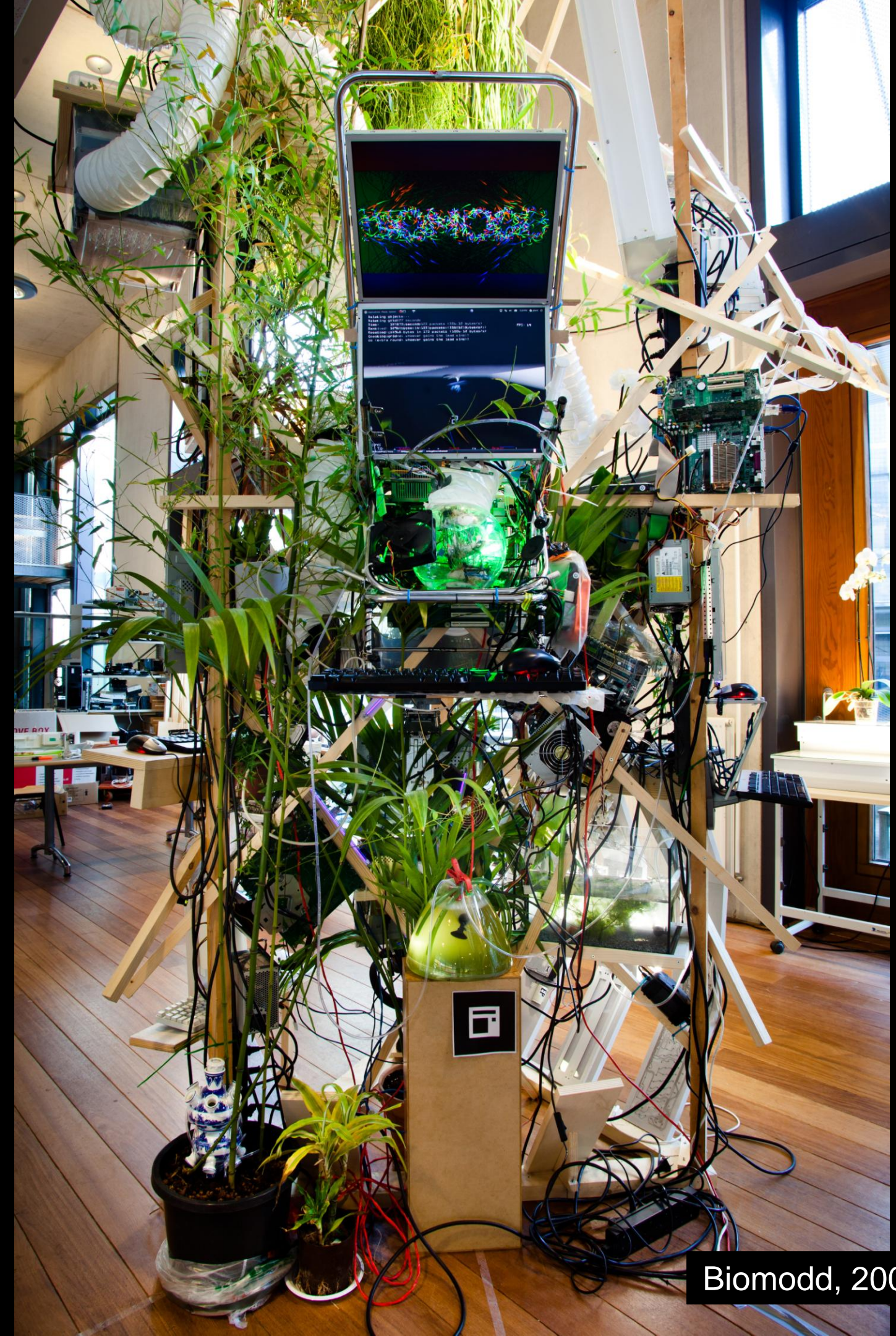
Advancing cross-disciplinary and cross-cultural collaboration

Angelo Vermeulen

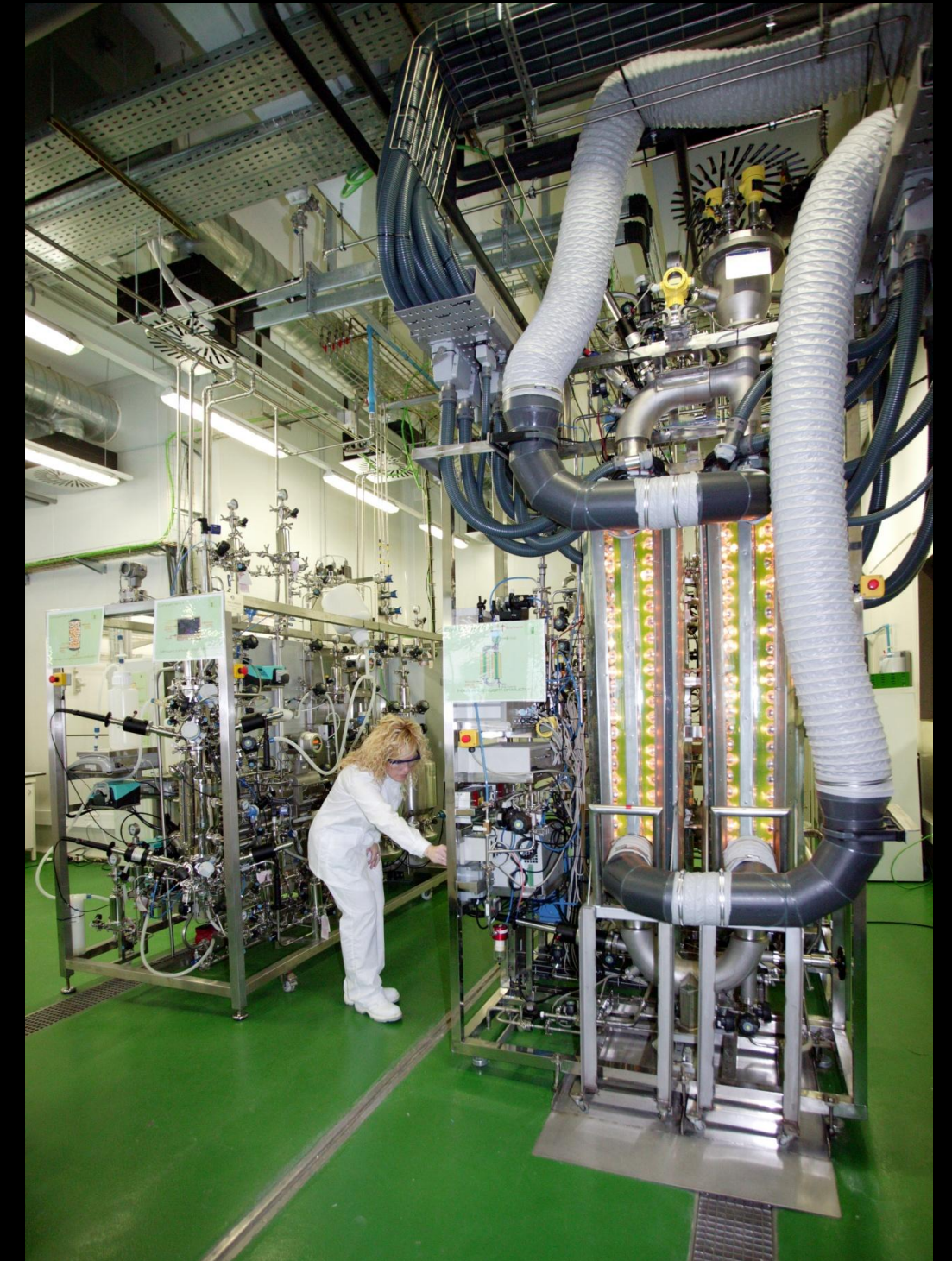
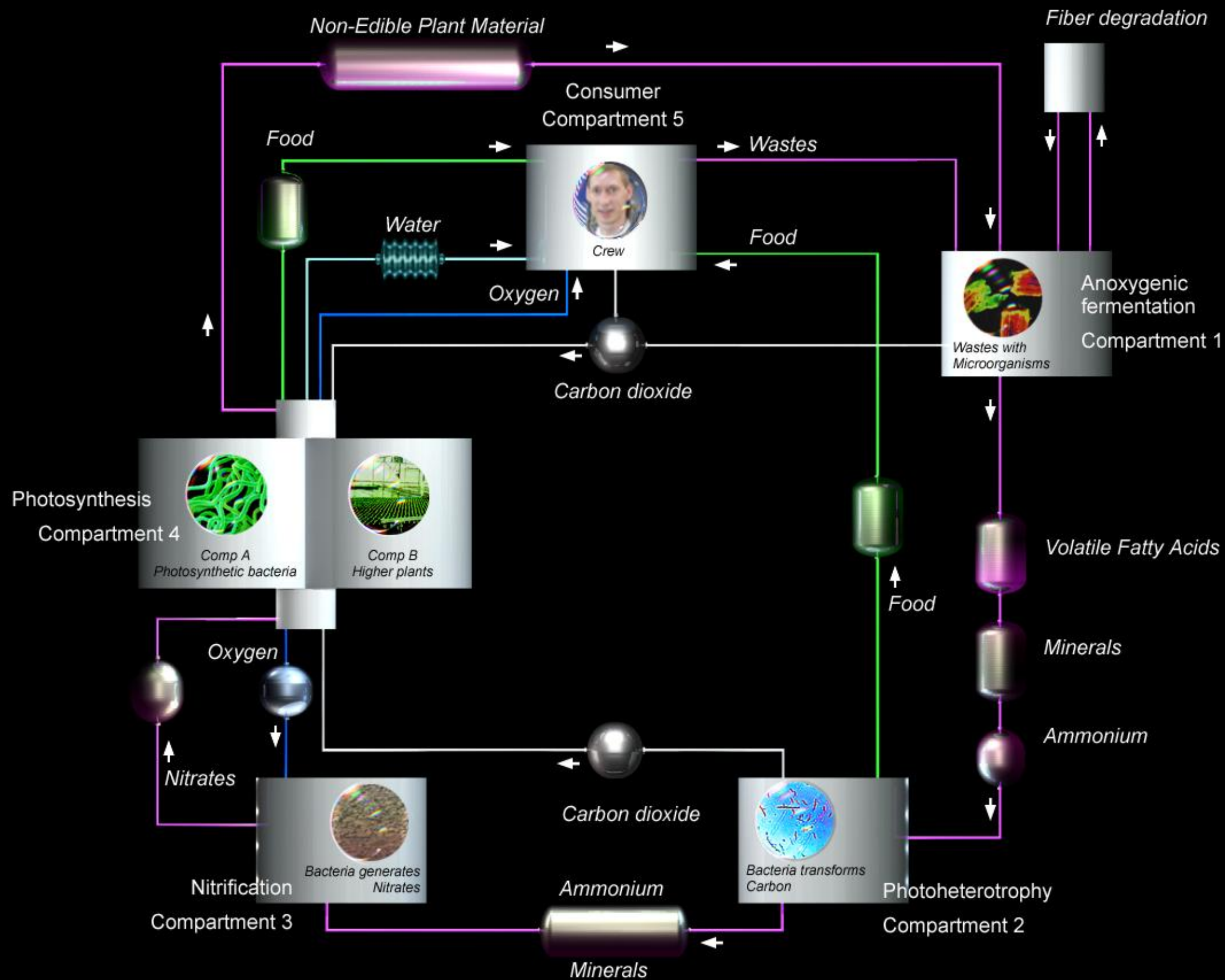
SEAD (Space Ecologies Art and Design) • TU Delft • LIQUIFER Systems Group



**Fig. 1.** a: schematic representation of the ventral view of a *Chironomus* head capsule (adapted from OLIVER et al. 1978), b: normal mentum, c: deformed mentum showing a mentum gap or so-called Köhn gap, d: normal mandible, e: mandible lacking one inner tooth, f: normal antenna, g: deformed antenna, h: normal pecten epipharyngis, i: deformed pecten epipharyngis with fused teeth. All illustrations are composite drawings based on photographs, except f and g (adapted from MADDEN et al. 1992). Nomenclature follows SAETHER (1980).



