Empowered by Innovation NEC

Introduction of NEC Space Business

(Launch of Satellite Integration Center)

July 2, 2014

Masaki Adachi, General Manager
Space Systems Division, NEC Corporation

NEC Space Business

A proven track record in space-related assets

Satellites

- Communication/broadcasting
- Earth observation
- Scientific

Ground systems

- Satellite tracking and control systems
- Data processing and analysis systems
- Launch site control systems

Satellite components

- Large observation sensors
- Bus components
- Solar array paddles
- Transponders
- Antennas

Rocket subsystems

Systems & Services

International Space Station

Offerings from Satellite System Development to Data Analysis

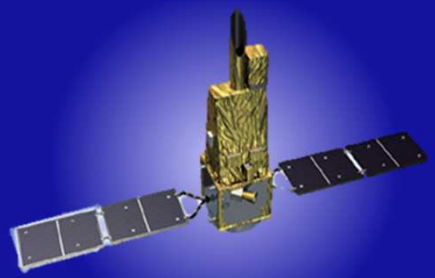
In-house manufacturing of various satellites and ground systems for tracking, control and data processing

Japan's first artificial satellite

OHSUMI 1970 (24 kg)

©JAXA

Scientific satellite



HISAKI 2013 (350 kg)

©JAXA

Communication/ broadcasting satellite

KIZUNA 2008 (2.7 tons)

©JAXA

Earth observation satellite

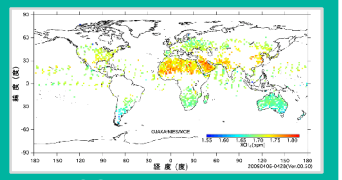
SHIZUKU 2012 (1.9 tons)

©JAXA

Large onboard-observation sensors

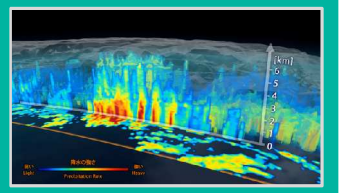
Optical, SAR*, hyper-spectral sensors, etc.

Thermal and near infrared sensor for carbon observation (TANSO)



CO_2 distribution

Dual-frequency precipitation radar (DPR)



3D distribution of precipitation

Image source: JAXA

Ground systems

Tracking and mission control, data processing, etc.

Tracking facility

Tracking station

TTC & M* station

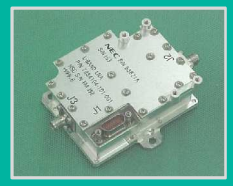
Observation image

Recording/ processing equipment

Onboard components

Transponders, solar array paddles, etc.

GPS* receivers



Low-noise amplifiers

Multi-transponders

High-accuracy earth sensors

Ion engines

Solar array paddles

***SAR**: Synthetic Aperture Radar

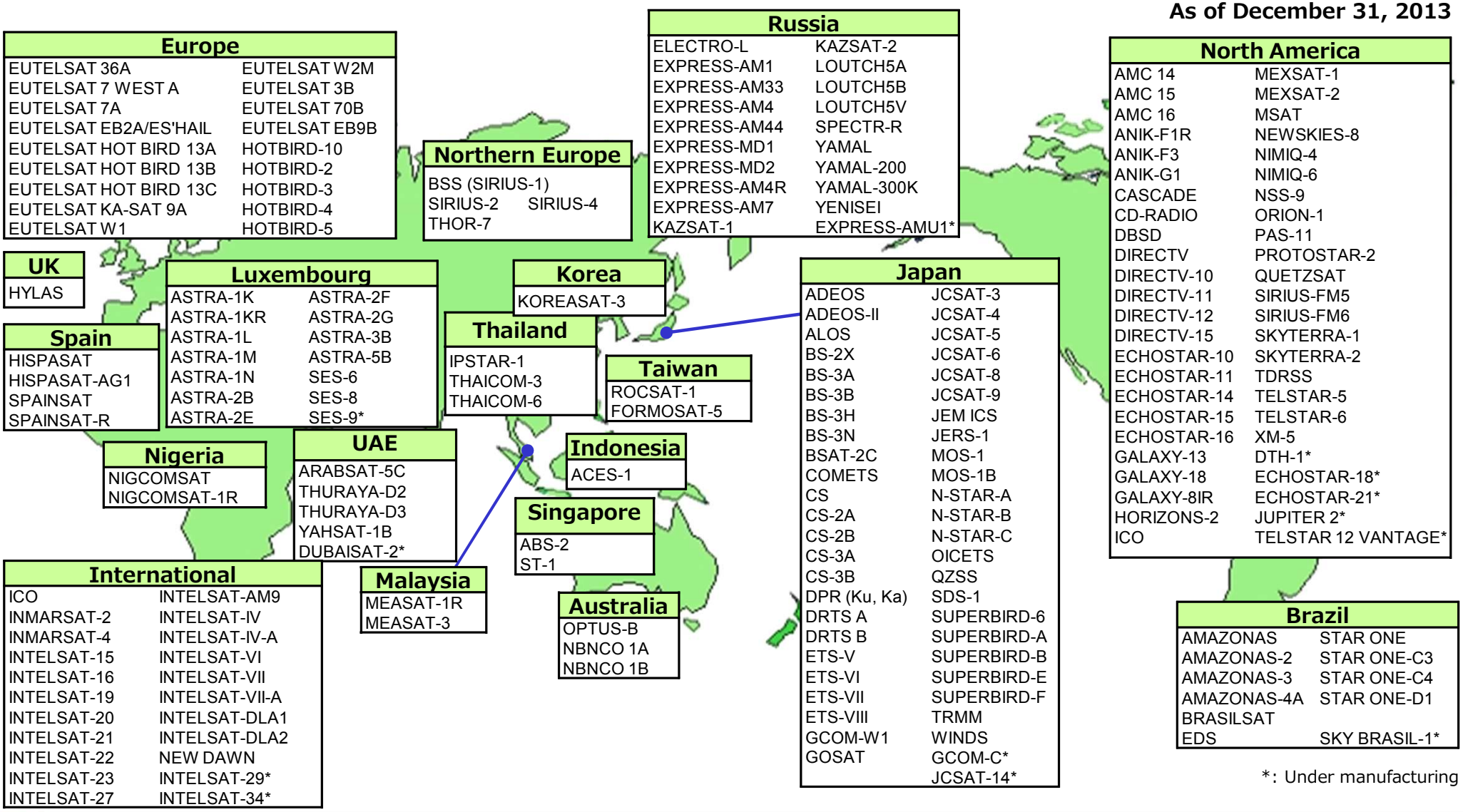
***TTC & M**: Telemetry, Tracking, Command & Monitoring

