

# JAXA Approach for Mission Success

~close coordination with contractors~

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# JAXA Approach for Mission Success

~close coordination with contractors~

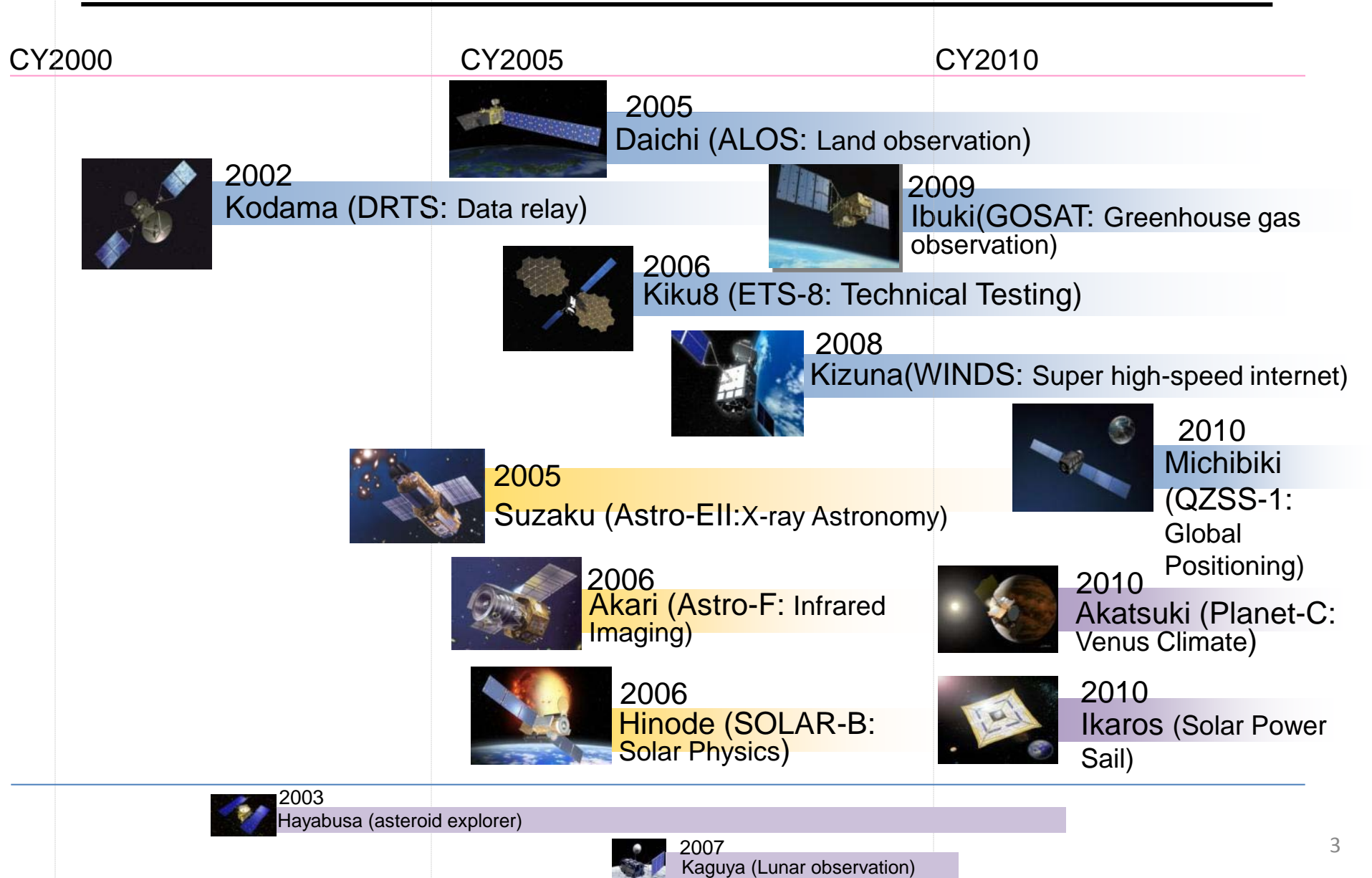
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## Contents

1. Recent JAXA Space Flights
2. JAXA's Role and Responsibility
3. Major S&MA Activities
4. Technical Improvement Activities in Development Projects