Biomodd, 2007 - (ongoing)





COPUOS Annual Session, United Nations, Vienna, 2012



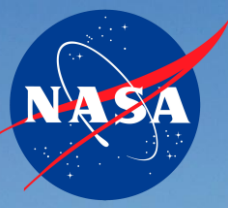
ESA Topical Team Arts & Science, EAC, Cologne, 2011



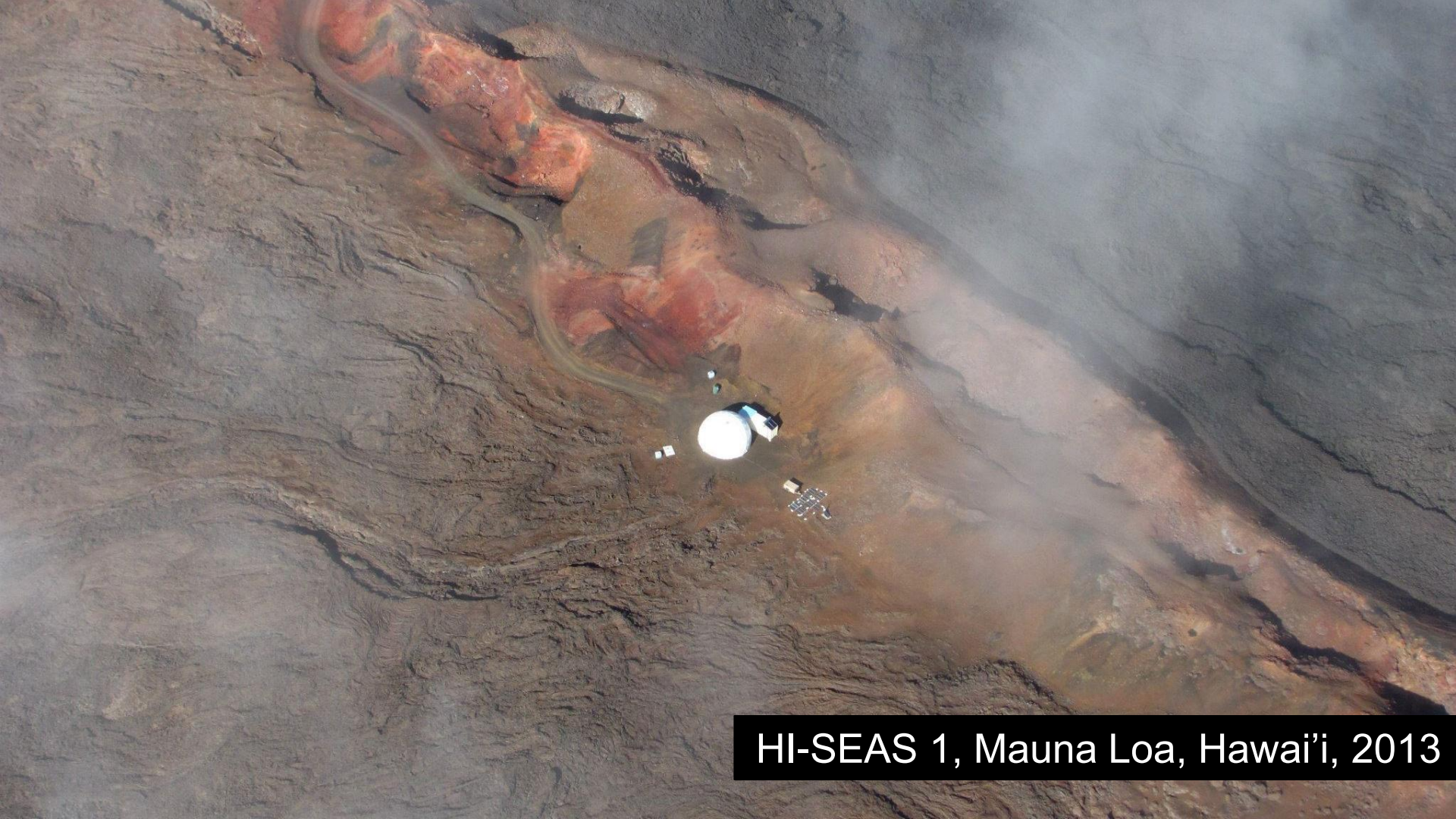
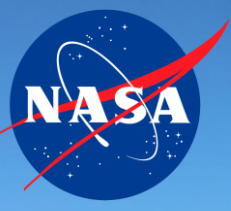
Geobiology in Space Exploration, ESA & NASA, Morocco, 2011



MEDUSA, COMEX & LIQUIFER Systems Group, 2012

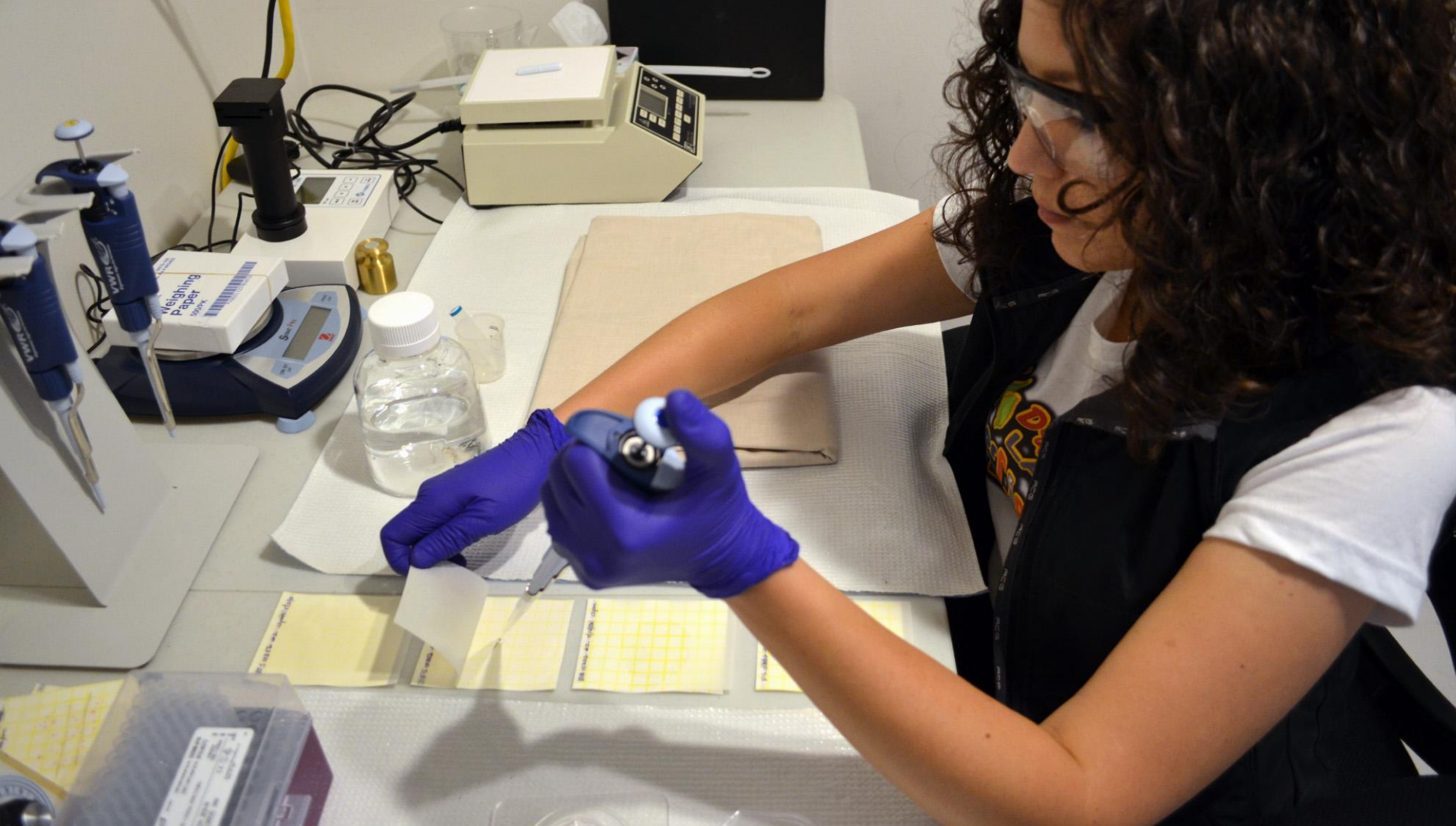
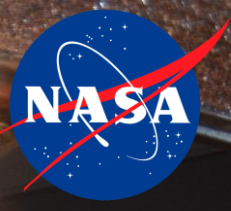


HI-SEAS 1, Mauna Loa, Hawai'i, 2013



HI-SEAS 1, Mauna Loa, Hawai'i, 2013





HI-SEAS 1, Mauna Loa, Hawai'i, 2013



- Diversity
- Autonomy
- Leadership

# PARTICIPATORY SYSTEMS

[ABOUT](#) [NEWS](#) [PEOPLE](#) [PROJECTS](#) [PUBLICATIONS](#) [VACANCIES](#)

## PHD CANDIDATES



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Starships – or interstellar craft – are considered the next major leap in the exploration of the Cosmos by mankind. Currently starship development is in its infancy due to the lack of a practical and adequate propulsion technology. If we consider manned interstellar travel the challenge is even more complex, and also shifts towards creating a fully autonomous system that is resilient over a long period of time. In fact a starship can be considered as the ultimate model for closed, autonomous systems, and as such has functional applicability in creating a more sustainable Earth. Traditionally, space systems design is being guided by incorporating as many contingencies as possible, and then training and anticipating for that. However, because of the sheer scale and inherent unpredictability of an interstellar mission, this approach cannot be relied upon any longer. A fundamentally different design paradigm is needed.

### LINKS

- [Faculty of Technology, Policy, Management, Systems Engineering](#)
- [TU Delft](#)



No. 725,509.

