NARLabs
國家實驗研究院

National SPace Organization

A center of innovation and excellence for space technology

Ming-Chih Cheng

National Space Organization

Presented at JPTM 2013, Sentinel Asia
Bangkok, Thailand, 11/27-29

www.narlabs.org.tw

Organization

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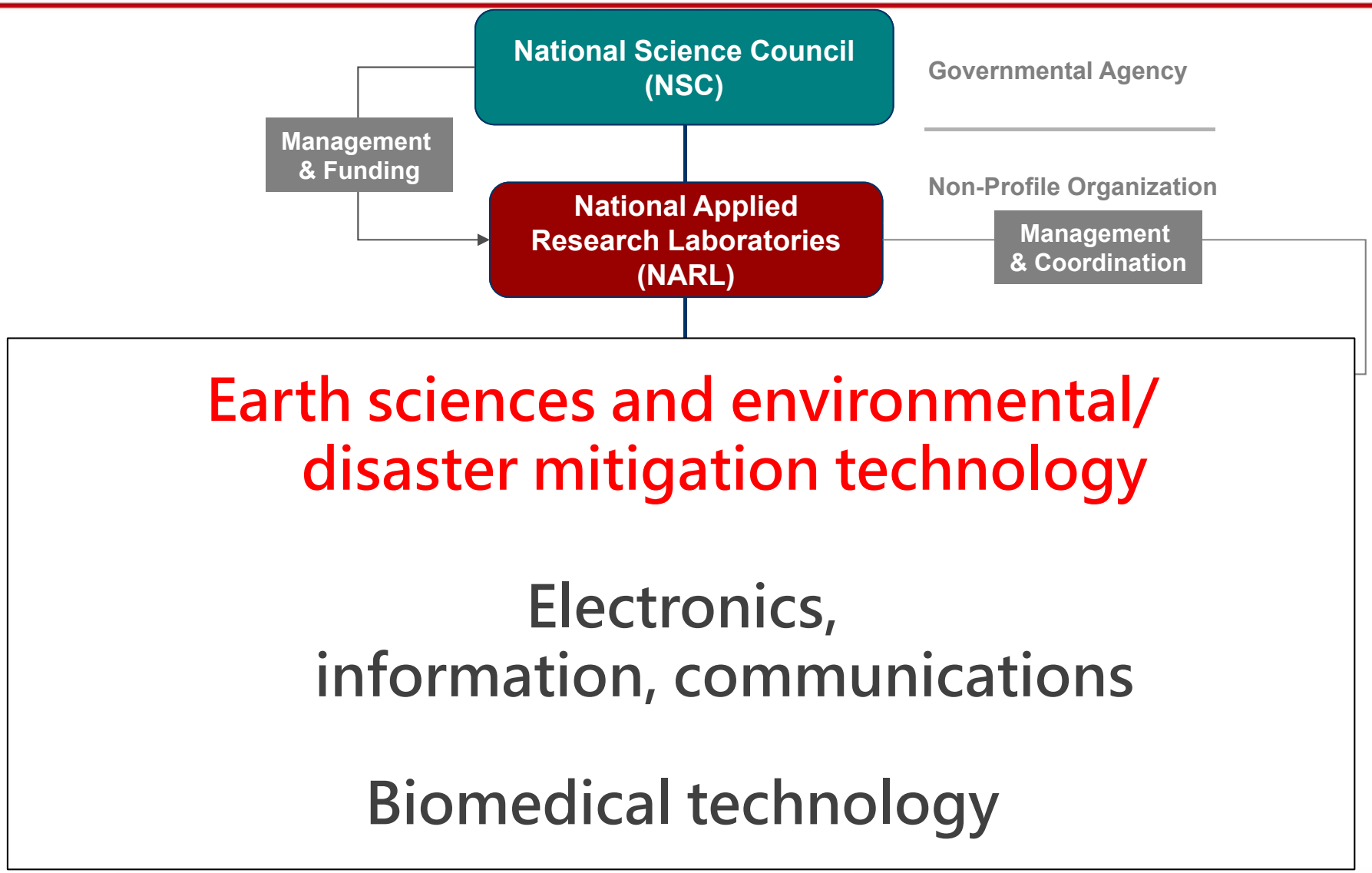
Commitment · Passion · Innovation



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NARLabs Synergy in Disaster Reduction

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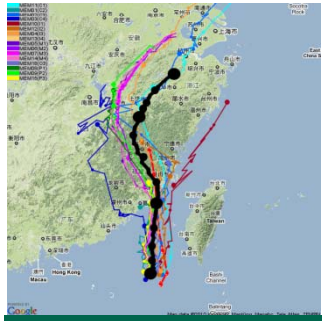
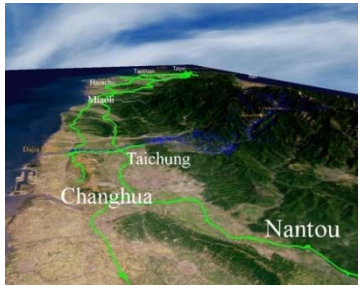
- Synergize capability & capacity within NARLabs (NSPO, NCHC, NCDR, NCREE, TORI, TTFRI), academia, and research institutes, to provide services in Earth Observation, Simulation, and Disaster Management
  - Disaster Management: Flood, Drought, Earthquake, Landslide, Nuclear & Complex Disasters
  - Environment Monitoring
  - and Others