# 1. Recent JAXA Space Flights

## Currently-operating JAXA's satellites on-orbit



# 1. Recent JAXA Space Flights

## Japanese Launch vehicles



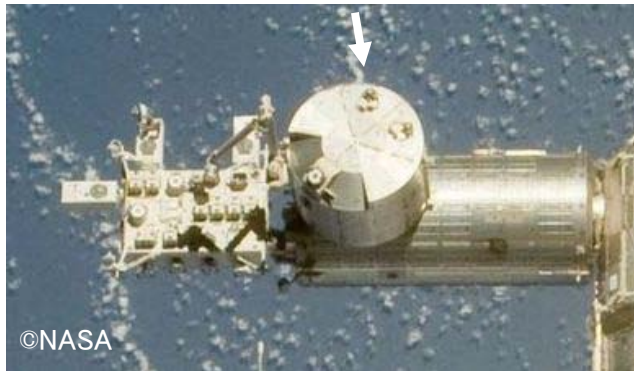
	H-2A (Standard)	H-2B	Epsilon(under development)
GTO	4.0ton	8ton	
LEO	10ton	16.5ton (ISS orbit)	1.2ton

# 1. Recent JAXA Space Flights

## International Space Station Program

### “KIBO”

Japanese Experience Module (JEM)

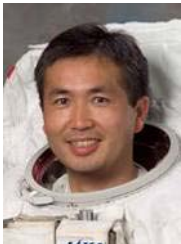


### “HTV”

Transportation Vehicle



### ISS



Wakata

2009.3 – 2009.7



Noguchi

2009.12 – 2010.6



Yamazaki

2010.4



Furukawa

2011.Spring -

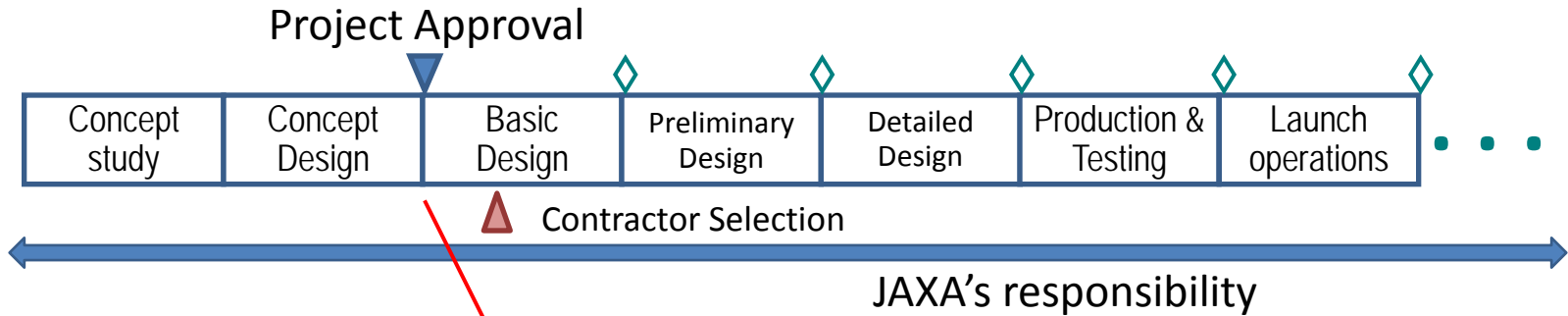
## 2. JAXA's Role and Responsibility

- ✓ Emphasizing upstream process and front-loading
  - Apply Systems Engineering (SE) that emphasizes upstream process management in the project lifecycle
  - Allocate adequate resource to upstream process (front-loading)
  
- ✓ Define appropriate level of JAXA responsibilities and roles in development projects
  - JAXA is responsible for requirements/specification definition, and flight operations.
  - A manufacturer is responsible for detailed design, fabrication and testing.
  
- ✓ To implement front-loading, JAXA S&MA disseminates information that are obtained from all JAXA's activities to JAXA and contractors.