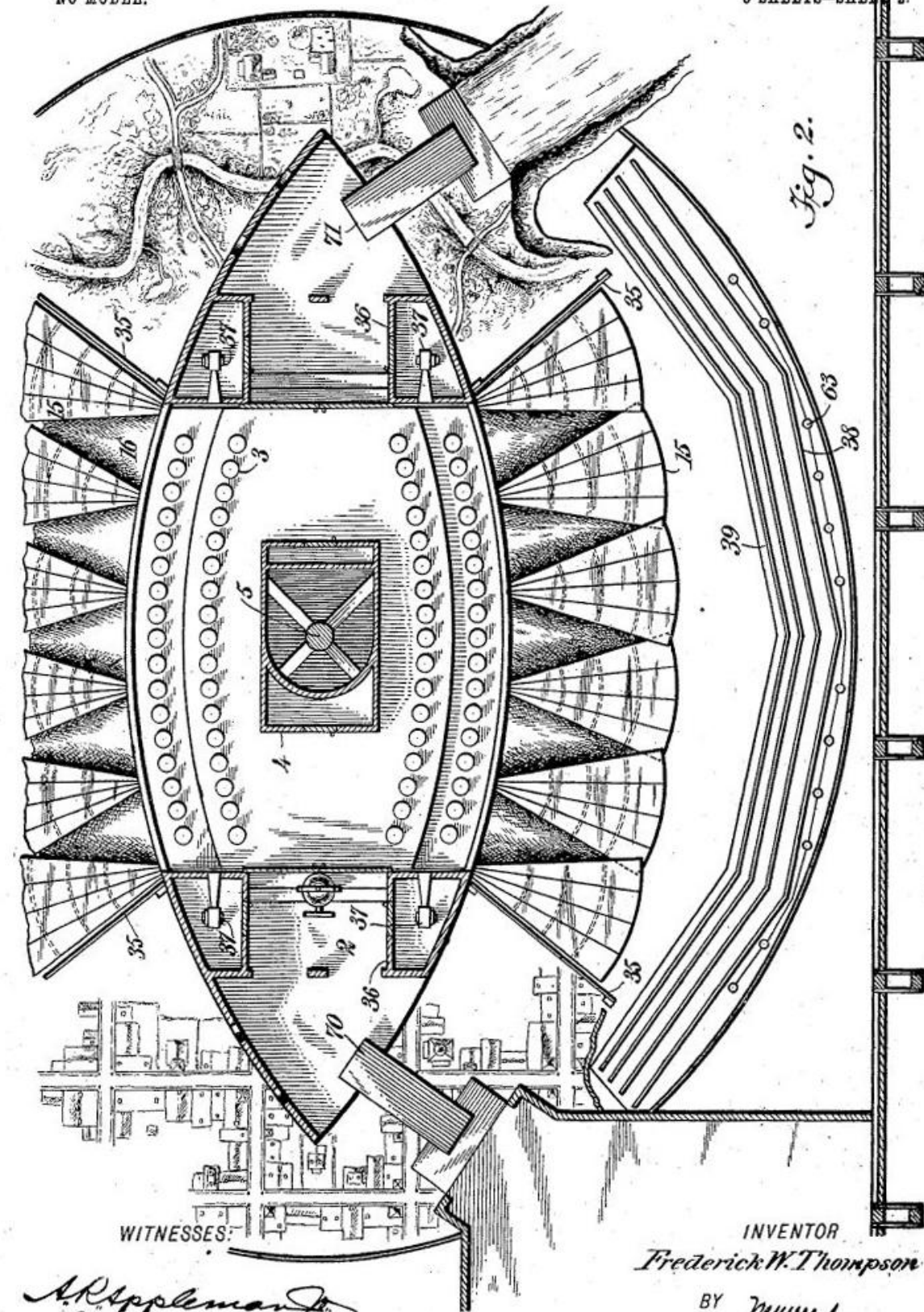
PATENTED APR. 14, 1903.

F. W. THOMPSON.  
SCENIC APPARATUS.

APPLICATION FILED NOV. 15, 1902.

NO MODEL.

5 SHEETS—SHEET 2.



WITNESSES:

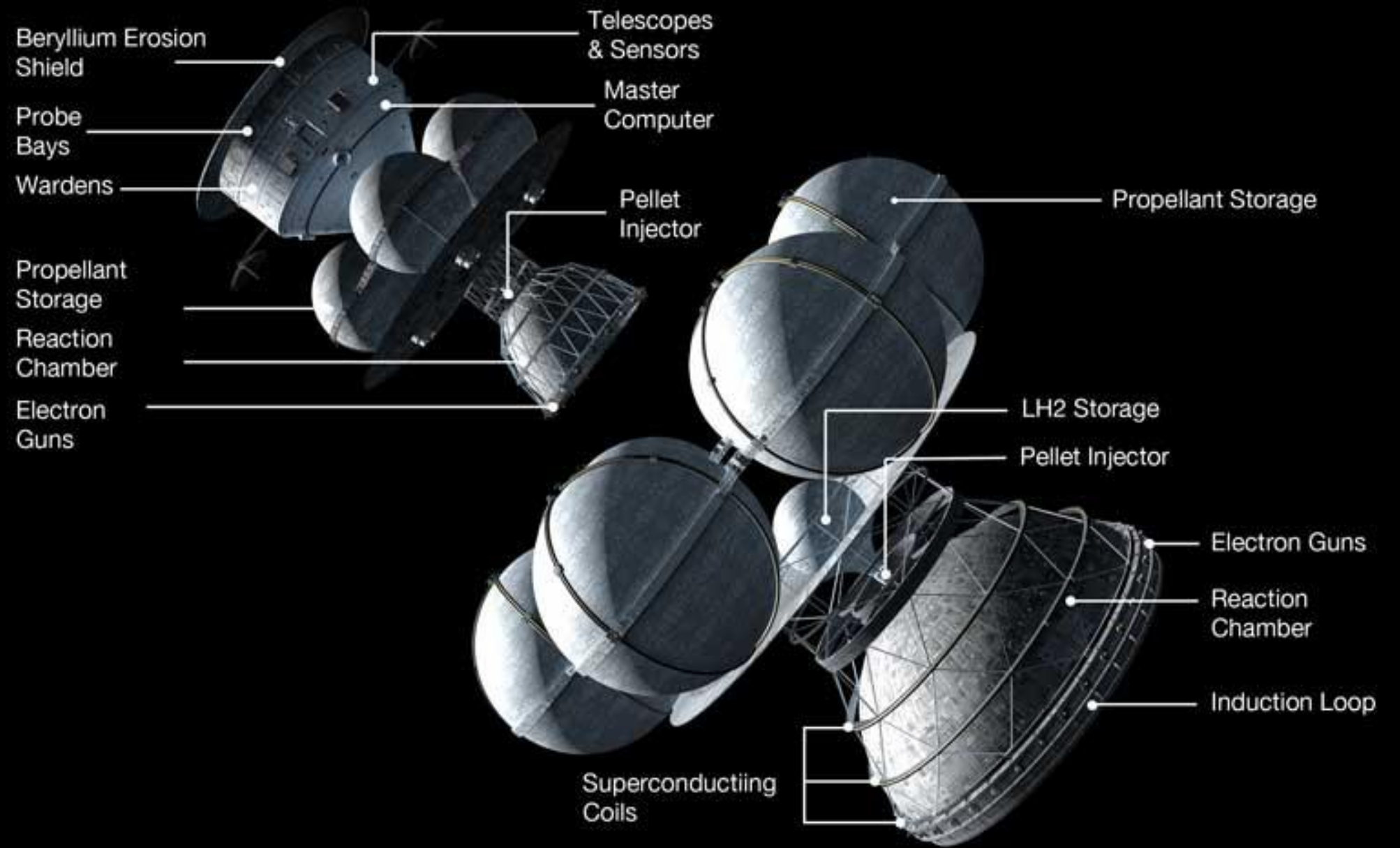
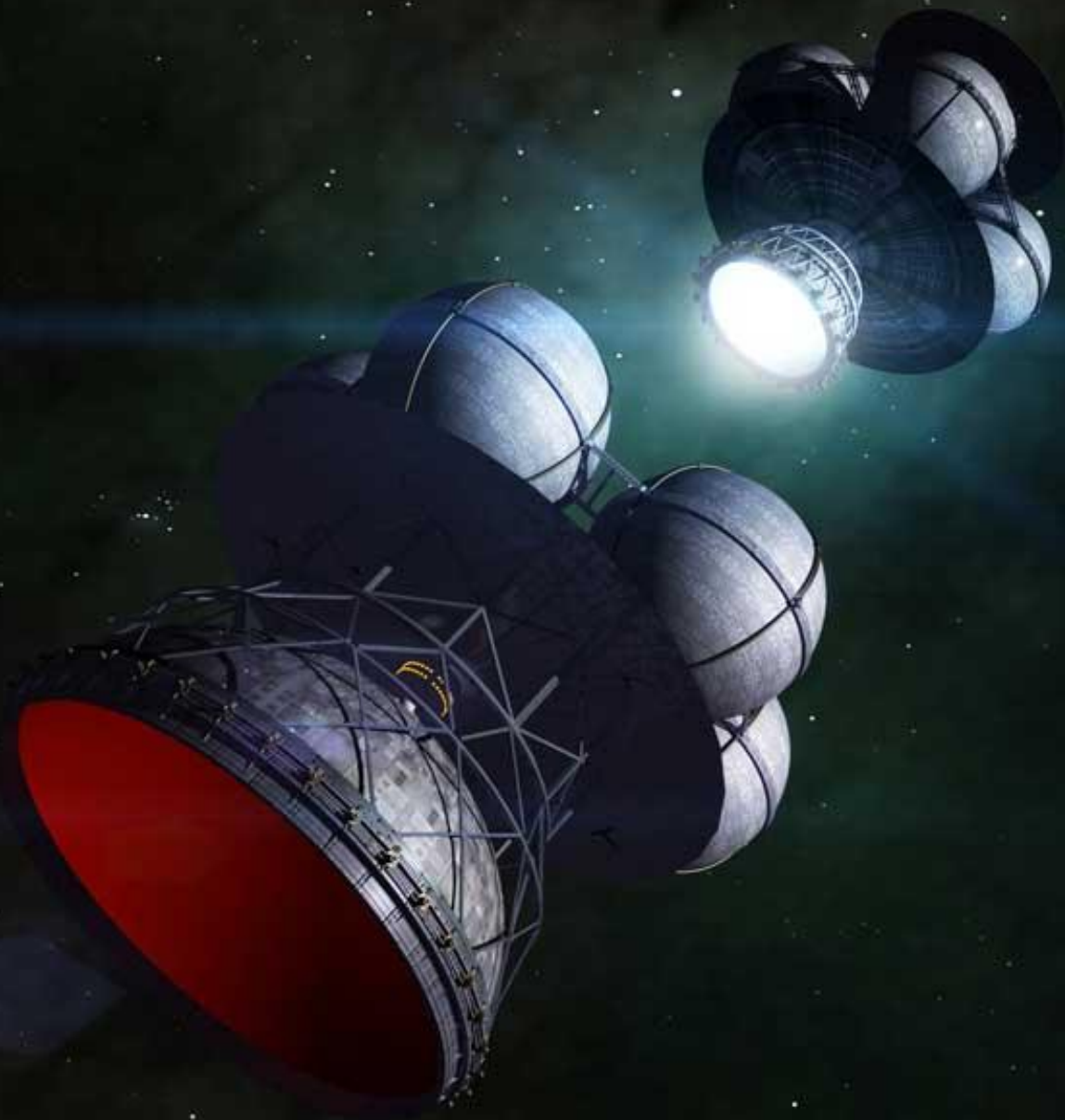
*A. Rappelman*  
*C. F. Ferguson*

INVENTOR  
*Frederick W. Thompson*  
BY *Mumford*  
ATTORNEYS.