***GPS**: Global Positioning System

World-renowned Satellite Components

Extensive track record of deliveries to system integrators worldwide.
Communication equipment of Over 7,000 units for more than 200 satellites

As of December 31, 2013



Europe

EUTELSAT 36A	EUTELSAT W2M
EUTELSAT 7 WEST A	EUTELSAT 3B
EUTELSAT 7A	EUTELSAT 70B
EUTELSAT EB2A/ES'HAIL	EUTELSAT EB9B
EUTELSAT HOT BIRD 13A	HOTBIRD-10
EUTELSAT HOT BIRD 13B	HOTBIRD-2
EUTELSAT HOT BIRD 13C	HOTBIRD-3
EUTELSAT KA-SAT 9A	HOTBIRD-4
EUTELSAT W1	HOTBIRD-5

Northern Europe

BSS (SIRIUS-1)
SIRIUS-2 SIRIUS-4
THOR-7

Russia

ELECTRO-L	KAZSAT-2
EXPRESS-AM1	LOUTCH5A
EXPRESS-AM33	LOUTCH5B
EXPRESS-AM4	LOUTCH5V
EXPRESS-AM44	SPECTR-R
EXPRESS-MD1	YAMAL
EXPRESS-MD2	YAMAL-200
EXPRESS-AM4R	YAMAL-300K
EXPRESS-AM7	YENISEI
KAZSAT-1	EXPRESS-AMU1*

North America

AMC 14	MEXSAT-1
AMC 15	MEXSAT-2
AMC 16	MSAT
ANIK-F1R	NEWSKIES-8
ANIK-F3	NIMIQ-4
ANIK-G1	NIMIQ-6
CASCADE	NSS-9
CD-RADIO	ORION-1
DBSD	PAS-11
DIRECTV	PROTOSTAR-2
DIRECTV-10	QUETZSAT
DIRECTV-11	SIRIUS-FM5
DIRECTV-12	SIRIUS-FM6
DIRECTV-15	SKYTERRA-1
ECHOSTAR-10	SKYTERRA-2
ECHOSTAR-11	TDRSS
ECHOSTAR-14	TELSTAR-5
ECHOSTAR-15	TELSTAR-6
ECHOSTAR-16	XM-5
GALAXY-13	DTH-1*
GALAXY-18	ECHOSTAR-18*
GALAXY-8IR	ECHOSTAR-21*
HORIZONS-2	JUPITER 2*
ICO	TELSTAR 12 VANTAGE*

