Fraunhofer IIS

Modern On-Board-Processing based on FPGAs for Flexible Satellite Communication

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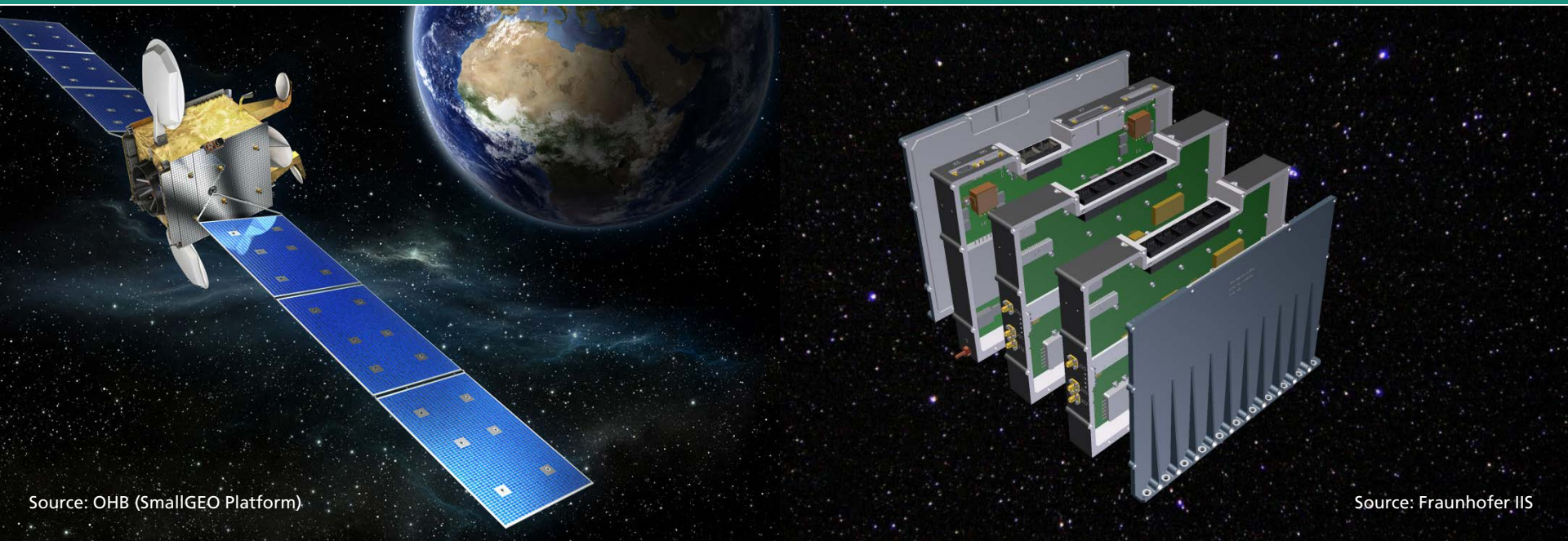

Source: OHB (SmallGEO Platform)

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Abstract

Flexible satellite payloads are important for the use cases of modern satellite constellations. A reconfigurable On-Board- Processor (OBP) based on Field-Programmable Gate Array (FPGA) technology provides the needed flexibility and enables adaptable signal filtering, regeneration, and switching / routing by reconfiguration of the digital signal processing chain. Additionally, new powerful FPGAs reinforce the possibilities for future application.

This presentation shows some details of an OBP design process with the example of the Fraunhofer OBP (FOBP), which is based on two radiation hardened FPGAs. The FOBP has a fully qualified Engineering Qualification Model (EQM) and shall be launched to a GEO within the Heinrich-Hertz satellite mission in 2021. Starting with the application field of satellite communications, the presentation introduces the system design, including requirement engineering. Afterwards, details of the top down design flow are given by elaborating the hardware, firmware (FPGA design), and the software. The presented FOBP provides a dependable, powerful, reconfigurable, and scalable processing platform for on-board processing. A live demonstration shows the FOBP in-band telemetry and telecommand capabilities.

Focus of the presentation are the FPGAs of the FOBP together with the key aspects of hardware, firmware, and software design. This enables an outlook to possible applications and future FPGA-based OBP systems and demonstrates the demand as well as the high potential of FPGA-based OBPs.