A Trip to the Moon, Frederick Thompson, 1901



USS Enterprise, Star Trek, 60s & Imperial Star Destroyer, Star Wars, 70s



Deadalus, British Interplanetary Society, 1973-1978

RADICAL INTEGRATION

# Biomodd

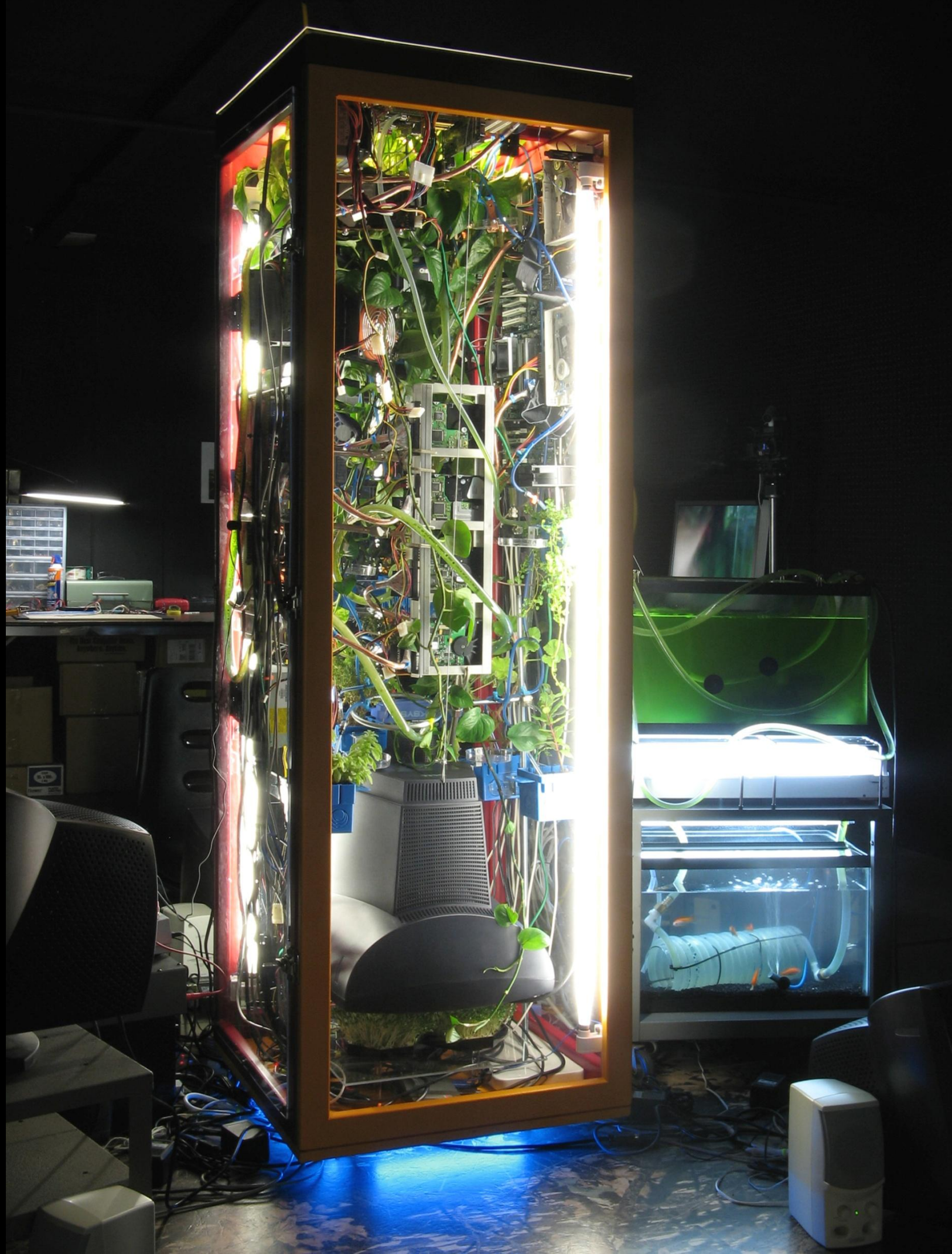








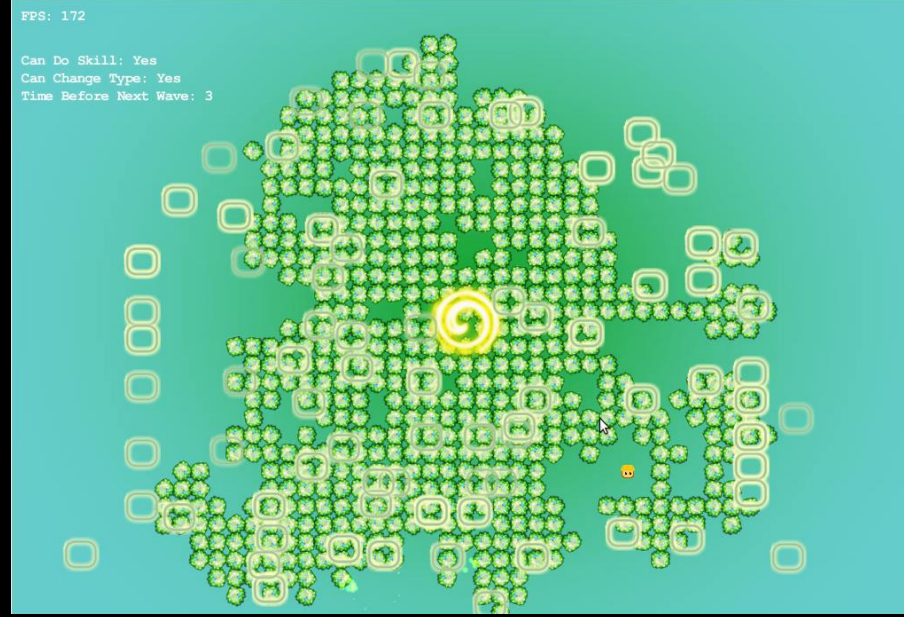
Biomodd London workshop, Create Space London, 2015



Biomodd [ATH<sup>1</sup>], @Lab, Athens OH, 2007-2008

Watch on Vimeo  
<https://vimeo.com/61763869>



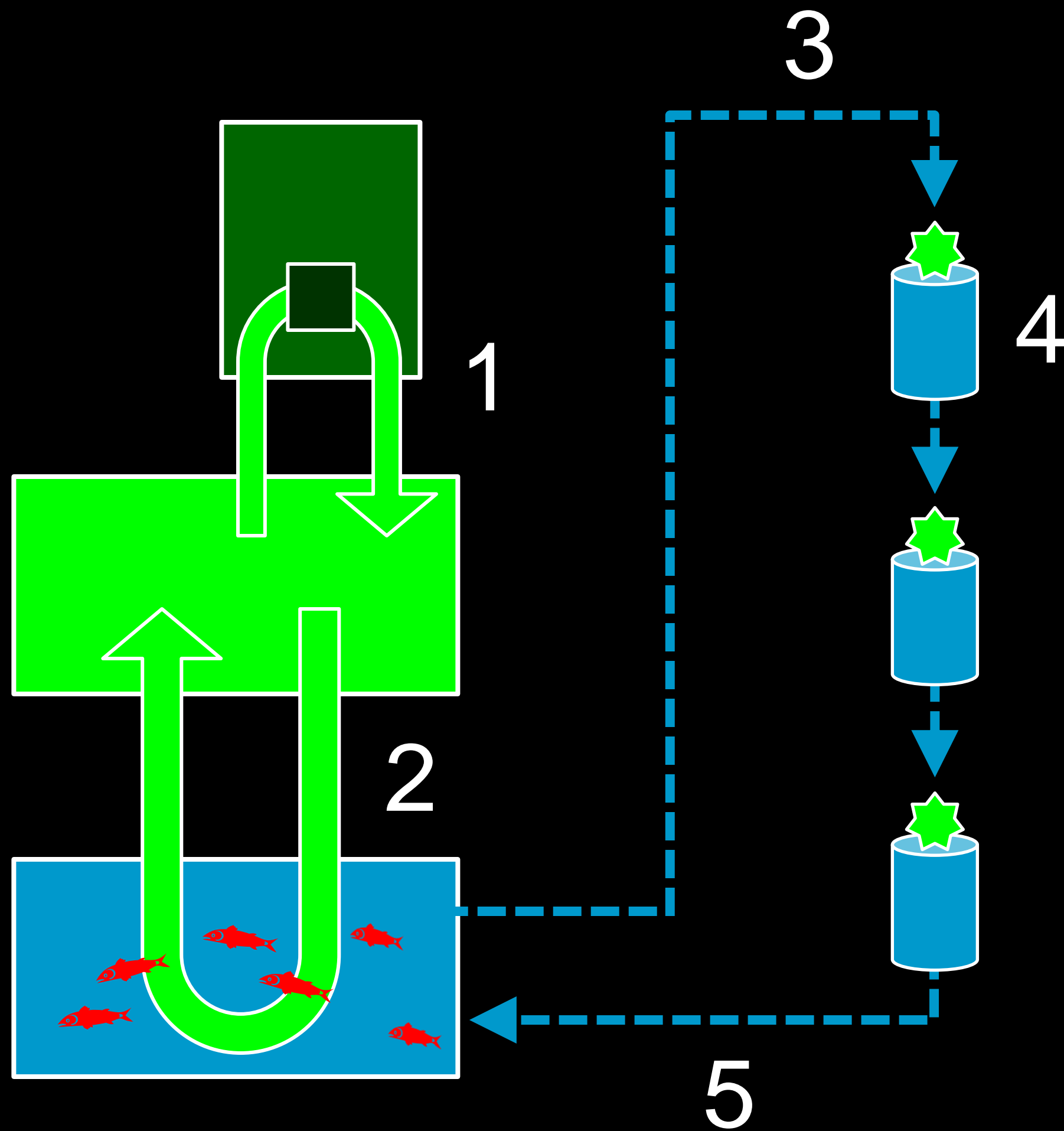


Biomodd [LBA<sup>2</sup>], UPLB, Los Baños, 2009

Watch on YouTube  
<https://youtu.be/uf01YJKYWBg>



Biomodd [LBA<sup>2</sup>], video by Waise Azimi & Angelo Vermeulen, 2009



Biomodd [LBA<sup>2</sup>], UPLB, Los Baños, 2009

This preprint—which does not incorporate reviewer feedback or final copy edits—is likely to differ from the camera-ready paper, which will appear in proceedings of ISEA 2015, the 21<sup>st</sup> International Symposium on Electronic Art.

## When Ideas Migrate: Postcolonial Perspectives on *Biomodd [LBA<sup>2</sup>]*

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### Abstract

*Biomodd* is a global series of art installations in which computer technology and ecology converge. Computer networks built from upcycled computer components are provided with living internal ecosystems. In a symbiotic exchange, plants and algae live alongside electronics and use the latter's waste heat to thrive. Sensors and robotics provide additional interaction possibilities with the organisms. The first version of the project was completed in the US, while the second version was built in the Philippines. Using a postcolonial stance, we reflect on the challenges involved in translating the project from one context to another. We focus on issues related to heat recycling in the tropics; authenticity and hybridity; obsolescence and the convertibility of capital; cultural sampling, remixing, and appropriation; and structures for social organization. We advance *Biomodd* as a significant contribution to art-science collaborative initiatives in the global South.

### Keywords

Postcolonial computing, installation art, collaboration, ICT4D, HCI4D, digital games, e-waste, recycling, gaming, ecology, biological art

### Introduction

Many practices of contemporary art have wandered into and set up shop in territories traditionally held by science, and vice versa. [1] This crossover between art and science seems particularly noticeable to those of us who live in what media theorist Rolando Tolentino has termed “advanced capitalist countries”, in which intellectual practices and concerns in scientific and artistic disciplines have experienced particular shifts and turns. [2, p. 101] However, a review of the literature on why science matters in so-called ‘global South’ countries (like the Philippines, from where we are currently writing this paper) reveals that questions of existential philosophy or aesthetics hardly figure. Instead, issues that do appear to matter—and for which the study of pure and applied sciences is encour-

aged—include improving food security, achieving better maternal health outcomes, preventing the spread of communicable diseases, and addressing other challenges articulated in texts such as the United Nations Millennium Development Goals. [3] In response to these socio-economic challenges, perspectives on information and communication technologies for development (ICT4D) and human-computer interaction for development (HCI4D) have been advanced within computing science. [4] While such perspectives are interdisciplinary and do draw from the arts, much work could be done to advance the intersectionality of the arts and the sciences and their role in addressing the diverse range of issues particularly in the “imperialized formations” of the global South. [2, p. 101]

For instance, art-science collaborations matter in addressing the global challenge of fostering what might be thought of as a *critical awareness of connectedness*. By this we mean a shared understanding of how the flourishing of human societies relies on our interaction with the natural ecosystems on which we depend, and on a critical engagement with the artificial systems that we create. This includes an acknowledgement and understanding of the fact that social, natural and artificial systems are continuously impacting on and reshaping each other. These dependencies and interactions have underpinned a diverse and burgeoning corpus of artistic and design work that has emerged over the years, marked by an interest in imagining a new “ecology of relations” through interfaces and systems that link humans, organic materials, and machines. [5] For instance, *The Telegarden* features a robot arm that tends to a garden and which human participants can remotely control. [6] *Mussels* control lights and sounds in Natalie Jeremijenko's *MUSSELxCHOIR*. [7] *Biolesce* uses electric motors to agitate algae that luminesce in response to the heart rate of audience members. [8] *Legend of the Sea Lord* uses mobile technologies to deliver a “mythological spectacle” and parable on the impact of human activity on marine ecosystems. [9] In each of these cases, the artists have responded to the invitation to address critical awareness of connectedness through poetic and technology-led forms of interventions.



