

Japan Space industry Workshop  
in ILA Berlin Airshow 2014

# NEC Space Business

May 22<sup>nd</sup>, 2014

NEC Corporation

Kentaro (Kent) Sakagami (Mr.)

General Manager

Satellite Systems and Equipment, Global Business Unit

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# NEC Corporate Profile

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Company Name: NEC Corporation

Established: July 17, 1899

Chairman of the Board: Kaoru Yano

President: Nobuhiro Endo

Capital: ¥ 397.2 billion (As of Mar. 31, 2013)

Consolidated Net Sales: ¥ 3,071.6 billion (FY ended Mar. 31, 2013)

Employees: 102,375 (As of Mar. 31, 2013)

Consolidated Subsidiaries: 270 (As of Mar. 31, 2013)



Kaoru Yano

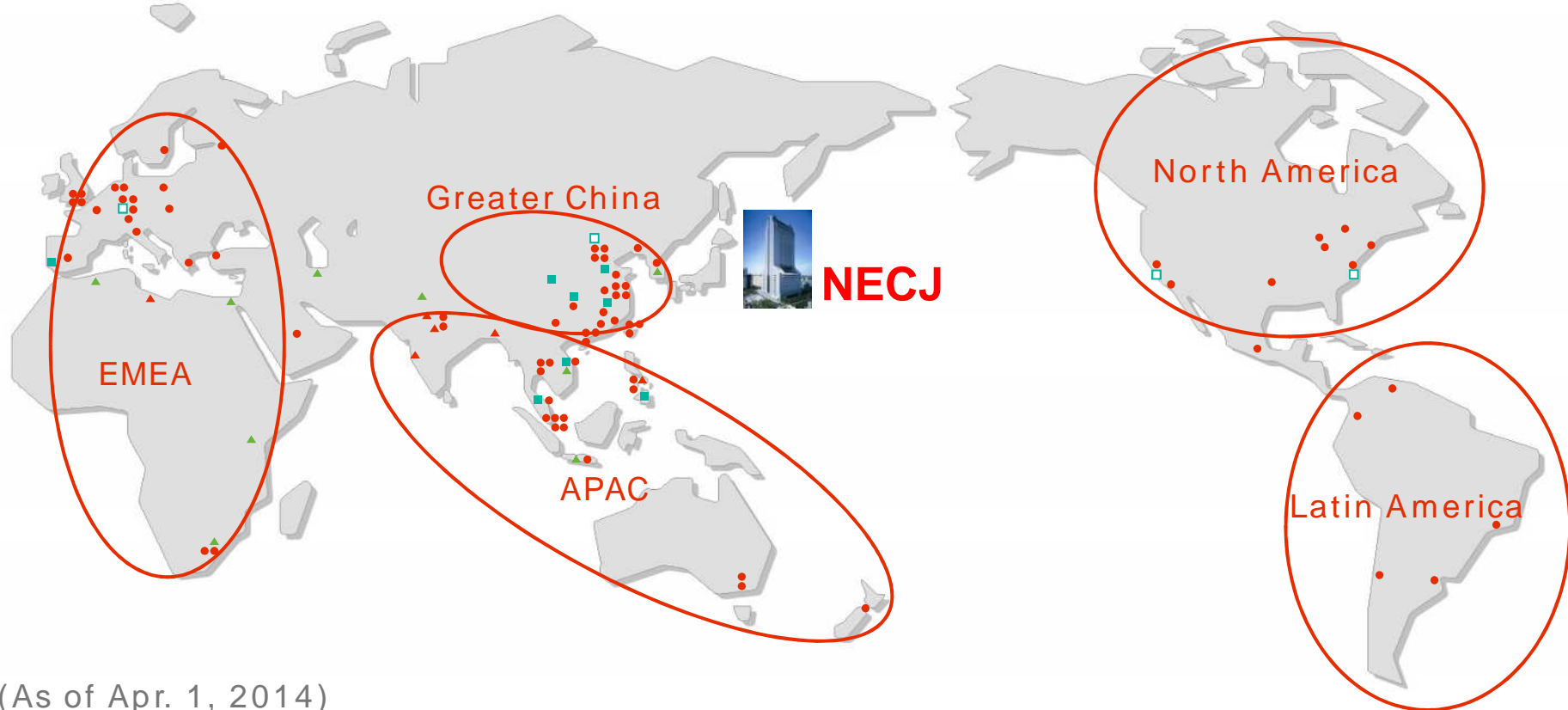


Nobuhiro Endo

Financial results are based on accounting principles generally accepted in Japan

# NEC Worldwide: “One NEC” formation in 5 regions

●	Marketing & Service affiliates	77	in	32	countries
■	Manufacturing affiliates	8	in	5	countries
▲	Liaison Offices	7	in	7	countries
▲	Branch Offices	7	in	7	countries
□	Laboratories	4	in	3	countries



(As of Apr. 1, 2014)

# NEC in EMEA

**1 NEC in Germany**

- NEC Deutschland GmbH
- NEC Display Solutions Europe
- NEC Laboratories Europe (Internal division of NEC Europe Ltd.)
- NEC Tokin Europe

