We. Create. Space.

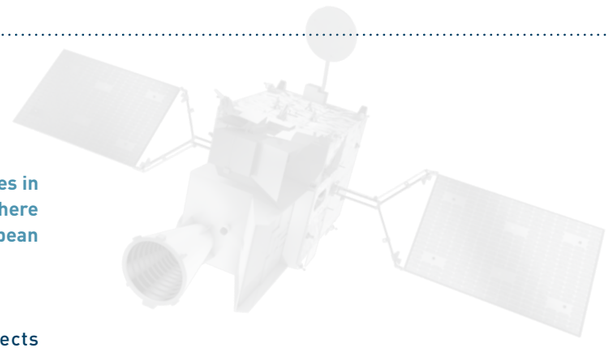
OHB

SPACE SYSTEMS

RISK REDUCTION

for contamination-critical hardware

QUALITY SERVICE FOR SPACE INDUSTRY
INTRODUCTION



OHB System AG is one of the three leading space companies in Europe. It belongs to the listed high-tech group OHB SE, where around 2,800 specialists and engineers work on key European space programs.

Quality for orbital systems
When realising high-end space systems, quality aspects addressing performance and safety budget are basic factors for mission success and customer satisfaction.

Contamination vs. performance
Contamination sources are present at any stage of production and integration activities. To overcome this issue, the cleanliness group from OHB's quality department is working on a variety of topics from the field of cleanliness engineering to facility and cleanroom management, in order to guarantee performance of orbital systems such as high-end optical satellites during their life in space. A service solution was built up on this basis in order to address risk reduction on critical hardware and to put product performance in the focus.

Focus on performance
Risk reduction for critical hardware with minimum cost effort and based on well-known processes and conditions - operated by a single business partner.

OHB heritage in cleanliness & contamination control
OHB is successfully operating in-house cleanrooms for instrument and platform integration, development of optical payloads and mechanisms. Class ISO5 and ISO8 are available and optimized for project related use.

Cleanliness consultancy has been provided to all kinds of in-house projects as well as to subcontractors and test houses since 2011 by ten specialists within the OHB quality group.

An in-house analytical laboratory is operated permanently for continuous monitoring of integration areas and analysis of actual cleanliness status of flight hardware.

The concept allows tracking and study of the evolution of contamination. With a strong link to the optics and the mechanical departments an exchange on potential performance degradation is established.

All procedures are linked to ECSS regulations and worldwide norms. A close exchange between European and national space agencies plus a wide network with specialist laboratories and collaboration partners complete our portfolio.

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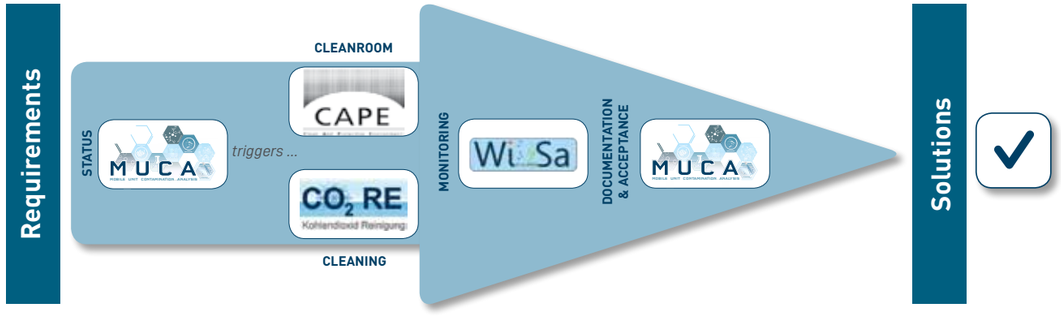
OHB QUALITY SERVICE
RISK REDUCTION FOR CONTAMINATION CRTITICAL HARDWARE

OHB quality service: A solution for risk reduction out of one box!

