

IABG Space Centre  
We give you space on earth



**COMPETENCE CENTRE  
OPTICS (CCO)**

**iABG**

# CCO

Competence  
Centre Optics



## TABLE OF CONTENTS

---

Overview

---

Infrastructure

Thermal Vacuum Chamber

Optical Ground Support Equipment

---

Space Test Centre

IABG'S NEW THERMO-OPTICAL TEST FACILITY –  
A FACILITY UNIQUE IN EUROPE

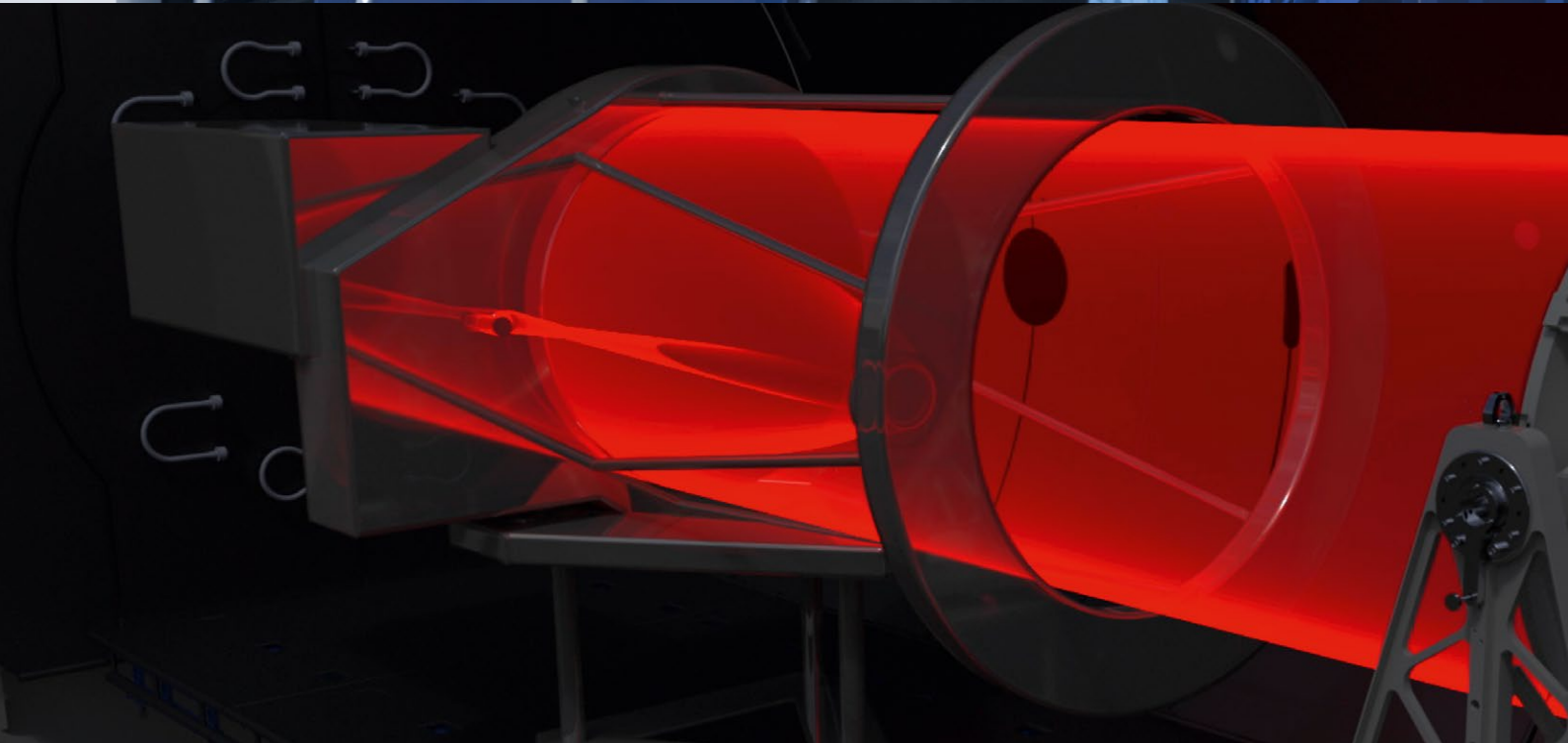
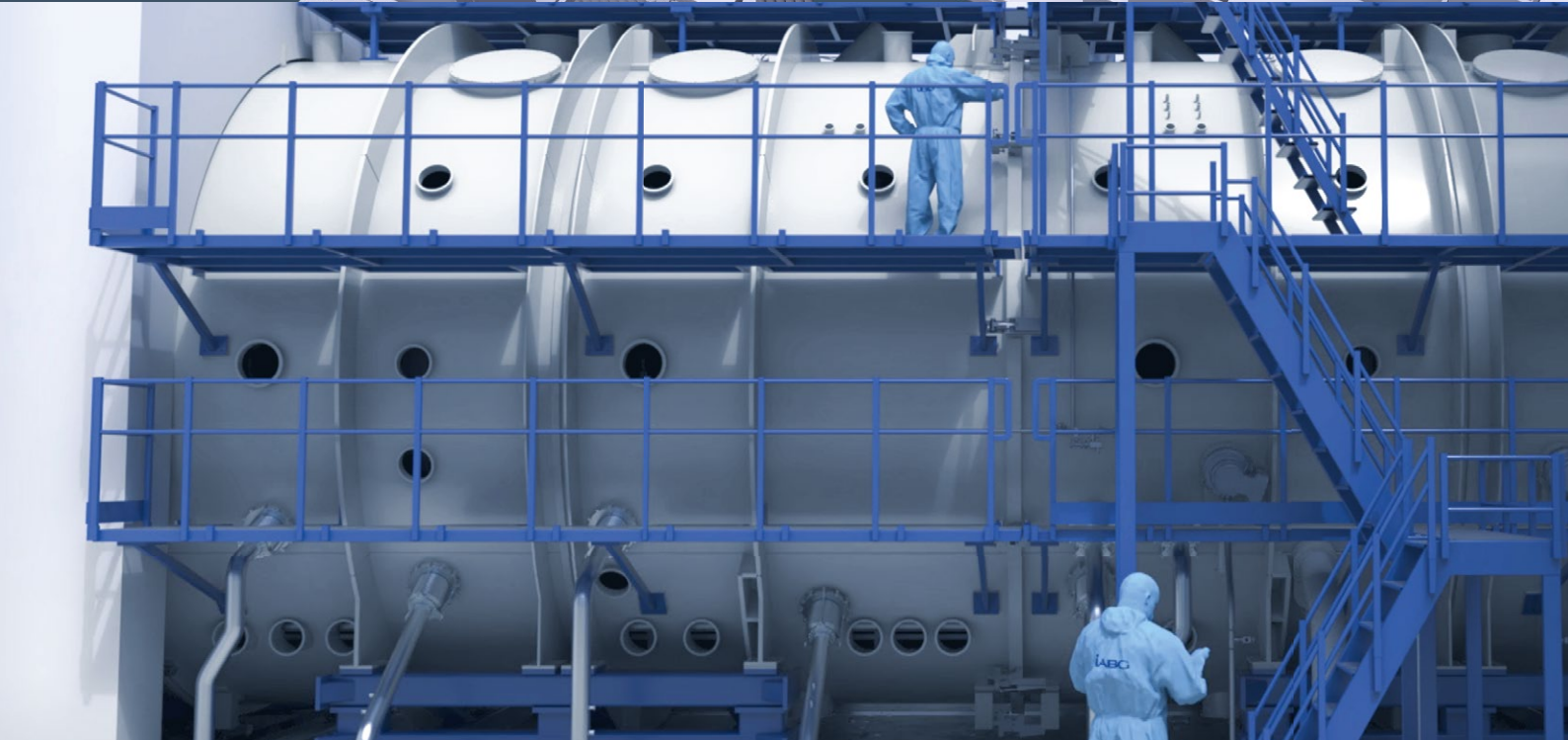
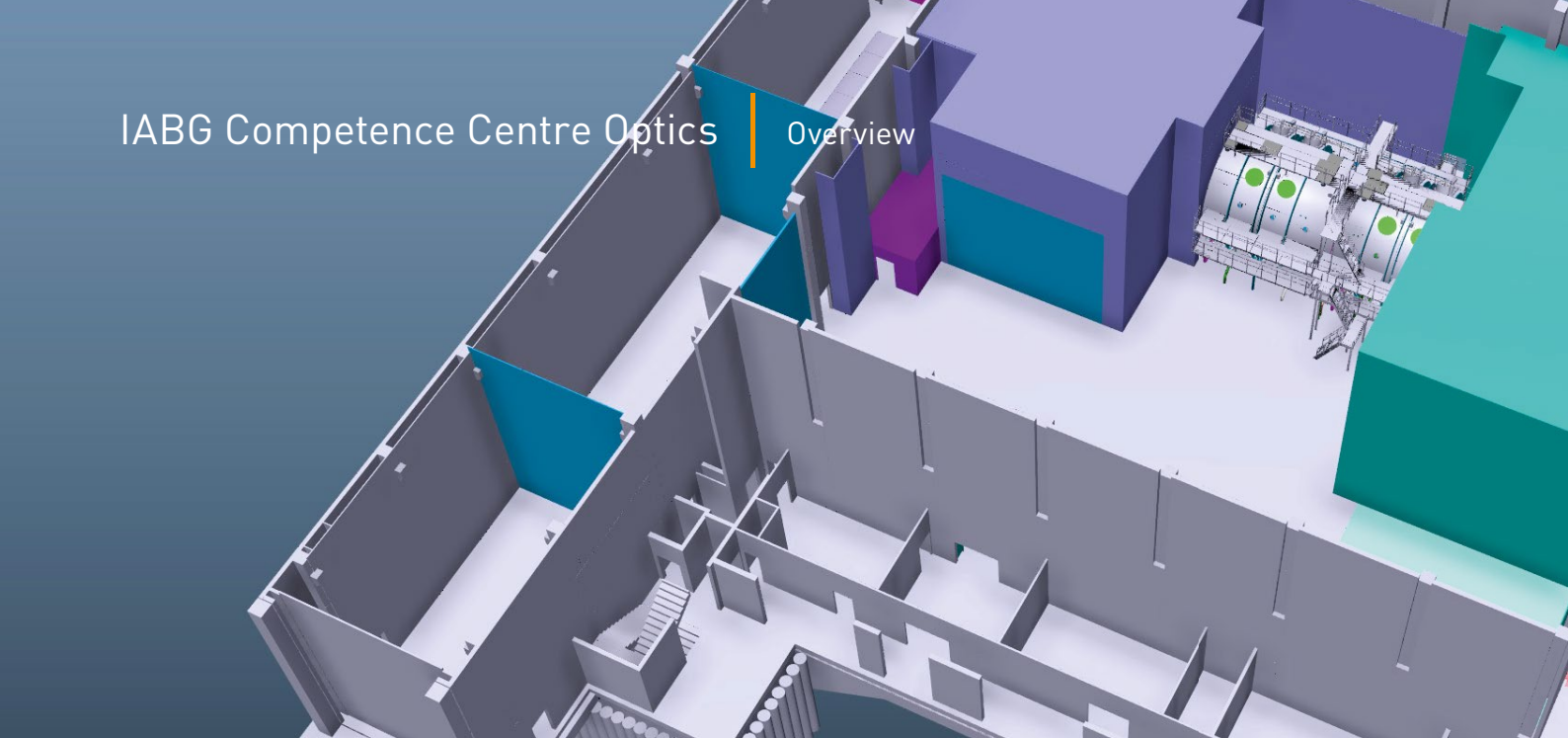
---