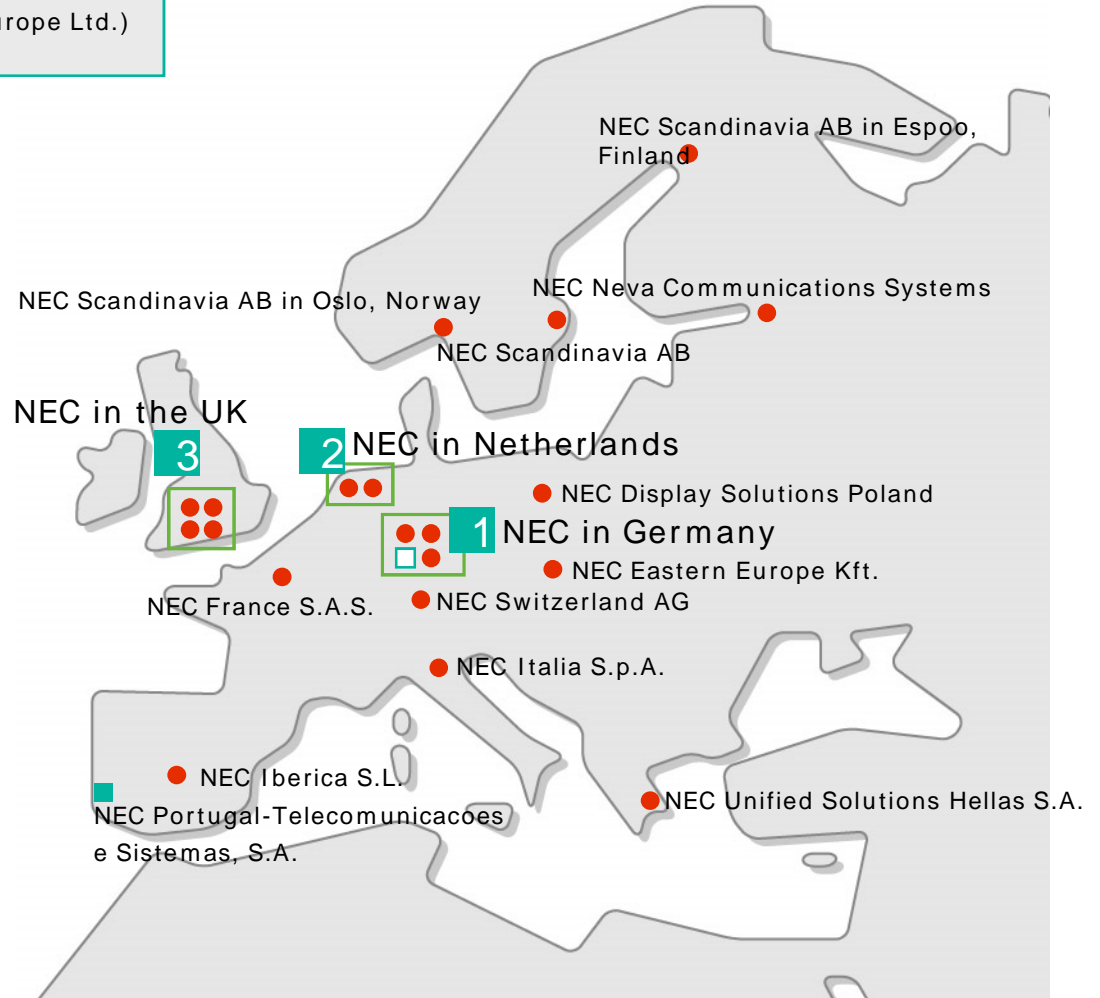
**2 NEC in Netherlands**

- NEC Logistics Europe
- NEC Nederland B.V.

**3 NEC in the U.K.**

- NEC Europe Ltd.
- NEC Capital (UK) plc
- NEC Technologies (UK)
- NEC Telecom MODUS Limited
- NEC (UK) Ltd.

- Marketing & Service affiliates:18
- Manufacturing affiliates:1
- ▲ Liaison Offices:0
- ▲ Branch Offices:0
- Laboratories:1

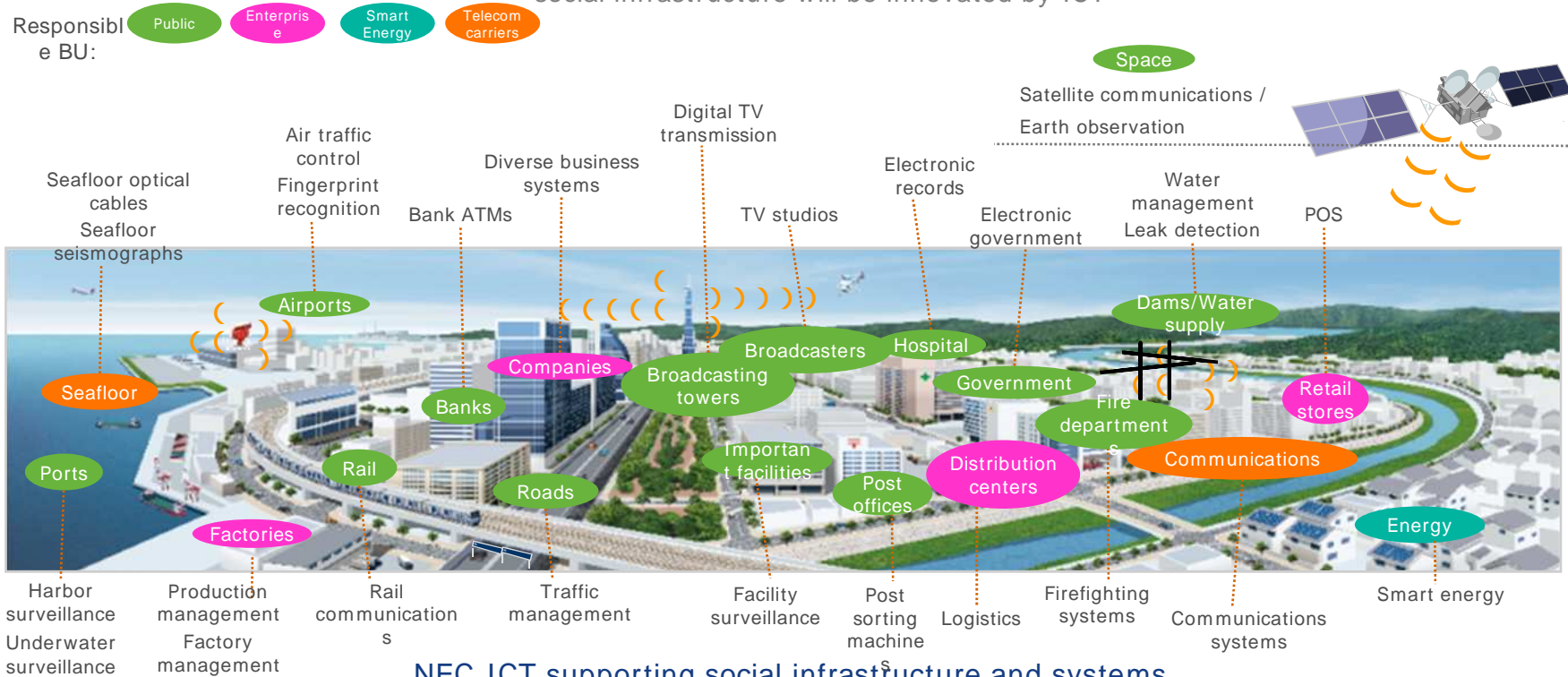


(As of Apr. 1, 2014)

