MITSUBISHI ELECTRIC
Changes for the Better

Future of Europe-Japan Industrial Cooperation

October, 2014
Mitsubishi Electric Corporation

1. Company Introduction

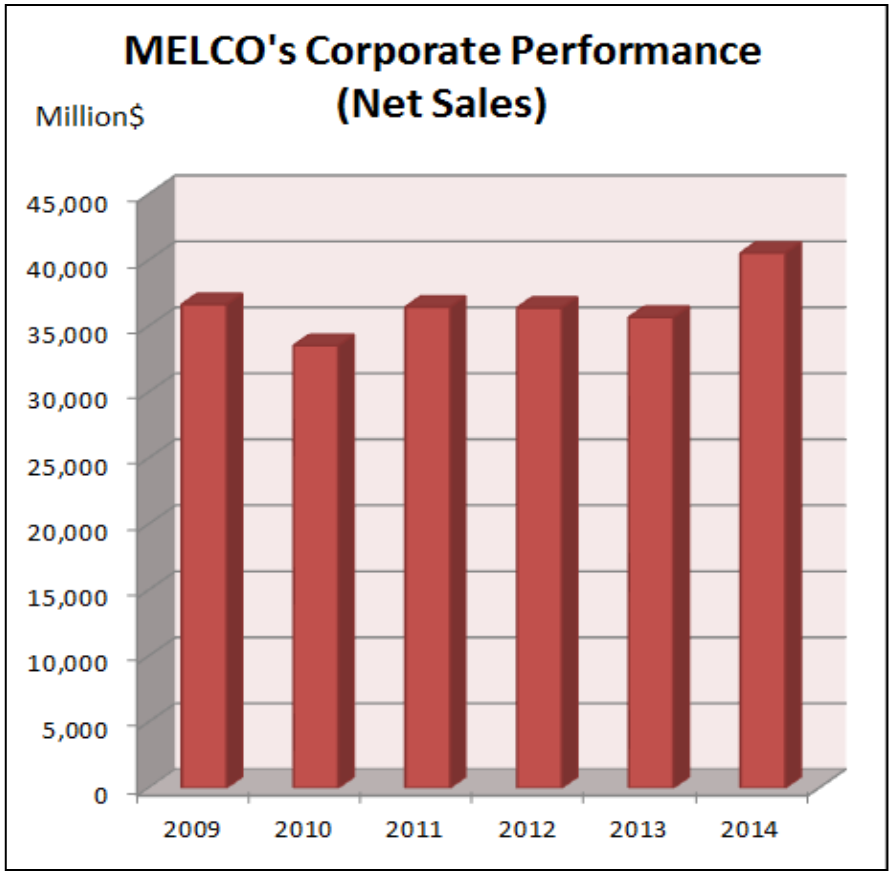
MELCO Introduction

Mitsubishi Electric Corporation (MELCO)