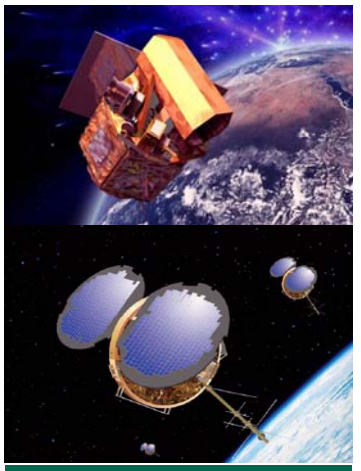


Typhoon Path and Precipitation

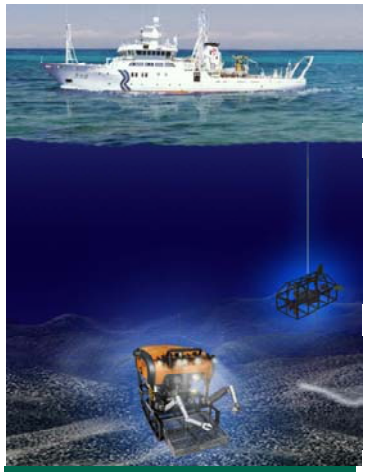
Earthquake



Cloud Computing



Earth Observation Satellites



Remotely Operated Vehicle

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Satellite Programs

FORMOSAT Programs

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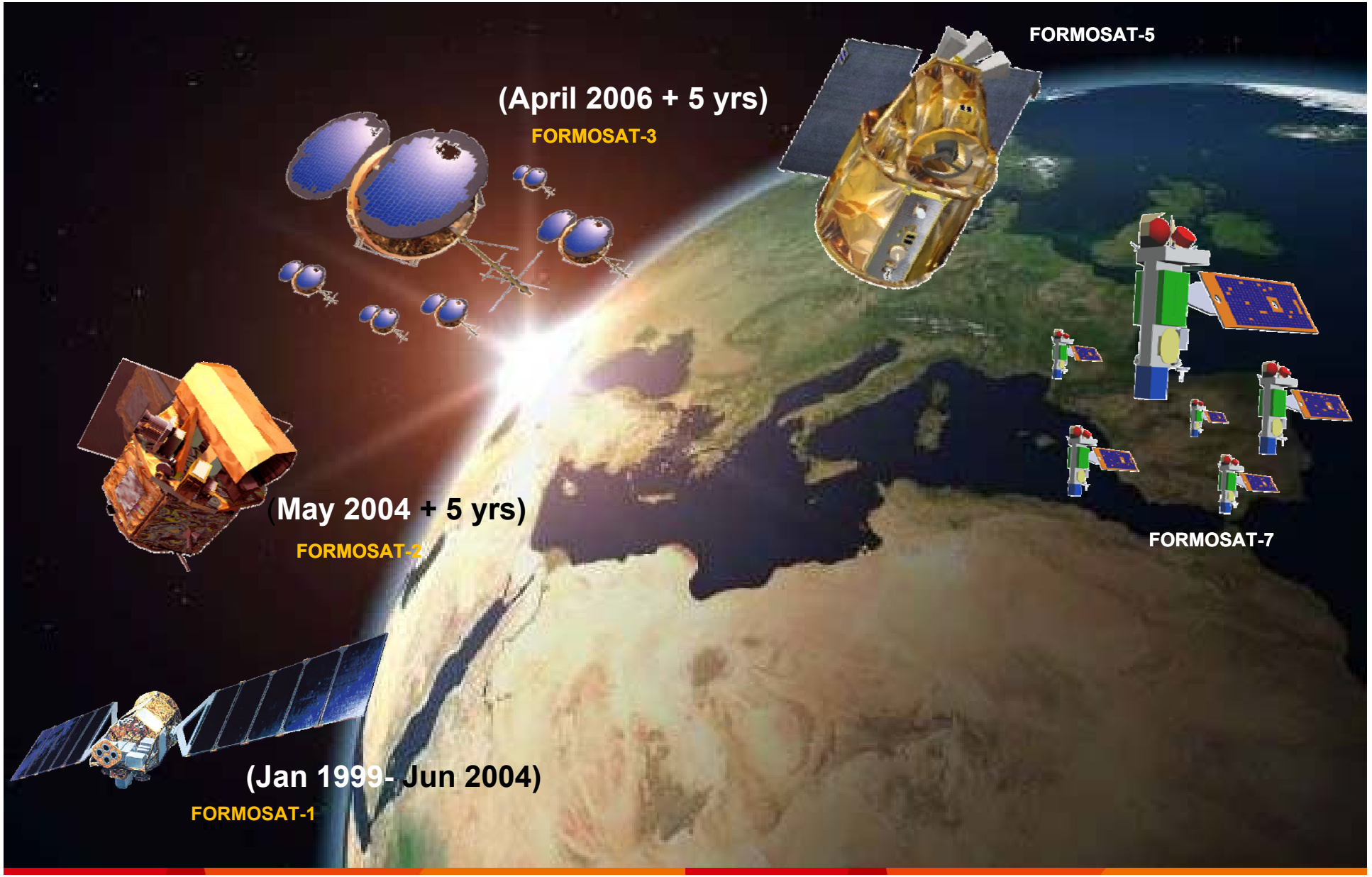

NSPO Mid-term Plan

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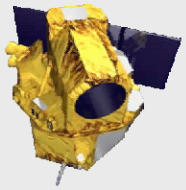
Self-reliant Spacecraft and Optic-Electric Remote Sensing Instrument Development

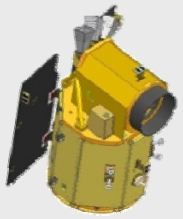


FORMOSAT-2

Remote Sensing Satellite Program

FORMOSAT-5

(Target Launch Date: 2015)

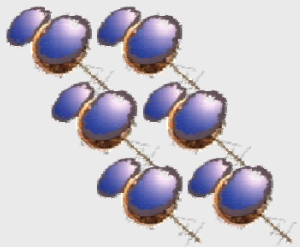


FORMOSAT-5 Follow-on (FORMOSAT-8)

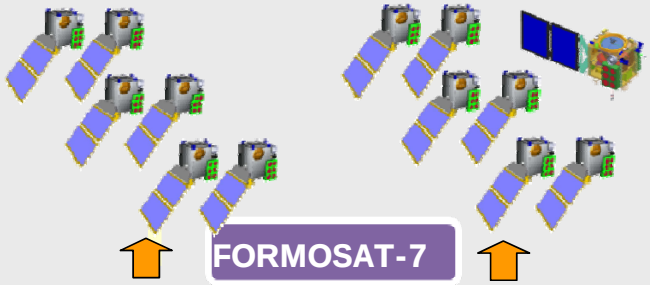
Earth Observations

- EV Monitoring
- Disaster Support
- Data Applications

GNSS RO Spacecraft and Constellation Operations Development



FORMOSAT-3



FORMOSAT-7

2016
1st Set Launch

2018
2nd Set Launch

Atmospheric Soundings

- Weather Predication
- Climate Research
- Space Weather

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Looking Forward

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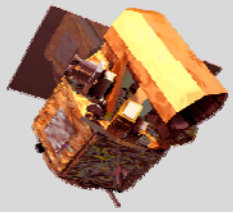
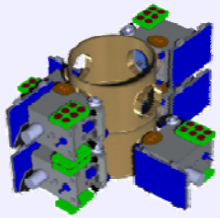
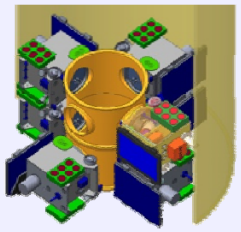
2004	2015	2016	2018	2019
FORMOSAT-2	FORMOSAT-5	FORMOSAT-7.1	FORMOSAT-7.2	FORMOSAT-8
	  Falcon 9	  Falcon Heavy	  Falcon Heavy	  (TBD)
Orbit: 891 km SSO **Revisit: 1 day** **Resolution:2m (PAN)/8m (MS)** **Swath: 24 km** **Life: 5 years**	**Orbit: 720 km SSO** **Revisit: 2 day** **Resolution: 2m (PAN)/4m (MS)** **Swath: 24 km** **Life: 5 years**	**Constellation Observing System for Meteorology, Ionosphere, and Climate (6 S/L)**	**Constellation Observing System for Meteorology, Ionosphere, and Climate (6+1 S/L)**	**Orbit: 720 km SSO** **Revisit: 2 day** **Resolution: 1m (PAN)/4m (MS)** **Swath: 24 km** **Life: 5 years**

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Formosat-5 & 8 Constellation

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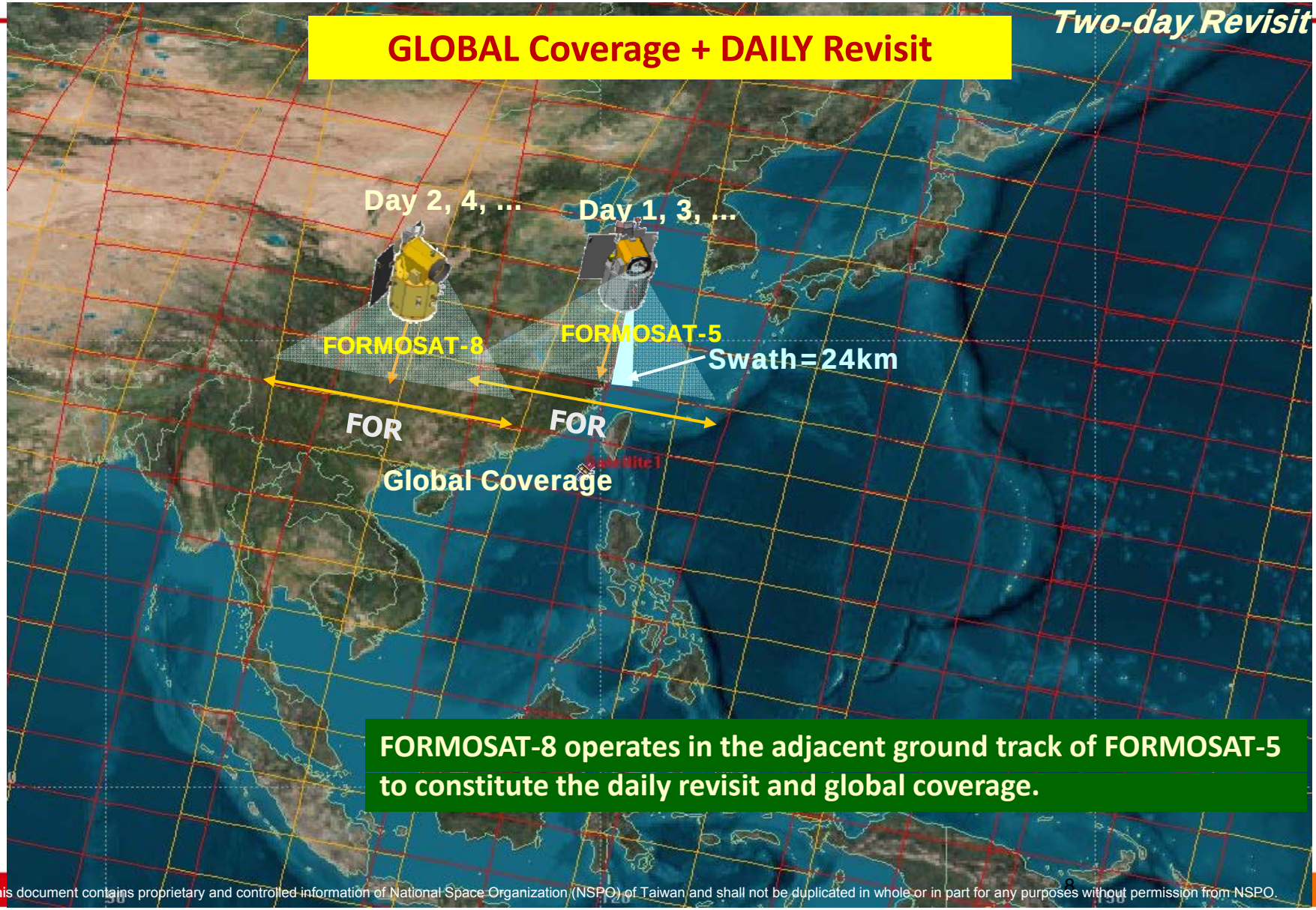