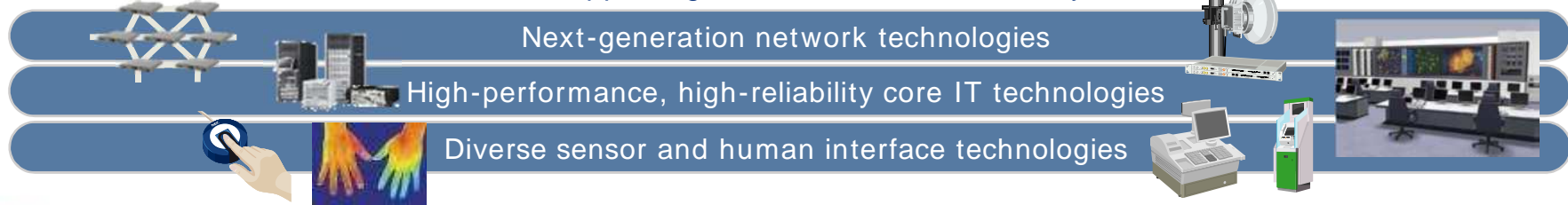
# Innovation of Social Infrastructure via ICT

Leveraging our proven results and strong position for global expansion

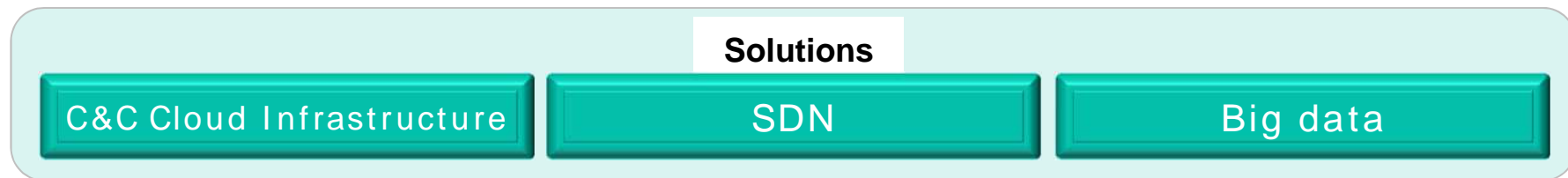
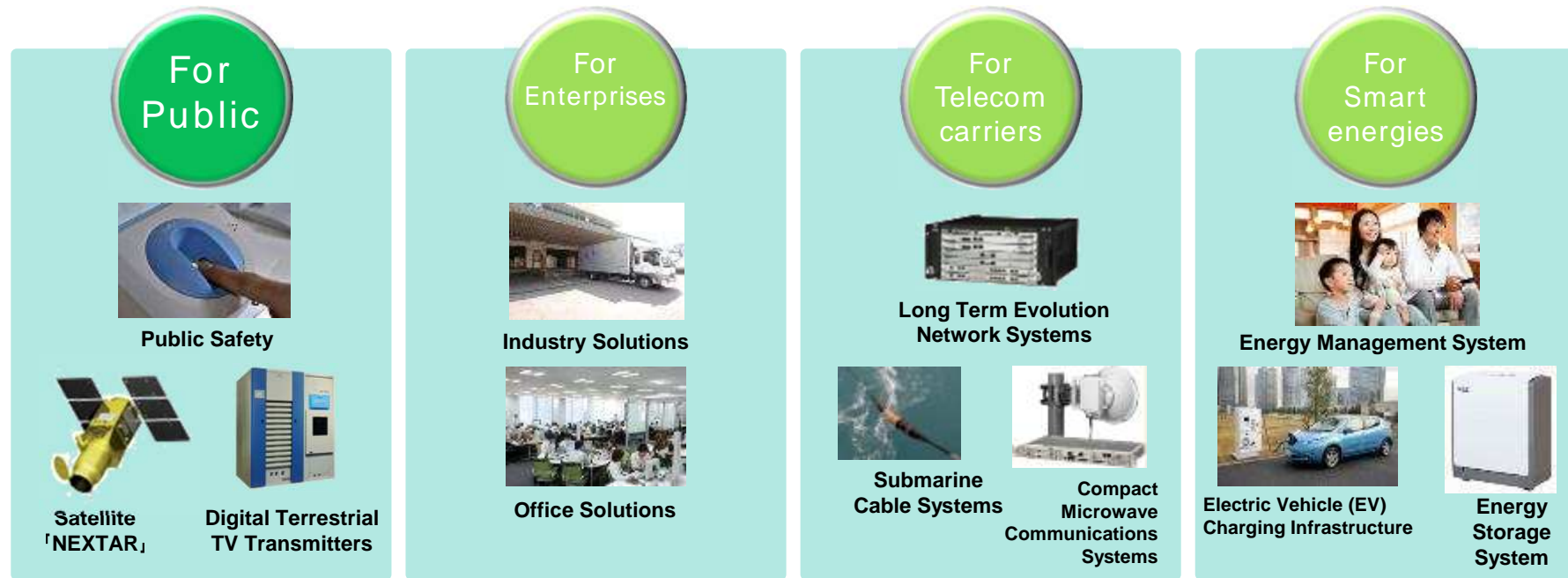
From the seafloor to outer space, concentrating management resources in areas in which social infrastructure will be innovated by ICT