2008), *Biomodd [LBA<sup>2</sup>]* (Los Baños and Manila, Philippines, 2008) and *Biomodd [LBA<sup>2</sup>]* (New York, USA, 2012). Images used with permission.

*cultural encounter, particularly in the context of orary globalization.* [12]

al critique of digital media and the electronic surfaced in the late 1990s but then disappeared technology and computing design discourse until a decade later. [13] We aim to contribute to *ing of postcolonial discourse in interactive art ology design* by using the lens of postcolonial to retrospect on *LBA<sup>2</sup>*.

### *Biomodd* Themes and Approaches

imagines and integrates relationships between natural, and artificial systems. The project was the second author of this paper in 2007 and has taken in collaboration with various groups and in the USA, Philippines, Slovenia, Belgium, lands, New Zealand, Chile, and the UK. [14] hows some of the different *Biomodd* versions. project does not solely aim to create a singular like many other process-oriented projects, *Bio-*jects nevertheless coalesce into physical struc- have been shown in exhibition contexts, where- installation stands as a material testament to the negotiations, and other exchanges underpinning

is predicated on a range of concerns that, taken form a conceptual framework.

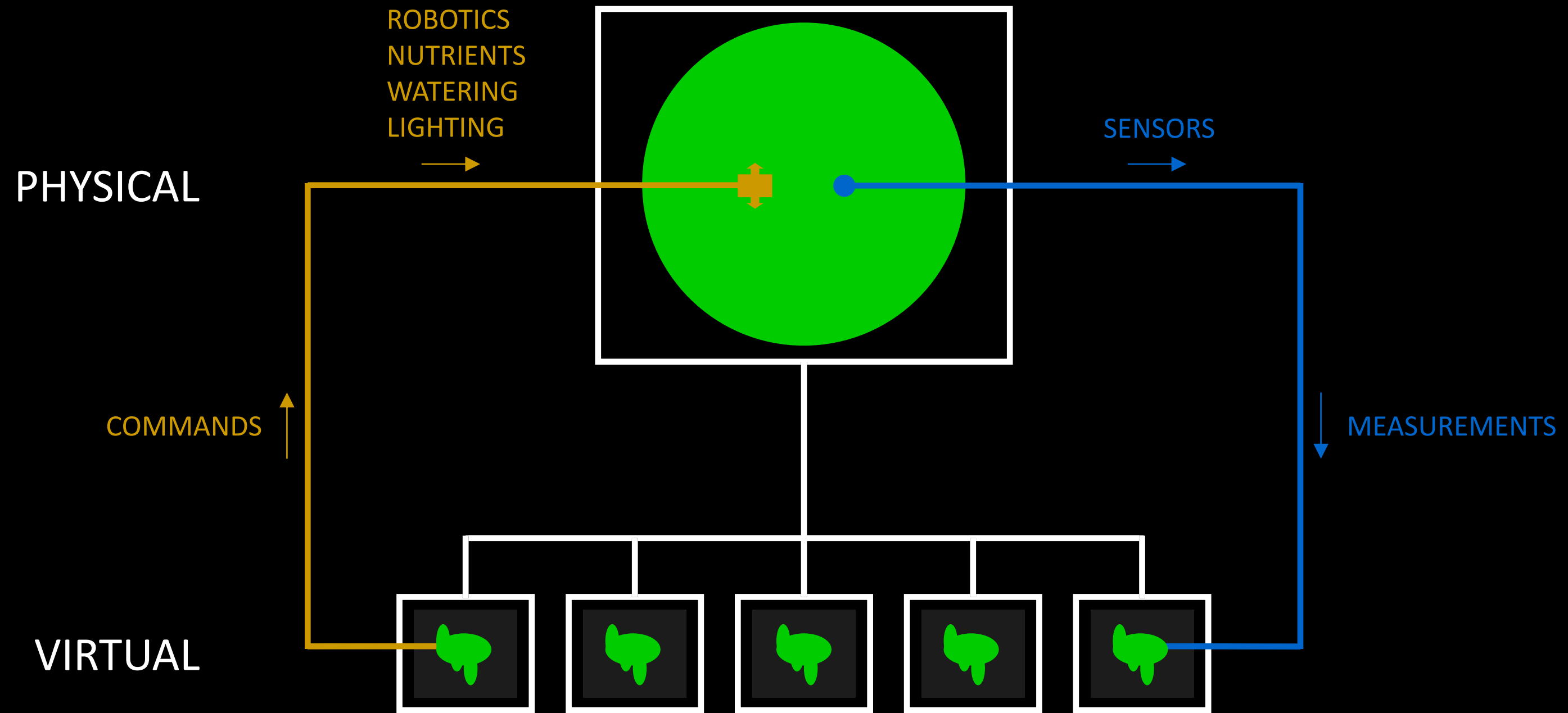
**Modding and hardware hacking:** *Biomodd's* derived from the practice of *case modding*, the transforming computer cases into imaginative *Biomodd* is inspired by the codes and tech- *case modding* subculture.

**and its creative reuse:** Obsolete hardware is *Biomodd* functionally and visually. As we dis- next section, the difference between obsoles- industrialized West and in the global South practical and design problems in *LBA<sup>2</sup>*.





# ENTANGLED REALITY







Biomodd [NYC<sup>4</sup>], robotics component of entangled reality system, NYSCI, 2011-2013



Biomodd [TAI<sup>8</sup>], National Taiwan Museum of Fine Arts, Taichung, 2016



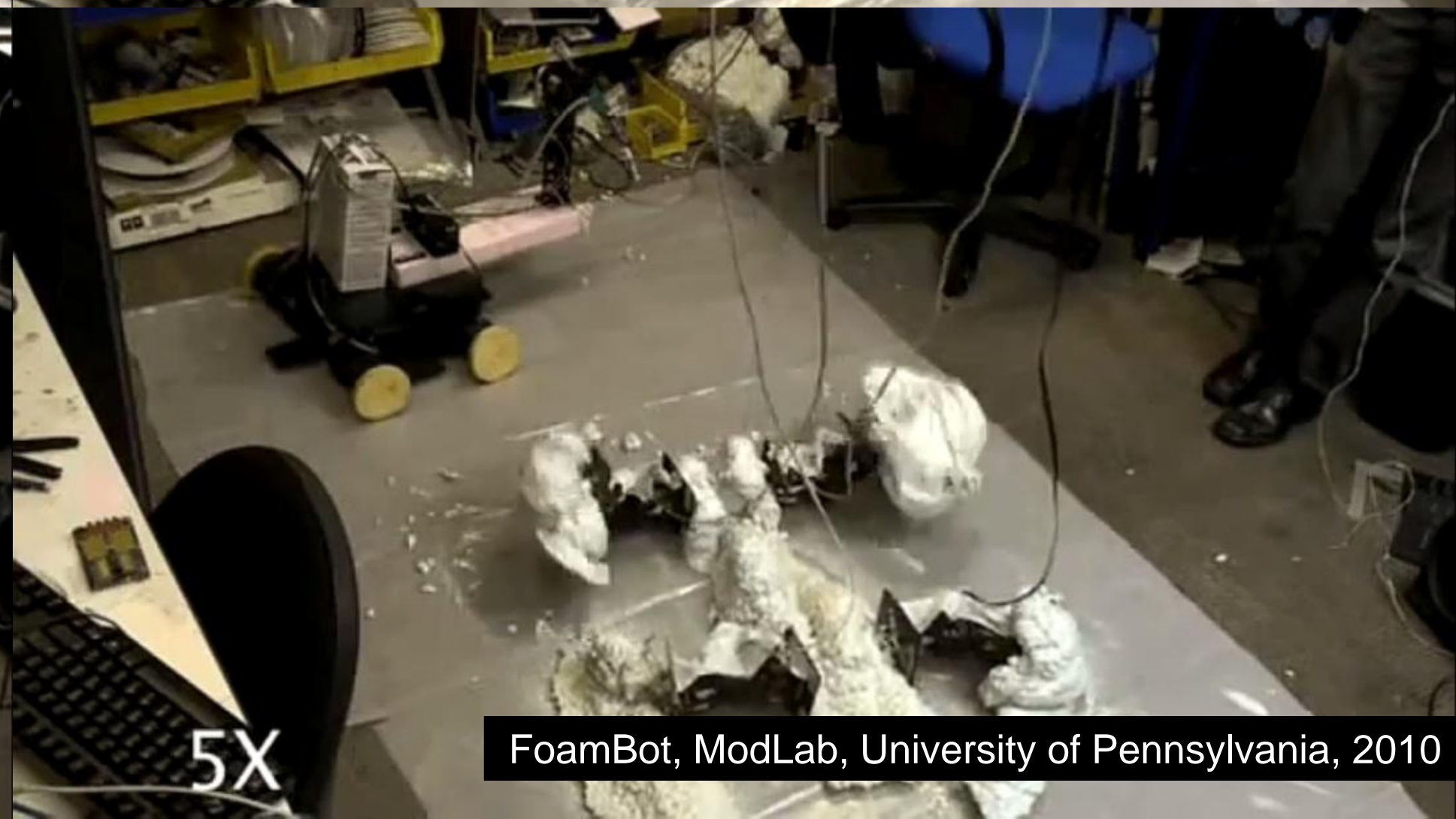
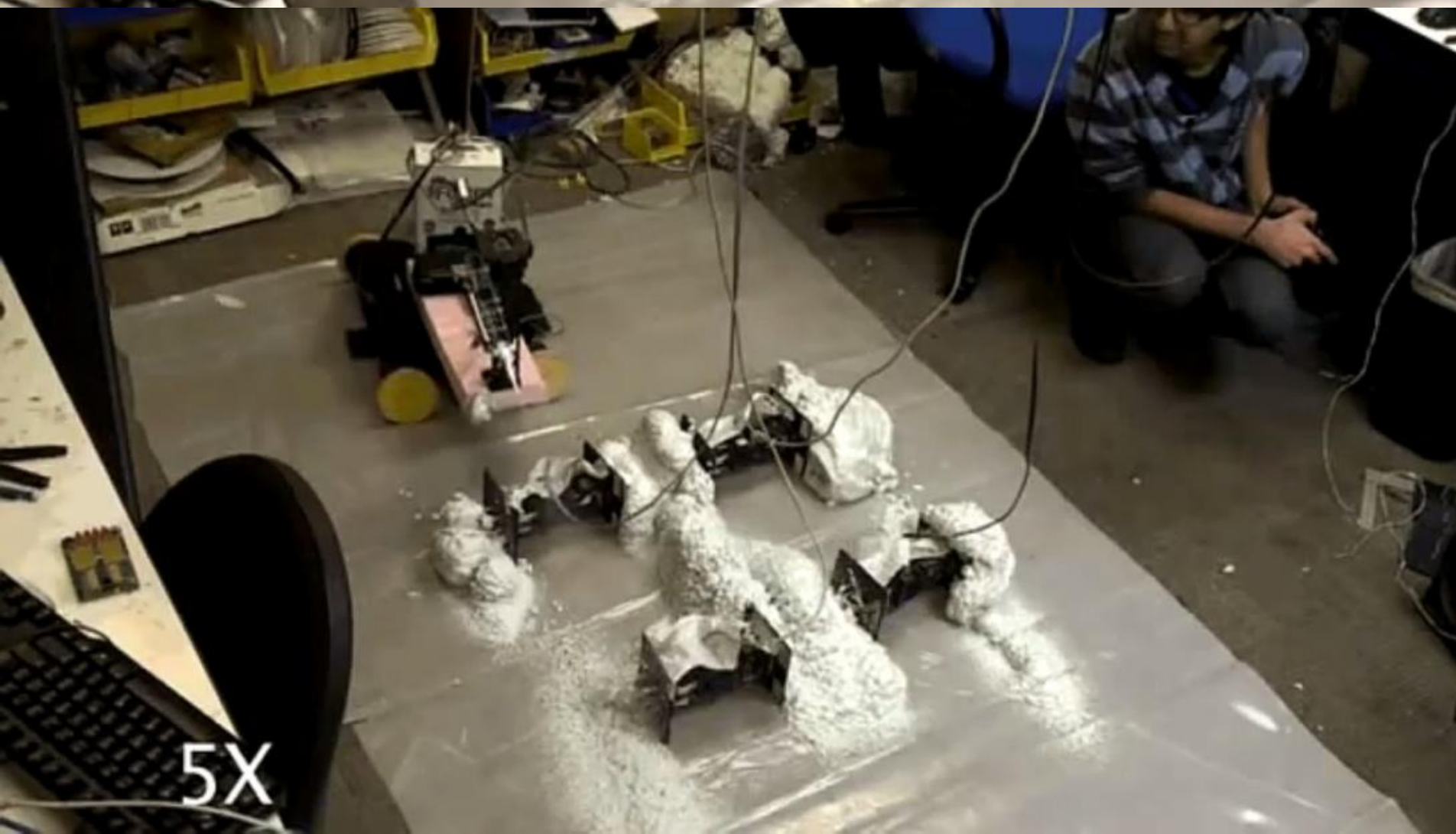
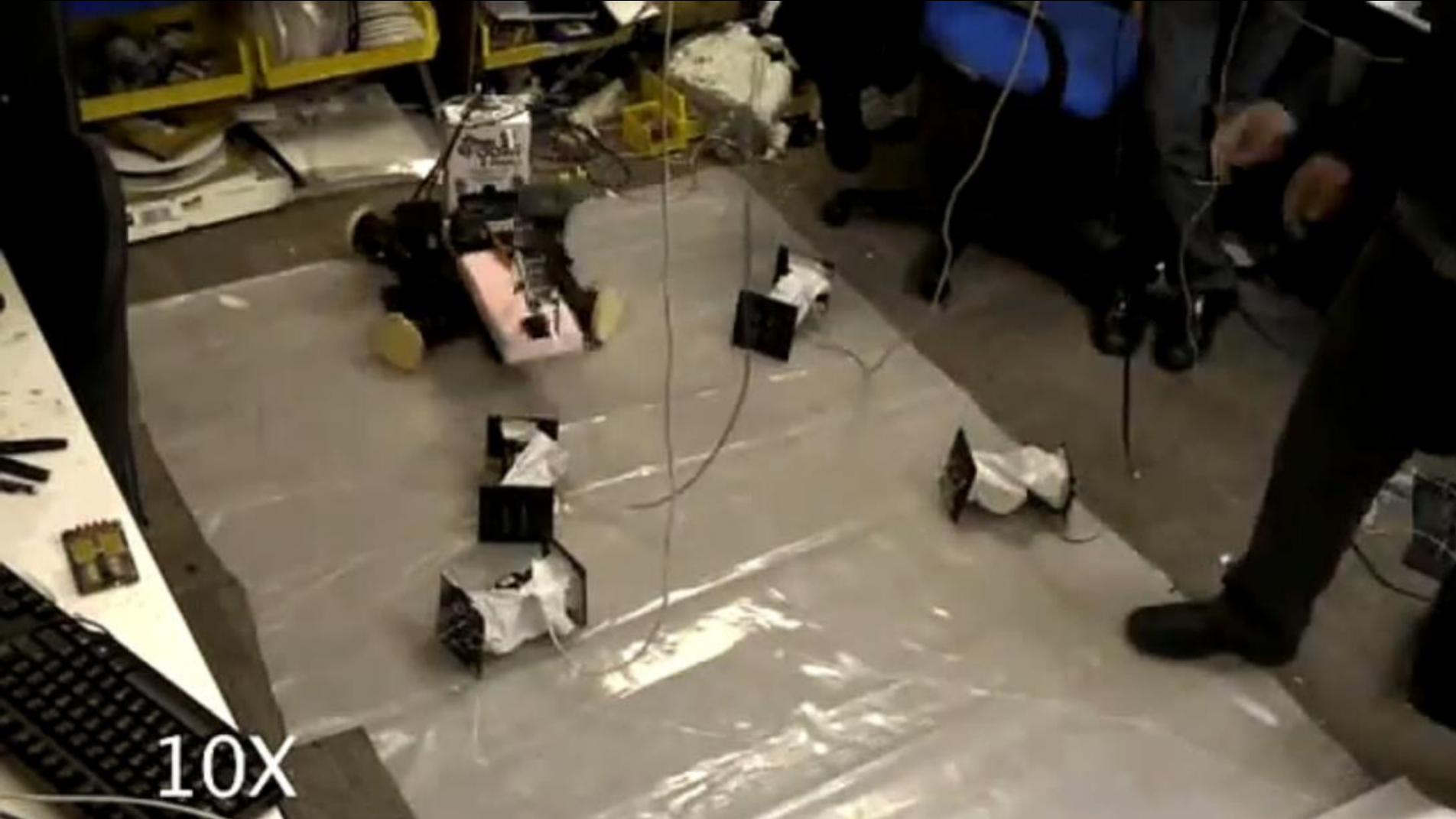
Biomodd [TAI<sup>8</sup>], National Taiwan Museum of Fine Arts, Taichung, 2016