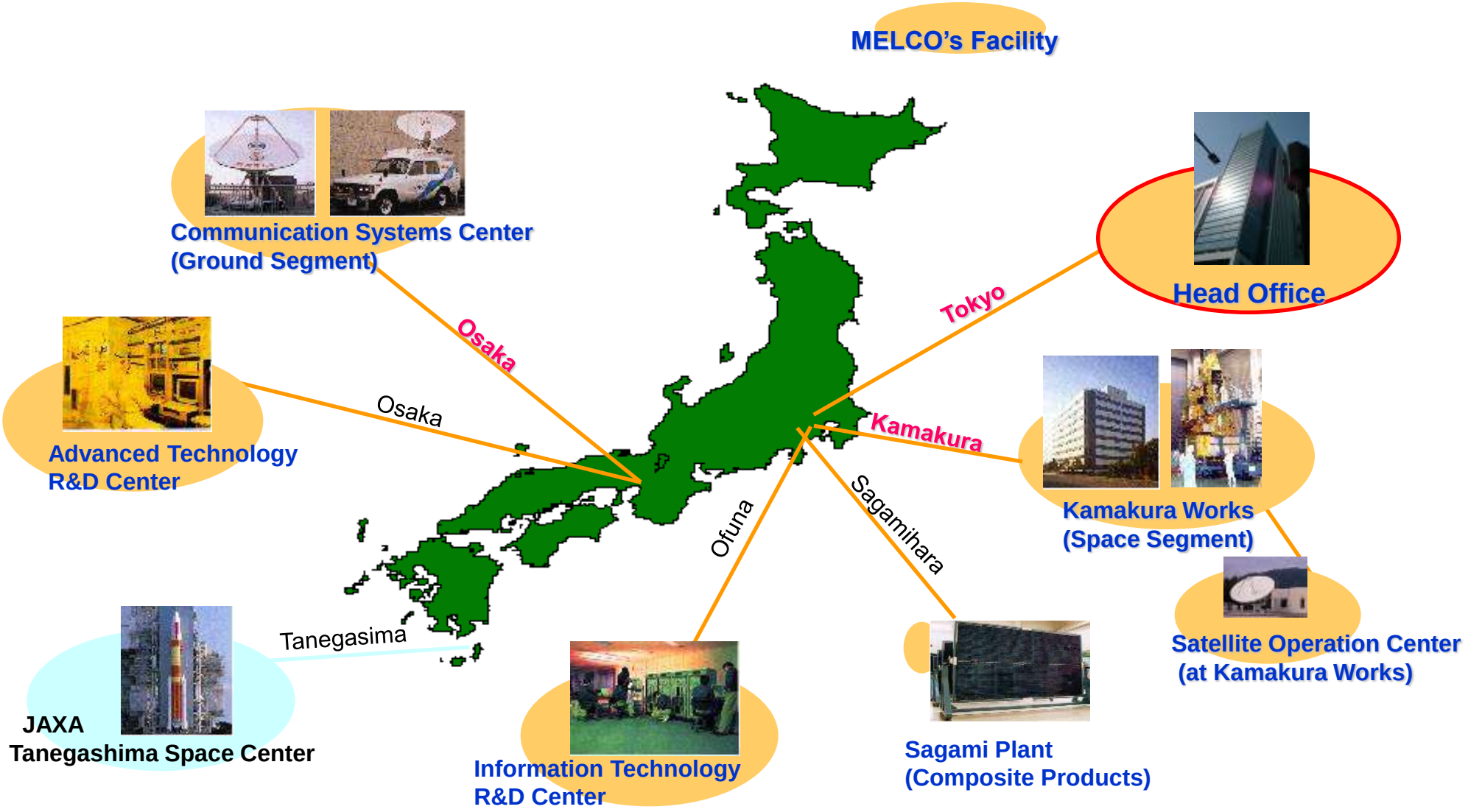
MELCO, one of the long-established & blue-chip company (founded in 1921), is world's leading manufacturer of electronic products and systems in a broad range of fields, automotive equipment, factory automation systems etc. Over the past four decades, we have been involved in many satellite projects for telecom operators, government agencies, and other large-scale clients.

President & CEO	:	Masaki SAKUYAMA
Head Quarters	:	Tokyo, JAPAN
Net Sales in 2013	:	US$40,543M*
Employee	:	120,958**
Moody's Rating	:	A1***

* As of Mar.31,2014, Exchange rate of JPY100 against USD
** Inclusive employees of consolidated subsidiaries
*** As of Jan, 2014