## NEC ICT supporting social infrastructure and systems

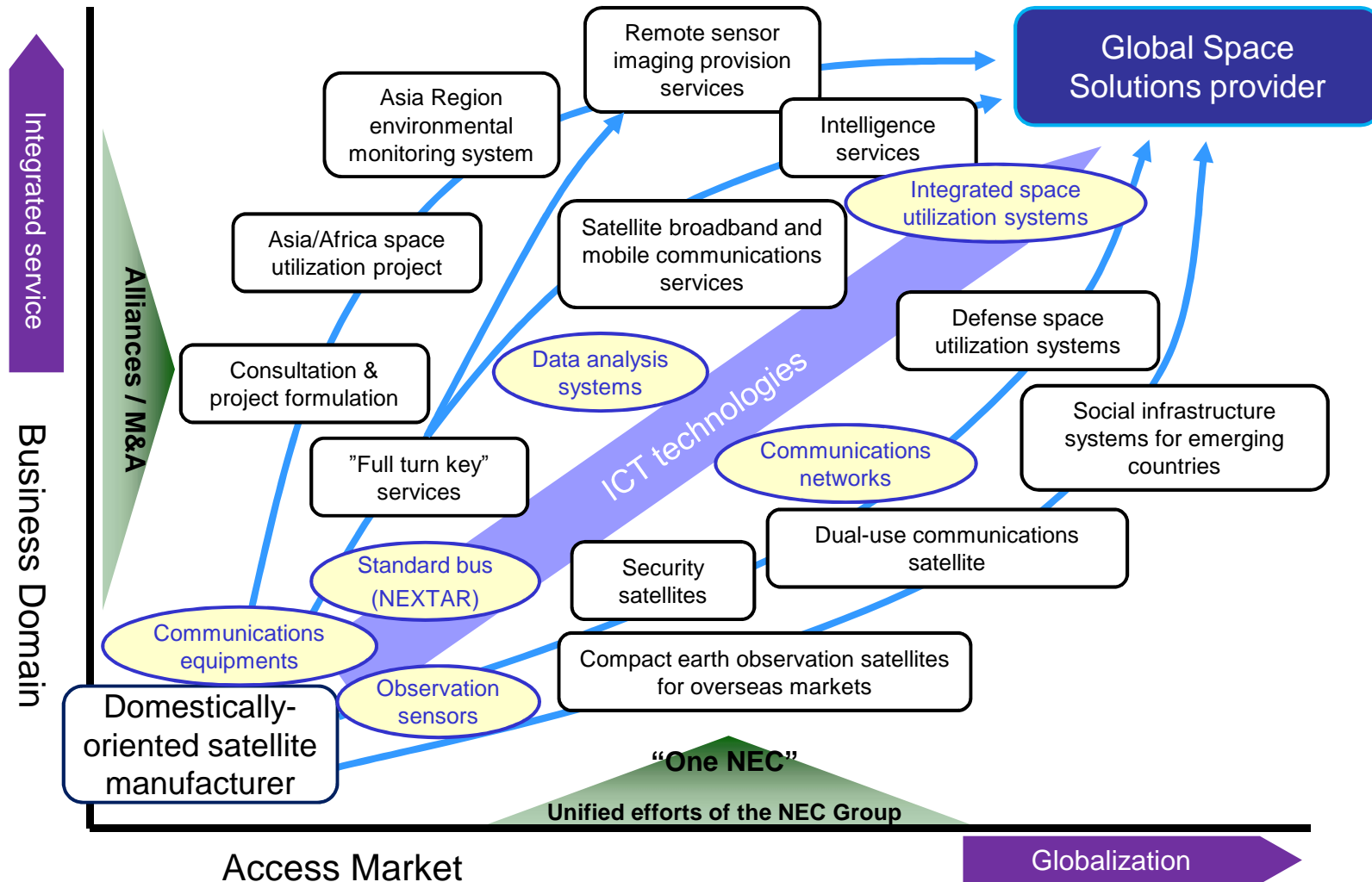


# Business Domains



# Vision of Space Business

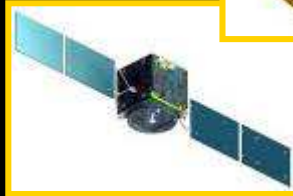
NEC will become a **“Global Space Solutions Enterprise”** through a fusion of Satellite and ICT Technologies



# NEC Space Business Outline

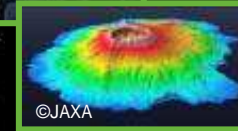
## Satellite system

- Communication / Broadcast
- Earth observation
- Engineering
- Science
- Exploration



## Ground system

- Telemetry, command & Ranging
- Data receiving
- Launch operation



Providing  
Space Solution



## Components

- Bus equipment
- Observation sensors
- Transponders
- Optical communication
- Large deployable antenna



## Rocket equipment

- Communication
- GNC control
- Data handling



## Data utilization

- Imagery processing & analysis system
- Disaster management



## International Space Station

- Control processor
- Data network
- Audio & video response system
- Micro-gravity experimental unit
- Robotic arm





# Satellite Manufacturing Bases

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## NEC FUCHU Site

Floor Space : 19,000m<sup>2</sup>

Facility :

Assembly and test room (Clean room), High bay, Clean bench, Vibration test equipment, Space simulation chamber, Oven-refrigerators, Anechoic chamber, Shield room and EMC test facilities, etc.



## NEC SAGAMIHARA Site

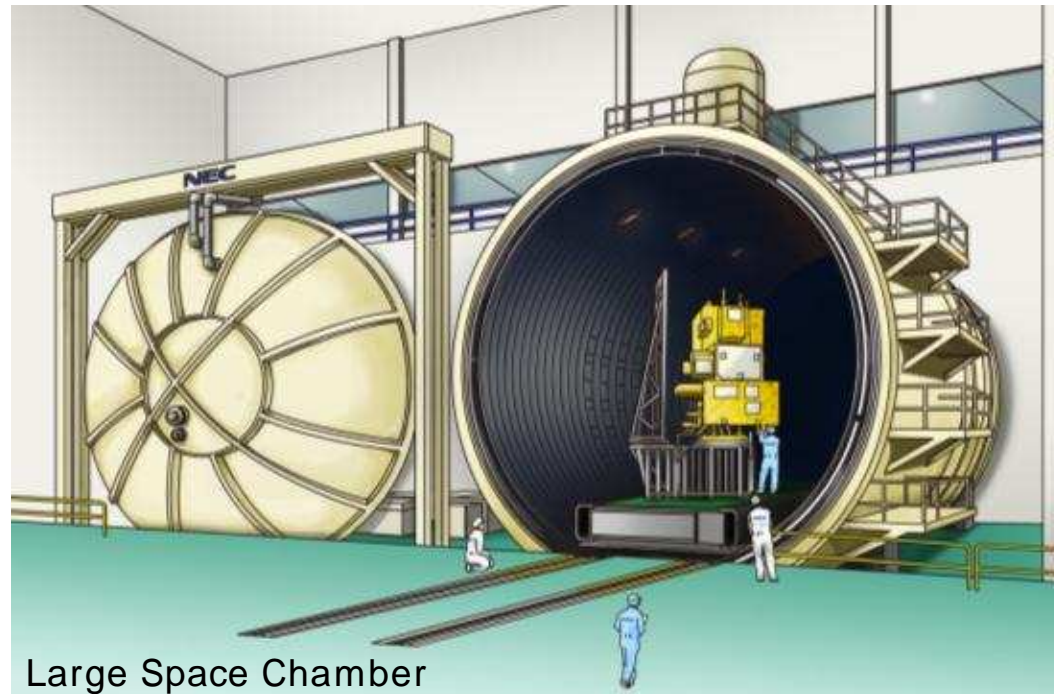
Space Building:7,000m<sup>2</sup>

Facility :