OHB Quality Service: MUCA / CAPE / CO2RE / WiSa
Knowledge about the status of the hardware and feasible protection measures are essential for effective risk reduction on hardware. The decision for a proper process to be run is driven by an in-time data provision and the quality of the information available.

The OHB quality service offers an as-is-state data analysis on-site with MUCA and protective measures with CAPE (cleanroom) and CO2RE (cleaning). Tracking of the cleanliness status is provided by WiSa (witness sample program) - all offered by a single supplier.

OHB quality service process
The OHB quality service process leads to successful results on the complex path from the statement of requirements to the optimal performance by combining well-known stand-alone solutions:



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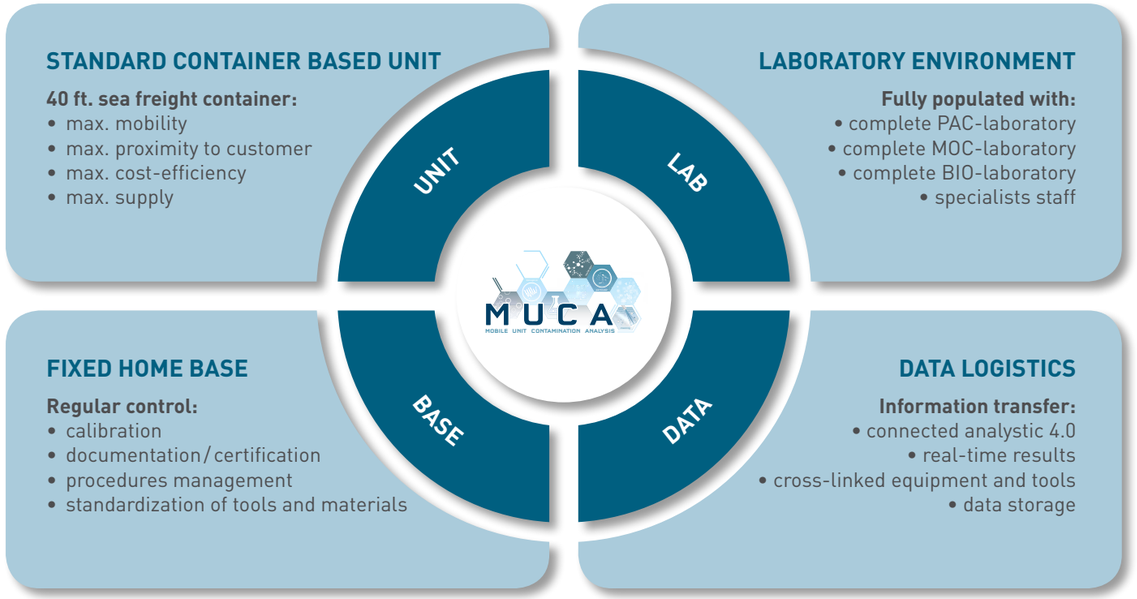
OHB QUALITY SERVICE
ANALYSING CONTAMINATION

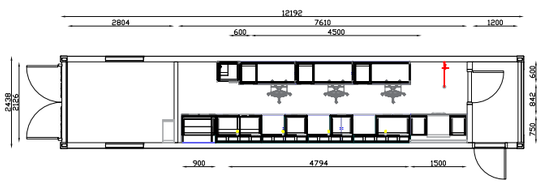


Mobile Unit for Contamination Analysis: on-site verification laboratory

MUCA is a mobile container laboratory installed in a standard 40 ft. sea freight container including a fully equipped PAC, MOC and Bio laboratory. Analysis data results are transferred to the persons responsible for decision-making in real-time. On-site verification and documentation of the actual cleanliness status of the hardware is provided to be in line with European space standard guidelines. This service allows new options in measurement, demonstration and training as well as improvement of support and standardization world-wide.

Concept:
- particulate analysis: air and fall-out
- chemical analysis: air sampling and contamination sedimentation
- biological contamination analysis
- environmental contamination tracking
- logistic concept 4.0 for real-time data transfer.