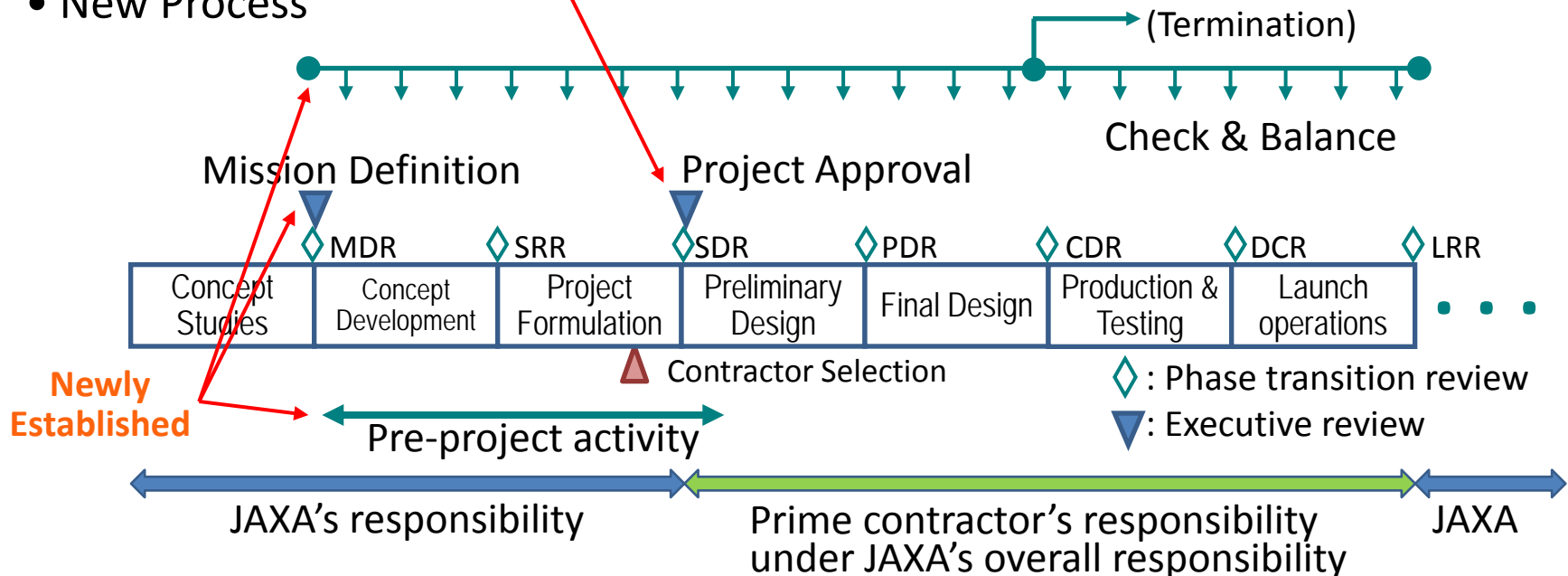
## 2. JAXA's Role and Responsibility

### Re-establishment of Project Lifecycle Process

- Previous Process



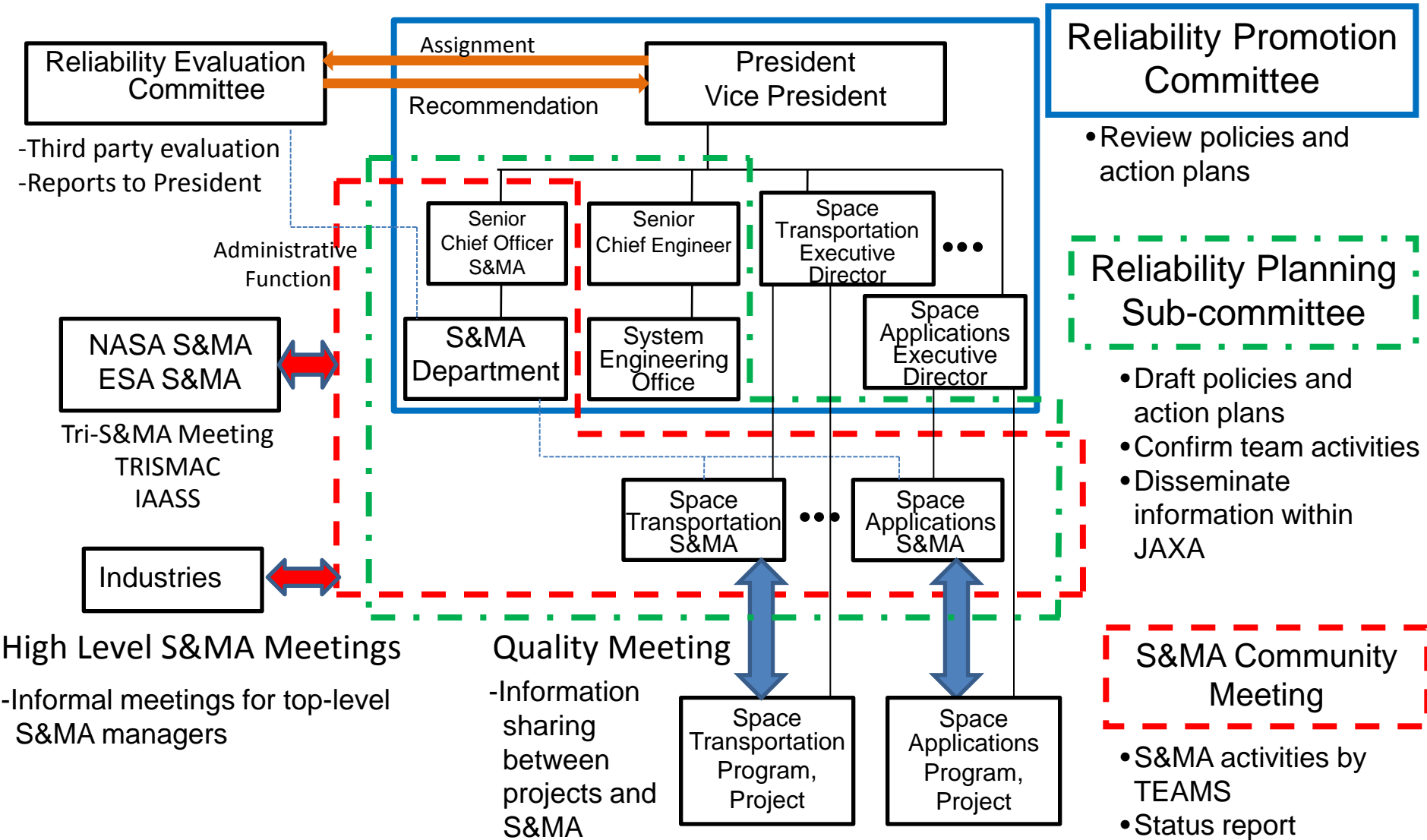
- New Process



MDR=Mission Definition Review, SRR=System Requirement Review, SDR=System Definition Review, PDR=Preliminary Design Review, CDR=Critical Design Review, DCR=Development Completion Review, LRR=Launch Readiness Review