Assembly/Test facilities and clean room (High bay) for small-scale Spacecraft, Solar Array Paddle, Antenna, Radar, etc.

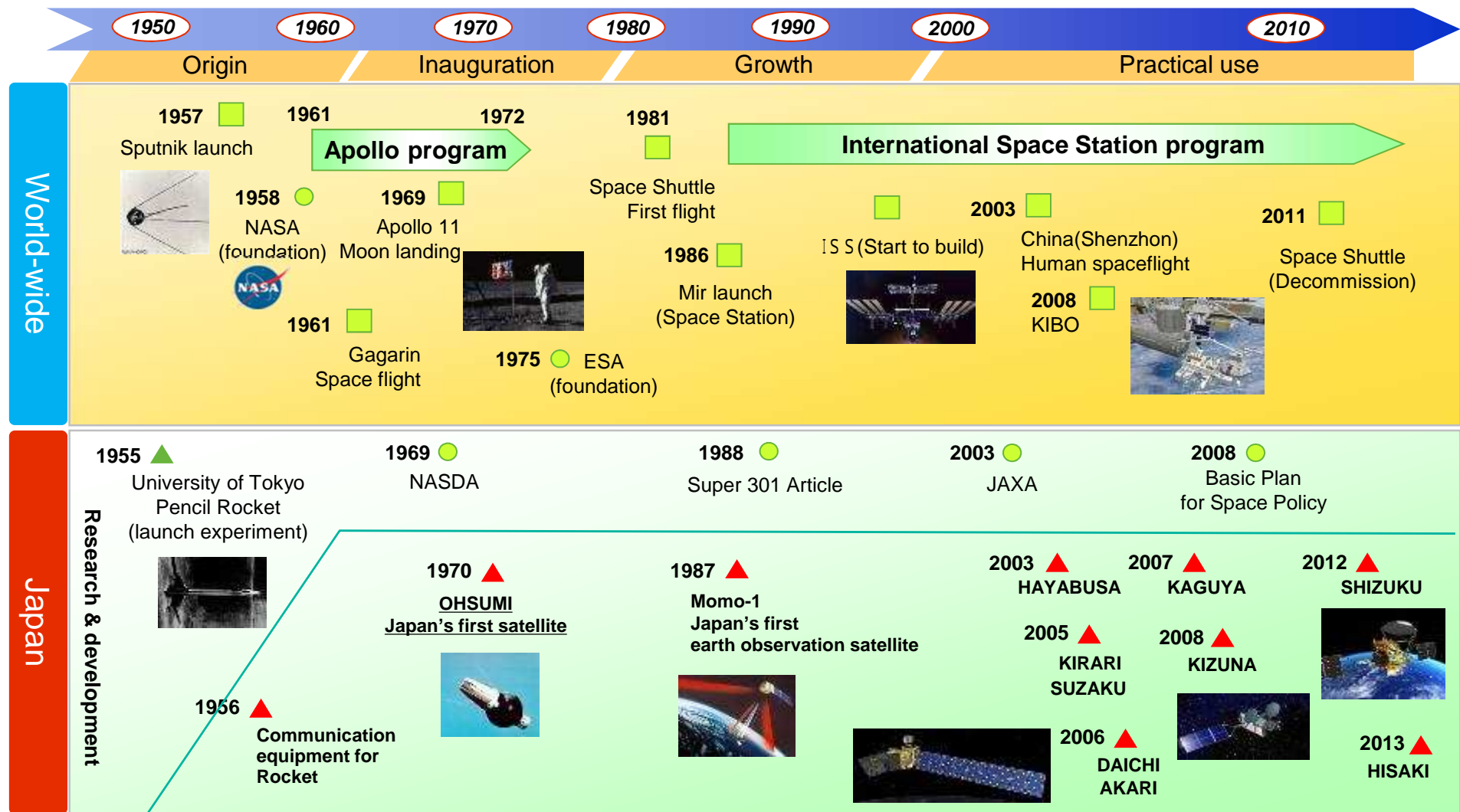
# Facility Expansion in Fuchu Site

- NEC is constructing the new comprehensive AIT (Assembly, Integration and Testing) facility at its existing plant in Fuchu Site.
- In addition to the Fuchu plant's existing operations, the new facility will enable NEC to assemble as many as eight satellites at any one time.
- Its Operations are expected to begin in June 2014.



# History of Space Development and NEC

NEC developed Japan's first satellite "OHSUMI" in 1970



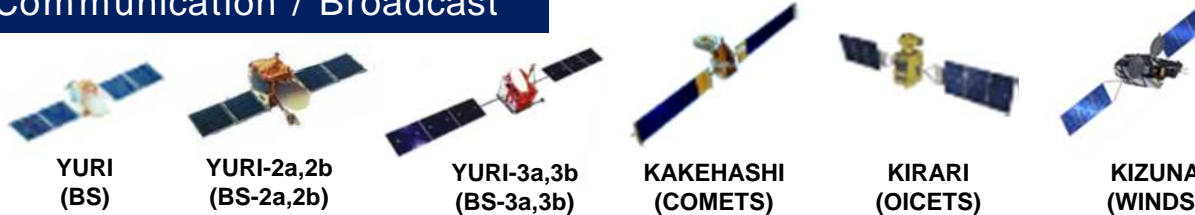
Remarks **NEC**

Courtesy of JAXA

# Major Japanese Satellites Integrated by NEC

NEC has integrated wide range of satellites ( 67 satellites in Orbit )

