

Anti-Microbial Surface for Manned Space Flight Application: Highlight of the Matiss Project

C. Thévenot, L. Campagnolo (*MEDES for CADMOS*)

S. Rouquette, P. Benarroche, S. Barde (*CADMOS-CNES*)

L. Lemelle, C. Place, D. Letourneau, E. Mottin (*ENS de Lyon*)

G. Nonglaton, P. Marcoux (*CEA Létî*)

J. Teisseire, E. Garre (*Saint Gobain*)

MATISS, a Proxima's experiment

Physiology

Echo
Everywear
Perspectives



Life support

Aquapad
Matiss

Material science

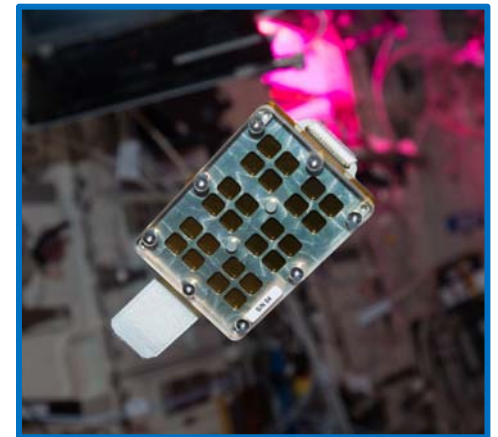
Fluidics

Education

Exo-ISS

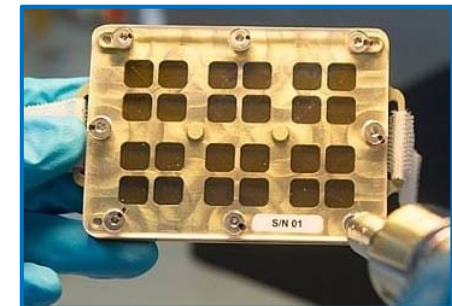
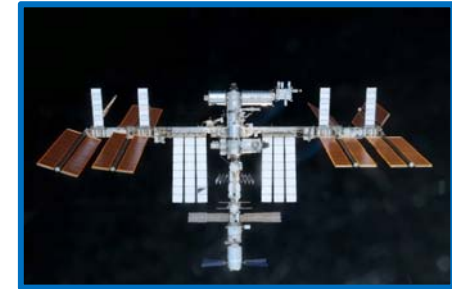
Matiss Project Overview

- **Matiss 1: Tech Demo during PROXIMA Mission**
 - Evaluation of antimicrobial glass surfaces in μg
- **Matiss 2 : Continue data collection and kinetic study**
 - Visible light and XRF microscopy
- **Roadmap for Matiss 3 : CNES – CEA Léti R&T program**
 - Applications for materials in space industry



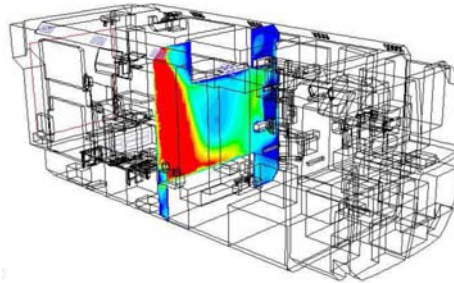
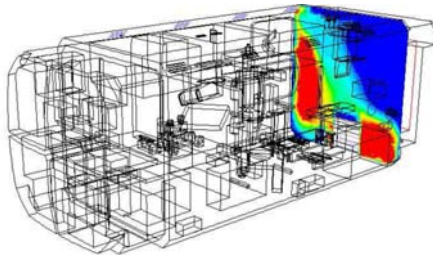
Matiss 1 – Spatialization

- **Objective**
 - Long term exposure of antimicrobial glass surfaces to ISS aerosol
- **Constraints**
 - Safety requirements in particular for crew because of shatterable material utilization
- **Result**
 - Development and qualification of Matiss Sample Holder