# 3. Major S&MA Activities

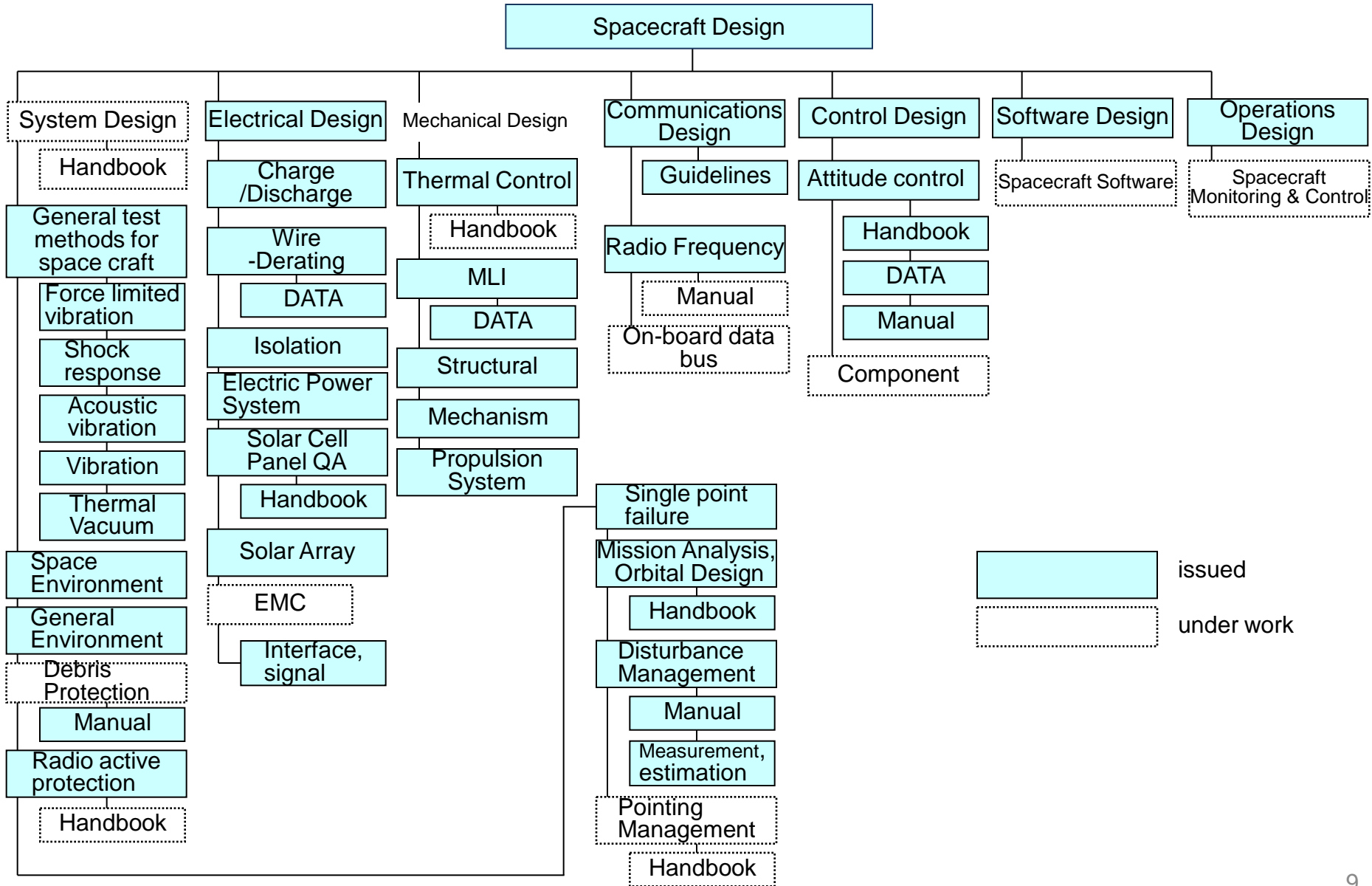
## JAXA S&MA Organization and Major Activities