Space Related Facilities



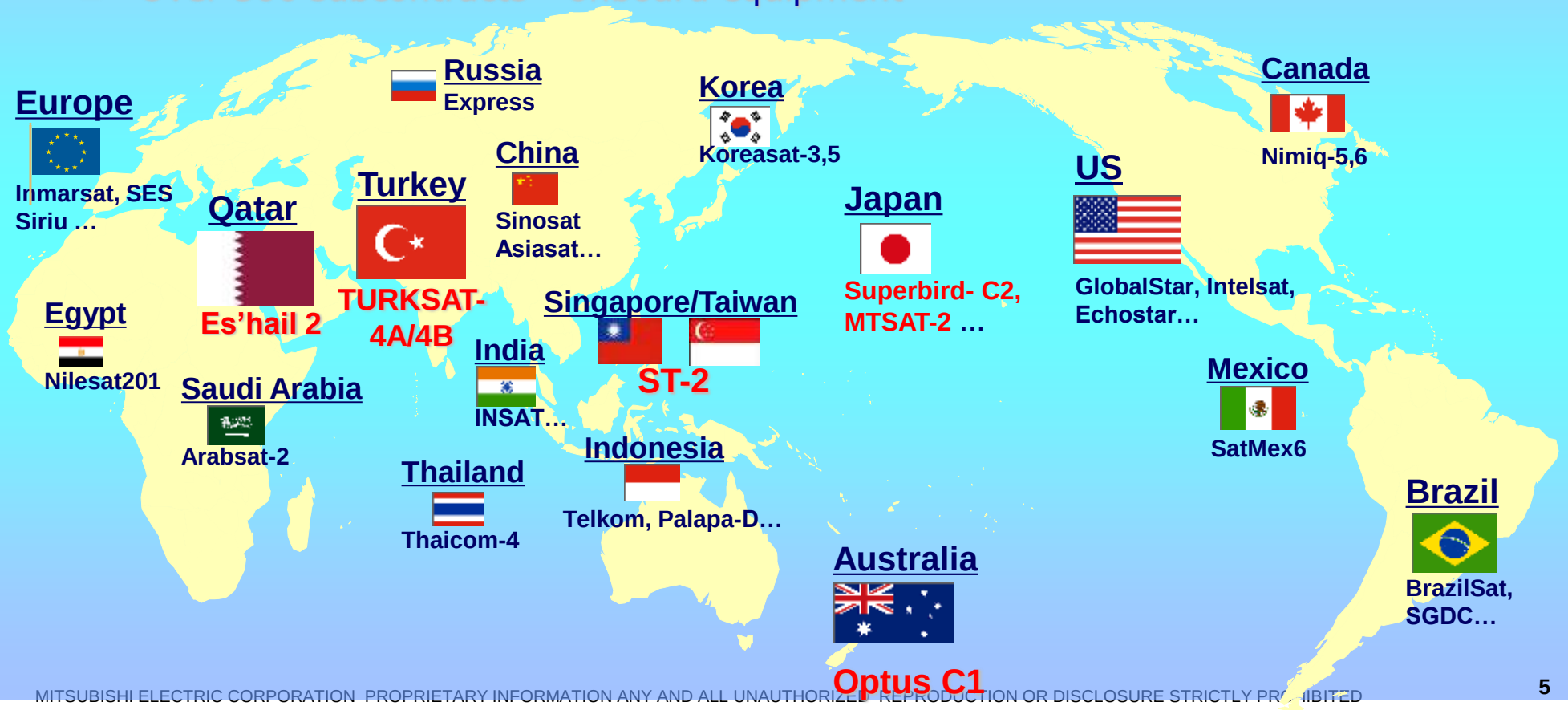
2. Space Business at MELCO

MELCO's achievements in space business

Participated in around 560 satellite projects all over the world

- Top satellite manufacturer leading space activities in Japan
- 560 satellite projects MELCO has participated in
  - About 60 prime contracts -satellite system
  - Over 500 subcontracts - onboard equipment

Prime-contract
Sub-contract



MELCO's Satellite System

Contributes to the creation of global social infrastructure

Communication

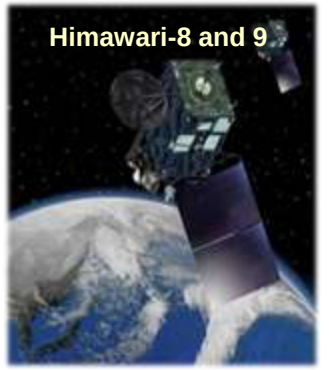
- **MELCO's strategic core model: GEO Satellite bus "DS2000"**
- **Utilized in areas of communication and broadcasting**
- **Chosen as the prime contractor for**
  - ・Türksat-4A/4B (Turkey)
  - ・ST-2 (Singapore/Taiwan)
  - ・Superbird C2 (Japan) …and others.