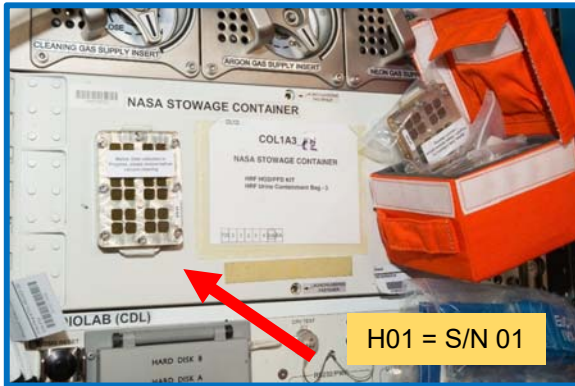


Matiss 1 – Exposure in Columbus

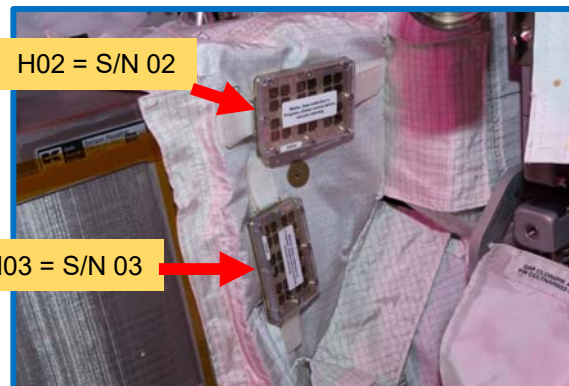
- Locations selected in order to
 - Have 3 holders in areas with a sufficient forced air flow through the sample holders
 - Have 1 holder in a location with stagnant air containing humidity
 - Not interfere with any other payload or maintenance activities
- Support of Thales Alenia Space to identify locations
 - 3D modelling of velocity field in Columbus module