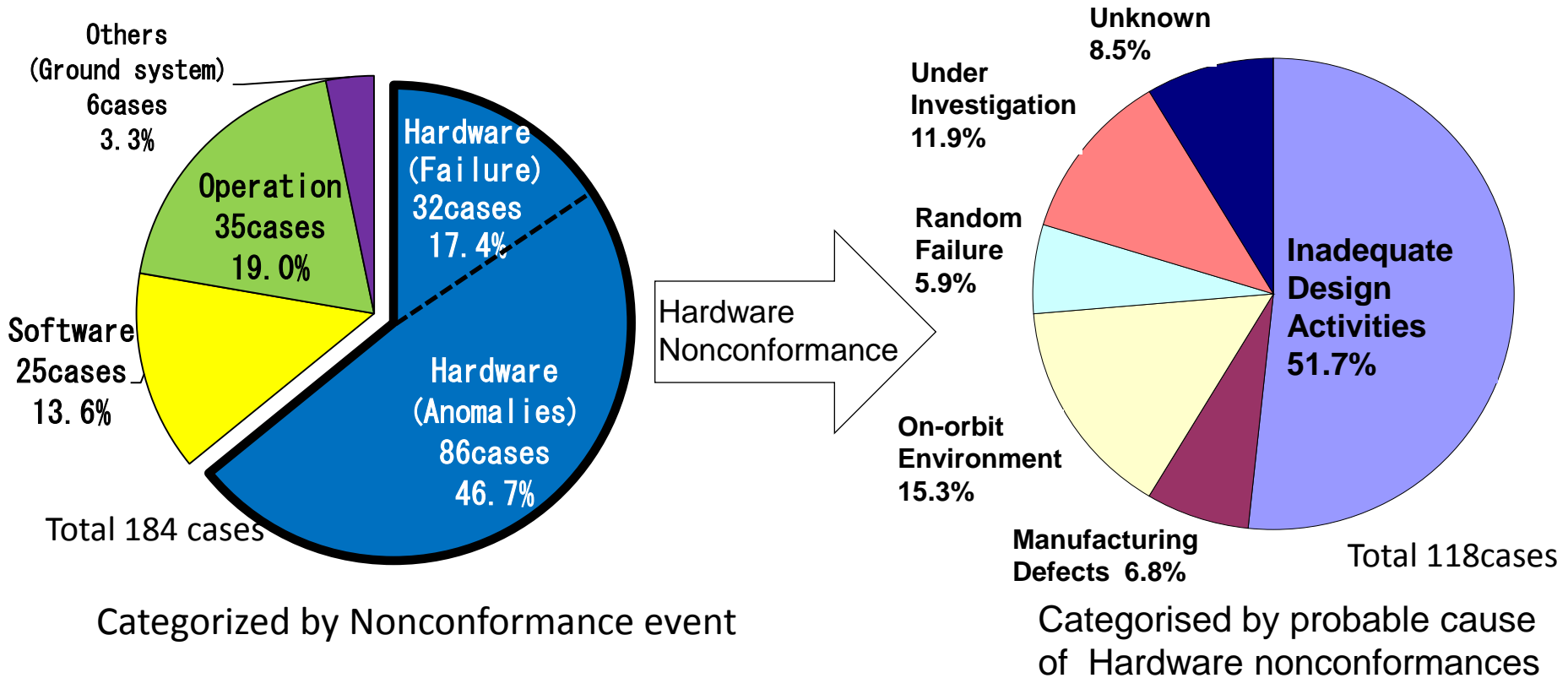
# 3. Major S&MA Activities

## Spacecraft Design Standards



# 3. Major S&MA Activities

## Nonconformance Analysis



Categorized by Nonconformance event

Categorised by probable cause of Hardware nonconformances

- ✓ two-thirds of nonconformances occurred in hardware.
- ✓ More than half of hardware nonconformance caused by inadequate design activities

**Countermeasure for inadequate design activities**

**Sample : Visibility improvement in design activities at contractors**

# 3. Major S&MA Activities

## Visibility improvement of design activities in contractors

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➤ JAXA proposed contractors to consider “Mieruka of design activities and improvement of design related activities” to reduce the number of nonconformances caused by inadequate design activities

### (1) Purpose

- To promote the “Mieru-ka (visibility improvement) of design, evaluation for test results” so that a designer and his/her manager can identify risks and concerns at upstream

### (2) Flow down of requirements to a prime contractor as a part of the reliability program

- Improvement of descriptions in design evidence documents and careful check and review by organization that has design responsibility.
  - Clear description of such as design philosophy, design parameter with reference source, analysis condition, analysis method and so on
- Development of a process to consult with experts inside contractors and JAXA.
- The designer’s technical review and documentation for evaluation of test result.

# 3. Major S&MA Activities

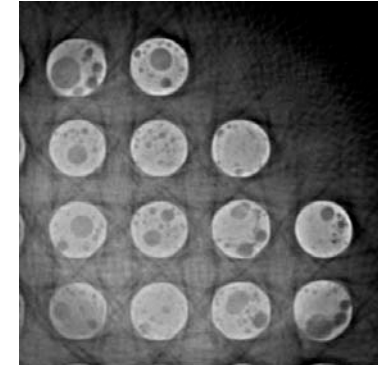
## Development of new assembly technology

Reliability of Column Grid Array(CGA) and Lead Free Parts assembly were evaluated for space application

<CGA>

CGA is greatly preferred due to high-speed signal processing, availability of numerous I/Os, and reduction in size and weight of components for space application as for BGA.

JAXA started to study technical issues of CGA usage for space application.