Addressing:
- on-site verification of hardware
- on-site training and demonstration for acceptance and audit
- standardization and certification worldwide.



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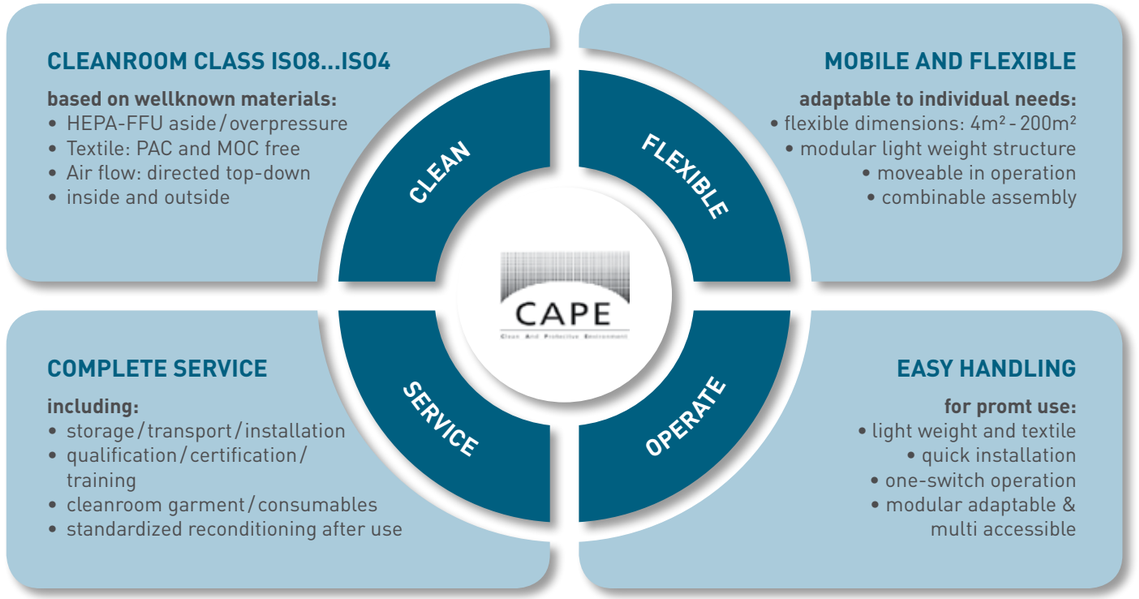
OHB QUALITY SERVICE
PROTECTING HARDWARE



Clean And Protective Environment: flexible protection

CAPE is a cleanroom environment based on a fully textile encapsulation combined with a light-weight structure and a filter system aside. The system is modular including airlocks and feedthroughs to guarantee a maximum in flexibility and mobility for a large variety of applications where a clean and protective environment is fundamental:
- protective measure for critical hardware; planned or in case of emergency
- temporary cleanroom environment in-house, at test house or subcontractors
- cleanroom inside and outside: installation inside a running cleanroom
- adaptable to any facility restrictions / movable in operation
- cleanroom class from ISO8 to ISO4.

The CAPE-system, invented by Fraunhofer IPA, was optimized for time-critical use cases: straightforward transport and shipment, quick installation and maximum secureness for critical hardware. An ISO4 cleanroom class environment, available from 4 m² to 400 m² base area and flexible in height, can be provided within hours (1h-8h) including installation and qualification.

CAPE facts:
- ISO8...ISO4 cleanroom
- flexible in size
- modular
- movable
- quick installation
- multiple access.