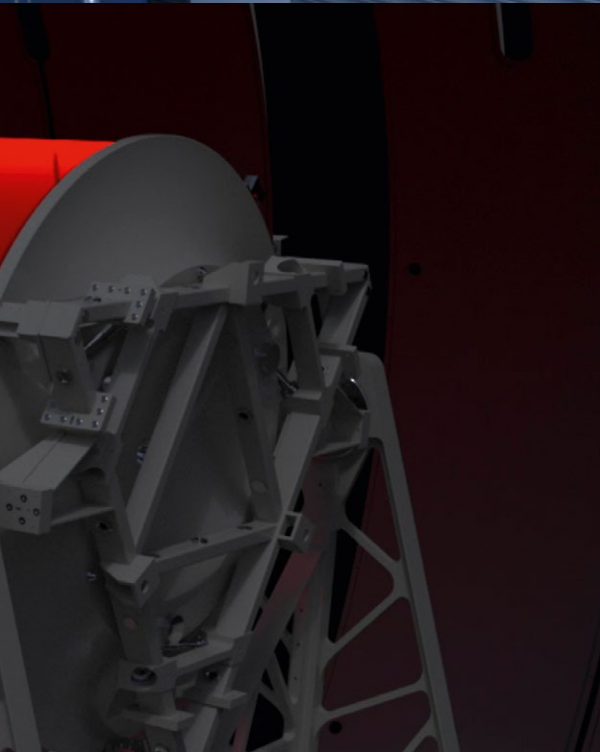
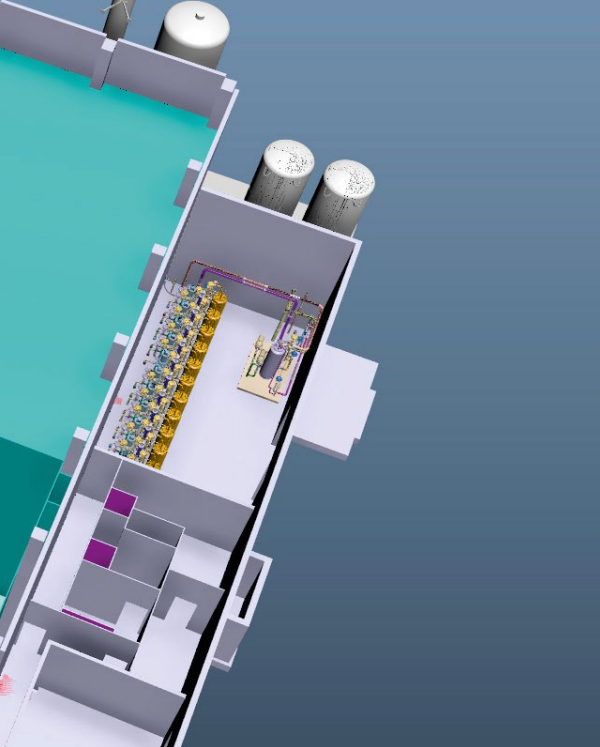
MANUFACTURE INDEPENDENT COMPETENCE CENTRE FOR PERFORMING  
DEVELOPMENT AND QUALIFICATION TESTS ON RECONNAISSANCE  
SATELLITES AND ELECTRO-OPTICAL SYSTEMS