UK

HYLAS

Luxembourg

ASTRA-1K	ASTRA-2F
ASTRA-1KR	ASTRA-2G
ASTRA-1L	ASTRA-3B
ASTRA-1M	ASTRA-5B
ASTRA-1N	SES-6
ASTRA-2B	SES-8
ASTRA-2E	SES-9*

Korea

KOREASAT-3

Thailand

IPSTAR-1
THAICOM-3
THAICOM-6

Taiwan

ROCSAT-1
FORMOSAT-5

Japan

ADEOS	JCSAT-3
ADEOS-II	JCSAT-4
ALOS	JCSAT-5
BS-2X	JCSAT-6
BS-3A	JCSAT-8
BS-3B	JCSAT-9
BS-3H	JEM ICS
BS-3N	JERS-1
BSAT-2C	MOS-1
COMETS	MOS-1B
CS	N-STAR-A
CS-2A	N-STAR-B
CS-2B	N-STAR-C
CS-3A	OICETS
CS-3B	QZSS
DPR (Ku, Ka)	SDS-1
DRTS A	SUPERBIRD-6
DRTS B	SUPERBIRD-A
ETS-V	SUPERBIRD-B
ETS-VI	SUPERBIRD-E
ETS-VII	SUPERBIRD-F
ETS-VIII	TRMM
GCOM-W1	WINDS
GOSAT	GCOM-C*
	JCSAT-14*

Spain

HISPASAT
HISPASAT-AG1
SPAINSAT
SPAINSAT-R

Nigeria

NIGCOMSAT
NIGCOMSAT-1R

UAE

ARABSAT-5C
THURAYA-D2
THURAYA-D3
YAHSAT-1B
DUBAISAT-2*

Indonesia

ACES-1

Singapore

ABS-2
ST-1

Malaysia

MEASAT-1R
MEASAT-3

Australia

OPTUS-B
NBNCO 1A
NBNCO 1B

International

ICO	INTELSAT-AM9
INMARSAT-2	INTELSAT-IV
INMARSAT-4	INTELSAT-IV-A
INTELSAT-15	INTELSAT-VI
INTELSAT-16	INTELSAT-VII
INTELSAT-19	INTELSAT-VII-A
INTELSAT-20	INTELSAT-DLA1
INTELSAT-21	INTELSAT-DLA2
INTELSAT-22	NEW DAWN
INTELSAT-23	INTELSAT-29*
INTELSAT-27	INTELSAT-34*

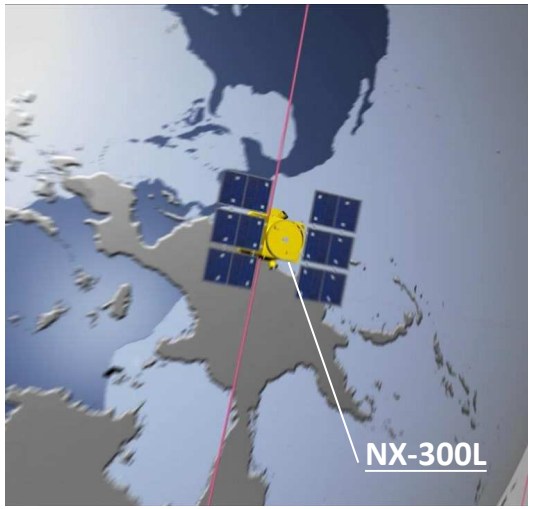
Brazil

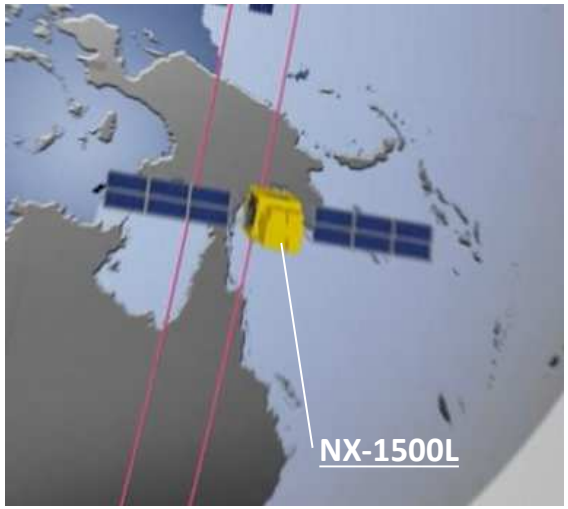
AMAZONAS	STAR ONE
AMAZONAS-2	STAR ONE-C3
AMAZONAS-3	STAR ONE-C4
AMAZONAS-4A	STAR ONE-D1
BRASILSAT	
EDS	SKY BRASIL-1*