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FORMOSAT-5 Program

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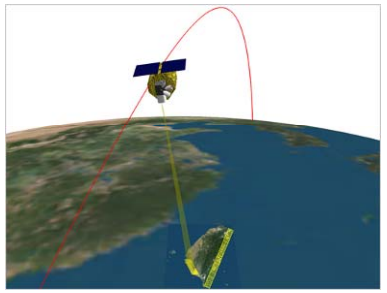
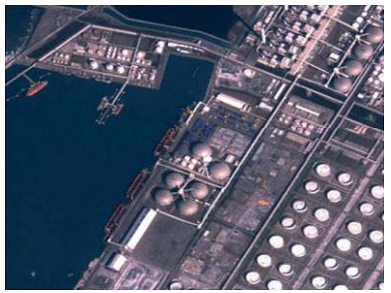
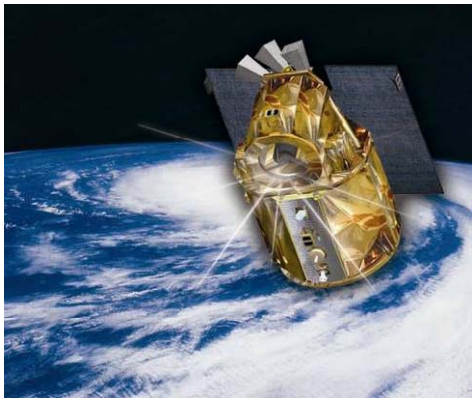
Mission: To build up Taiwan's self-reliant space technology on the remote sensing satellite system and to continuously serve the global imagery users' community of FORMOSAT-2.

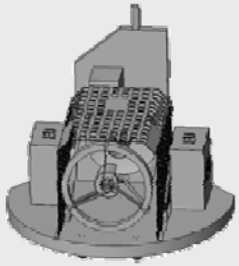
- To develop Taiwan's indigenous remote sensing instrument (RSI) and spacecraft bus
- To promote the space science experiment & research



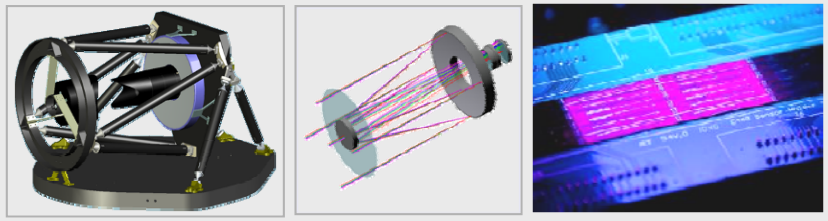




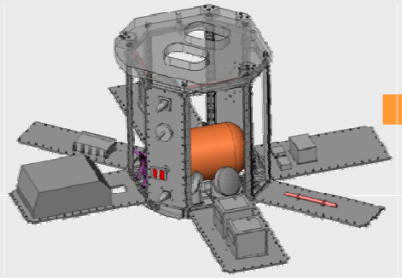
FORMOSAT-5
(Launch in 2015)



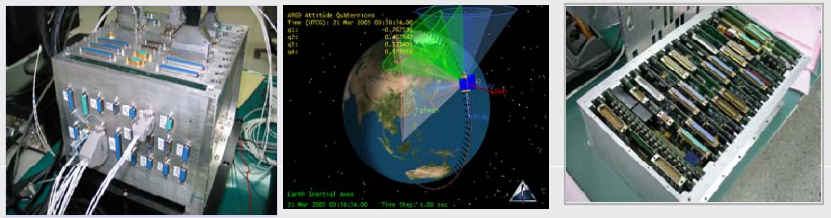
Remote Sensing Instrument



To develop the RSI by integrating the domestic resources



Spacecraft Bus



To demonstrate the capability of spacecraft system and key components

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The Key System Specification

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Key Parameter	Specification
Orbit	SSO @ 720km/98.28°
Revisit Period	2 days
Mission Life	5 years
GSD	PAN (2m) / MS (4m)
Swath	24 km
Spectral Bands	PAN + 4MS
RSI Image Sensor	CMOS Image Sensor
RSI duty Cycle	8%
Satellite Weight	525 kg

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FORMOSAT-5 Configuration

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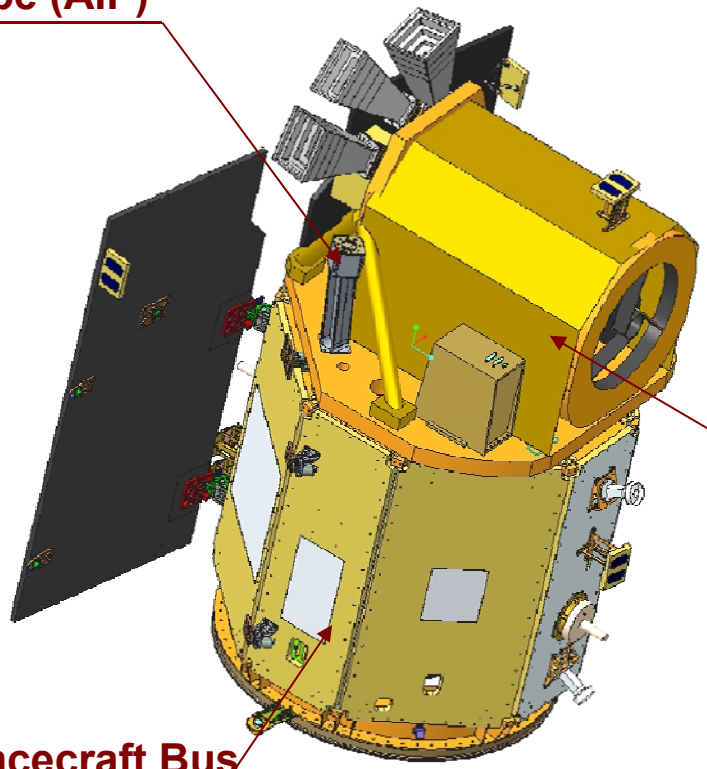
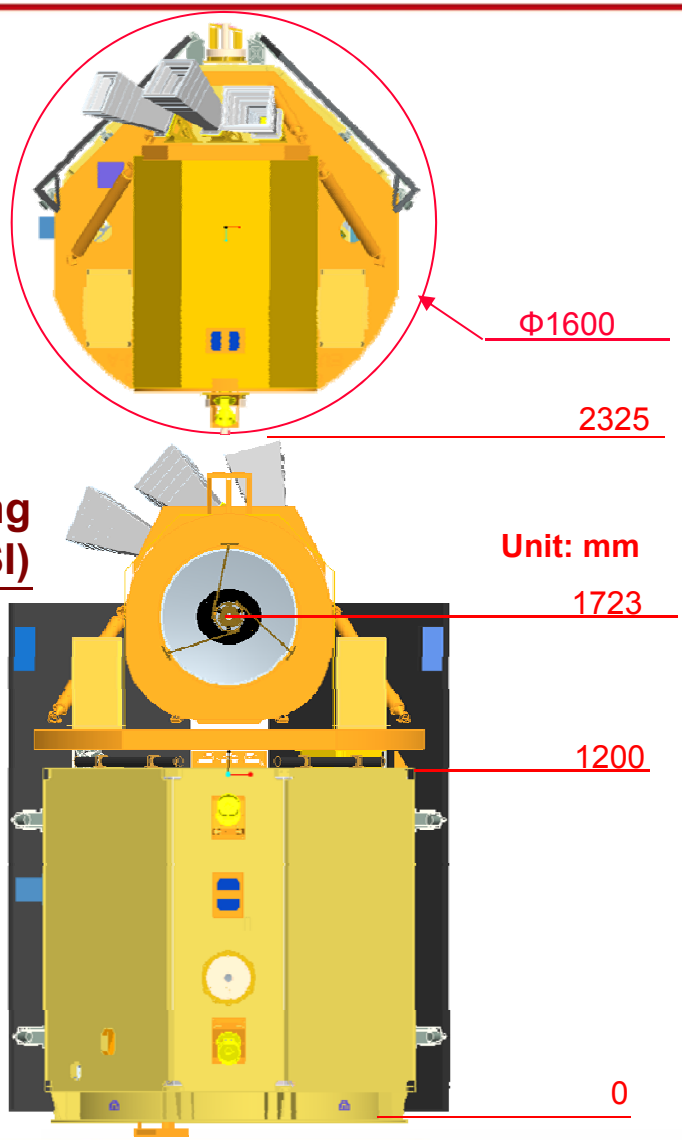
Advanced Ionospheric Probe (AIP)