---

STRATEGIC IMPORTANCE TO SUPPORT PROJECTS FOR SCIENTIFIC  
ENVIRONMENTAL MONITORING UP TO SECURITY RELATED PROGRAMMES







## CCO • Overview

### World class test facility for the development and qualification of optical systems and components

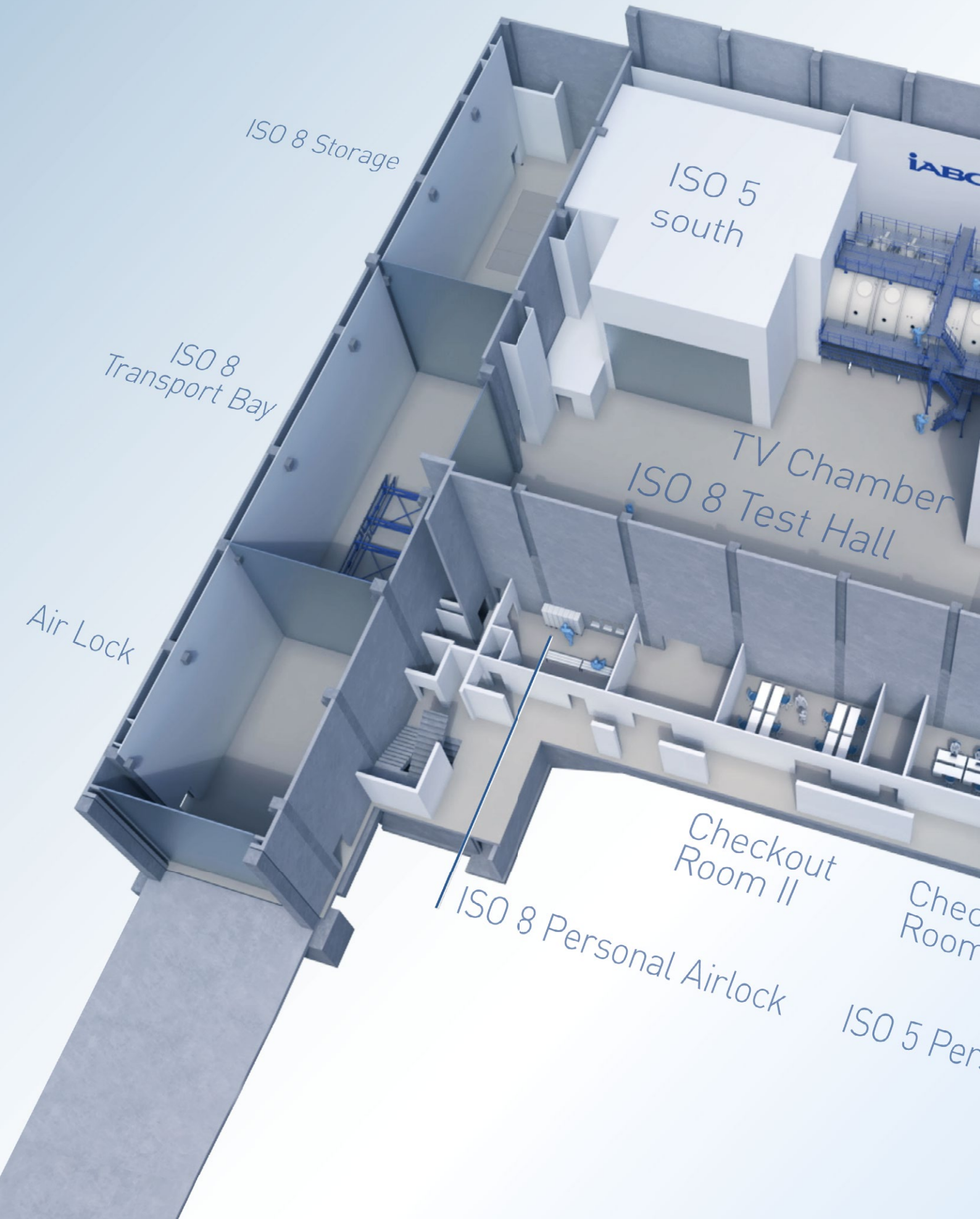
For future space-based earth observation and reconnaissance systems with optical payloads, customers are increasingly demanding more stringent requirements. Consequently, test facilities with advanced technical capabilities, e.g. for the calibration of large optical systems, will become necessary.

Therefore, IABG is establishing the Competence Centre Optics CCO for the qualification, calibration and functional performance tests of electro-optical systems, subsystems, instruments and components under ambient or space conditions within a Thermal Vacuum Chamber.

#### The CCO consists of the following main elements:

- CCO infrastructure established as stand alone complex with dedicated ISO 8 and ISO 5 Areas, Checkout Rooms, Offices, Meeting Rooms, Storage and logistic facilities. A direct access to the existing space test centre and its test facilities and infrastructure is realised
- Modular designed TV Chamber with a usable diameter of 5 m and a length up to 14 m
- Huge ISO 5 clean rooms on both ends of the TV Chamber
- Vibration decoupled optical bench in the TV Chamber and the ISO 5 rooms
- Optical Ground Support Equipment (OGSE) for the characterisation of optical systems (e.g. 2 Flat Mirror Assemblies FMA, 2 Collimator Mirror Assemblies CMA and 2 Collimator Source Assemblies CSA)

Supplementary to the provision and operation of the CCO infrastructure, facilities and OGSE, IABG will setup expertise regarding calibration and verification of optical payload systems by the establishment of an extended team of specialists in the domains of testing and customer support.





## CCO • Infrastructure

The CCO is an extension to the already existing facilities of the Space Test Centre

Nevertheless, the CCO is designed as a fully independent test infrastructure with all needed infrastructure and facilities under one roof.

The connection of the CCO and Space Test Centre is realized via the existing Main Loading Gate.

The transfer of hardware and components between CCO and Space Test Centre is possible while maintaining ISO 8 cleanliness conditions and with sufficient decoupling to minimize perturbations.

The CCO provides an ISO 8 Test Hall and ISO 5 Areas on both ends of the TV Chamber.

While one ISO 5 Area can be used for preparation of the OGSE setup, the second ISO 5 Area is dedicated to the customer for preparation of the test article before installation in the chamber.

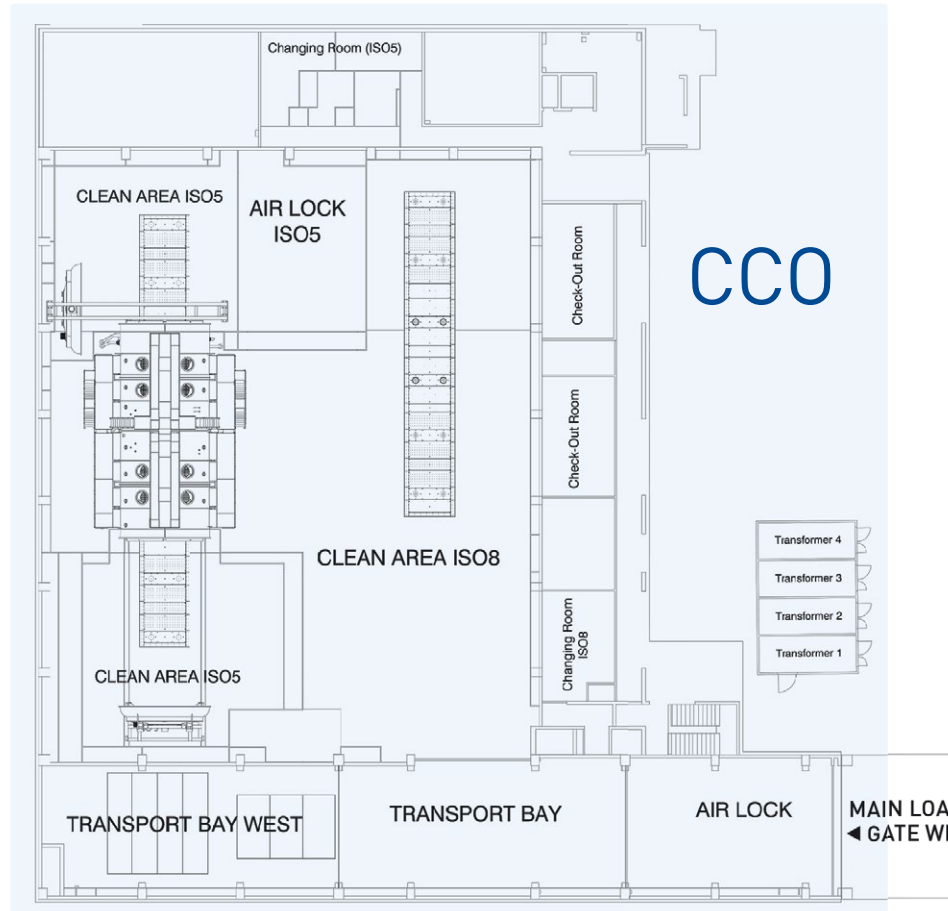
The modular TV Chamber with Optical Bench Installation is set up in between the two ISO 5 Areas.

Checkout Rooms, Office Areas and Meeting Rooms are located close to the Test Hall in the CCO building to accommodate the test teams.