## Communication / Broadcast



## Engineering



## Earth Observation



## Science / Astronomy



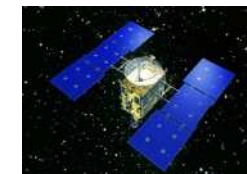
## NEC's Records of World-First Missions

- World-First On-Orbit Two-Way Optical Communication



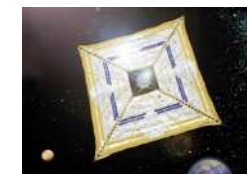
KIRARI (OICETS)

- World-First Asteroid Probe (Guinness Record)



HAYABUSA (MUSES-C)

- World-First Space Yacht (Guinness Record)



Small Solar Power Sail Demonstrator IKAROS

Courtesy of JAXA

# In Operation

## Earth Observation Satellites



SHIZUKU (GCOM-W1)  
Global Change Observation  
Mission 1<sup>st</sup>-Water

Launch : 2012  
Weight : 1900kg

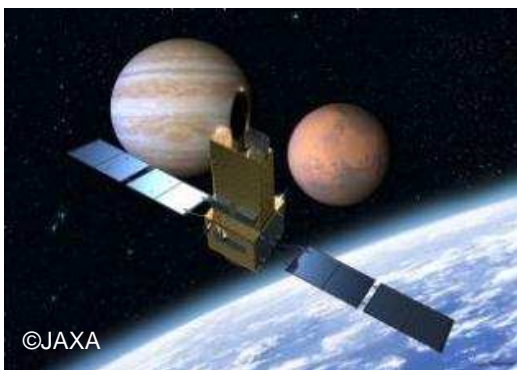
## Communication and broadcast satellites



KIZUNA (WINDS)  
Wideband Inter-Networking  
engineering test and  
Demonstration Satellite

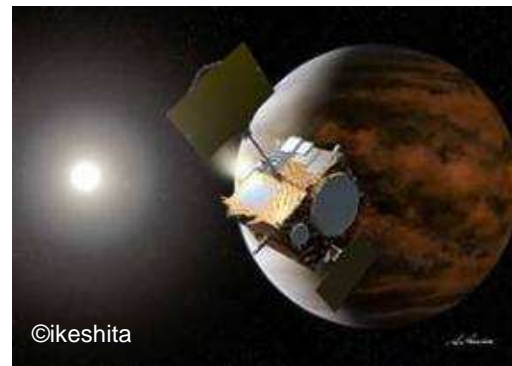
Launch : 2008  
Weight : 2700kg

## Scientific satellites



HISAKI (SPRINT-A)  
Spectroscopic Planet  
Observatory for Recognition  
of Interaction of Atmosphere

Launch : 2013  
Weight : 348kg



AKATSUKI (Planet-C)  
Venus Climate Orbiter

Launch : 2010  
Weight : 500kg

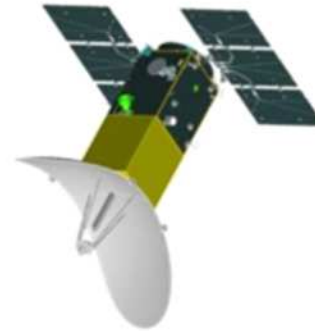
# Under Development

## Earth Observation satellites

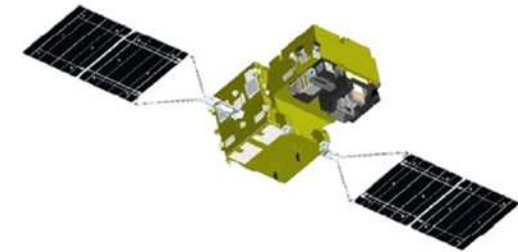
Advanced Space System ASNARO  
To be launched in 2014  
Weight : 495kg