Navigation

- **Emits positioning signals for car and maritime navigation, aviation.**
- **First navigation satellite system in Japan:**
  4 units of quasi-zenith satellites
- **First quasi-zenith satellite "Michibiki" launched on Sep. 2010**

Earth Observation

- **Observes the earth from LEO, equipped with optical &SAR sensors.**
- **・GOSAT**
  – observe the greenhouse gases
  ・ ALOS-2
  – disaster surveillance
  ・"Himawari 7/8/9"
  – meteorological observation



Heritage of Satellite System

Over 10 spacecrafts in operation

As of September, 2014

In Orbit

DRTS : GEO
In orbit since Sep/02

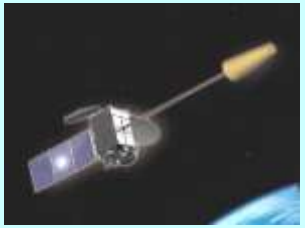
SOLAR-B : LEO
In orbit since Sep/06

HTV #1/#2/#3#4
Transfer Vehicle
(Aug/09, Jan/11, Jul/12, Aug/13)

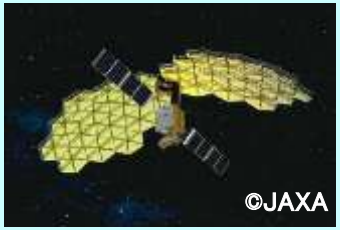
OPTUS C1 :GEO
In orbit since Jun/03

GOSAT : LEO
In orbit since Jan/09

ST-2 : GEO
Hi- power Communications
In orbit since May/11



MTSAT-2 : GEO
In orbit since Feb/06

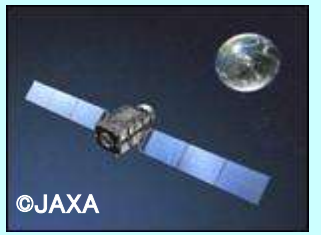


ETS-VIII : GEO
In orbit since Dec/06

TURKSAT-4A/B : GEO
Hi- Power Communications

SB-C2 : GEO
In orbit since Aug/08

ALOS-2 : LEO
Environmental Observation



QZS#1 : HEO
In orbit since Sep/10

Himawari-8/9: GEO
Meteorology

Back-log

Es'hail 2: GEO
Hi- Power Communications

QZS #2/#3/#4
HEO & GEO, GPS

HTV#5/#6/#7
Transfer Vehicle

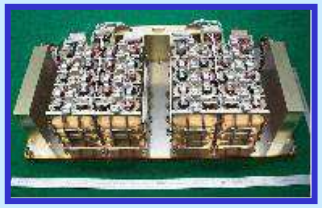
GOSAT-2 : LEO
CO2 monitoring

3. Future Europe-Japan Industrial Cooperation

Industry Level Cooperation

Satellite Components

MELCO

Solar Array Panel	Li-Ion Battery Assembly	Heat Pipe Embedded Honeycomb Panel
		
Share 33%	Share 42%	Share 36%

LTPA base

European Space Industry

- -TAS
- - Airbus
- - OHB
- ---

Transmitter/Receiver
Attitude Sensor…

Satellite System

MELCO Standard GEO Platform
DS2000

Not yet provided

European SATCOM Operator

- -SES
- - Eutelsat

Lunch Service

MELCO COMSAT

SB-C2 : GEO

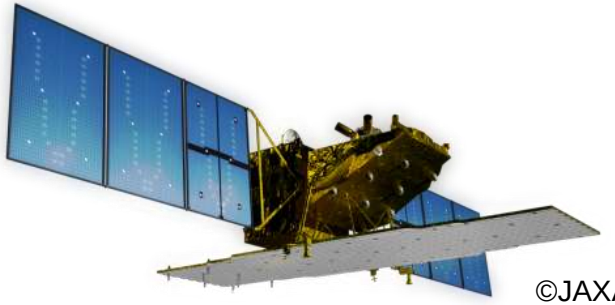
ST-2 : GEO

Lunched by Ariane-5

Government･Agency Level Cooperation(IDEA1)