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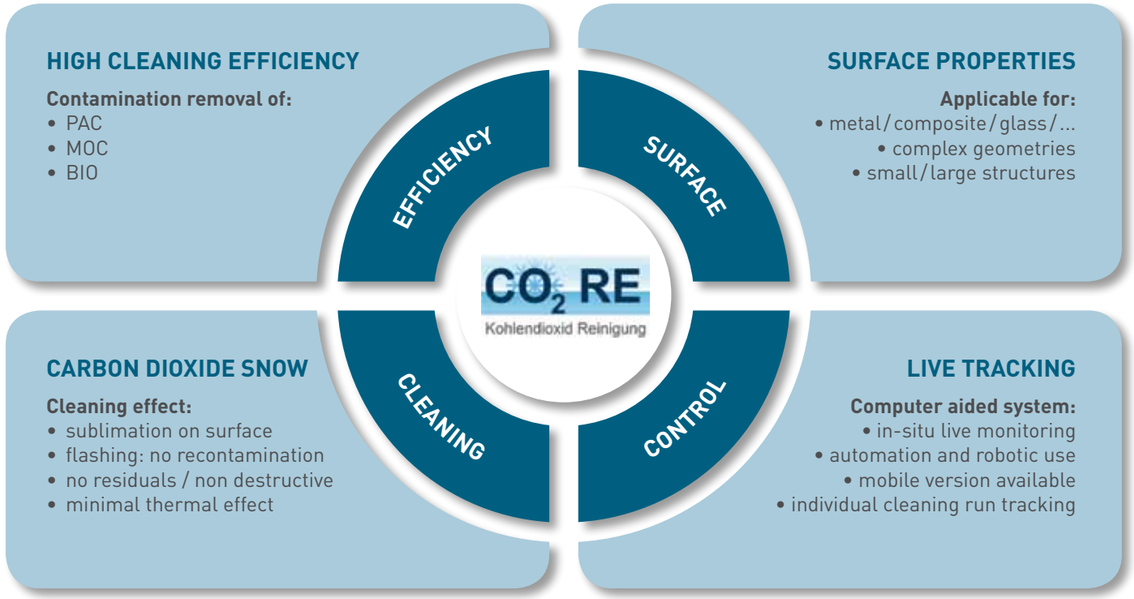
OHB QUALITY SERVICE
CLEANING HARDWARE



Carbon dioxide snow cleaning: cleaning to the core

CO2RE-Cleaning is a liquid carbon dioxide (CO2 snow flakes) based cleaning method to remove particular, molecular and biological contamination from almost any surface independent of the type of material and the complexity of geometry. The efficiency of this cleaning method is equal to established liquid treatment trains but with the key benefit of absence of residuals after treatment. The cleaning effect is based on the evaporation of carbon dioxide snow flakes and the resulting flashing of all contamination fragments from the surface. A defined clean air flow is used to avoid recontamination by transport of fragments and also for monitoring purposes. The process allows a live tracking of individual cleaning runs and results in a certification document.

Cleaning service at OHB for

- structures / panels
- harnesses
- coatings
- optics
- GSE

Mobile cleaning service for

- large structures
- fairings
- facility crane
- container
- shaker
- vacuum chamber