Synthetic aperture radar ASNARO2  
To be launched in 2016  
Weight : ~550kg



Global Change observation Mission Climate (GCOM-C)  
Weight : 2,000kg



©JAXA

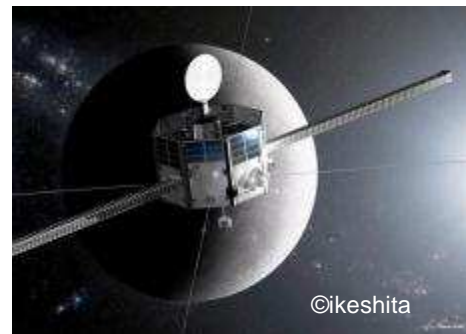
## Scientific satellites

Asteroid Explorer Hayabusa2  
To be launched in 2014  
Weight : 600kg



©ikeshita

Mercury magnetospheric orbiter (MMO)  
To be launched in 2015  
Weight : 280kg



©ikeshita

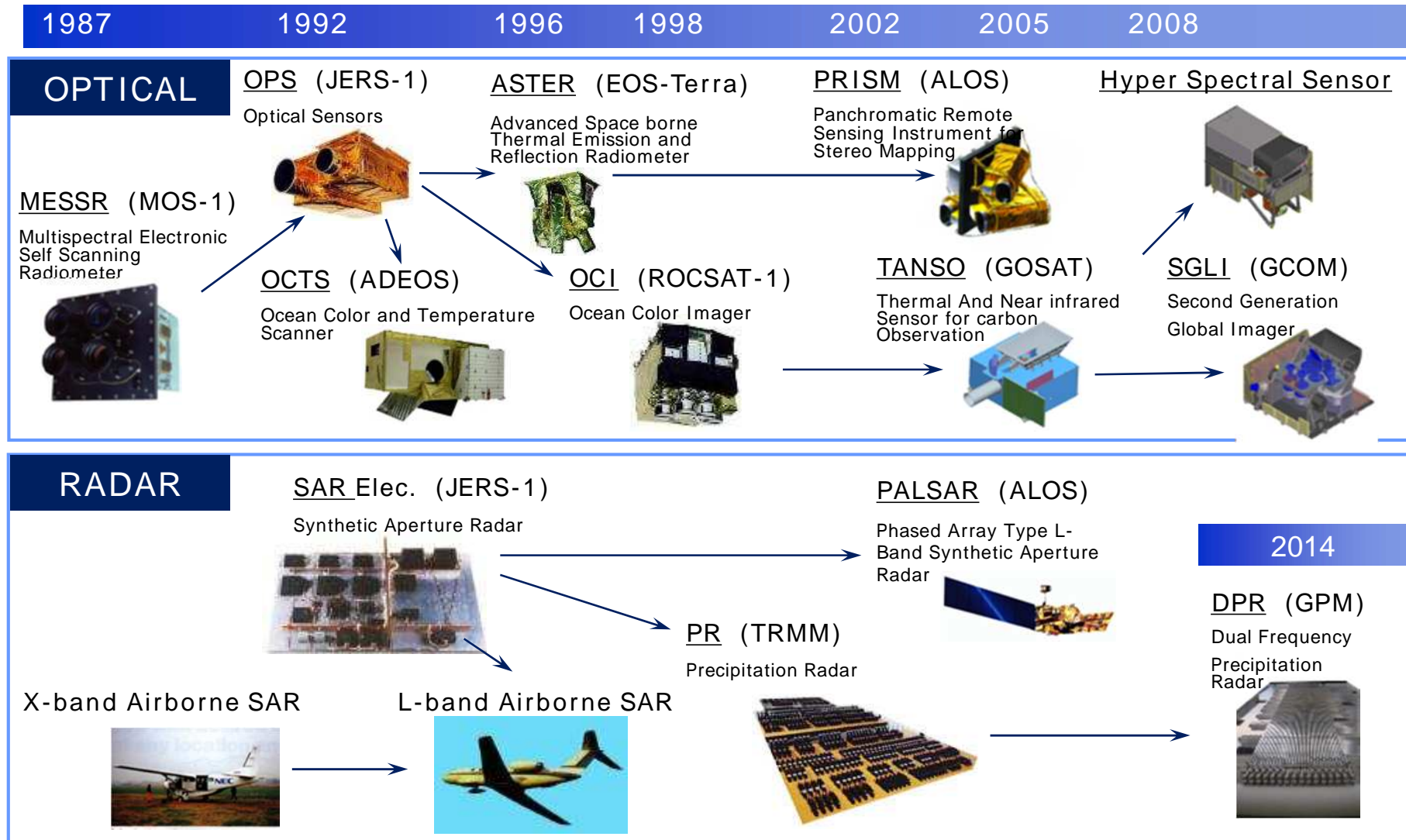
X-ray Astronomy Satellite ASTRO-H  
To be launched in 2015  
Weight : 2,400kg



©ikeshita

# Wide Variety of Earth Observation Sensors

NEC has been involved in the development of a wide variety of optical and Radar sensors



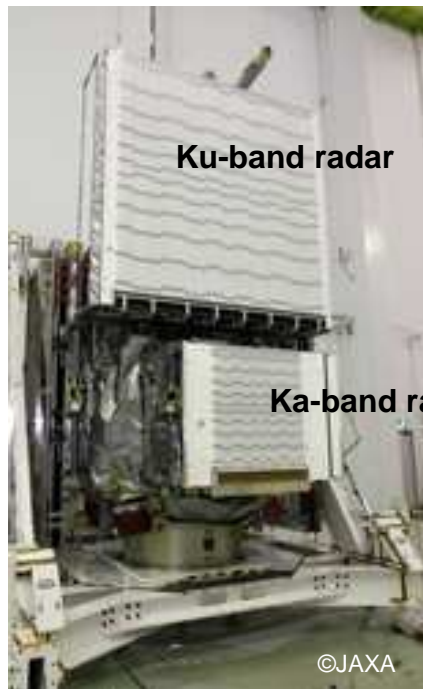
# Global Precipitation Measurement /Dual-frequency Precipitation Radar (GPM/DPR)

The Dual-frequency Precipitation Radar (DPR) on board the core satellite of the Global Precipitation Measurement (GPM) program successfully obtained its first images of Earth.

NEC Press Release  
March 25, 2014



**GPM Core Satellite**  
Co-developed by Japan and USA  
Launched on Feb. 28, 2014



**Ku-band radar**

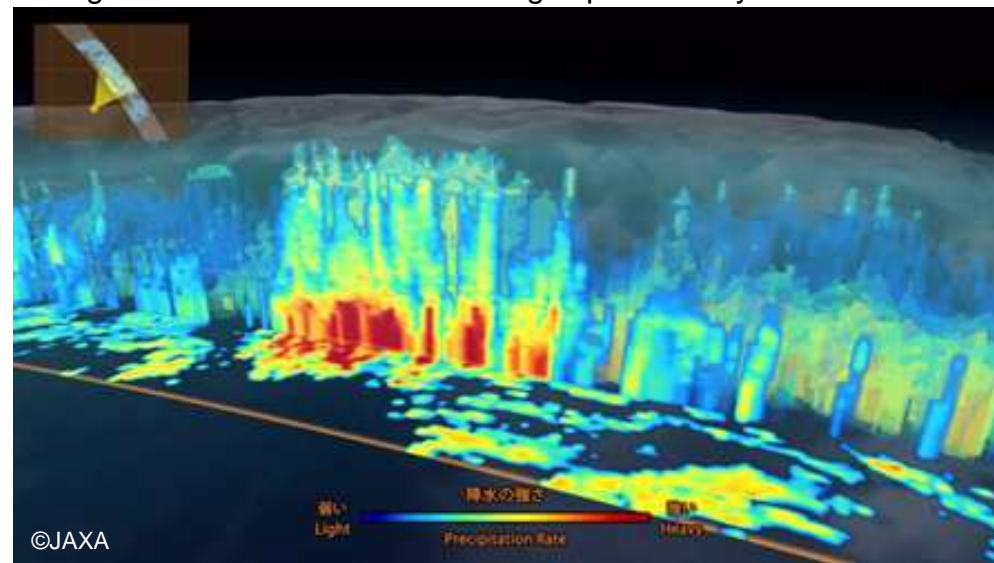
**Ka-band radar**

©JAXA



Waveguide:128x2  
(Ka) (Ku)

First image obtained from the DPR Images provided by JAXA and NASA





# Satellite positioning system: Quasi-Zenith Satellite-1 "MICHIBIKI"

NEC is contributing to the integration of a satellite positioning system and its operation.  
NEC takes charge of a satellite positioning mission system, ground system in the First Quasi-Zenith Satellite "MICHIBIKI".