Remote Sensing Instrument (RSI)

Spacecraft Bus



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Smart Agility Capability

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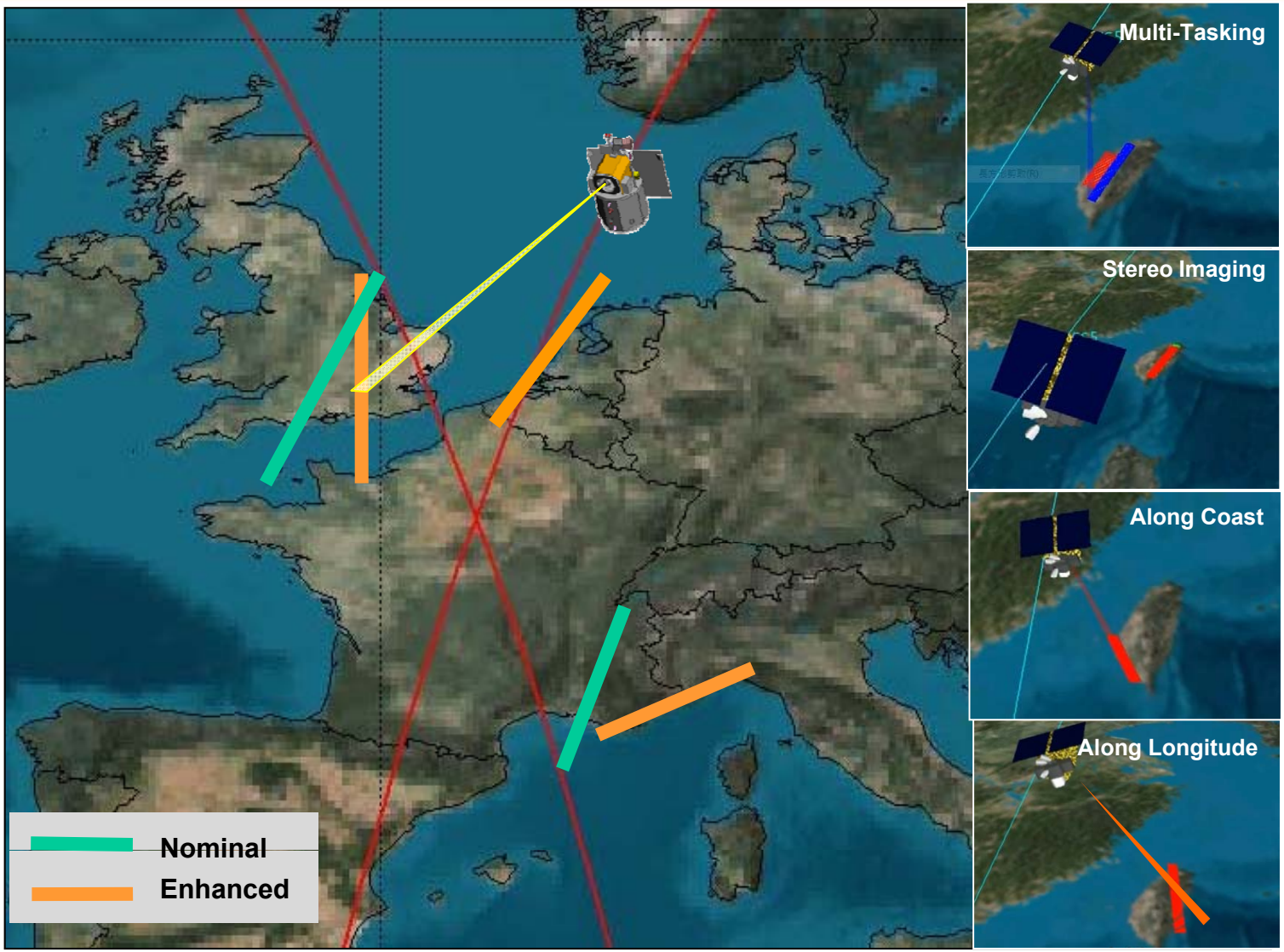

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First HR EO Satellite Utilizing CIS

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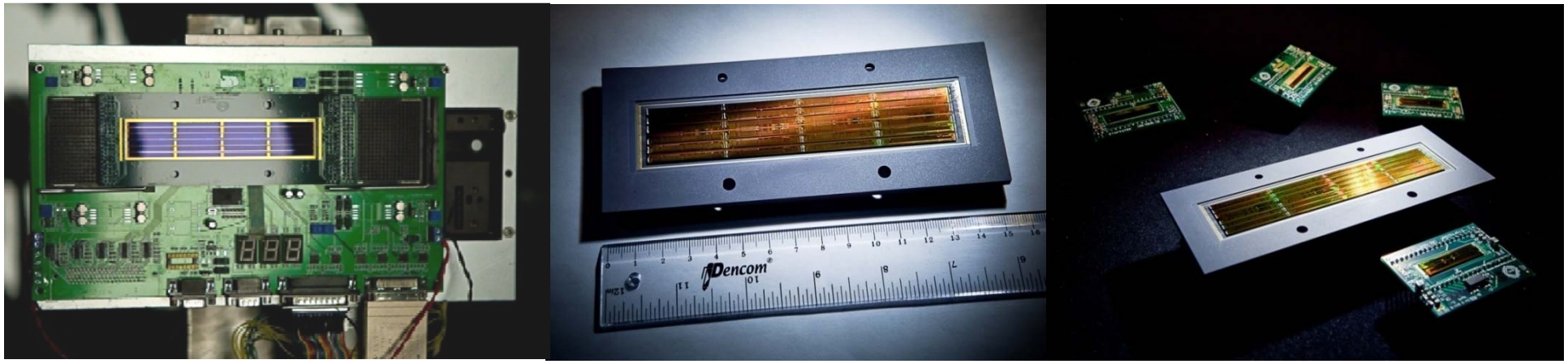
- Largest CMOS Single Chip in the World
  - 12 cm x 2.4 cm chip
  - PAN+4 MS bands
  - 12,000 10μm pixels (PAN); 6,000 20μm pixels (MS)
- FORMOSAT-5 will become the first high-resolution EO satellite utilizing CMOS-type image sensor.