### IABG Space Test Centre has

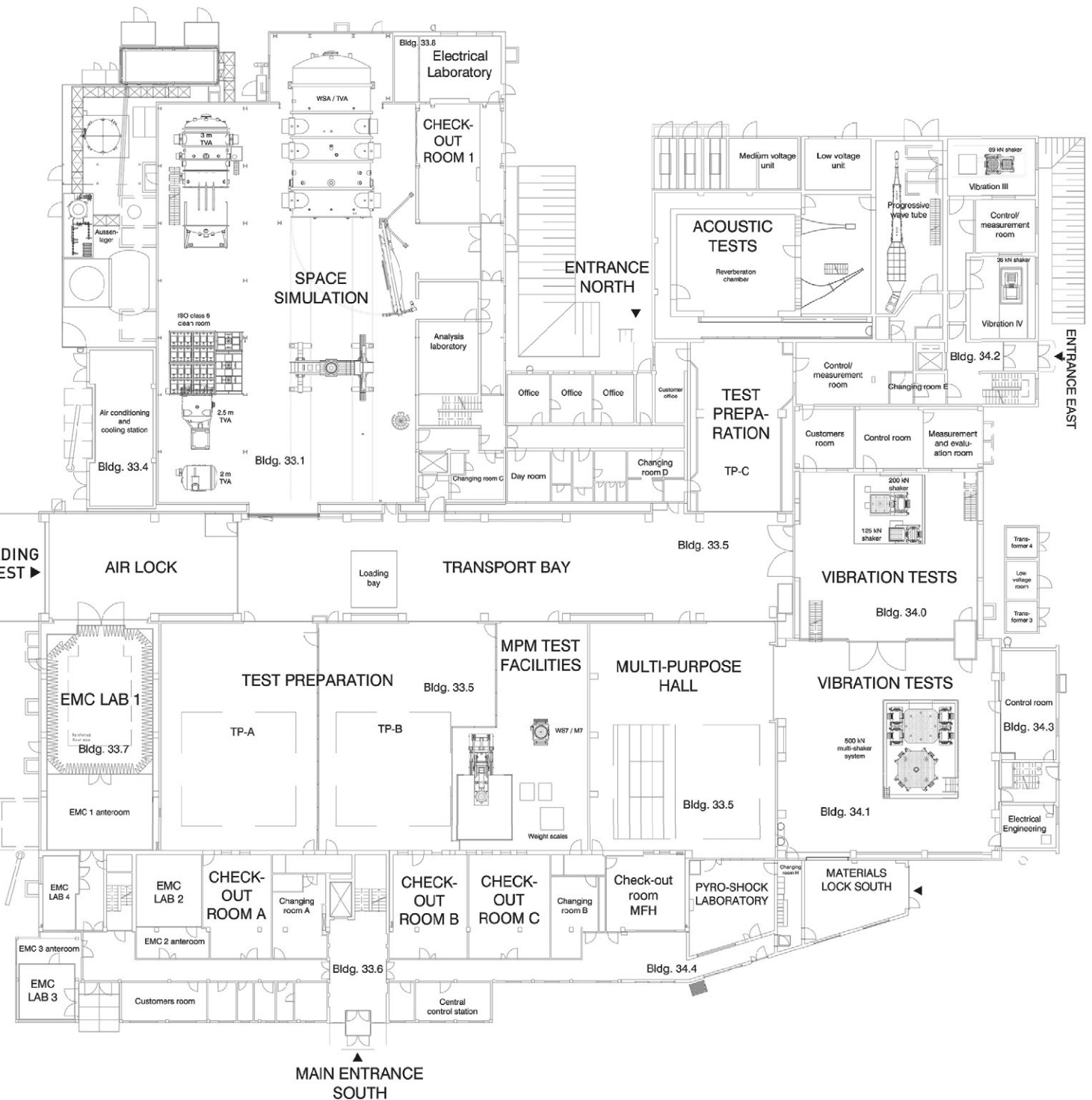
- more than 55 years experience in testing space hardware
- first class heritage with customers all over the world
- operates a variety of facilities for environmental test campaigns from small components up to large satellite systems, for civil, scientific and military projects
- experience in providing consultancy support for Quality Management related aspects as well for the definition and realisation of test facilities and Programme support.

IABG is completely independent from any hardware supplier and agency, thus entirely objective, neutral, and free in its decisions.

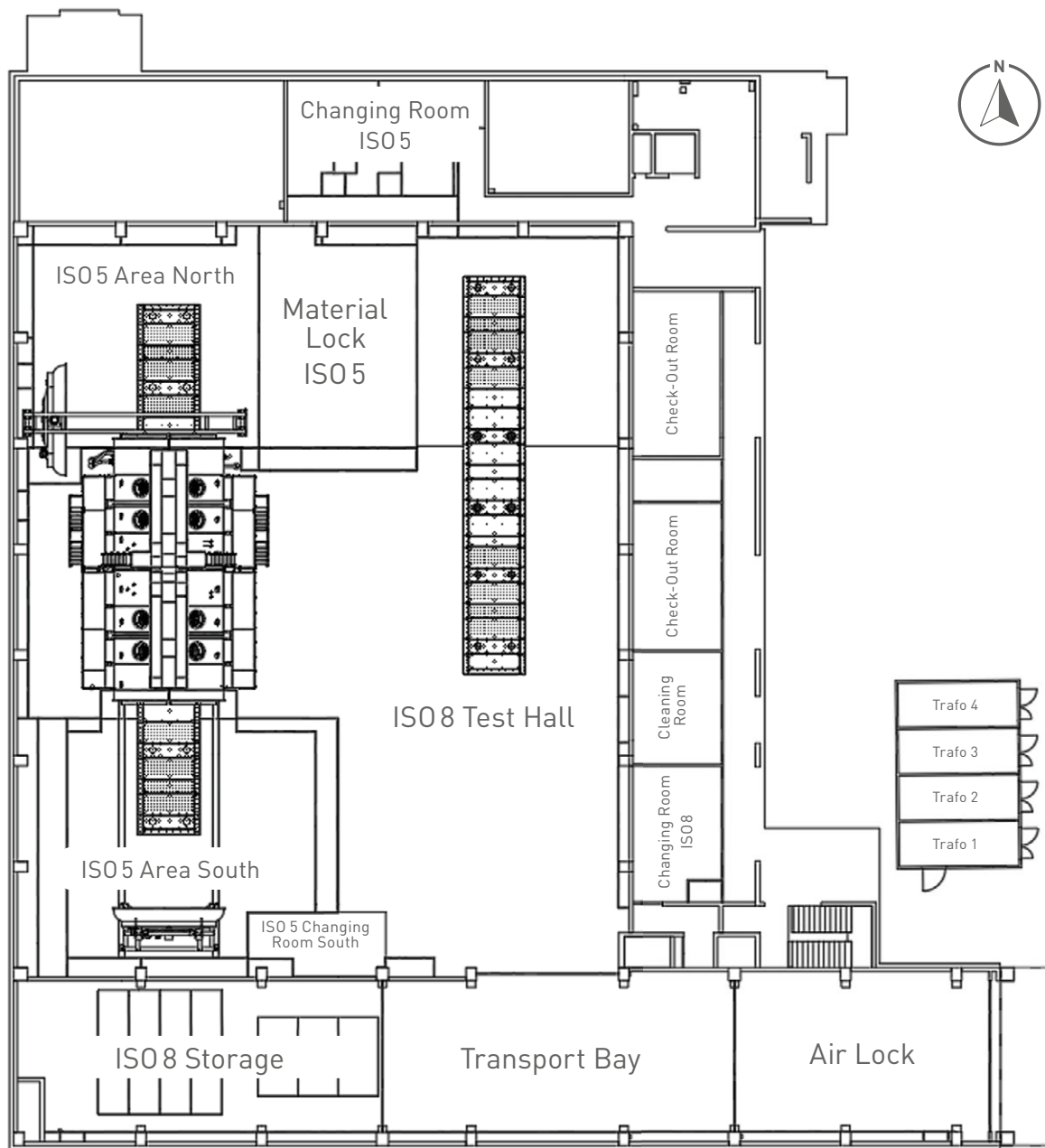




## IABG Space Test Centre with connected CCO



Top view of the CCO



Main Loading Gate

Air Lock

Transport Bay

ISO 8 Storage

ISO 8 Test Hall

ISO 5 Area North

ISO 5 Area South

ISO 8 Changing Room

ISO 5 Changing Room North

ISO 5 Changing Room South

Checkout Rooms

Offices

## Areas

The central area is the ISO 8 Test Hall which houses the Thermal Vacuum Chamber. In the south of the building the Air Lock, Transport Bay and ISO 8 Storage Area are located. In the eastern part of the building the Checkout Rooms as well as the Cleaning Room and the ISO 8 Changing Room are located.

**Main Loading Gate** • Connecting the Space Test Centre with the CCO building such that the cranes of the respective Transport Bays can travel through both facilities.

**Air Lock** • The test articles enter the CCO via the Air Lock. In this area containers are cleaned and prepared to enter the Transport Bay.

**Transport Bay** • The connecting link between the Air Lock and Test Hall is the Transport Bay. Within this area ISO 8 conditions and a crane are provided.