Biomodd [TAI<sup>8</sup>], National Taiwan Museum of Fine Arts, Taichung, 2016

EVOLVABILITY





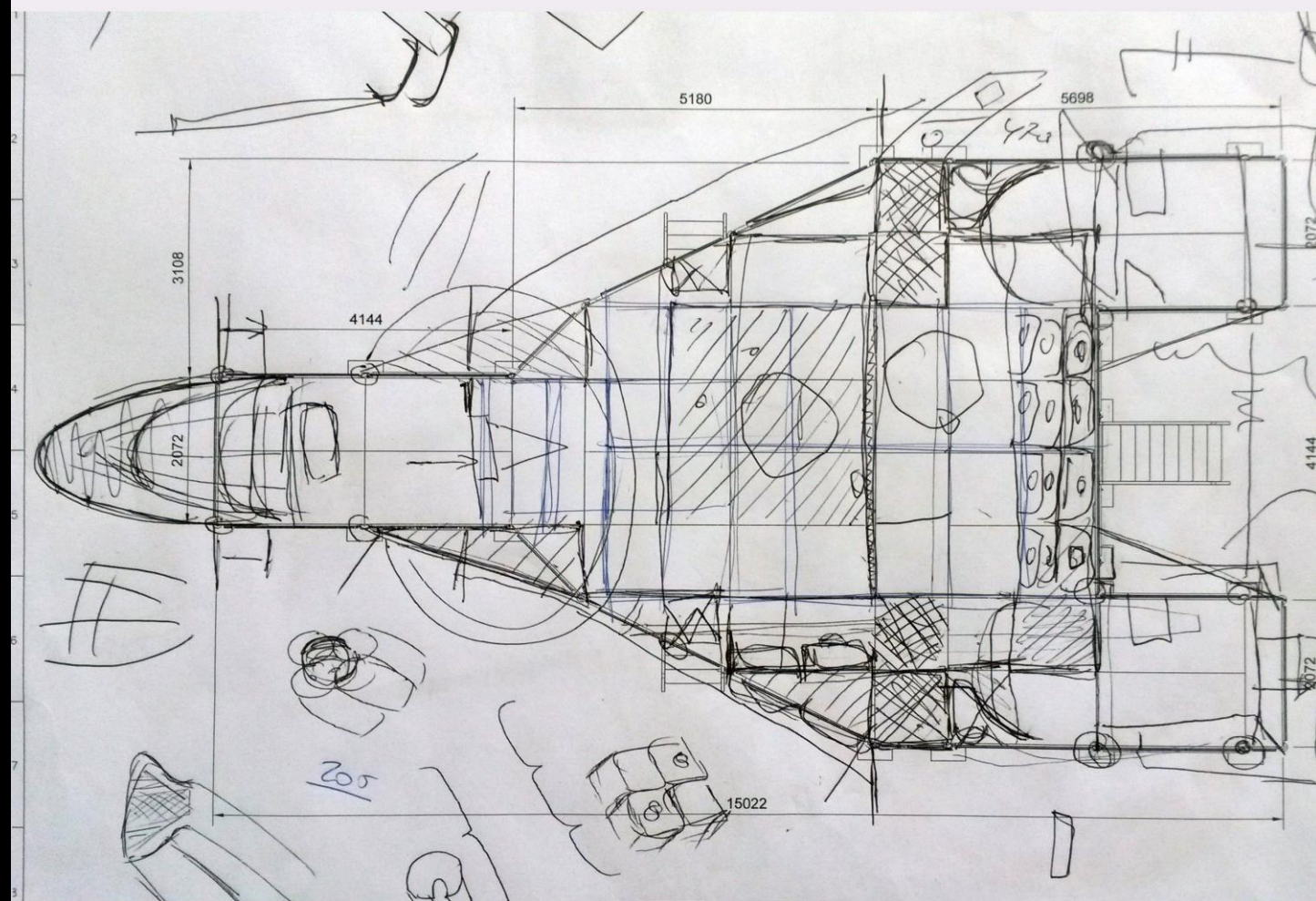
FoamBot, ModLab, University of Pennsylvania, 2010



CO-CREATION



- BIOMODD
- ★ BIOMODD
- SEEKER AND RELATED PROJECTS
- RESEARCH



Seeker, various locations, 2012 - (ongoing)