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Highlights on FORMOSAT-5

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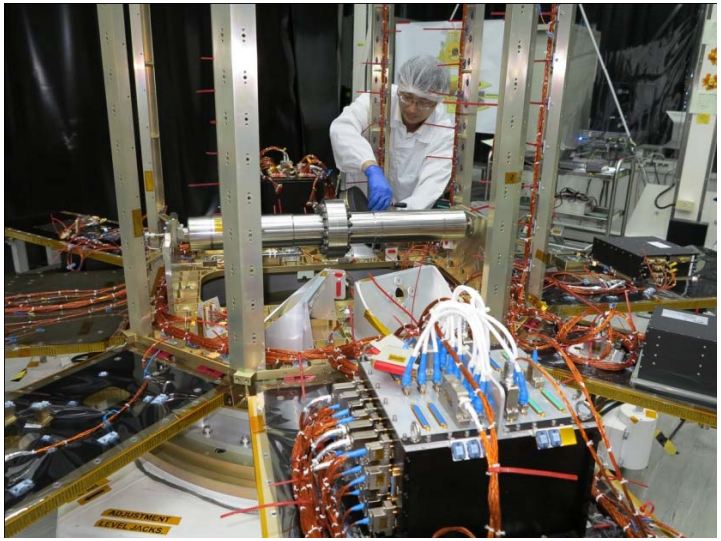

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Highlights on FORMOSAT-5

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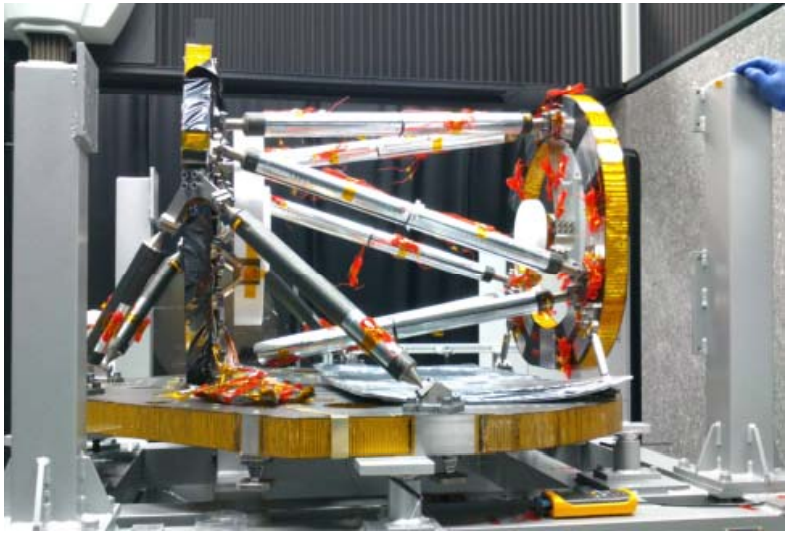

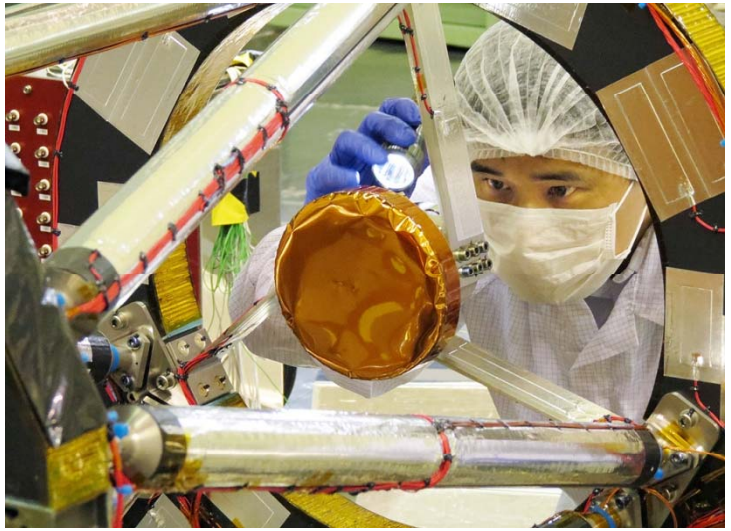

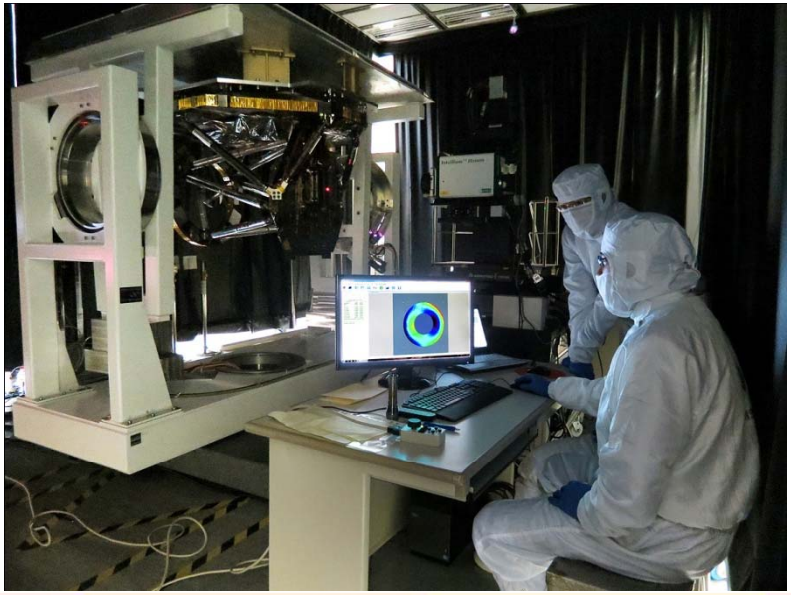

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Educational Outreach

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isprs

information from imagery

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Milestones

- NARL changed her logo in 2013

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NARL 國家實驗研究院 National Applied Research Laboratories

- FORMOSAT-2 is going to be 10 years old in 2014

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NARLabs-NSPO supports to **Sentinel Asia**

NARLabs-NSPO Supports to SA

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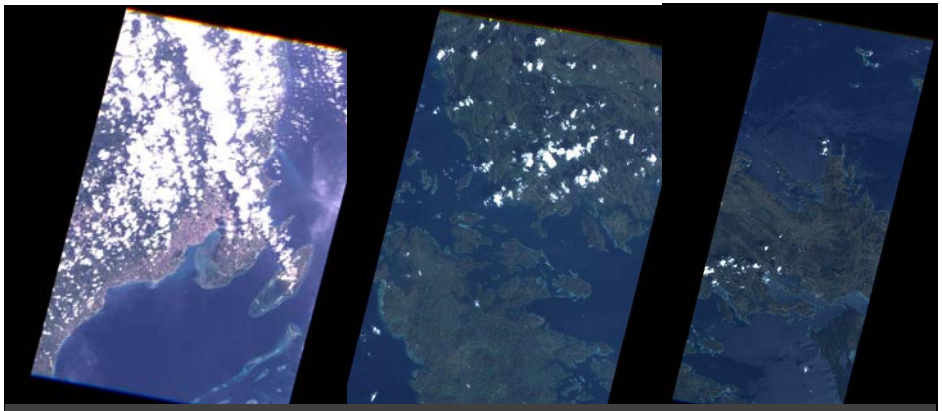
Disaster Type	2010	2011	2012	2013
Earthquake	0	5	3	0
Landslide	2	0	1	3
Tsunami	1	0	0	0
Volcano eruption	2	1	0	1
Flood	5	16	4	5
Flash flood	2	3	0	2
Others	1	0	7	2
Total	13	25	15	13