Reinforcing signal for the GPS.  
Comparable signal with GPS satellite.

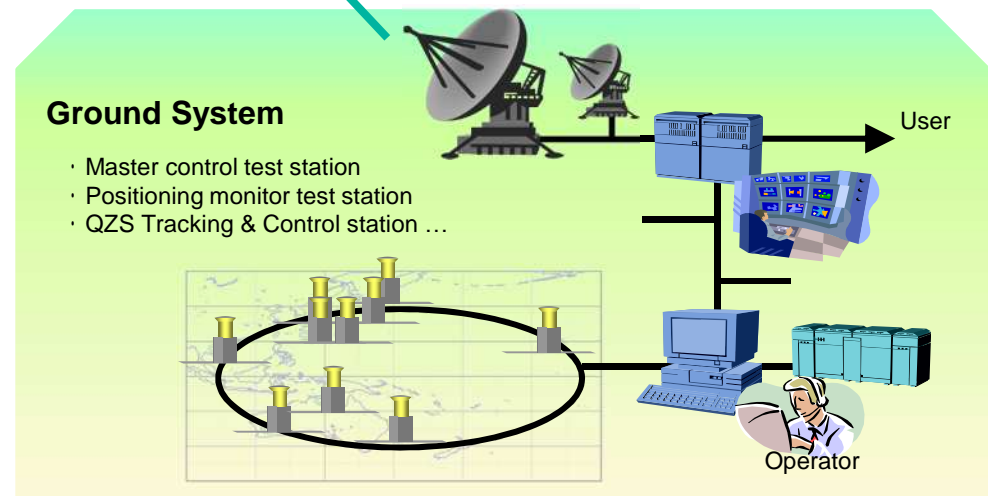
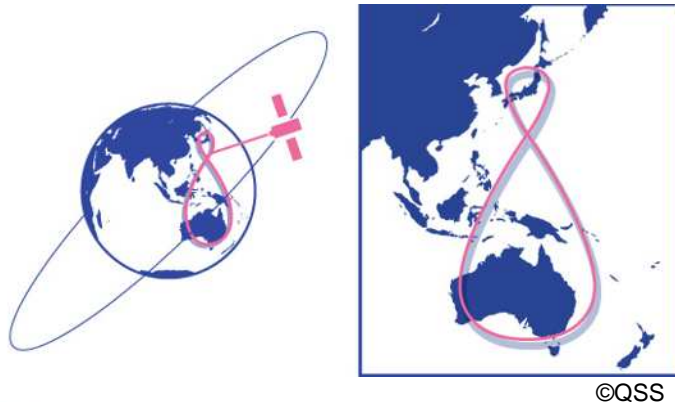


QZSS will begin in 2018 with a four-satellite.

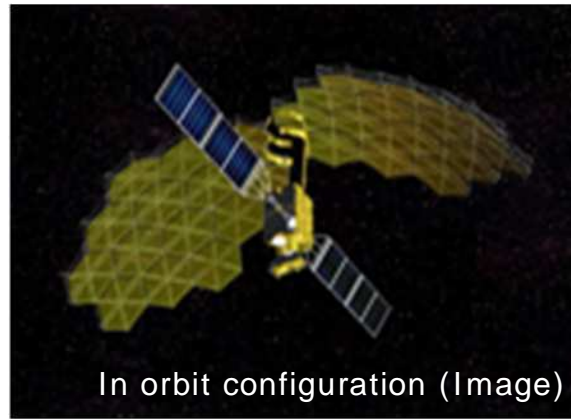
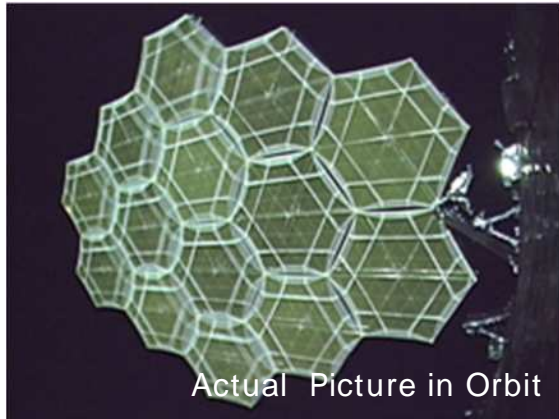
Positioning signal

Navigation message  
Telemetry / Command ...

Quasi-zenith Satellite Orbit (QZO)



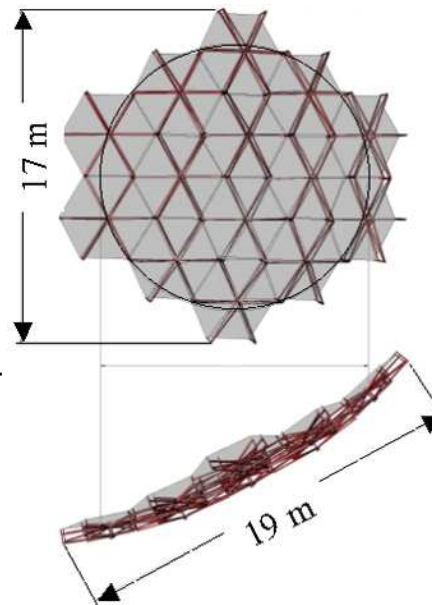
# Large Deployable Reflector: LDR



- Modular Construction (Flexible in Size)
- Compact Stowed Configuration
- Light Mass
- High Surface Accuracy (  $\lambda/50$  : S- Band)

## Features of Module Structure

- Easily meet the requirement for the reflector size by changing the number and size of modules.
- The combination of respectively adjusted reflector modules allows to ensure the surface preciseness and high-precise alignment.
- Simultaneously produce and adjust several modules to shorten the production schedule.



# Ground Systems



ARABSAT TTC&M Station 13m DIA. Antenna (RIYADH)



JAXA TT&C Station (Kiruna, Sweden)



JAXA TANEGASHIMA Launch Control Facility



JAXA ALOS Processing Facility  
(Earth Observation Research Center)

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Thank you very much for your attention

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**NEC**