Earth Observation Field

ALOS-2(L-band SAR) ⟷ TERA-SAR(X-band SAR) Cooperation



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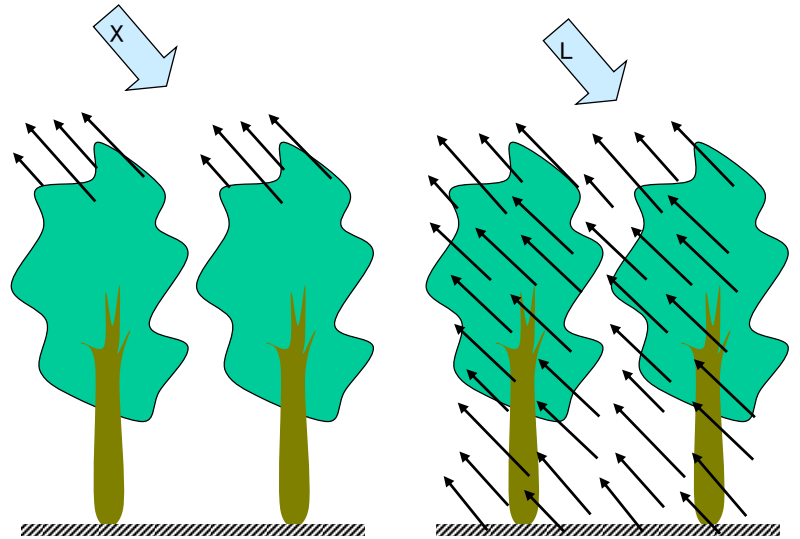
- Launched by H2A in May, 2014.
- Advanced L-band SAR with Active Phased Array Antenna technologies
  - Normal collection
    - 3/5m resolution, 70km swath
  - High resolution mode
    - 1x3m resolution, 25km swath
  - Scanning mode
    - 100m resolution, 490km swath

- **L-SAR and X-SAR have different scattering characteristics**
- **There is possibility to make new data utilization by combining L/X SAR data.**



X-band （wavelength:～3cm）
-Surface scattering on canopy top
-Cannot penetrate the canopy

L-band（wavelength :～25cm）
-Back scattering on the trunk and ground
-Can penetrate the canopy

Government·Agency Level Cooperation(IDEA2)

Satellite Navigation Field

QZS(Quasi Zenith Satellite) ⟷ Galileo + EGNOS Cooperation

Common Development of GNSS Application

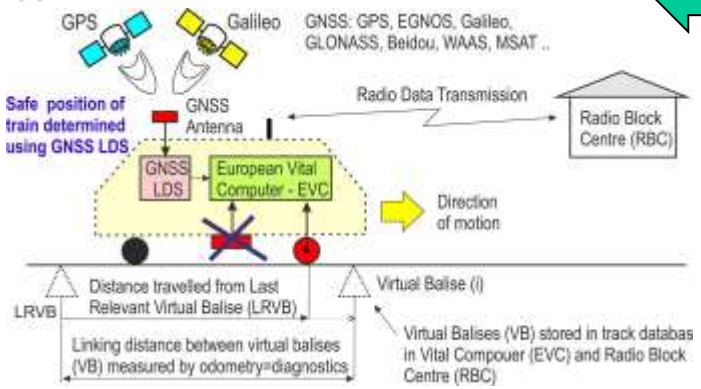
Safety of Life	Mass Market	Professional
• Aviation • Rail • Maritime • Inland waterways • Ambulance • Police / Fire • Search and Rescue • Personal Protection • Traffic surveillance • Dangerous goods trans. • ADAS	• Personal communication and navigation • Cars / motorcycles • Trucks & buses • Light Commercial Vehicles • Personal outdoor recreation • Others…	• Oil and Gas • Mining • Timing • Environment • Fleet Management • Asset Management • Geodesy • Meteorological forecasting • Land Survey / GIS • Precision survey • Precision Agriculture • Fisheries / EEZ • Vehicle control and robotics • Construction / Civil Engineering • Space

Integrity (**error-free**), Standards, Regulation, Continuity, Availability, Accuracy

Low costs, Low power cons., Small size, Friendly use, Best perf. accordingly

High precision, High accuracy, High reliability

Cooperative investigation of SOL(Safety of Life) application is one of candidates



European Space Solutions, 2014
Safety concept of GNSS based train location determination system

European GNSS Programs Galileo and EGNOS,
3rd Meeting of the International Committee on GNSS, 2008

Government･Agency Level Cooperation(IDEA3)

Parts、Parts Procurement Field

EEE Parts

Common development of high functional EEE parts（FPGA, ASIC and etc.)

Parts Procurement

- **Modern spacecraft require large amounts of EEE components (typically make up 8-20% of the cost of a spacecraft)**
- **For space programs, the co-ordinated or centralized procumbent of the EEE parts has merits to improve the overall quality, reliability, on –schedule delivery of the components and also for cost reduction by bulk purchasing.**

Function of CPPA