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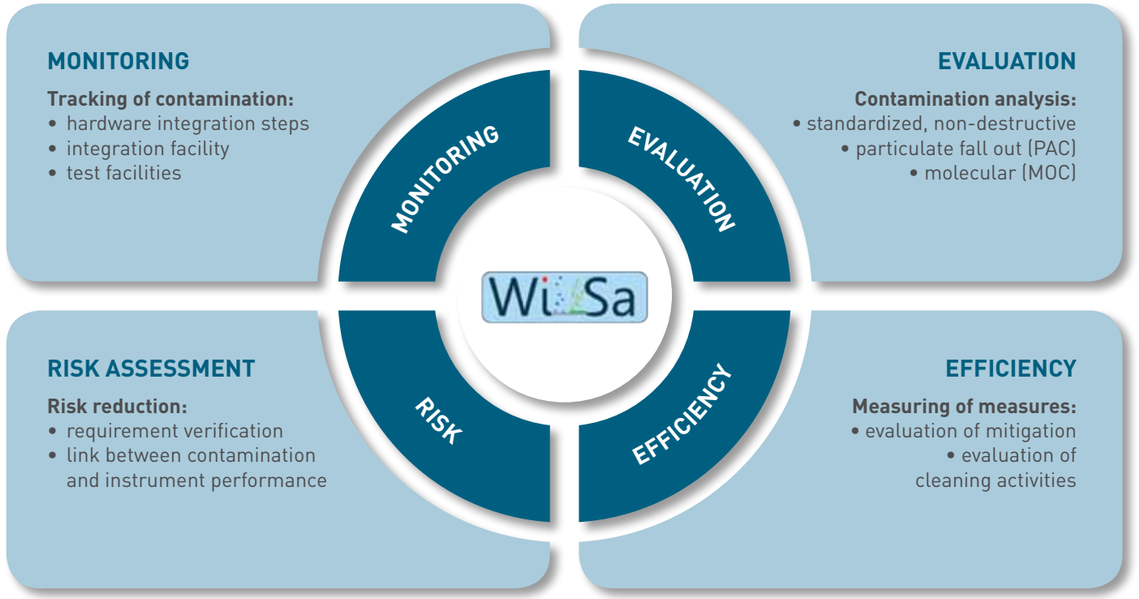
OHB QUALITY SERVICE
MONITORING CONTAMINATION



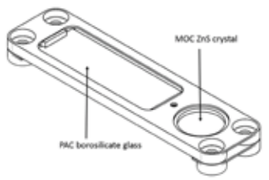
Witness Sample: standardisation of contamination analysis

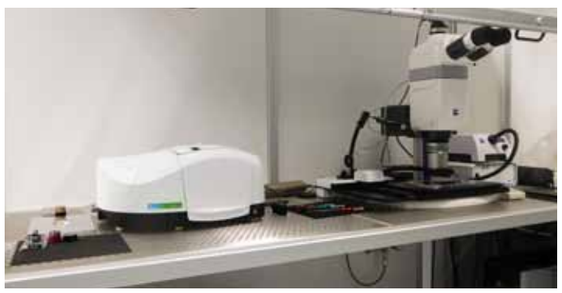
OHB established, together with Fraunhofer IPA its own witness sample (WiSa) program for monitoring of particulate (PAC) and molecular (MOC) contamination.

This program consists of witness sample, holder, and transport system as well as sample readout and report generation. The samples are used to accompany the complete integration process of (optical) instruments. They are the connection link between contamination and instrument performance and enable the assessment of contamination risks to hardware as well as requirement verification. The witness samples allow for monitoring of integration facilities as well as monitoring and assessment of test areas such as vacuum chambers. In addition, the samples can be used for evaluation and assessment of transport concepts for hardware (e.g. containers), of mitigation activities (e.g. protective covers) and cleaning activities.

For **particle analysis**, a light microscope system in scanning transmission mode is used. The active area is 14 cm². The amount, real size and distribution of the particles is tracked and a PAC value is calculated (obscuration factor).

The **molecular chemical contamination** is analyzed by transmission FTIR spectroscopy according to ECSS. Further analysis is offered by TC-GC/MS. All measurements are non-destructive and samples are stored.





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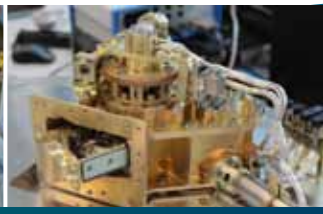

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About OHB System AG

OHB System AG is one of the three leading space companies in Europe. It belongs to the listed high-tech group OHB SE, where around 2,800 specialists and system engineers work on key European space programs. With two strong sites in Bremen and Oberpfaffenhofen near Munich and more than 35 years of experience, OHB System AG specializes in high-tech solutions for space. These include small and medium-sized satellites for Earth observation, navigation, telecommunications, science and space exploration as well as systems for human space flight, aerial reconnaissance and process control systems.

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