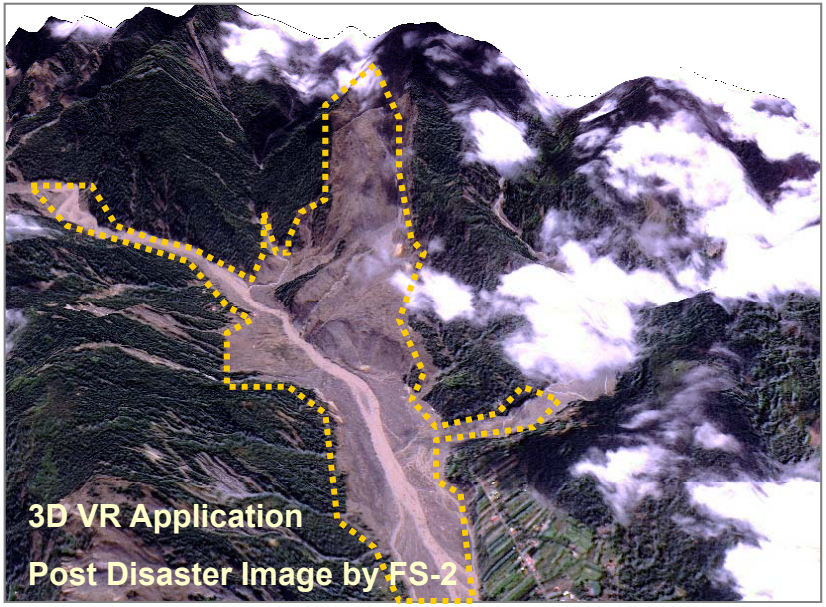


FS-2 Images on 11/13, 17, 18 after Haiyan Hit the Philippines

SENTINEL ASIA Sentinel Asia

Environmental Monitoring for Asia

Is being proposed to contribute to Platform for Image and Applications Services under SA umbrella



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Sentinel Asia Step3

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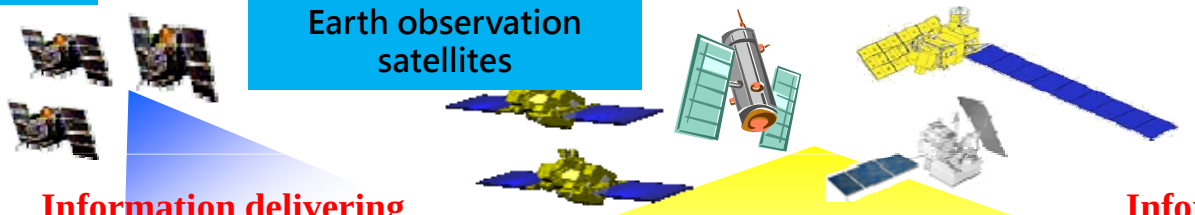
Positioning satellites

Earth observation satellites

Communication satellites



Information delivering to personal terminals

Monitoring

Information/data transmission

Pre-disaster

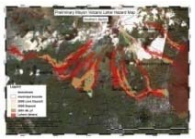
Mitigation:

-Community education

Preparedness:

-Hazard map

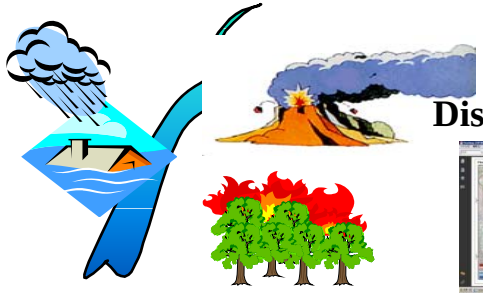
-Early warning system



Just after disaster

Response:

-Emergency observation



Disaster information

Post-disaster

Recovery:

-Monitoring

Working Group

Wildfire
Flood
Glacier
Tsunami

Information sharing
(Web-GIS)

Human network
Capacity Building, Outreach

Kaku, K. (2013), Sentinel Asia [PowerPoint slides]

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SA Implementation

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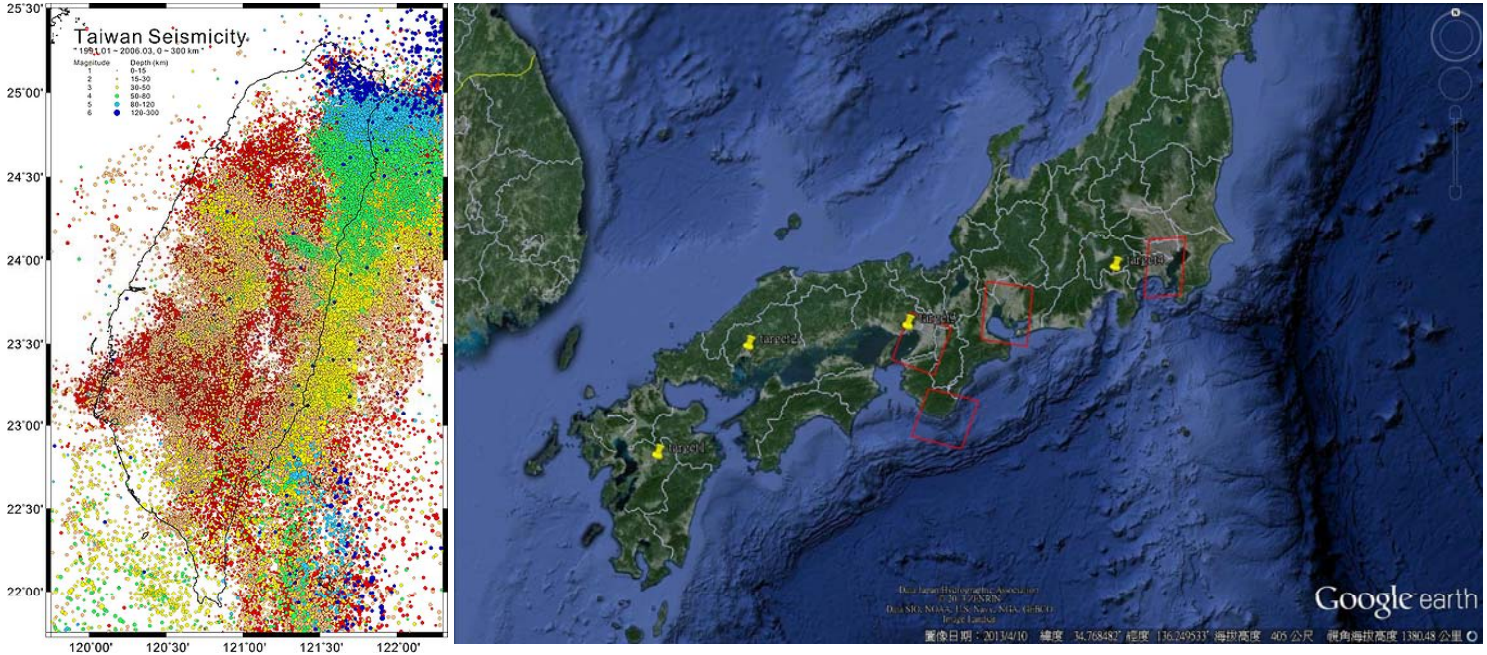
- In SA Step 3, proposing to extend observation supports by continuous monitoring by multi-sensors, incl. FORMOSAT-2
- For pre-identified disaster prone areas
- Optical/Radar image data fusion



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SA Collaboration Framework

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FORMOSAT-2

Non-Japan User

Down link

Command

Existing framework
New Observation Data (in emergency) ; Standard P
Emergency Observation Request (in emergency)
Non Emergency Observation Request

FS-2 data for SA users

SENTINEL ASIA

Sentinel Asia Step3 Collaboration Framework

Mirror Site

Japan User
(Non-disaster User)

Partners

GIS. FCU

Industrial Technology Research Institute
工業技術研究院

FS2 Image Data Center

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NSPO

Processing Level 1A Data

RESTEC

Processing & Ortho rectification for Japan – Ortho data

NCHC

AIST

Environment Monitoring Application based on Formosat Japan Dataset

- Japan Dataset
- Optical and Radar Data Fusion

Partners

National Institute of Advanced Industrial Science and Technology AIST

TOKAI UNIVERSITY

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FORMOSAT-2 Disaster Response