Photo Kristof Vrancken / Z33

Seeker [HS<sup>2</sup>], Z33, Hasselt, 2013

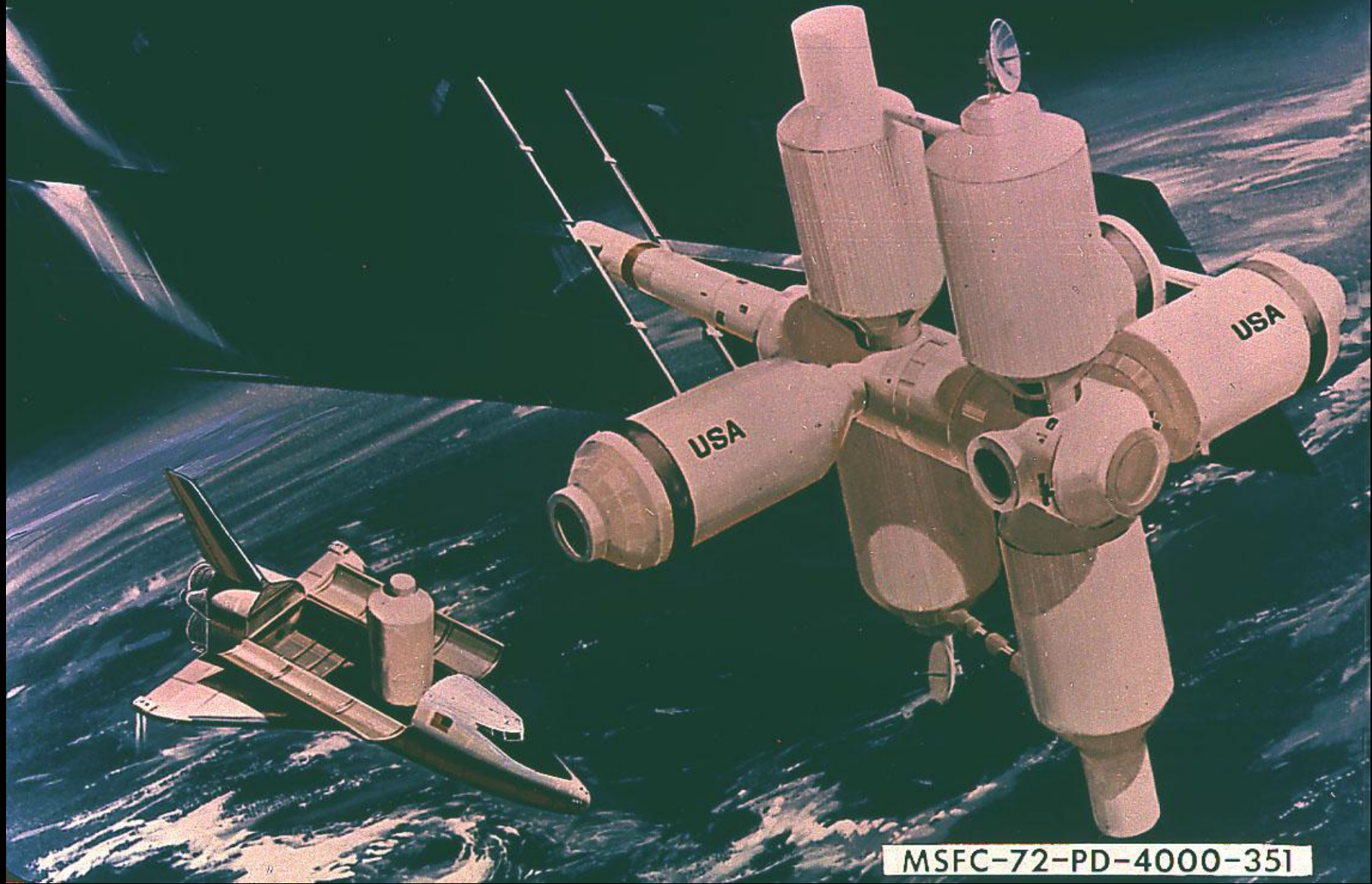




Seeker [LJ<sup>4</sup>], Museum of Modern Art, Ljubljana, 2013

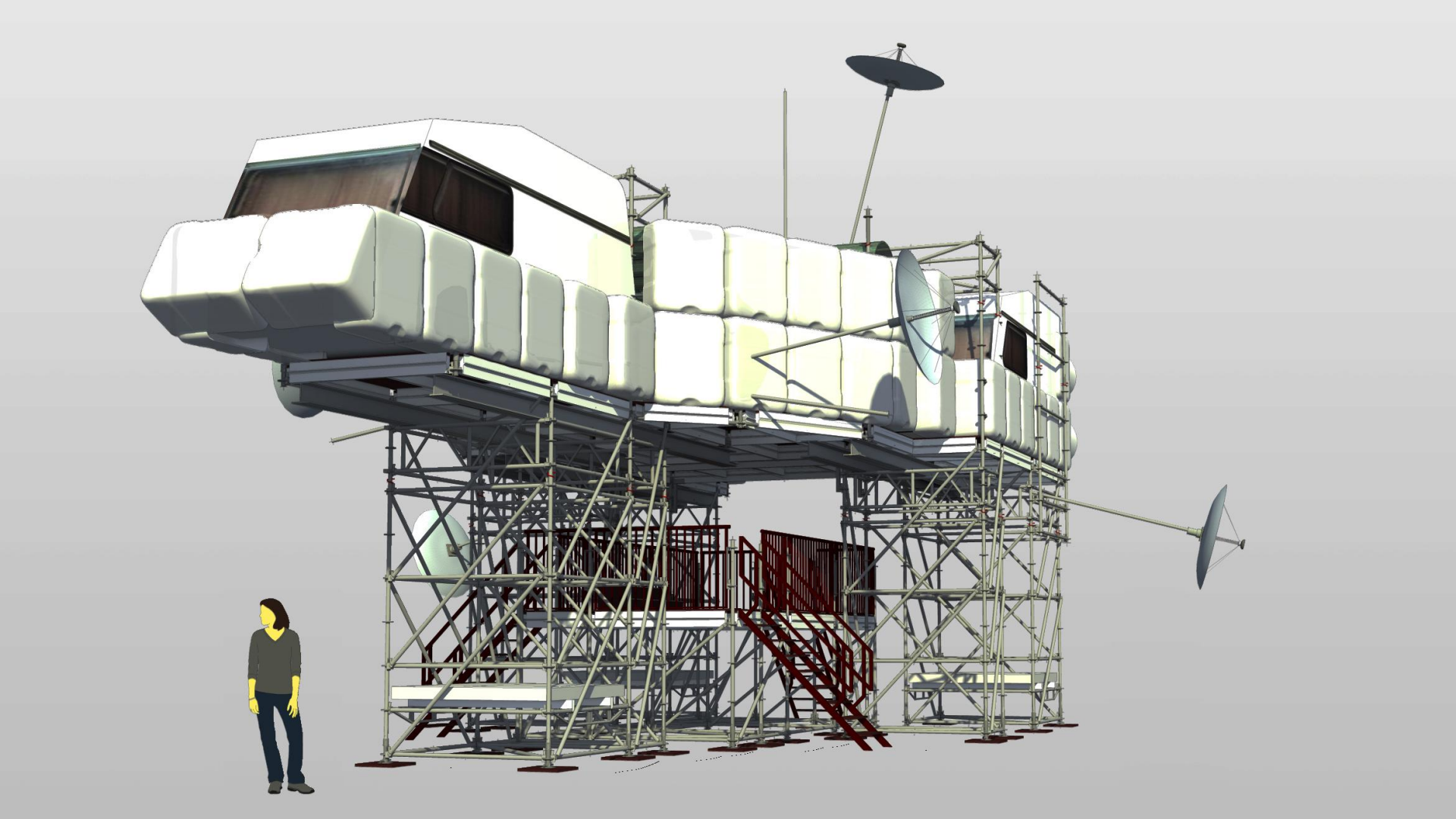


NASA-S-72-1139-X



MSFC-72-PD-4000-351





Seeker [EH<sup>3</sup>] / Seeker [ES<sup>5</sup>], Eindhoven / Enschede, 2013-2014

Design Paul van Hedel



Seeker [EH<sup>3</sup>], Dutch Design Week, Eindhoven, 2013



Photo Matylda Krzykowski



Seeker isolation missions, Z33, Hasselt & Museum of Contemporary Art, Ljubljana, 2013



There are now 9 humans from 5 nations together in space on the International  
[@Space\\_Station: go.nasa.gov/1FnafB0](https://www.nasa.gov/1FnafB0)