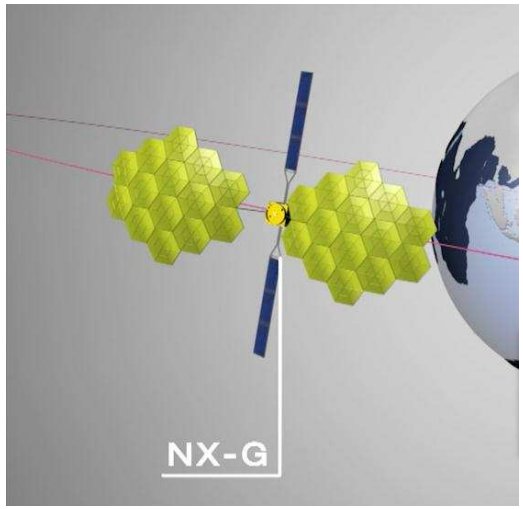
*: Under manufacturing

Aiming for World Markets with the NEXTAR Standardized Satellite System

- Three types of NEXTAR* to cover satellites from 500 kg to 3 tons
- The same standard platform is used in the core of these NEXTAR
- The standard platform features many of NEC's strengths, including autonomous control functions, SpaceWire (a communication standard for spacecraft) and SpaceCube2 (a standard onboard computer).







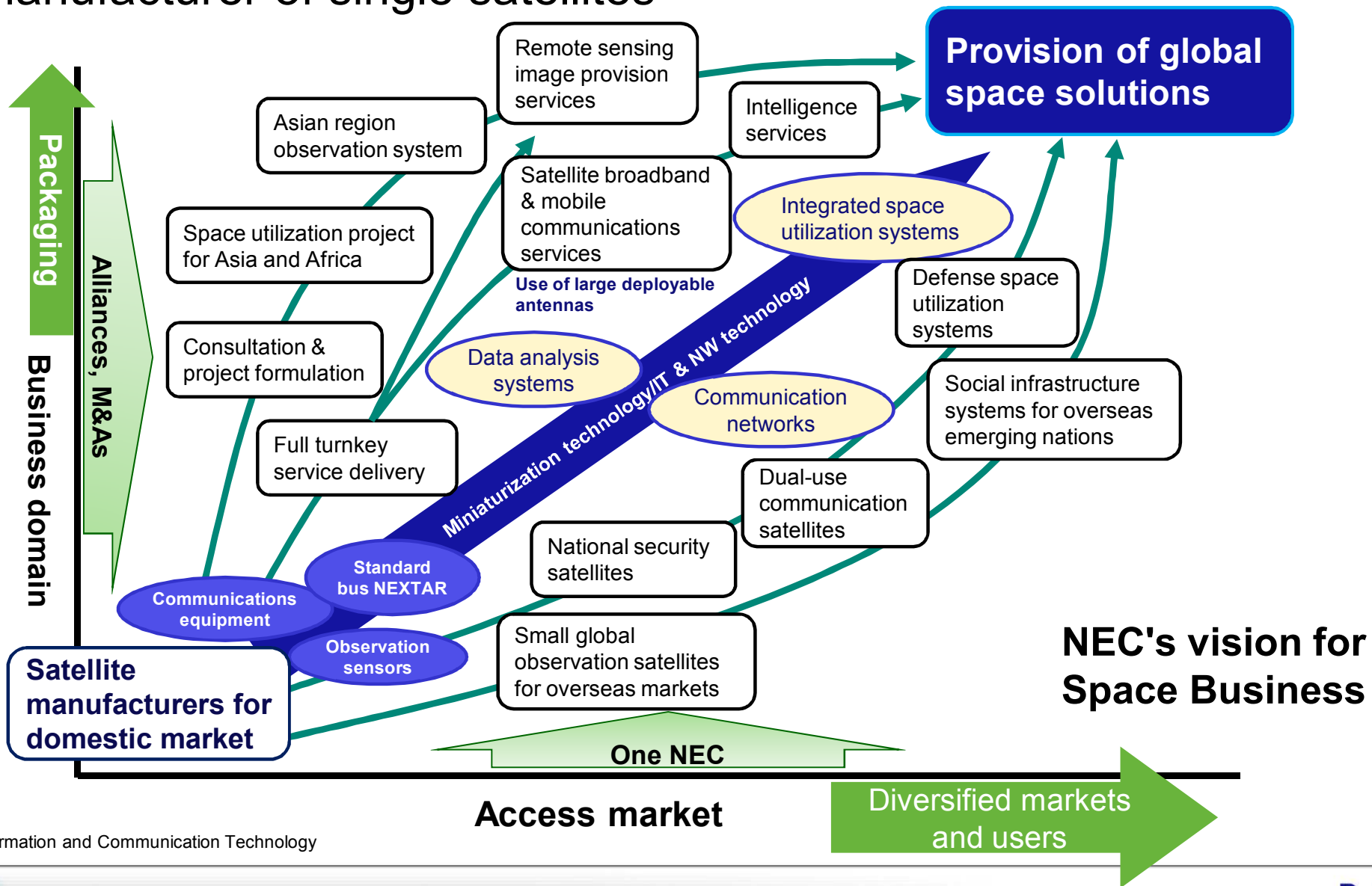
Bus type	**NX-300L (300-500kg)**	**NX-1500L (1000-1500kg)**	**NX-G (1.5-3 tons)**
	Applications: Earth observation, etc.	Applications: Earth observation, etc.	Applications: Communications, etc.