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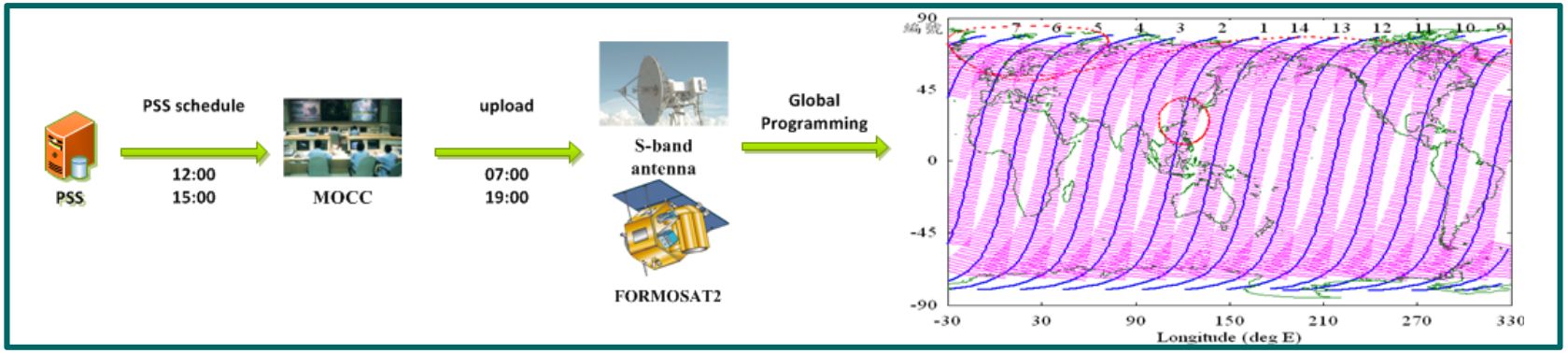

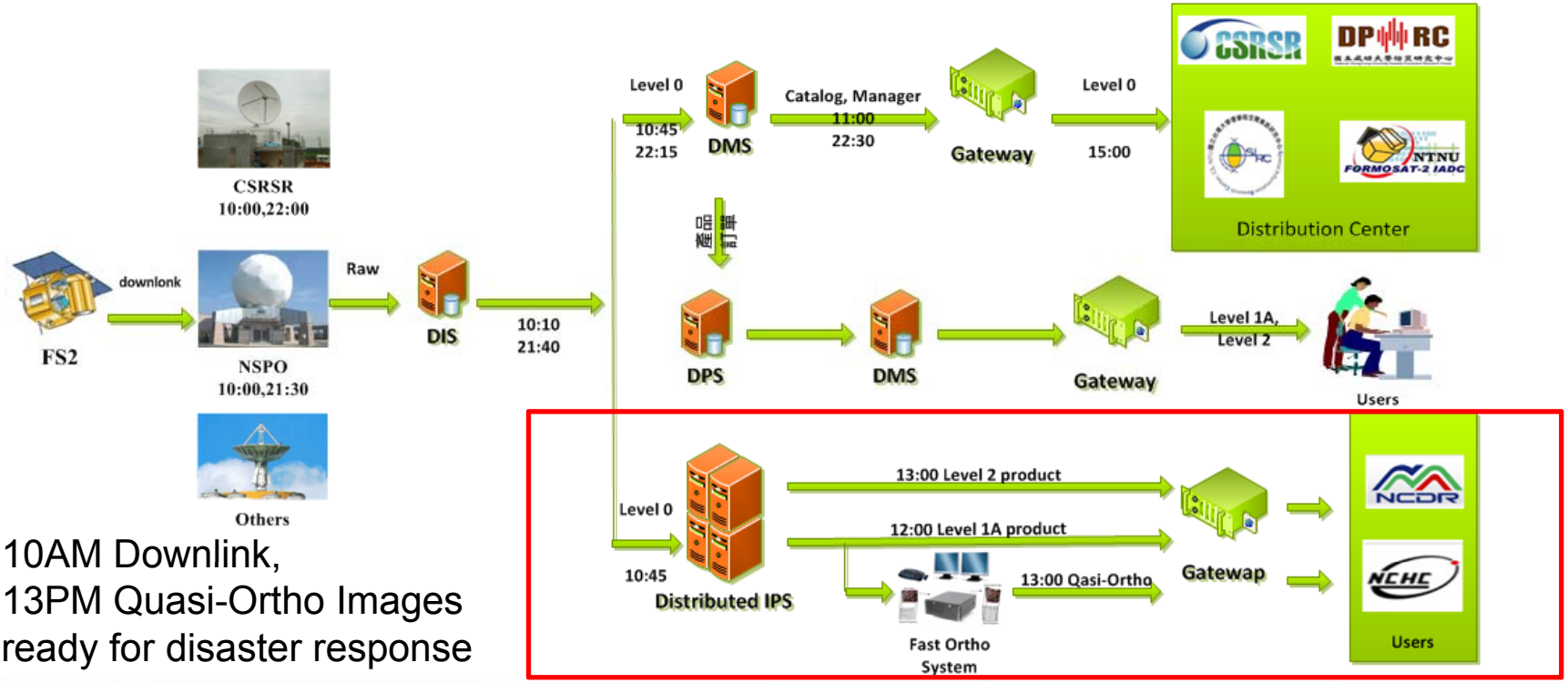

10AM Downlink,
13PM Quasi-Ortho Images
ready for disaster response

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Multi-sensor Scheduling

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- **OGC EO-SPS (Sensor Planning Service) implementation**
- **To improve response performance**

User schedules satellite tasking through SPS I/F

SPS provides detailed info of each tasking (such as maneuver time, viewing angle) for user to understand how the satellite resources are used