**ISO 8 Storage** • Storage of sensitive containers can be done in the ISO 8 Storage. Due to the fact that this area is fully operated under ISO 8 conditions, it can be used as additional test preparation area. It also provides the access to the underfloor storage area and global leak test chamber.

**ISO 8 Test Hall** • Central area of the CCO test facility. It provides ISO 8 conditions and houses the Thermal Vacuum Chamber. One ISO 5 area is accommodated at each end of the Thermal Vacuum Chamber.

**ISO 5 Area North** • At the northern opening of the Thermal Vacuum Chamber an ISO 5 cleanroom is positioned. The ISO 5 Area North is dedicated to customers' preparatory work on test articles.

The personnel access to this ISO 5 cleanroom is a direct entry from the CCO office area. The ISO 5 Area North has a dedicated Material Lock to the ISO 8 Test Hall for test article reception.

**ISO 5 Area South** • At the southern opening of the Thermal Vacuum Chamber an ISO 5 cleanroom is positioned. The ISO 5 Area South is dedicated to IABG's preparatory work on OGSE but can be made available to customers in case the OGSE for the tests is provided by the customers.

**ISO 8 Changing Room** • The building's east wing houses the ISO 8 personnel Air Lock.

**ISO 5 Changing Room North** • Connects the office floors to the ISO 5 Area North. It provides two separated change booths.

**ISO 5 Changing Room South** • Connects ISO 8 Test Hall to the ISO 5 Area South. It provides one change booths.

**Checkout Rooms** • For installation of customer EGSE and operation of the test equipment, two checkout rooms are available next to the Test Hall.

**Offices** • The CCO provides a huge number of offices and meeting rooms for the test teams. Social areas and kitchens are located in close vicinity.





## CCO • Thermal Vacuum Chamber

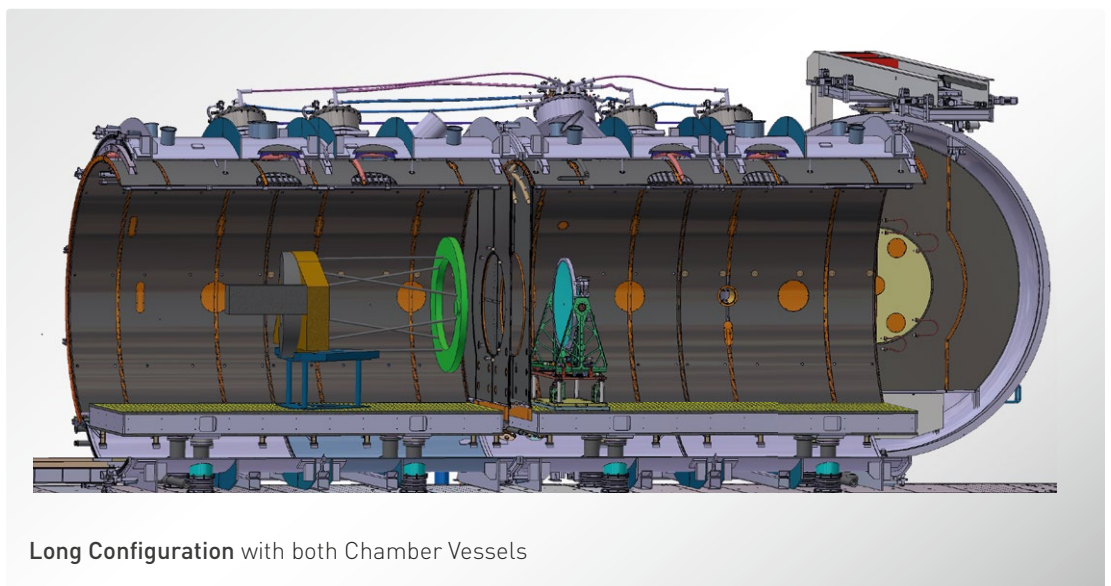
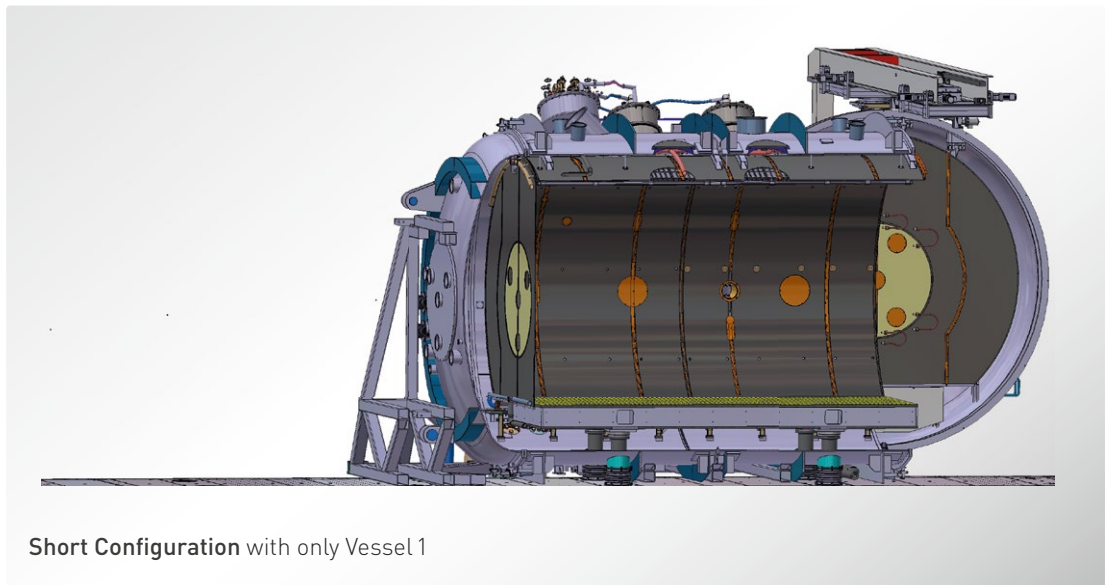
The Thermal Vacuum Chamber is the core of the CCO. The facility is designed based on a modular concept with two TV Chamber vessel elements. While the usable diameter of the TV Chamber is invariably 5 m, the length of the TV Chamber depends on the facility configuration.

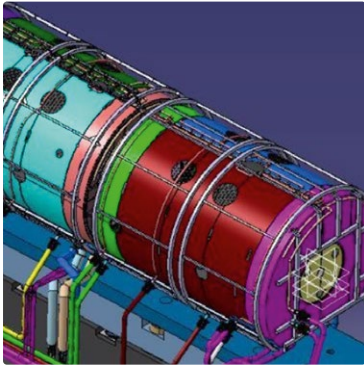
### Two facility configurations are possible

- First configuration with both TV Chamber vessel elements connected offering a TV Chamber length of 14 m. This configuration is used in case the OGSE will be placed inside the TV Chamber. A thermal partition shroud with a closable aperture is available to separate both test volumes
- Second configuration with only one TV Chamber vessel offering a TV Chamber length of 7 m. For this configuration, customer OGSE can be placed outside the TV Chamber on the same Optical Bench Installation as the specimen in the chamber. A project specific Darkroom can be established between the ISO 5 Area South and the TV Chamber vessel.

The Optical Bench Installation is located under the complete TV Chamber for both configurations and protrudes in each of the ISO 5 areas.