NEXTAR enables satellite systems to be provided in a short time and at low cost

***NEXTAR**: NEC Next Generation Star

Combining all of the Strengths of NEC

Becoming an ICT*-based solution systems provider from a manufacturer of single satellites



ICT: Information and Communication Technology

Example of the “Use of Space Package”

Customer needs differ depending on countries and regions. We propose solutions tailored to the needs of each customer

Step 1
Preparation of user environment

- Space center facility development
- Remote sensing data processing and licensing of technology to be used
- Small satellite development, technology licensing
- Small global observation satellite development

Step 2
Data collection and storage, product creation

- Analysis
- Creation of effective products taking advantage of sensor characteristics
- Application of know-how of suppliers providing added value

Step 3
Product utilization and evaluation

- Development and implementation of national territory development plan
- Infrastructure maintenance

■ Maintenance functions

- Natural disaster control
- Forest monitoring
- Agriculture monitoring, etc.

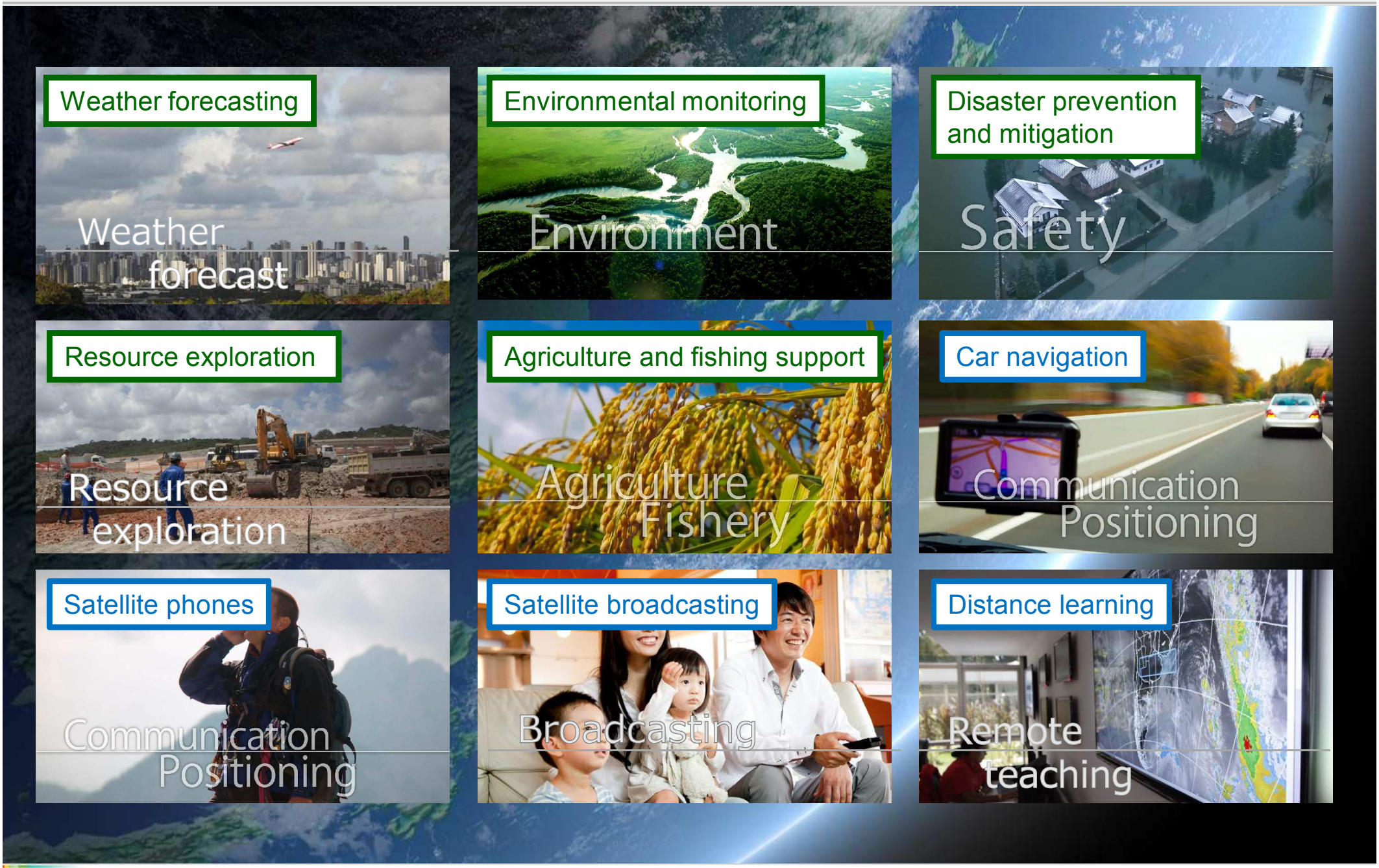
■ Development of content

- National land maps
- Hazard maps/disaster prevention and mitigation, river flooding/floods, landslides, etc.
- Environmental monitoring Illegal dumping, vegetation, crop yields, disaster situation (forest fires, floods)