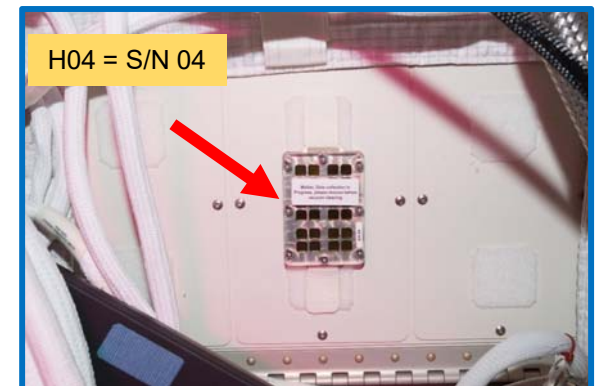
Matiss 1 – Exposure in Columbus



EPM rack front panel



Return Grid Sensor Housing



EDR rack front panel

Good air flow areas

Stagnant air containing humidity area

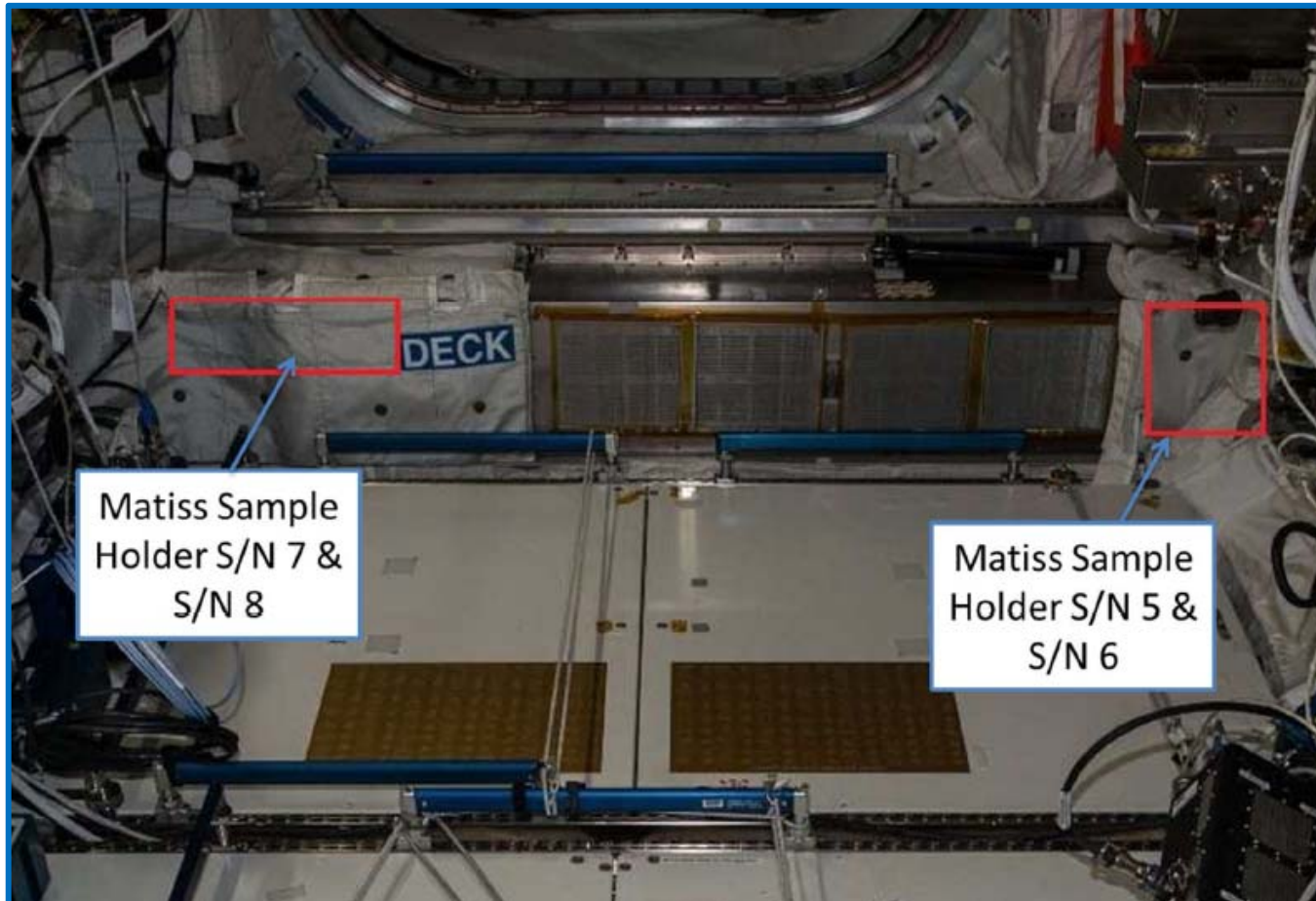
Matiss 1 - Timeline and constraints for return

- **Upload on of 4 sample holders**
 - Launched on Cygnus CRS OA-5 on 17th October 2016
 - Installed in 3 different locations in Columbus module on 21st November 2016
 - Exposed during **192 days** (installed just after T. Pesquet arrival and removed just before his departure from ISS)
 - Returned on Soyuz 49S on 2nd June 2017
 - Arrived at CADMOS for inspection on 8th June 2017
 - Shipped to PI laboratory and still under analysis
- **Constraints**
 - Shipment within 1 week to CADMOS to avoid non-controlled environmental conditions
 - No X-Ray scan during return ground/air transportation
 - Temperature range: $0^{\circ}\text{C} < T < 50^{\circ}\text{C}$

Matiss 2 – Similarities and differences with Matiss 1

- **Similarities with Matiss 1**
 - Use of identical hardware -> only safety reflight/series assessment required
 - Upload of 4 sample holders
- **Differences with Matiss 1**
 - Upload of sample holders in individual bubble wrap bag instead of Nomex pouch
 - Installation of all samples holders in the same location (Return Grid Sensor Housing) in Columbus module but still at the same time
 - Different exposure durations for each sample holders (45 days, 90 days, 180 days and 360 days) to evaluate the kinetic component