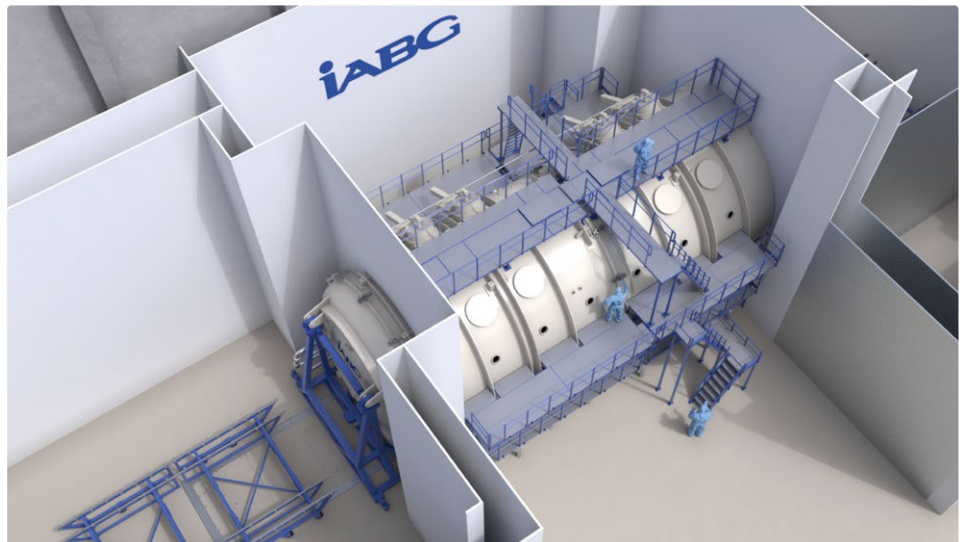
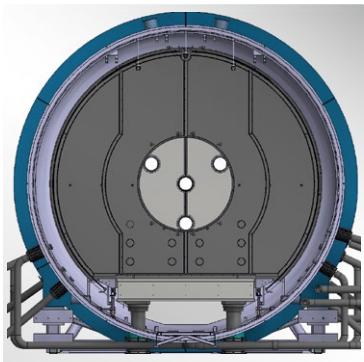
### TV Chamber in Short and Long Configuration





## TV Chamber

The two TV Chamber vessels are lined with shroud elements. For each vessel five individually controllable shrouds are installed. By this, a highly stable thermal environment within each of the TV Chamber vessels can be realised with the possibility to operate the vessels at different temperatures. The TV Chamber is complemented by two ISO5 areas one on each end of the chamber. While one area is foreseen for specimen preparation and setup, the other area can be used for OGSE preparation.

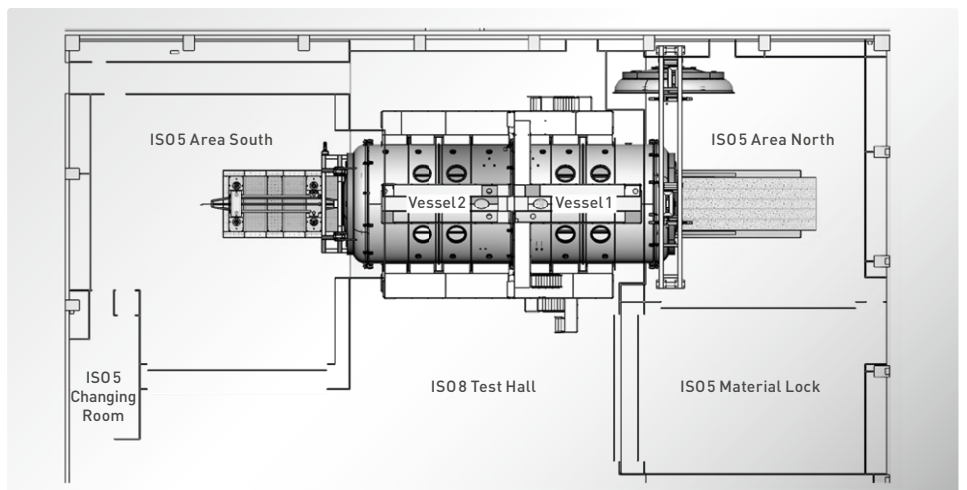
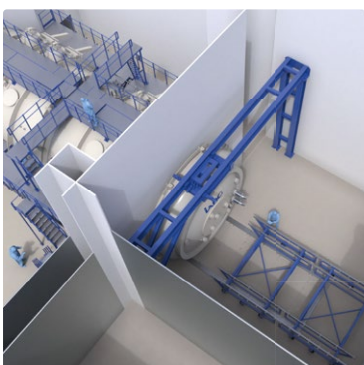


Different individual shroud elements of TV Chamber

Front view of TV Chamber

ISO 5 Area North plus ISO 5 Material Lock

The TV Chamber is situated on the hall floor and spans the sprung mass of the Optical Bench Installation without any contact.

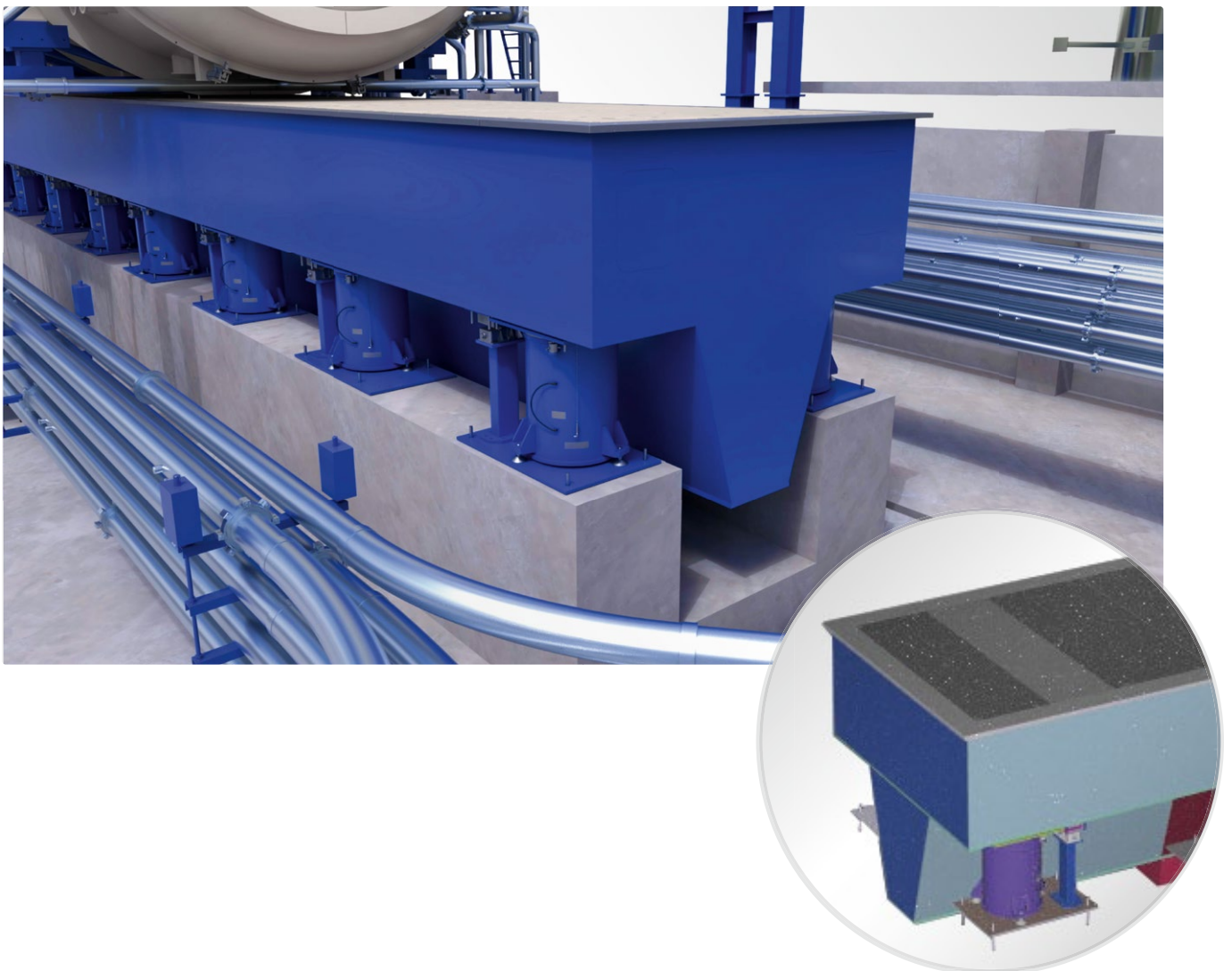


## Optical Bench Installations

Within the floor of the ISO 8 Test Hall, two sprung masses are integrated. They shall provide uncoupling from vibratory noise according to VDI 2038 VC-E. While the first sprung mass is fully equipped to serve as Optical Bench Installation (OBI1) for the thermal chamber, the second installation (OBI2), is planned for future use but is equipped with an isolation system, too.

