Device

Low cost high performance on-orbit equipment using commercial-off-the shelf devices

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Purpose of Research

To repair/recover an artificial satellite in orbit, highly autonomous search for and approach to the satellite is necessary. On the other hand, outer space devices have limited functions and are also extremely expensive, making the above difficult. We have investigated commercial parts (of automobiles, mobile phones, etc.) that can work in outer space and developed systems with software that can deal with malfunctions, for low-cost high-performance satellite-borne devices which we have made and which have been adopted for IKAROS, Hayabusa 2, and many other missions.
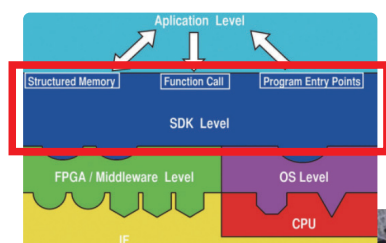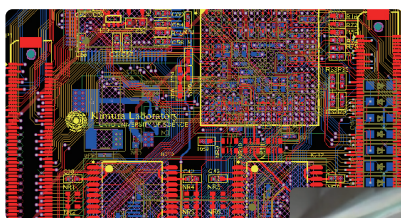

Space computer

Camera installed in Hayabusa2 (left) and an image of the touchdown (right)

Summary of Research

In the present study, we are developing high-performance, satellite-borne devices at low cost based on the following three technologies and our experience in many satellite missions.

1) Orbit environment compatibility evaluation technology for commercial devices

Before a commercial device is put into orbit, its compatibility with the orbit environment (radiation, high vacuum, etc.) must be evaluated. We have established such an evaluation technology and a collection of commercial devices which have successfully operated on orbit. Using these resources, we can develop a camera and a computer suitable for a wide range of missions.

2) Satellite-borne circuit board design technology

In order to manufacture ultra-small, high-performance, satellite-borne devices from commercial parts, a circuit/board design technology is required. The world's smallest space camera, etc. developed in our laboratory shows the excellence of our satellite-borne device design technology.

3) Software technology for advanced AI

High performance and reliability depend on not only hardware but also software technologies. Based on our software resources nurtured over many missions, a flexible and reliable software platform has been developed. Our software simulator, when connected to hardware, can reproduce the behavior of a satellite under various conditions. This provides a system for effective hardware testing.

Points
- **Outer space computer**
- **World's smallest outer space camera**

Future Developments

- Ultra-small, deployable outer space camera module.
- Controller/image acquisition and processing unit for extreme environments.

- ■ Successfully participated in IKAROS, Hayabusa 2, and many other satellite missions
- ■ Prototype: engineering modules, etc. made

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