RETWEETS: 1,951  
 LIKES: 2,380

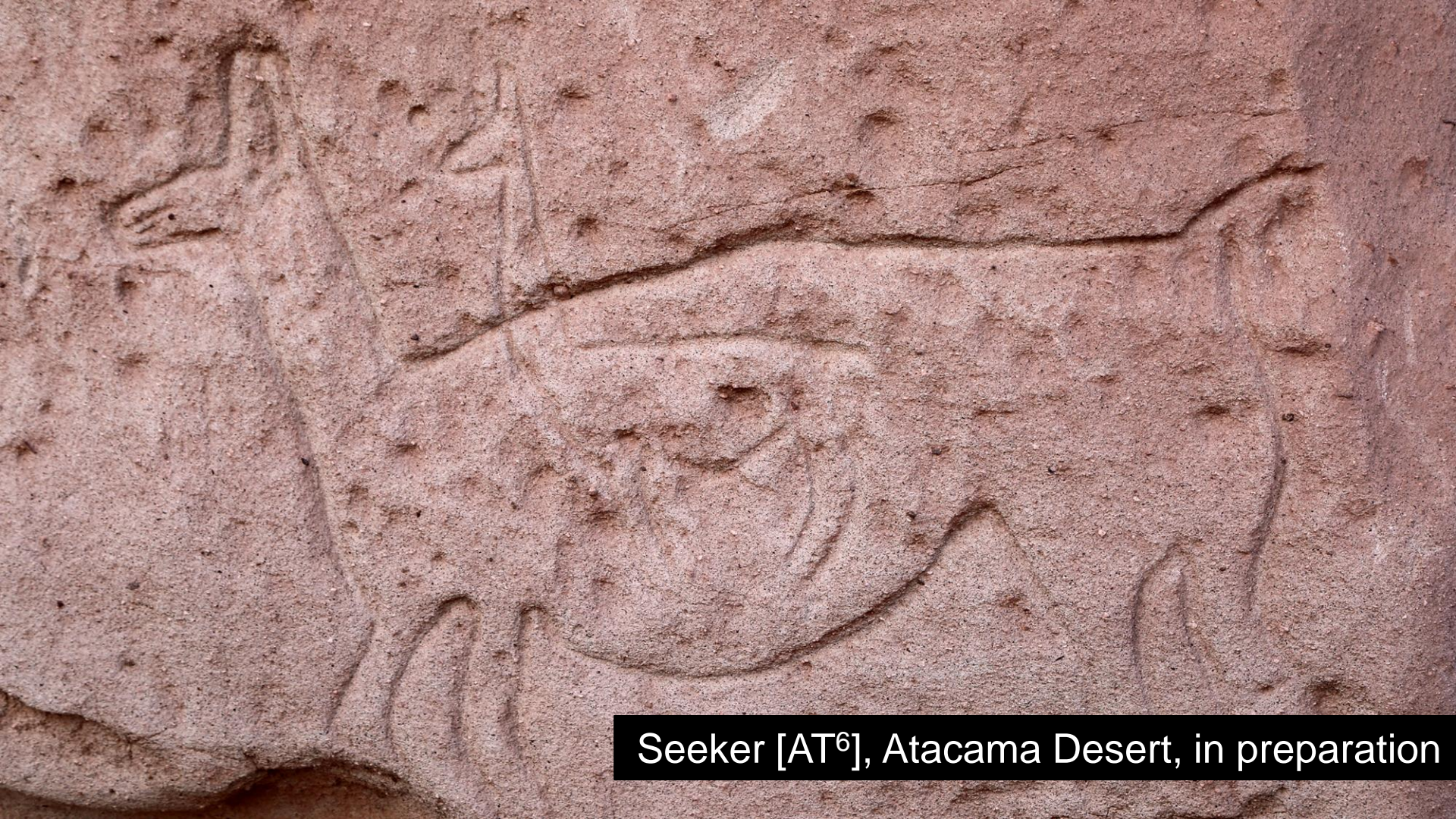


12:39 PM - 4 Sep 2015

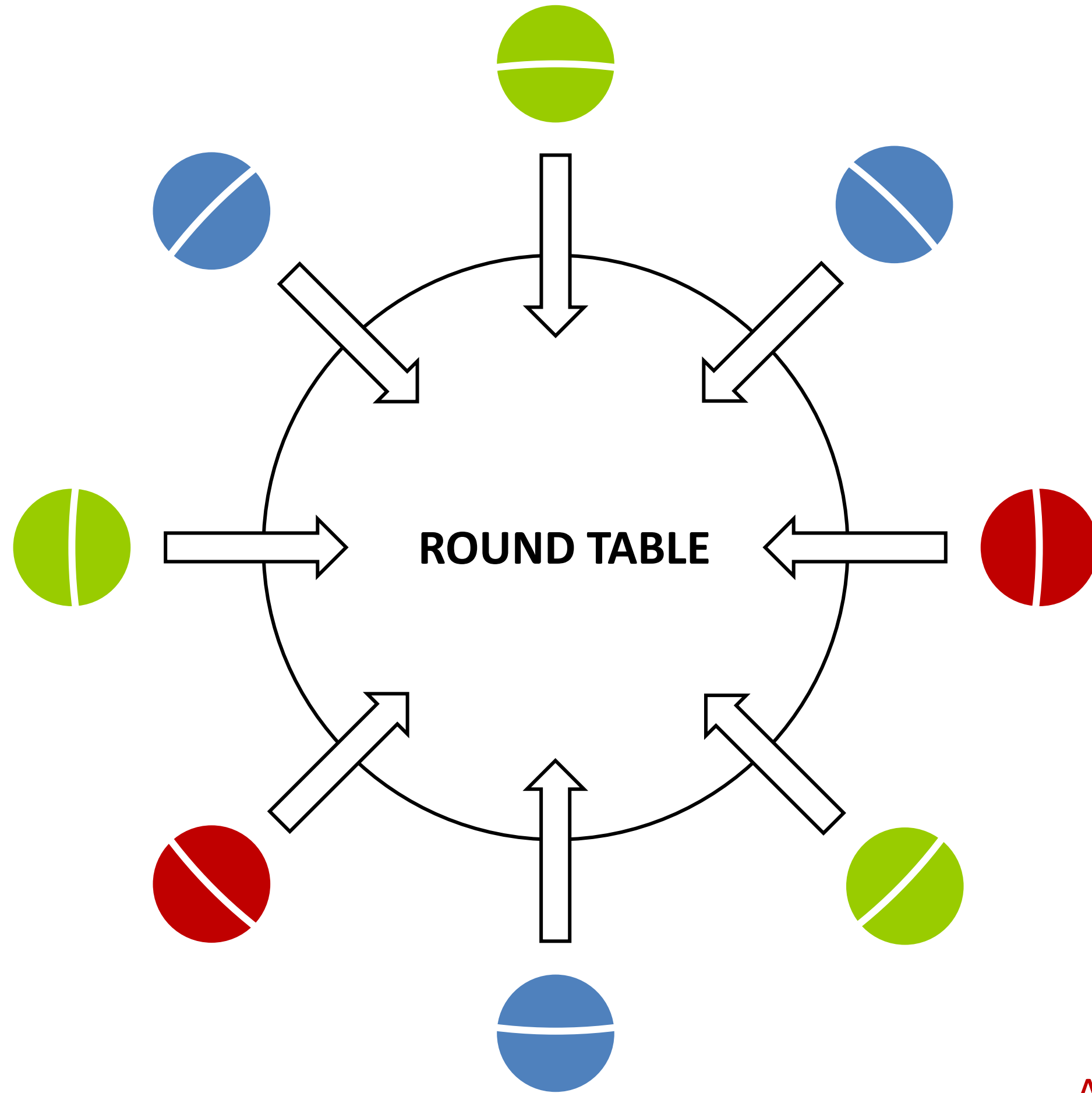




Seeker [AT<sup>6</sup>], Atacama Desert, in preparation

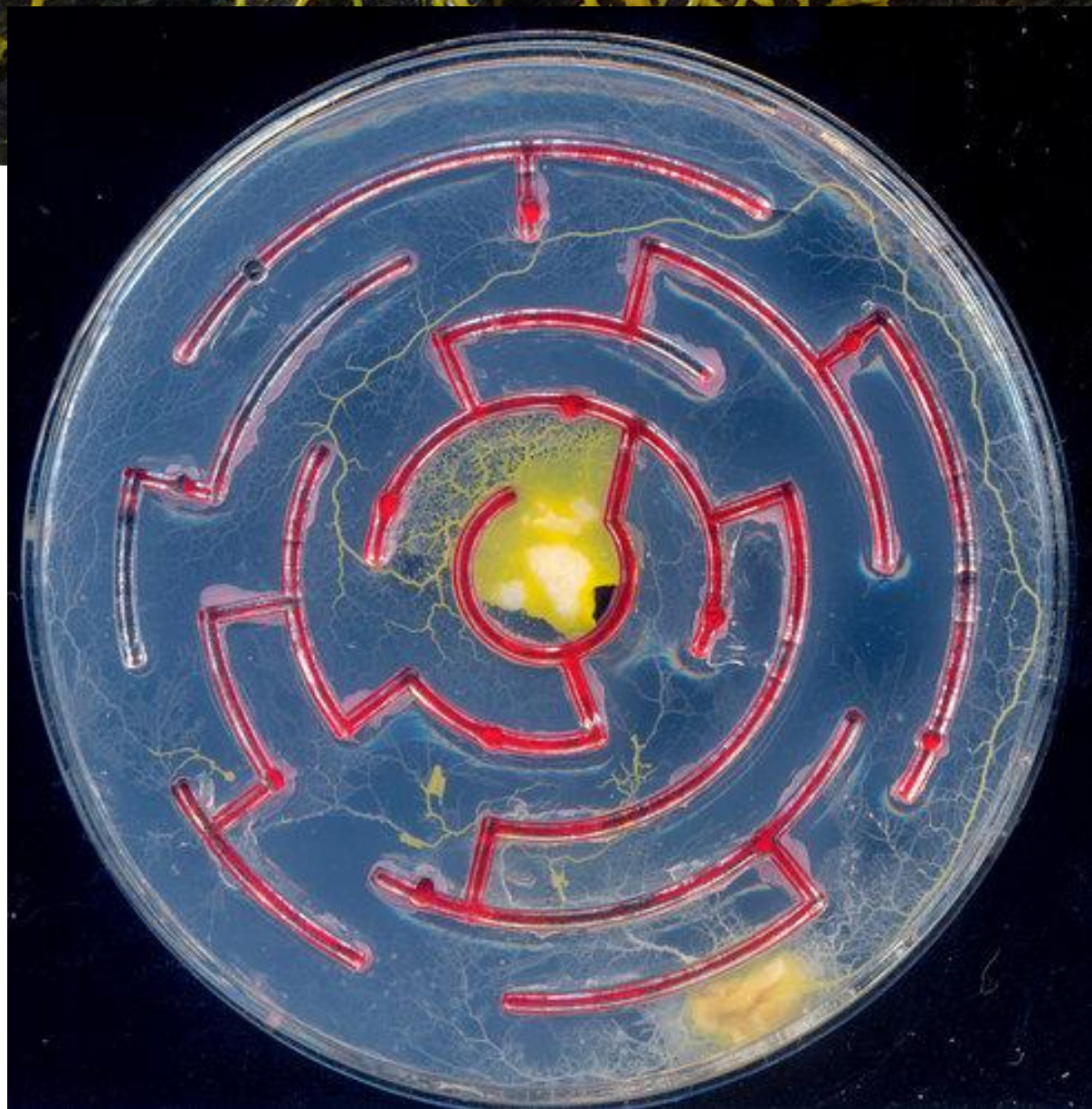


Seeker [AT<sup>6</sup>], Atacama Desert, in preparation



HUMAN  
BIOLOGICAL  
ARTIFICIAL INTELLIGENCE





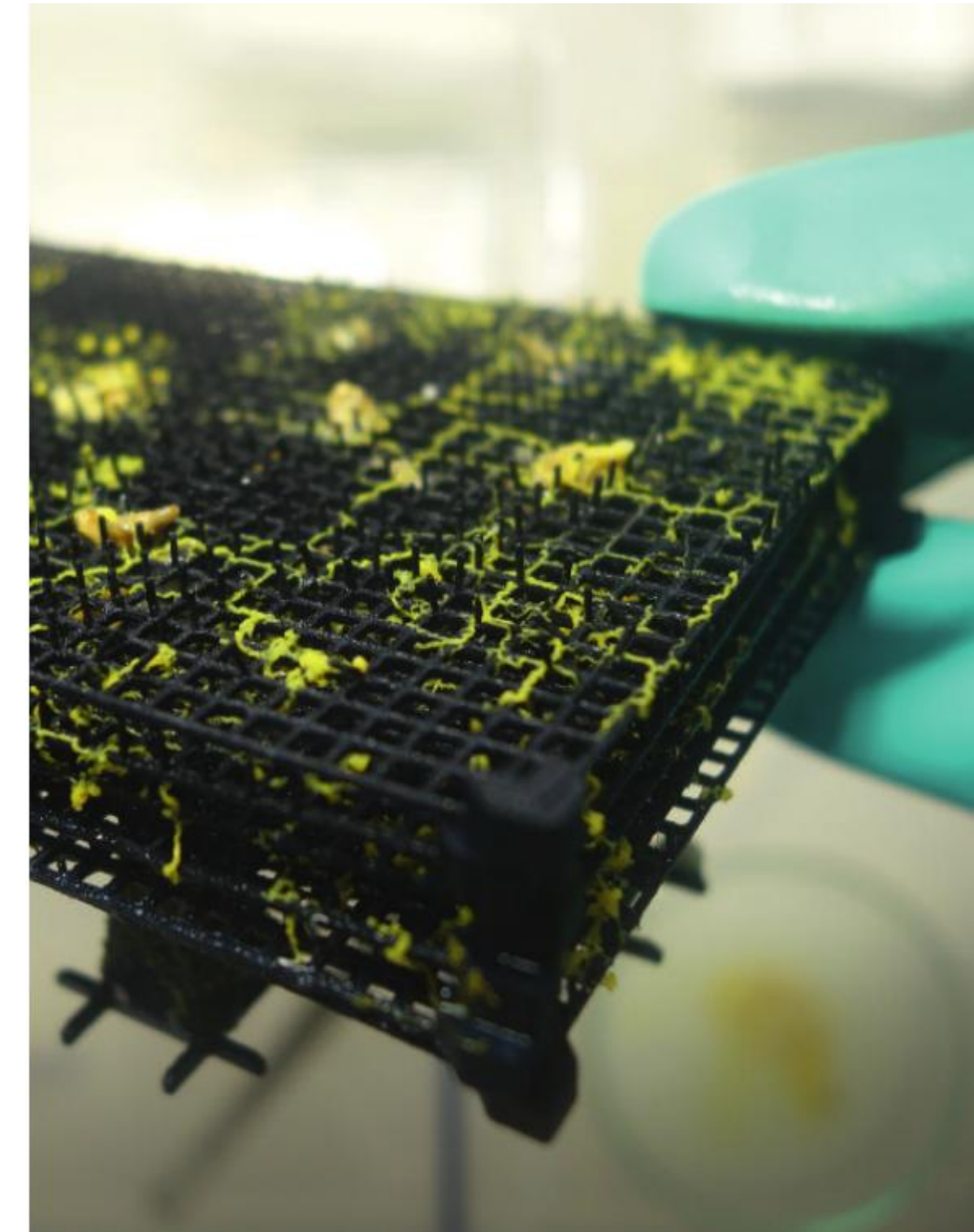
### Maunsell Fort – Bridging Towers

In this second part, the aim of this experiment was to create an optimised connection between the Maunsell Fort towers and designing a landscape pattern which will provide outdoor activities as well as bridging the towers. The slime mould was used as a tool to find optimised patterns in three-dimensional space showing the connection between different floors of different buildings according to the placement of oats.

<b>Slime mould</b>	Physarum polycephalum <a href="http://www.carolina-science.com/">http://www.carolina-science.com/</a>	
<b>Dish</b>	Containment box (Polypropylene)	200 x 150 x 80 mm
<b>Food</b>	Oat flakes Distilled H <sub>2</sub> O	
<b>Inlay</b>	3D printed mesh EOSNT P760 Polymer laser sintering system	6 sheets 100x70x3mm

#### Experiment ingredients

The 3D meshes had to be printed at an external company due to the filigree geometry. The polymer laser sintering method was used since it doesn't rely on scaffold structures that would interfere with the geometry. Further, this printing technology allows printing in sub-millimetre dimensions in all planes. Before the experiment could start the containment box and the grids had to be pre-processed. First the containment box was fitted with a humidifier access point and drainage holes for condensed water. Second the grid had to be connected to the containment box using styrofoam inlays in order to send it securely to the MRI facility. Then all equipment, the 3D meshes and the containment box were sterilised with ethanol and placed in the glove box. After an additional sterilisation the slime mould and sterilised food (20 min 160°C) were moistened and placed in strategic points on each layer of the grid. During the growth process the styrofoam inlays were extracted from the box and were added again prior to postal transfer to the MRI facility.



1. Radical integration
2. Evolvability
3. Co-creation

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SPACE  
ECOLOGIES  
ART AND  
DESIGN