PKG-Column area void

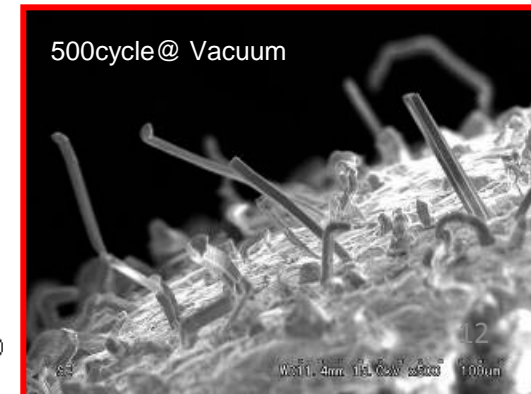
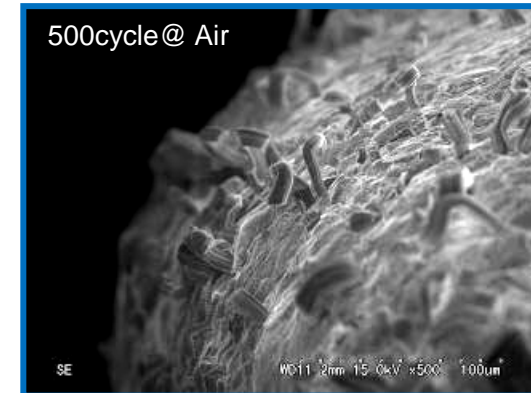
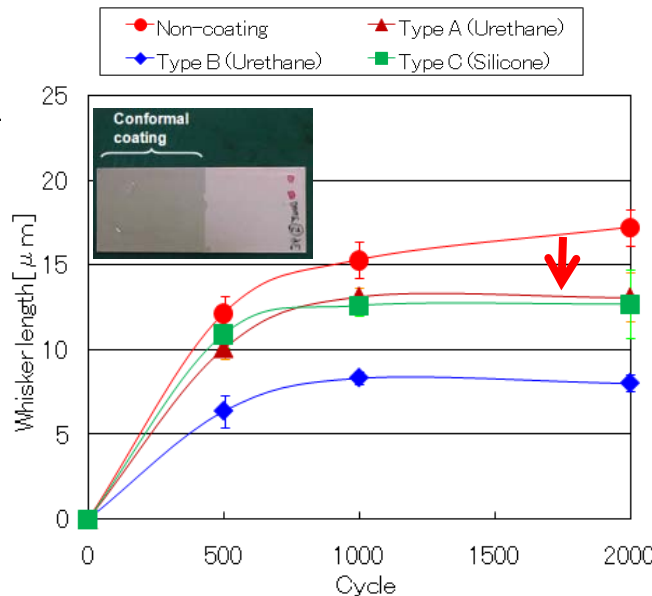
➔ **Inspection Method (X-ray, CT), New-Criteria for void, etc**

<Lead-free>

Whisker mitigation and evaluation method for space application.

➔ **-Conformal coating effects evaluation**  
**-Thermal vacuum test**

JAXA S&MA shares these information with the projects and contractors.



# 3. Major S&MA Activities

## Audit and surveys of contractors

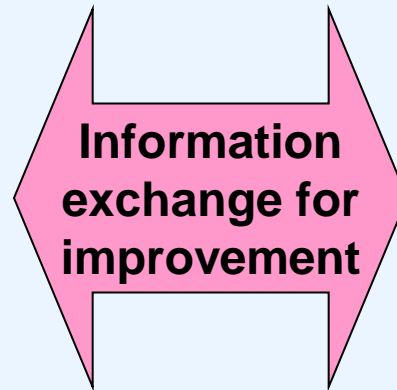
### HQ S&MA

#### S&MA Management Audit (for contractor's QMS)

(In case of)

- common S&MA trouble affecting multiple Projects
- large-scale change of contractor's QMS

-Per annual implementation plan or when necessary  
(5 major contractors)



### Projects/S&MA offices

#### S&MA Program Audit (for each project)

(In case of)

- serious S&MA trouble affecting own Project
- drastic change of project's S&MA program

-when necessary

(3 major contractors and several minor)

### 3. Major S&MA Activities

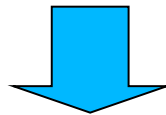
#### Informal opinion exchange meetings with contractors

##### **(1) Purpose and Outline**

- Meeting between JAXA S&MA Management and Contractors' Management
- Understand Contractor Management S&MA policy (difficult to discuss during audits) and introduce JAXA's S&MA policy
- Free discussion about S&MA matters including issues and requests.
- Enhancement of mutual understanding and the Managers' leadership for S&MA improvement

##### **(2) Information acquired from these meetings (examples)**

- Necessity to watch for nonconformance prevention and work site organization, utilizing site inspections.
- More attention should be paid to vendors management.
- Human factors related issues should be resolved.
- Contractors expect JAXA to provide information related to parts and so on.