### The OBI1 consists of

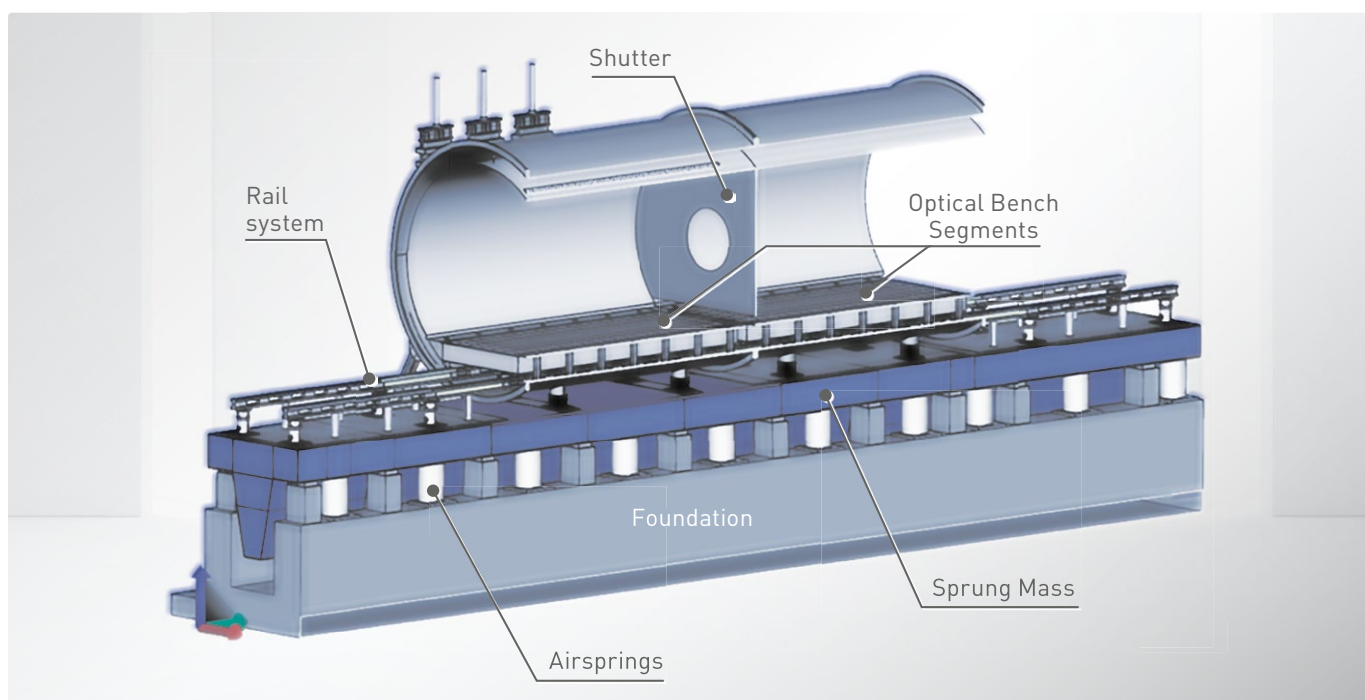
- the decoupled monolithic foundation
- the T-shaped sprung mass, supported by the isolation system (air springs)
- a mounting grid
- the mainstays bearing the quasi-isostatically supported optical bench segments
- the mainstays through the thermal chamber are equipped with vacuum tight feedthroughs



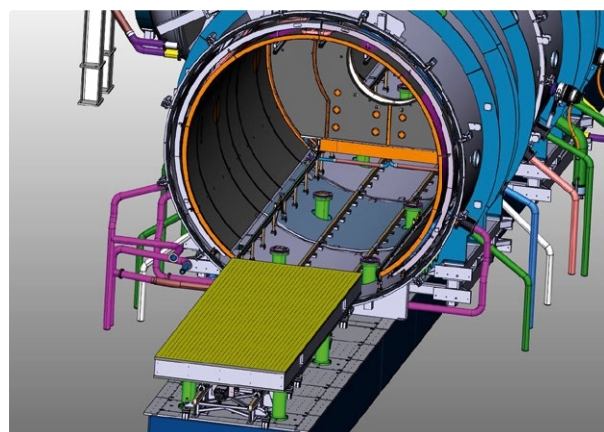
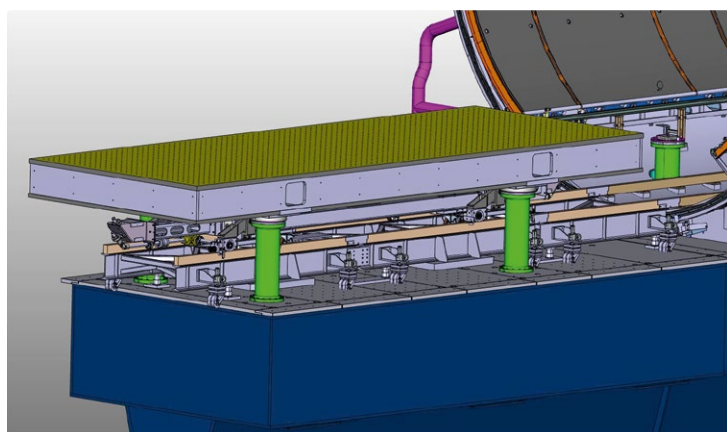


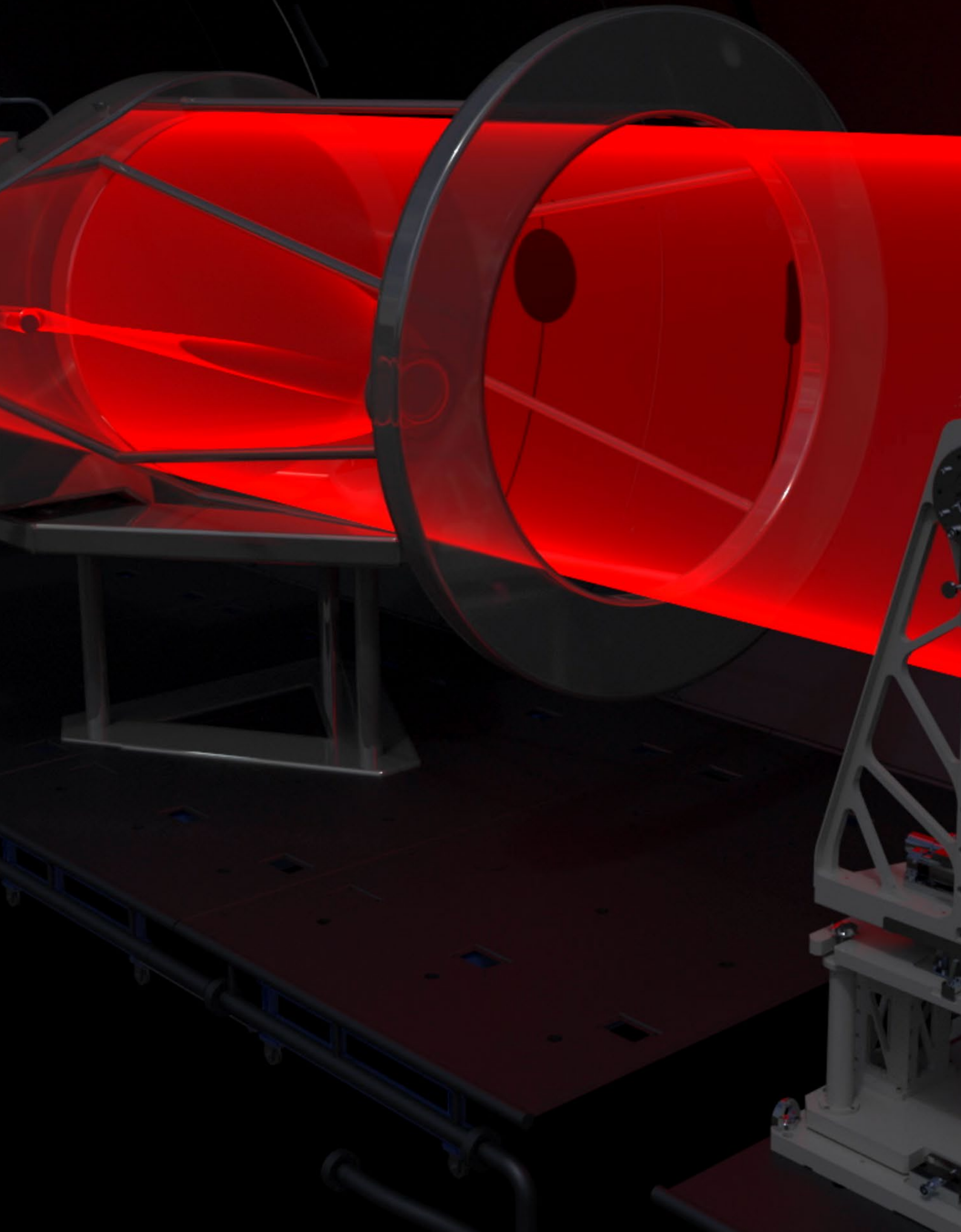
## Main components • TVChamber and OBI

OBI1 with monolithic foundation, T-sprung mass with air springs, optical bench assembly and TVC.



