

**TRISMAC 2024@ESRIN**

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# **Emphasizing Space Parts Supply Chain and Space Parts Consortium in Japan**

**Space Parts Consortium  
Head of Secretariat  
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# 1. HIREC Services



S&MA Support  
to Space Projects



Radiation Tolerant Tests



FIDES Services  
(Guideline sales, analysis)



Parts Evaluation and  
Acquisition Service



Space Parts(MPU, etc)  
Manufacturing and Sales



Space Parts Up-screening,  
Programs Writing to FPGA



S&MA Training



Consultation



Certification for Space Parts  
(on behalf of JAXA)

## 2. Necessity for Establishment of Space Parts Consortium

(Motivation)

- Under Covid-19 situation, some Critical Parts were difficult to buy in timely, and rising the price to extremely high(8 times)
- This situation is improving lately, but we recognized; Japanese space parts supply chain was very weak, particularly in critical parts such as; MPU、 FPGA、 Memory, and Power Unit

We need to improve this situation

(Complimentary to JAXA role)

- JAXA's main role is identified as “Technical Support to Government”
- So JAXA has no budget for enhancement of space parts supply chain
- Industries/Private sector are expected to take in place of Space Parts Supply Chain Enhancement.

(Solution for JAXA and Industries/Private sector)

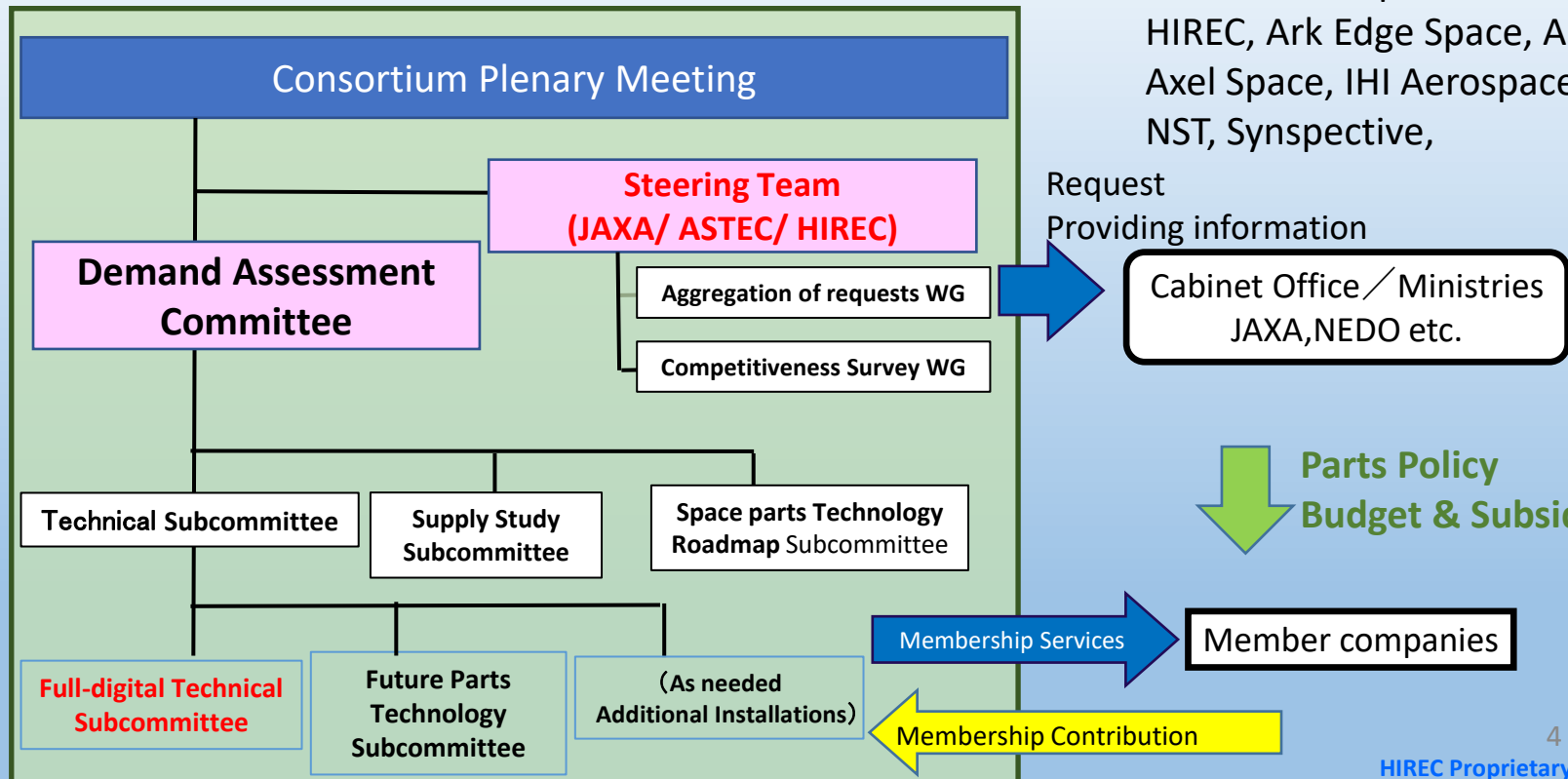
- Industries/Private Sector can request budget associated with Supply Chain enhancement to directly government.
- Industries/Private Sector may get benefits from enhanced space parts supply chain, and get R&D budget to realize national space parts.