■ Ripple effect on related industries

- Weather forecasting
- Agriculture and fishing support (Farmland expansion and improvement, yield adjustment)
- Flood control works (dam construction, etc.)
- Satellite phones, satellite broadcasting
- Distance learning

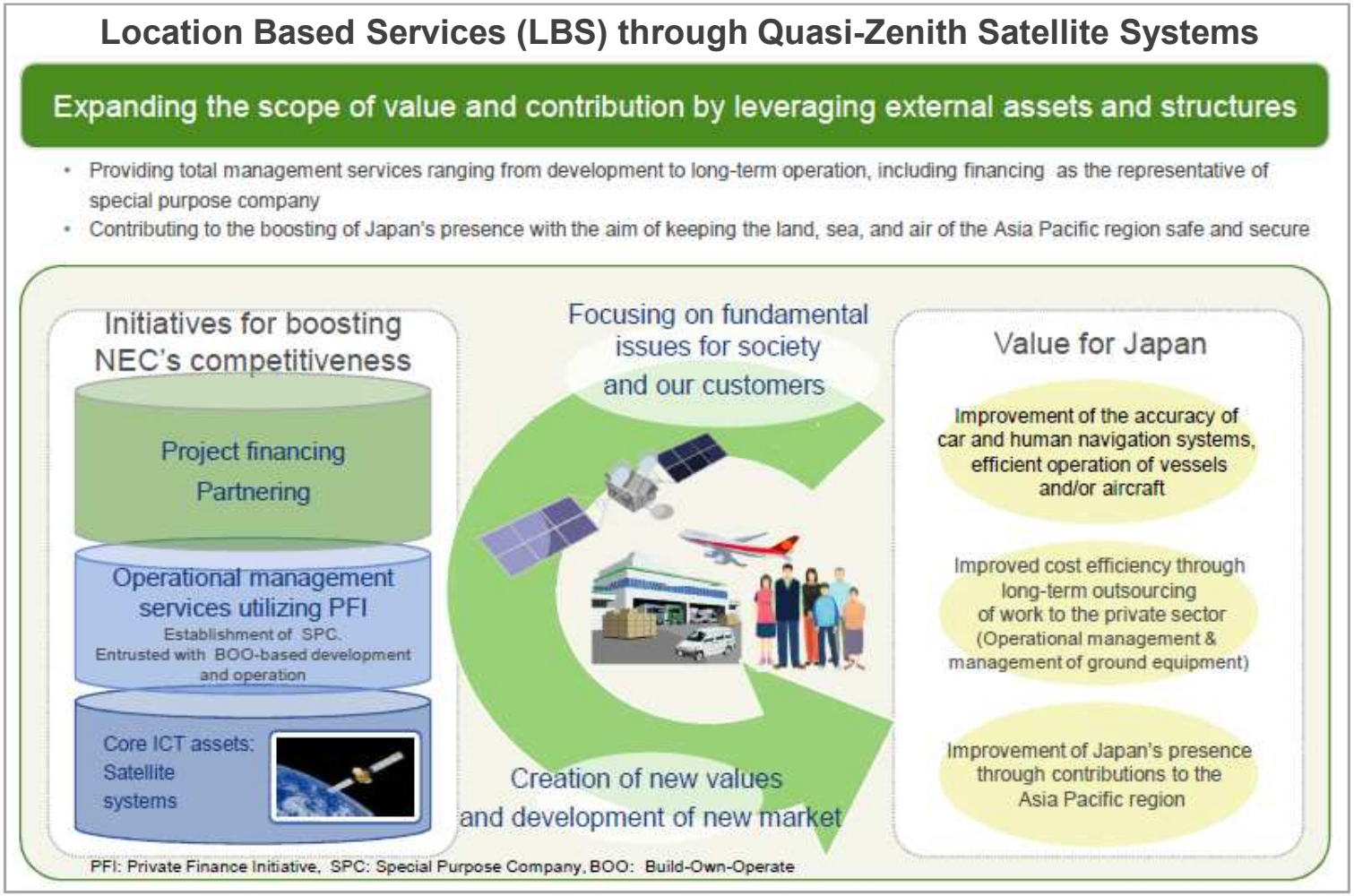
Space Systems and Solutions for Society



New Business Approaches

- Proactive approach to the government's request for PFI*-projects
- Expanding capabilities for service business in the commercial market

