DLR at a glance

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has approximately 8000 employees at 20 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Bremerhaven, Dresden, Goettingen, Hamburg, Jena, Juelich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Oldenburg, Stade, Stuttgart, Trauen, and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.

DLR's mission comprises the exploration of Earth and the Solar System and research for protecting the environment. This includes the development of environment-friendly technologies for energy supply and future mobility, as well as for communications and security. DLR's research portfolio ranges from fundamental research to the development of products for tomorrow. In this way, DLR contributes the scientific and technical expertise that it has acquired to the enhancement of Germany as a location for industry and technology. DLR operates major research facilities for its own projects and as a service for clients and partners. It also fosters the development of the next generation of researchers, provides expert advisory services to government and is a driving force in the regions where its facilities are located.

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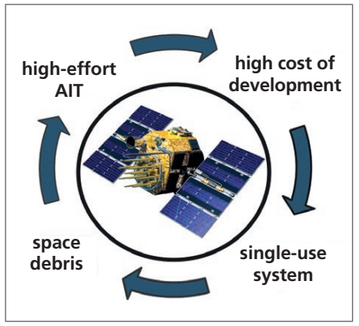
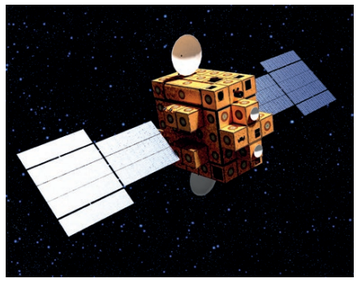
iBOSS – intelligent Building Blocks for On-Orbit Satellite Servicing and Assembly

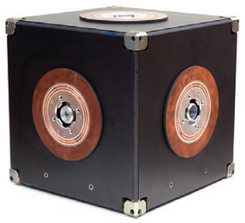
DLR

iBOSS concept



Drawbacks of traditional and AIT-intense satellite development


Design study for an iBOSS-based satellite (iSAT)


Modular iBOSS building block (iBLOCK)


Multifunctional intelligent Space System Interface (iSSI)

Overview

The iBOSS approach (intelligent Building Blocks for On-Orbit Satellite Servicing and Assembly) is a DLR-funded initiative to develop and bring into operational use a novel modular spacecraft concept enabling On-Orbit Servicing (OOS) and On-Orbit Assembly (OOA), respectively reconfiguration and expansion.
Key elements are:
- a catalogue of standardised modules comprising both structural and functional elements,
- a standardised multi-functional 4-in-1 interface for mechanical coupling, power and data transmission and thermal interconnection, and
- comprehensive computer-aided satellite design and verification processes.

Motivation

The classical satellite design approach focuses on unique solutions resulting in one-of-a-kind single-use systems with high development costs and long lead periods, causing space debris at spacecraft's end of life. The iBOSS approach substitutes classical satellite design by converting traditional satellite subsystems into specific standardised building blocks forming altogether a maintainable modular spacecraft. It thereby supports sustainability, maintainability, and upgradeability. The iBOSS design approach has positive effects on the overall mission effectiveness, including enhanced flexibility in satellite development and production as well as a division of system complexity to a level manageable by small and medium-sized enterprises.

iBOSS-based spacecraft (iSAT)

With prequalified off-the-shelf building blocks (iBLOCKs) connected via the intelligent Space System Interface (iSSI), cost-efficient, rapid on-demand development of iBOSS-based satellites (iSATs) and other flexible space systems becomes possible. The intelligent Computer-Aided Satellite Design software (iCASD) enables quasi in-situ generation of specific iSAT configurations considering user and mission requirements as well as constraints for mission-specific components and modules. Furthermore, any iSAT configuration can be tested and verified in detailed spacecraft simulations provided by the comprehensive Virtual Testbed for iBOSS (VTi). iCASD and VTi help to reduce development time and costs and ensure spacecraft quality and reliability.

iBOSS building blocks (iBLOCKs)

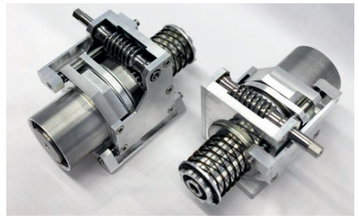
Standardised iBLOCKs allow to assemble space systems, both orbital and planetary. Each iBLOCK carries different subsystem components. The outer dimensions of the baseline iBLOCK are 40 x 40 x 40 cubic centimetres, which can be extended to multiples of the baseline shape for special functionalities like tanks, dedicated payloads, etc. The mass of a fully integrated iBLOCK (without subsystem components) is approximately 17 kilogrammes.

intelligent Space System Interface (iSSI)

Standardised multifunctional 4-in-1 iSSIs connect iBLOCKs and other spacecraft or planetary subsystems and components like solar panels, additional payloads, or other dedicated units. This highly integrated multifunctional interface provides mechanical and thermal coupling as well as power and data transfer (4-in-1). With its androgynous and symmetric design, countless iBLOCK combinations become possible. The iSSI electronics assure intelligent interface monitoring and control, enabling innovative redundancy and utilisation concepts based on decentralised design.

Fuel Transfer Interface (FTI)

The FTI is a reusable androgynous interface for the transfer of propellant (gaseous or liquid) between iBLOCKs (i.e. from tank to thruster). It also serves the purpose of refuelling e.g. in the context of life extension and supports the replacement of propulsion components. Propulsion subsystem iBLOCKs are equipped with one or more FTIs.

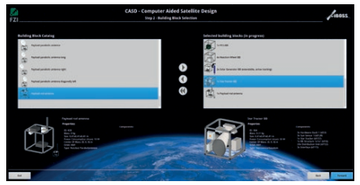

Fuel Transfer Interface (FTI)

iBLOCK catalogue

The iBOSS catalogue offers a range of standardised and verified iBLOCKs for all kinds of envisaged mission profiles, orbits, and lifetimes in different quality classes and with different performance parameters of the integrated components. Developing an iSAT using iCASD and VTi is very economical and reduces common risks, as the catalogue comprises only pre-tested and pre-qualified iBLOCKs. Furthermore, the iBOSS standard documentation defines all boundary conditions and provides user guidelines for easy implementation.

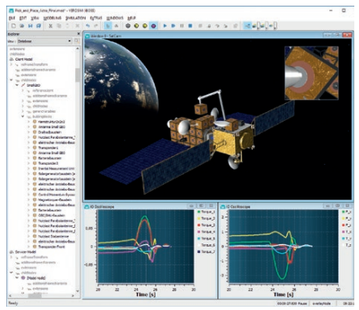
intelligent Computer Aided Satellite Design (iCASD)

The iCASD software enables an interactive configuration of iSATs by optimal selection and placement of iBLOCKS depending on given or selected mission parameters. Solutions are automatically calculated, visualised and used to plan reconfiguration activities or to carry out comprehensive simulations using the VTi.


User interface of the intelligent Computer Aided Satellite Design (iCASD) software

Virtual Testbed iBOSS (VTi)

The VTi provides a fully simulation-based systems engineering approach, taking virtual iSATs throughout the entire spacecraft life cycle. From initial design studies to on-orbit assembly, operation, servicing and robotic manipulation in space, iSATs can be designed, explored, verified, and validated from component up to system level. The VTi thereby helps customers to configure new satellites, supports engineers in developing new components as well as entire spacecraft and eases the communication between different stakeholders.


Comprehensive Virtual Testbed for iBOSS (VTi)

For contact and more information visit us at:
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