### 3. Establishment of the Space Parts Consortium - November 6, 2023

#### Purpose of Consortium

- ◆ To keep flexibility and autonomy for spacecraft development
- ◆ To develop an all-Japan strategy for space parts based on the needs and issues, and to develop related action plans, and budget requests etc.
- ◆ To Coordinate between Private and Public sector

#### Consortium Structure



Member Companies : JAXA, ASTEC, HIREC, Ark Edge Space, AstroScale, Axel Space, IHI Aerospace, MELCO, NST, Synspecive,

Request  
Providing information

Cabinet Office / Ministries  
JAXA, NEDO etc.

Parts Policy  
Budget & Subsidies

Membership Services

Member companies

Membership Contribution

## 4. Technical items that should be reflected in JAXA's Space Parts Technology Roadmap

Critical Semiconductor parts Technology	What needs to be done
Satellite Computing and Fully Digitalized Parts Technology	<ul style="list-style-type: none"> <li>(1) RHBD Technology 16nmFinFET</li> <li>(2) Development of further miniaturization technology</li> <li>(3) Improvement of environmental resistance of 3D mounting (thermal environment, vibration, shock, etc.)</li> </ul>
Technology for High-speed, High-capacity Communication	<ul style="list-style-type: none"> <li>(1) Wide Bandgap (WBG): GaN device technology for utilization</li> <li>(2) Development of next-generation WBG devices (Ga2O3, diamond, etc.)</li> <li>(3) Assessment technology of utilizing High-Speed AD/DA Converters in space applications</li> </ul>
Power Supply System Compatible parts Technology	<ul style="list-style-type: none"> <li>(1) Assessment technology of utilizing Power Devices Developed for EVs in space applications</li> <li>(2) All-solid-state battery (private sector development and assessment technology for utilizing in space application)</li> </ul>
Peripheral Technologies	What needs to be done
Parts Evaluation Technology	<ul style="list-style-type: none"> <li>(1) PEM (Plastic Encapsulated Microcircuits) Assessment Technology for Resistance of Parts to the Aerospace Environment.</li> <li>(2) Whisker Countermeasure Assessment Technology.</li> <li>(3) Space Environment Evaluation Technology for Lead-Free Bonding Whisker Countermeasure Assessment Technology.</li> <li>(4) MEMS (Micro Electro Mechanical Systems) Development of Assessment technology.</li> <li>(5) Radiation Tolerance Assessment Technology for General Parts.</li> </ul>

## 5. Achievement in FY2022～FY2023

As a pilot activity of the Space Parts Consortium, we proposed private-sector requests to the Keidanren Space Development and Utilization Committee (March 2023) and successful to incorporate **2 items** into the Basic Space Plan Update.

- (1) **New Development of important micro-processor for space**
- (2) **Coordination for irradiation test opportunities**

# Expectations for Japanese FPGAs and supply chain restructuring

## Monopoly by U.S. companies

AMD and MicroChip dominate the global market for space FPGAs.



RT Kintex UltraScale@AMD (20nm)



RT PolarFire@MicroChip (28nm)

## Current situation in Japan

• There are **no Japanese FPGAs** for space that have been put into practical use.

→As a result, there is no negotiating power and the required quantity cannot be purchased at the time when it is needed.

• As an FPGA that is promising for practical use, there is an "**NB-FPGA**" that uses **atomic switches**, and some space demonstrations are being conducted.

[Features of NB]

- **Low power consumption**
- **High radiation tolerance**
- Rewritable

FPGA Switch Configurations	Size	Power Efficiency	Manufacturers
SRAM + Transistor	Large	1	AMD (US)
Flash + Transistor	Medium	2	Microchip (US)
<b>Atomic switch</b>	<b>Small</b>	8	NBS (Japan)



Japan, like Europe, is also a manufacturer of FPGAs, etc.