**The Optical Bench Segments** have a usable area of 2.6 m by 6.8 m each with a mounting grid of 80 mm by 80 mm. A setup mass of 6,000 kg can be accommodated.







## CCO • Optical Ground Support Equipment (OGSE)

IABG's Optical Ground Support Equipment (OGSE) consists of the primary OGSE used for the characterisation of optical systems under test, and secondary OGSE used for alignment and monitoring of the OGSE and the device under test.

### Different test configurations and applications are possible:

- For the characterisation of optical instruments with large apertures the OGSE needs to be set up inside the TV Chamber to minimize environmental perturbations due to e.g. optical windows or ambient conditions. ISO 5 cleanliness requirements will be respected. The OGSE is provided by the CCO. Both TV Chamber Vessels will be connected and used in Long Configuration.
- For the characterisation of optical instruments with small apertures e.g. spectrometers the chamber will be setup in this configuration, required OGSE with only Vessel 1. OGSE can be set up outside of the TV Chamber in front of the chamber lid on the same Optical Bench Installations as the specimen in the chamber. If appropriate, IABG's OGSE can be used. Alternatively the customer can provide own OGSE. Between ISO 5 Area South and chamber lid a Darkroom may be installed to operate the OGSE. The TV Chamber will be equipped with a suitable optical window enabling a proper view to the instrument inside the test volume.
- Characterisation of the optical performance of optical components of larger optical systems and of optical systems without detectors, e.g. primary mirrors of telescopes is possible in ambient or in vacuum conditions respecting ISO 5 cleanliness requirements.

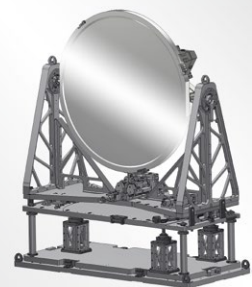
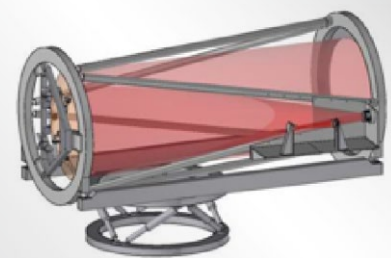


### Main components • Primary OGSE

The Primary OGSE consists of:

- Two Collimator Mirror Assemblies CMA with large aperture diameter of 1.5 m
- Two Flat Mirror Assemblies FMA with aperture diameter of 1.45 m
- Two Calibration Source Assemblies CSA for use with the CMA or as standalone system

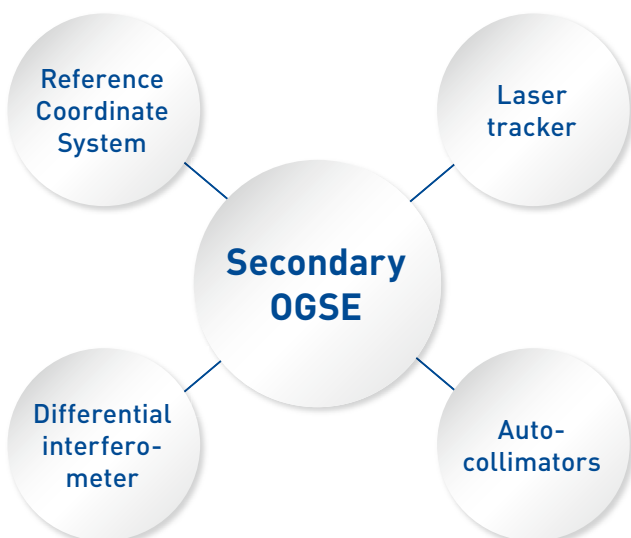
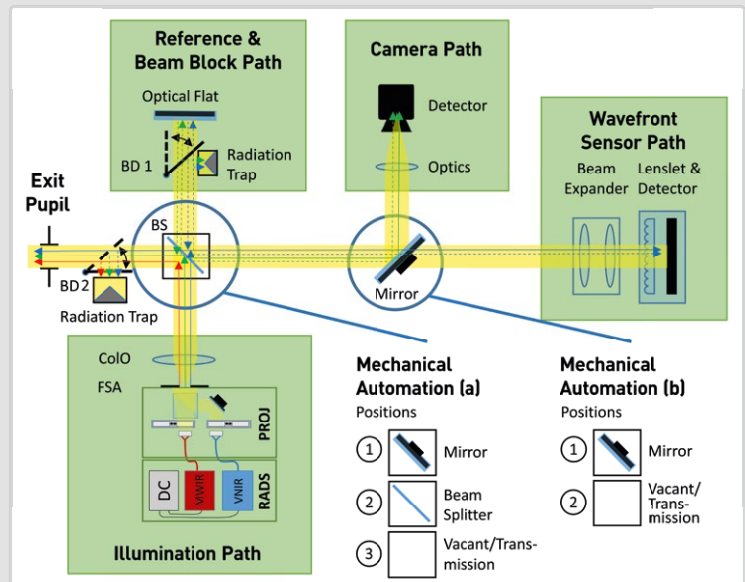
Each OGSE component can be controlled via the control unit that is part of the OGSE element, or, via the Control and Measurement System CMS.



## Calibration Source Assemblies

The Calibration Source Assemblies (CSAs) provide illumination as well as detection of radiation and can be operated as stand-alone systems, or in combination with the CMAs. The CSAs consist of four functional light paths.

- **Illumination path:** The illumination path contains the radiation sources illuminating the test target array which is positioned in the focal plane of the collimation optics. The test targets can be changed during operation by repositioning the target.
- **Camera path:** The camera path contains the imaging optics and a focal plane array.
- **Wavefront sensor path:** The wavefront sensor path contains a TBD no. of Shack-Hartmann sensors.
- **Reference and beam block path:** The reference and beam block path contains an optical switch, an optical flat and radiation traps. In combination with the camera module it enables the CSA to be used as an autocollimator, while in combination with the wavefront sensor module it creates a reference wavefront that enables the calibration of the wavefront sensor (TBC).



## Main components • Secondary OGSE

### Tasks:

- Adjustment and levelling of moveable plant components
- Provision of reference points and reference systems for the alignment of the primary OGSE as well as the optical systems on the optical bench against each other
- Monitoring of the alignment of the primary OGSE as well as the optical system during the test operation
- Monitoring of the positioner movements
- Detection and monitoring of thermal induced deformations of the optical bench

### Challenges:

- Partly use in vacuum conditions
- Measurement resolution:
  - Length variations up to: 5 – 20 pm
  - Angle changes up to: 0.001 – 0.004 arcsec



IABG

**IABG Space Test Centre**, opened in spring 1965 under the promotion of the Ministry of Scientific Research (BMwF)

150 employees, consisting of 60 % engineers / physicists and 40 % technicians

Turnover: approx. 30 M€ per year (2022)

Value of the test centre infrastructure and facilities: approx. 150 million €

Competence Centre Optics operational 2023

**Certified and accredited, respectively, according to the following international standards**

ECSS-Q-ST-20-07C  
EN 9100 (incl. ISO 9001)  
ISO/IEC 17025  
ISO 14001



We give you  
**Space**  
on Earth.

**iABC**



**AUTOMOTIVE**



**INFOCOM**



**MOBILITY, ENERGY & ENVIRONMENT**



**AERONAUTICS**



**SPACE**



**DEFENCE & SECURITY**



Download this brochure

IABG  
Einsteinstrasse 20  
85521 Ottobrunn  
Germany  
Phone +49 89 6088-4080  
Fax +49 89 6088-3194  
space@iabg.de  
www.iabg.de

Berlin Bonn Dresden Hamburg Karlsruhe Koblenz  
Lathen Lichtenau Noordwijk(NL) Oberpfaffenhofen