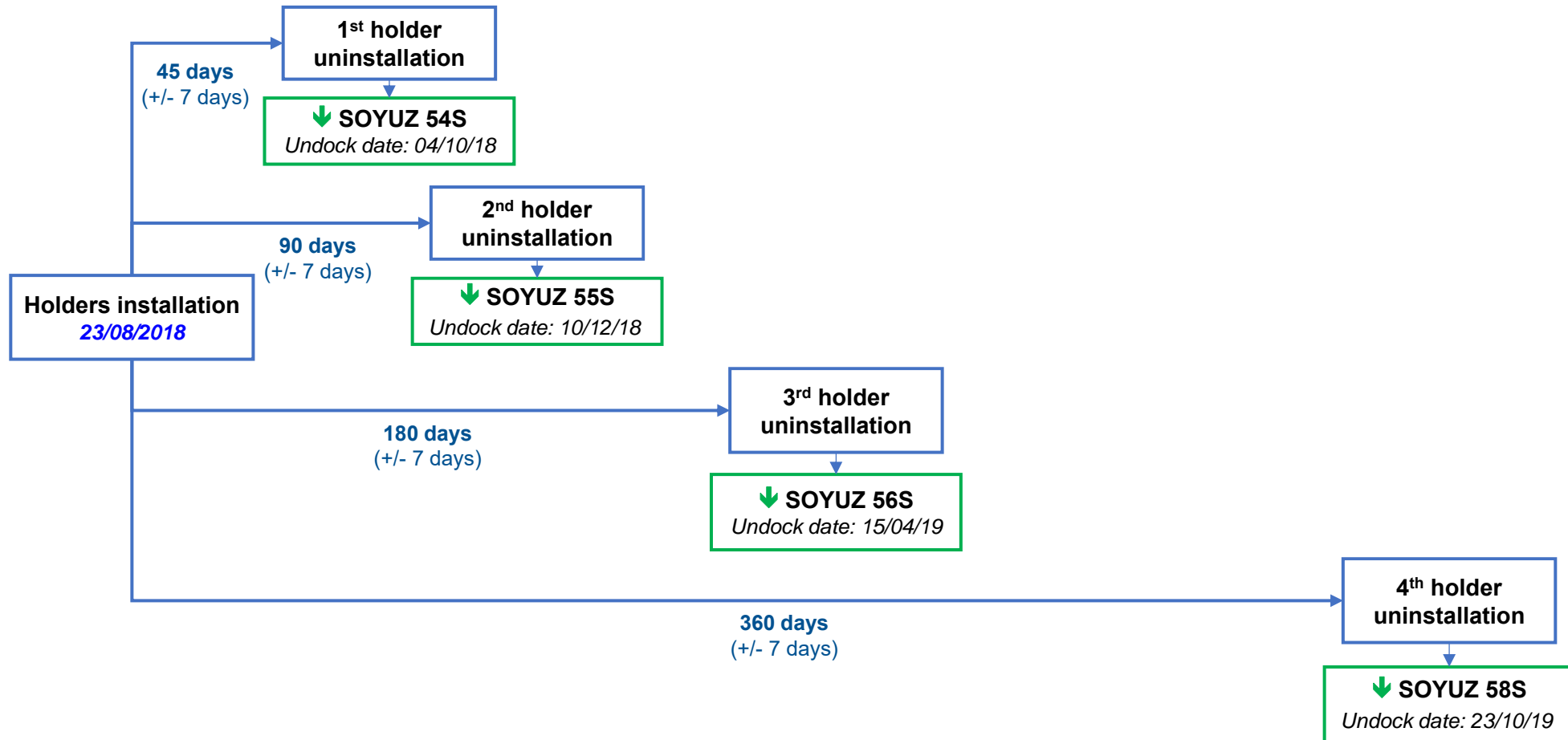
Matiss – Exposure in Columbus



Matiss 2 – Timeline and challenges

- **Timeline**
 - Upload of 4 sample holders on Cygnus CRS OA-9 (launch on 20th May 2018)
 - Installation of 4 samples holders on around 23rd August 2018
 - Download of 4 samples holders on Soyuz vehicles
- **Challenges**
 - ISS flight plan very dynamic with respect to vehicles launches
 - Trade-off between science objectives and requirements and flight plan modifications to be considered

Matiss 2 – Flowchart



Matiss 3 - Roadmap

- Why a roadmap?
 - Specifications about the antibacterial properties of surfaces for spatial activities do not exist
 - Evaluation of innovative surfaces to limit their contamination is encouraged by Space Agencies
 - Biological contamination control for human spaceflights is a major topic for future programs of exploration

Matiss 3 - Roadmap

- **Objective**
 - Define and design new control systems of biological contamination for the exploration,
 - Give a preliminary frame and a multiannual orientation to future activities conducted by CNES, ENS of Lyon and CEA-Leti
 - Define :
 - The most adequate antibacterial cover
 - The industrialization strategy of the deposit of the cover
- **How?**
 - Continue Matiss experiments with possible evolutions
 - Offer Matiss to partners as a test bench for other kind of studies

Matiss first results

Arrival at CADMOS on
8th of June 2017



Acknowledgments





THANK YOU FOR YOUR ATTENTION
Any questions?

cecile.thevenot@cnes.fr