A development program should be in place

① **Development of advanced FPGA (16nm) (Stardust Program).**

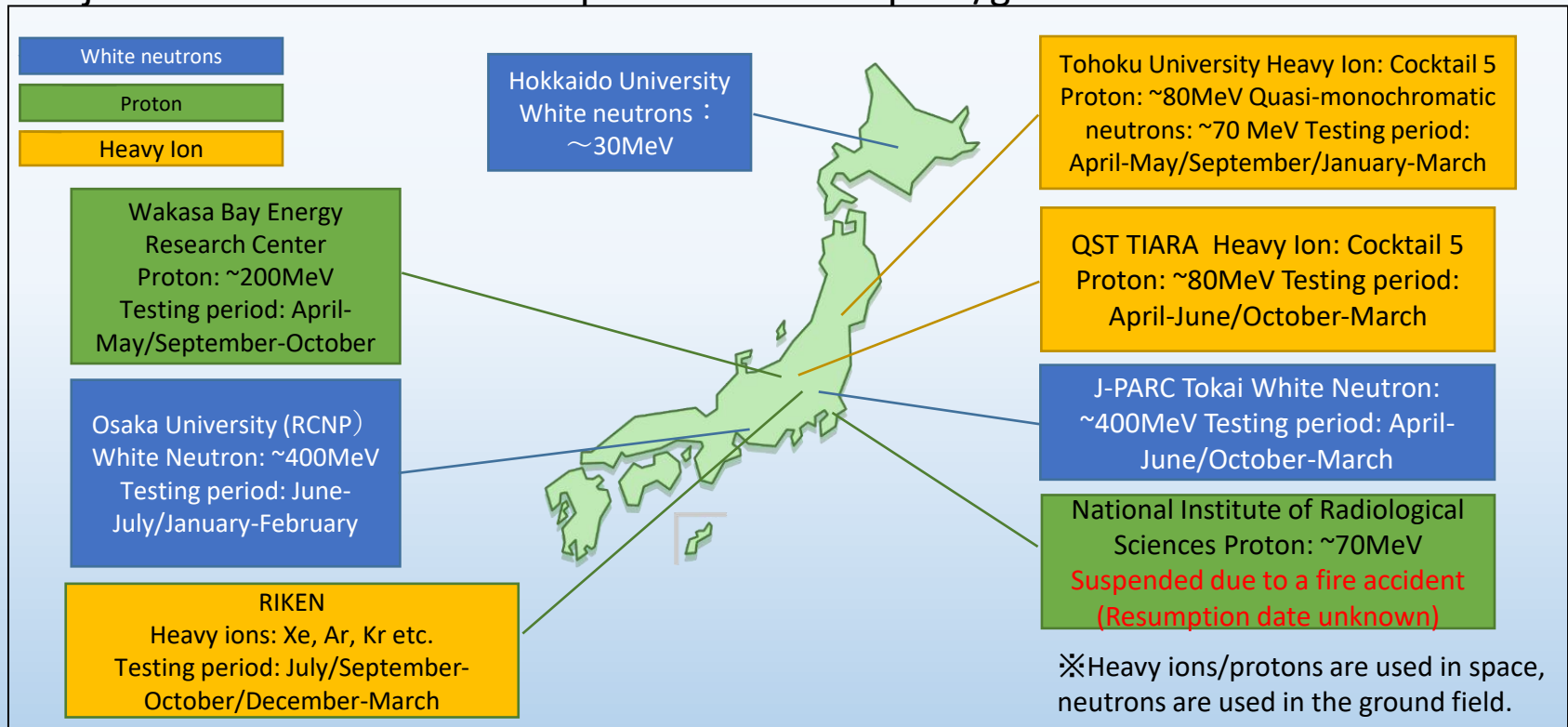
② **Development of general FPGA (65nm) bus equipment applications.**

Radiation-hardened chip redevelopment, practical application testing, including development tools, IP maintenance, and support system.

③ **Radiation evaluation opportunities should be procured collectively by the government, etc. We need a mechanism for allocating.**

# Challenges related to radiation testing

## Major irradiation facilities in Japan used in the space/ground field



## Issues related to the use of radiation facilities in Japan

- ✓ Due to the operation rules of the irradiation facility, the **irradiation test application period is basically only twice a year.**  
The user cannot perform the irradiation test at the required time.
- ✓ Since there is a **large demand for irradiation facilities** in the evaluation of ground parts, there is an issue with the machine time that can be obtained.
- ✓ **The cost of irradiation testing is so high** that it cannot be borne by the venture company.  
As a result, we are reducing the opportunities for their evaluation.



## 6. Forward Work Plan in2024

- (1) Full Digital Expertise Subcommittee: Focus on NB-FPGA.
- ( 2 ) Space Parts Technology Roadmap Subcommittee : Conducted a questionnaire on passive parts.
- ( 3 ) Future Parts Technology Subcommittee (Heterogeneous Integration/Chiplet Study).