**Meaningful opinion exchanges between Managers  
(JAXA plans to continue these meetings.)**

## 3. Major S&MA Activities

### JAXA's Quality Assurance Activities for Foreign Products

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➤ Issue:

Multiple parts/components purchased from foreign countries had nonconformances and failures. This caused project schedule delays and led to on-orbit non-conformances.

➤ Major Efforts at JAXA/Prime for Quality Assurance:

(1) Monitor parts manufacturer which may have potential issues for parts performance and schedule.

(2) Survey of manufactures .

(3) Strengthen procurement activity such as process inspection and product data review etc.

(4) Survey of the other source if needed.

(5) Share information among JAXA and contractors.

## 4. Technical improvement at development projects

### (1) Launch Vehicle development (J:JAXA, c:contractors)

- Development policy (J)
  - Risk minimization by minimization of new component development
  - Component commonality of H-2A and H-2B
- Benchmarking from various launch vehicle failures in the world (J)
- Reliability improvement campaign (J/c)
  - Design countermeasure for
    - Oxygen Turbo Pump cavitations, Valves trouble, SRB-A nozzle erosion/corrosion
- To take advice of experts and well experienced personnel (J/c)
- To build high quality into the products in the manufacturing process (c)
  - Thorough evaluation of two sigma deviation from standard value
- Launch operation dry run (c)

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## 4. Technical improvement at development projects

### (2) Satellite development (J:JAXA, c:contractors)

#### ➤ Development policy (J)

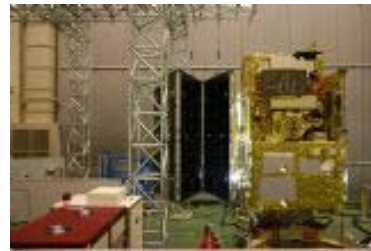
- Ensure satellite Bus system reliability: Minimize newly developed components
- The first priority on the mission achievement using existing engineering techniques except essential new engineering techniques

#### ➤ Detailed evaluation of applied techniques (J/c)






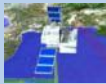


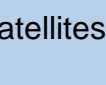



#### ➤ Reinforcement of analysis, test and inspection (Reflection of analysis result on-orbit satellite nonconformance information) (c)

- Identification and minimization of single failure points
- Improvement of charge and discharge tolerance and isolation tolerance

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# Launch Plan (Reference)

	JFY2010	2011	2012	2013 or later
Satellite	<p>▲ PLANET-C/IKAROS (Launched)</p>  <p>▲ Quasi-Zenith Satellite #1 (Launched)</p> 	<p>▲ GCOM-W1</p> 	<p>▲ ASTRO-G</p> 	<p>▲ GPM/DPR</p> <p>◆ EarthCARE/CPR</p> <p>▲ GCOM-C1</p> <p>▲ Astoro-H</p> <p>▲ ALOS-2</p> <p>▲ BepiColombo</p> <p>▼ Small Scientific Satellites</p>        <p><small>Copyright: ESA</small></p>
ISS Prit	<p>■ HTV #2</p>  <p><small>(Photo by NASA)</small></p>	<p>■ HTV #3</p>	<p>■ HTV #4</p>	<p>■ HTV#5   ■ HTV#6   ■   ■   ■</p>

Note: ▲ H-2A  
 ■ H-2B  
 ▼ Epsilon(next-generation solid propellant rocket)  
 ◆ Other

• PLANET-C: Venus Climate Orbiter  
 • IKAROS: Small Solar Power Sail Demonstrator  
 • GCOM-W1: Global Change Observation Mission 1stwater  
 • ASTRO-G : Radio-Astronomical Satellite  
 • GPM: Global Precipitation Measurement  
 • EarthCARE: Earth Clouds, Aerosols and Radiation Explorer

• GCOM-C1: Global Changing Observation Mission-Climate  
 • Astoro-G: Radio Astronomical Satellite  
 • ALOS-2: Advanced Land Observing Satellite-2  
 • Astro-H: X-ray Astronomy Satellite  
 • BepiColombo: Mercury Exploration Mission  
 • HTV: H-transfer Vehicle