Implementation example



Satellite Integration Center

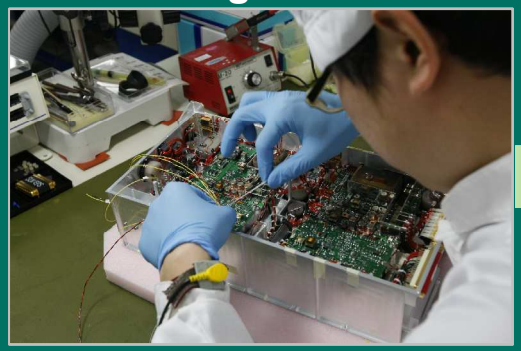
- Constructing integrated production systems for satellite systems
- Supporting new business models; i.e. PFI
- Promoting flexibility to meet international customer needs

Development of integrated production system for medium- and large-sized satellites at NEC's Fuchu Plant

Equipment manufacturing and testing floor

Satellite Integration Center

Equipment manufacturing and testing



Satellite assembly

Environmental testing

Summary

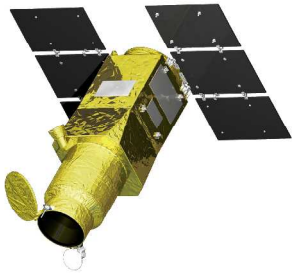
NEC aims to achieve 100 billion yen in sales for its Space Business by fiscal 2020 as a part of empowering Social Solutions Business

*Projected sales volume as of July 2, 2014

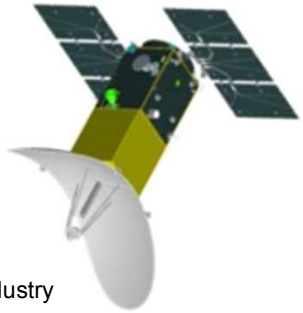
Reference 1: Satellites Under Development (To be launched in or after FY2014)

Global Observation Satellites

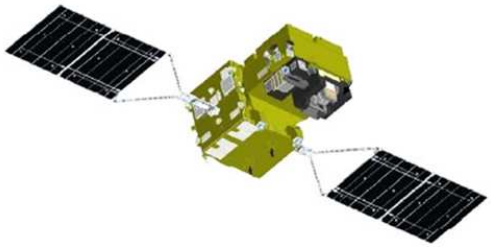
ASNARO
Global observation satellite with optical sensor
Project of METI*



ASNARO2
Global observation satellite with SAR sensor
Project of METI*



GCOM-C
Global Change Observation Mission - Climate
Project of JAXA



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*METI: Ministry of Economy, Trade and Industry

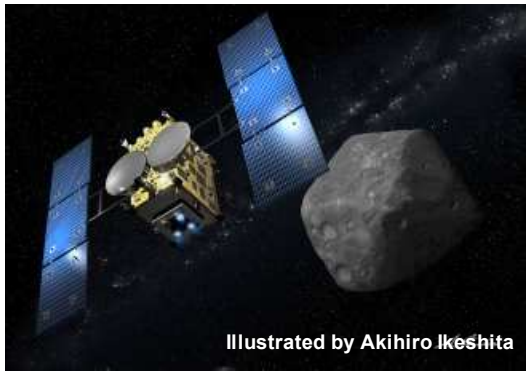
Communications/ Positioning Satellites

X-band satellite-1 and **X-band satellite-2**
Geostationary communications satellites
Ministry of Defense/DSN (PFI)

Also participating in the Quasi-Zenith Satellite System Project

Scientific Satellites

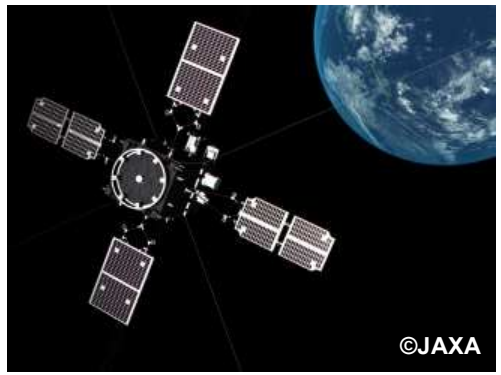
HAYABUSA-2
Asteroid explorer
Project of JAXA



MMO
Mercury Magnetospheric Orbiter
Project of JAXA

ASTRO-H
X-ray observation satellite
Project of JAXA

ERG
Exploration of energization and Radiation in Geospace
Project of JAXA



Reference 2: NEC's Track Record in Satellite System Integration

No.	Launch	Satellite name	Mission	Delivered to
1	1970	OHSUMI	Engineering test	ISAS
2	1971	TANSEI	Engineering test	ISAS
3	1971	SHINSEI	Scientific observation	ISAS
4	1972	DENPA	Scientific observation	ISAS
5	1974	TANSEI-2	Engineering test	ISAS
6	1975	TAIYO	Scientific observation	ISAS
7	1975	KIKU-1	Engineering test	NASDA
8	1976	CORSA	Scientific observation	ISAS
9	1977	TANSEI-3	Engineering test	ISAS
10	1977	HIMAWARI	Global observation (meteorological)	NASDA
11	1978	KYOKKO	Scientific observation	ISAS
12	1978	YURI	Communications/broadcast	NASDA
13	1978	ZIKIKEN	Scientific observation	ISAS
14	1979	HAKUCHO	Scientific observation	ISAS
15	1980	TANSEI-4	Engineering test	ISAS
16	1981	HINOTORI	Scientific observation	ISAS
17	1981	HIMAWARI-2	Global observation (meteorological)	NASDA
18	1982	KIKU-4	Engineering test	NASDA
19	1983	TENMA	Scientific observation	ISAS
20	1984	YURI-2a	Communications/broadcast	NASDA
21	1984	OHZORA	Scientific observation	ISAS
22	1984	HIMAWARI-3	Global observation (meteorological)	NASDA
23	1985	SAKIGAKE	Engineering test	ISAS
24	1985	SUISEI	Scientific observation	ISAS
25	1986	YURI-2b	Communications/broadcast	NASDA
26	1986	FUJI-1	Other (radio)	JARL
27	1987	GINGA	Scientific observation	ISAS
28	1987	MOMO-1	Global observation	NASDA
29	1989	AKEBONO	Scientific observation	ISAS
30	1989	HIMAWARI-4	Global observation (meteorological)	NASDA
31	1990	HITEN	Engineering test	ISAS
32	1990	HAGOROMO	Engineering test	ISAS
33	1990	MOMO-1b	Global observation	NASDA
34	1990	FUJI-2	Other (radio)	JARL
35	1990	ORIZURU	Engineering test	ISAS
36	1990	YURI-3a	Communications/broadcast	NASDA
37	1991	YURI-3b	Communications/broadcast	NASDA
38	1991	YOHKOH	Scientific observation	ISAS
39	1992	GEOTAIL	Scientific observation	ISAS
40	1993	ASCA	Scientific observation	ISAS
41	1994	MYOJO	Engineering test (rocket)	NASDA
42	1994	KIKU-6	Engineering test	NASDA
43	1995	HIMAWARI-5	Global observation (meteorological)	NASDA
44	1996	FUJI-3	Other (radio)	JARL
45	1997	HALCA	Scientific observation	ISAS
46	1997	KIKU-7/HIKOBOSHI	Engineering test	NASDA
47	1997	KIKU-7/ORIHIME	Engineering test	NASDA
48	1998	KAKEHASHI	Communications/broadcast (experiment)	NASDA
49	1998	NOZOMI	Scientific observation (exploration)	ISAS
50	2000	ASTRO-E	Scientific observation	ISAS
51	2000	LDREX	Engineering test	NASDA
52	2002	TSUBASA	Engineering test	NASDA
53	2002	DASH	Engineering test	ISAS
54	2003	HAYABUSA	Scientific observation (exploration)	ISAS
55	2005	SUZAKU	Scientific observation	JAXA/ISAS
56	2005	KIRARI	Engineering test	JAXA
57	2006	DAICHI	Global observation	JAXA
58	2006	AKARI	Scientific observation	JAXA/ISAS
59	2006	LDREX-2	Engineering test	JAXA
60	2007	KAGUYA	Scientific observation (exploration)	JAXA
61	2007	OKINA	Scientific observation (exploration)	JAXA
62	2007	OUNA	Scientific observation (exploration)	JAXA
63	2008	KIZUNA	Communications/broadcast (experiment)	JAXA
64	2010	AKATSUKI	Scientific observation (exploration)	JAXA/ISAS
65	2010	IKAROS	Engineering test	JAXA/ISAS
66	2012	SHIZUKU	Global observation	JAXA
67	2013	HISAKI	Scientific observation	JAXA/ISAS

NASDA:
National Space Development Agency of Japan
ISAS:
Institute of Space and Astronautical Science
JARL:
The Japan Amateur Radio League
JAXA:
Japan Aerospace Exploration Agency

Orchestrating a brighter world

NEC brings together and integrates technology and expertise to create the ICT-enabled society of tomorrow.
We collaborate closely with partners and customers around the world, orchestrating each project to ensure all its parts are fine-tuned to local needs.

Every day, our innovative solutions for society contribute to greater safety, security, efficiency and equality, and enable people to live brighter lives.

Empowered by Innovation

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