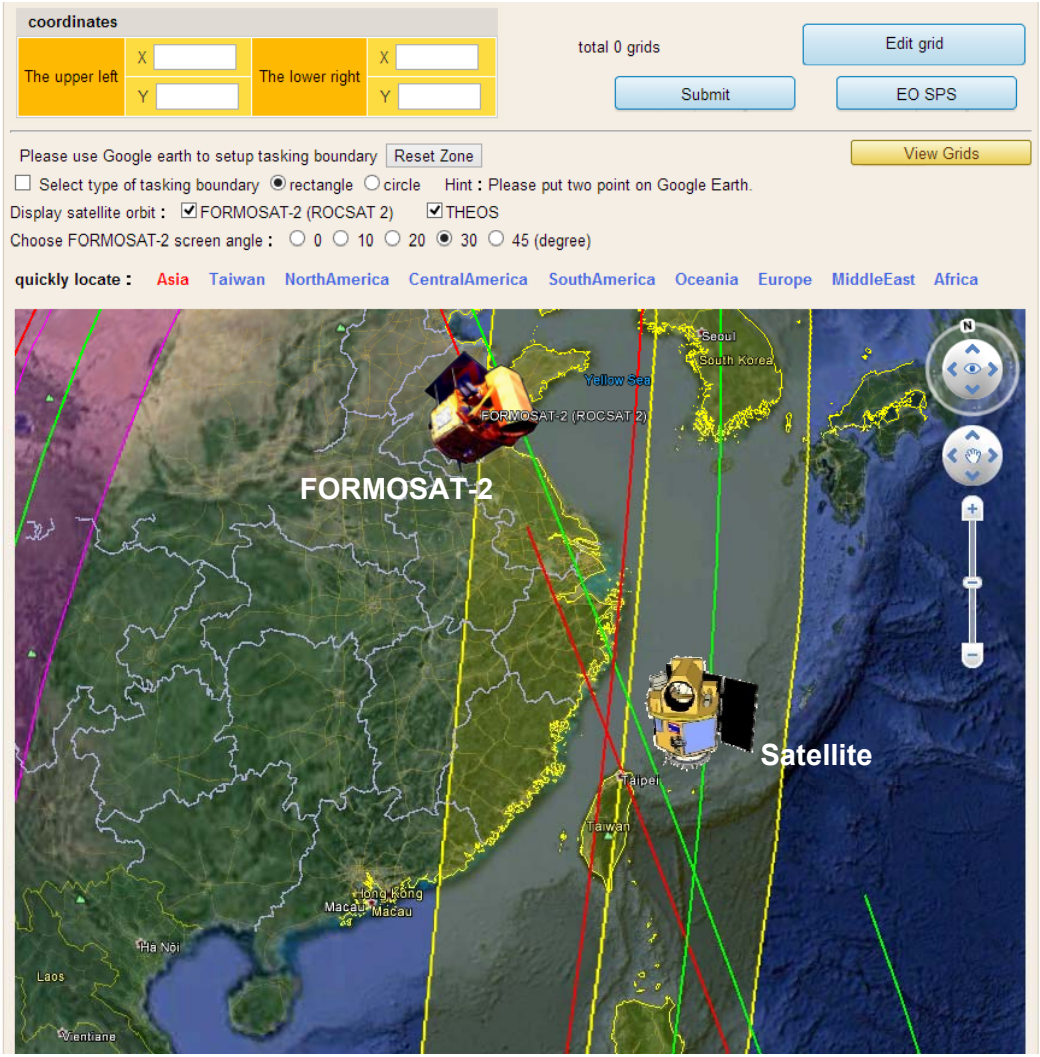

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Image Processing System

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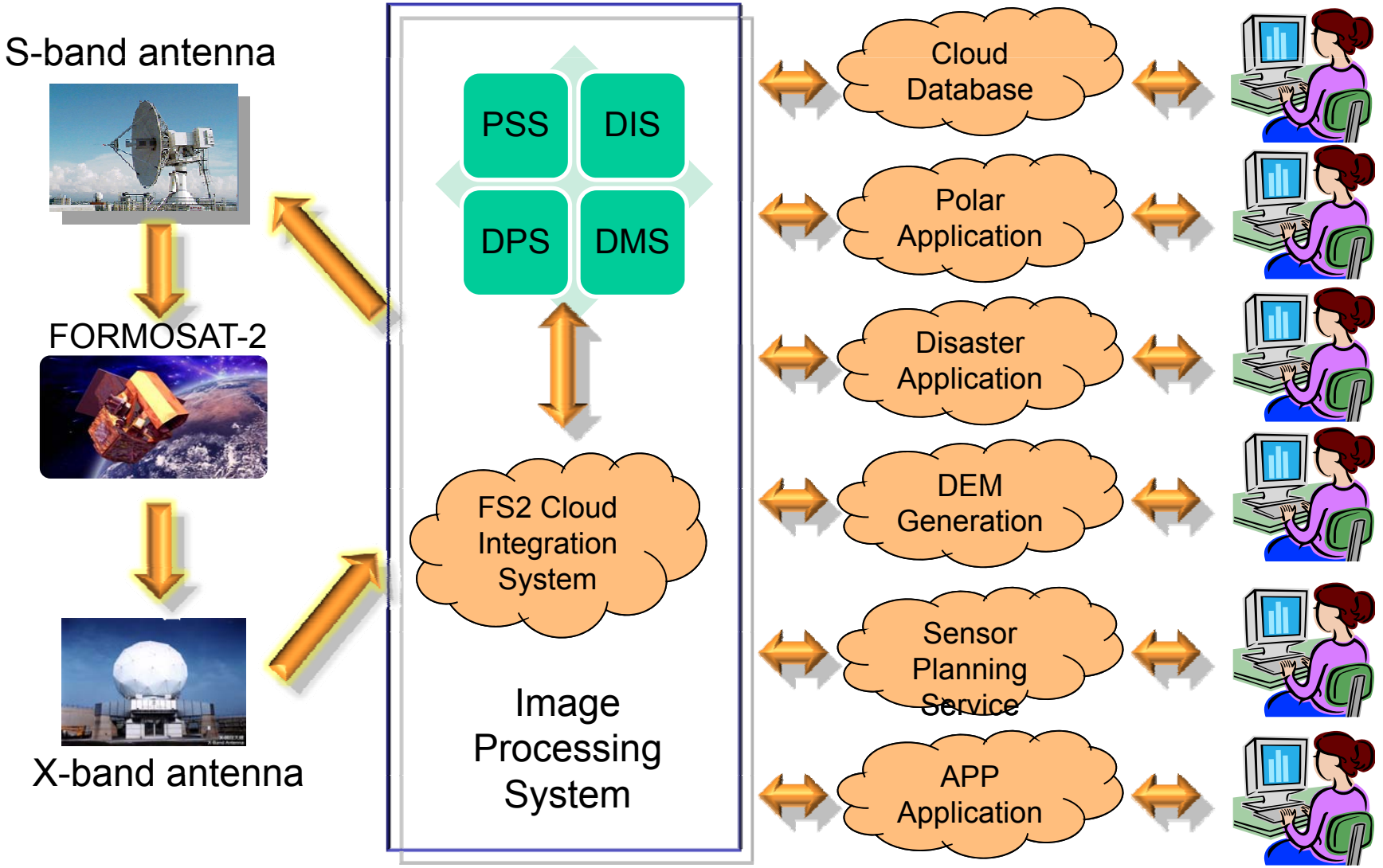

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System Automation

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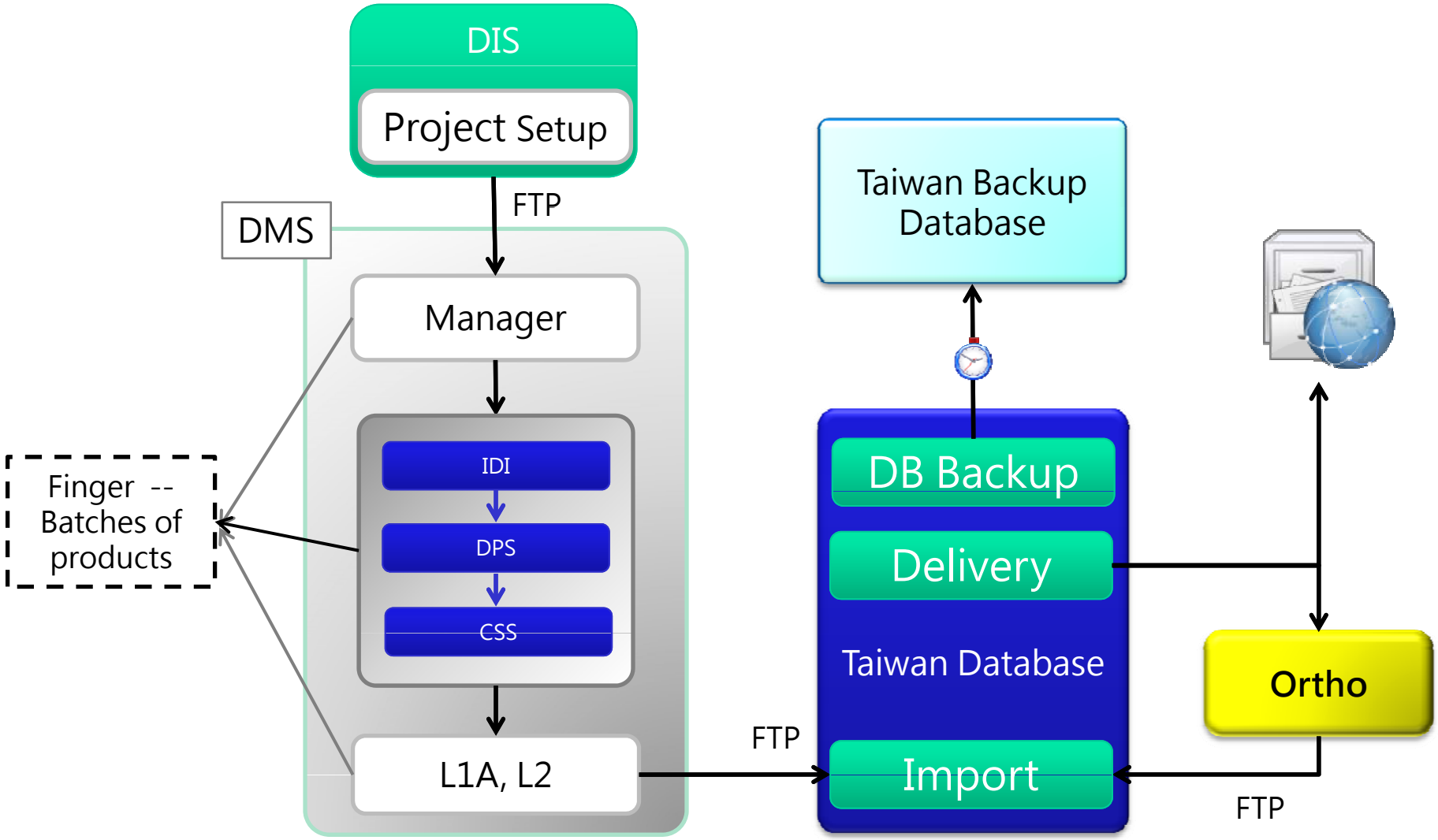

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Disaster Response Mobile Platform

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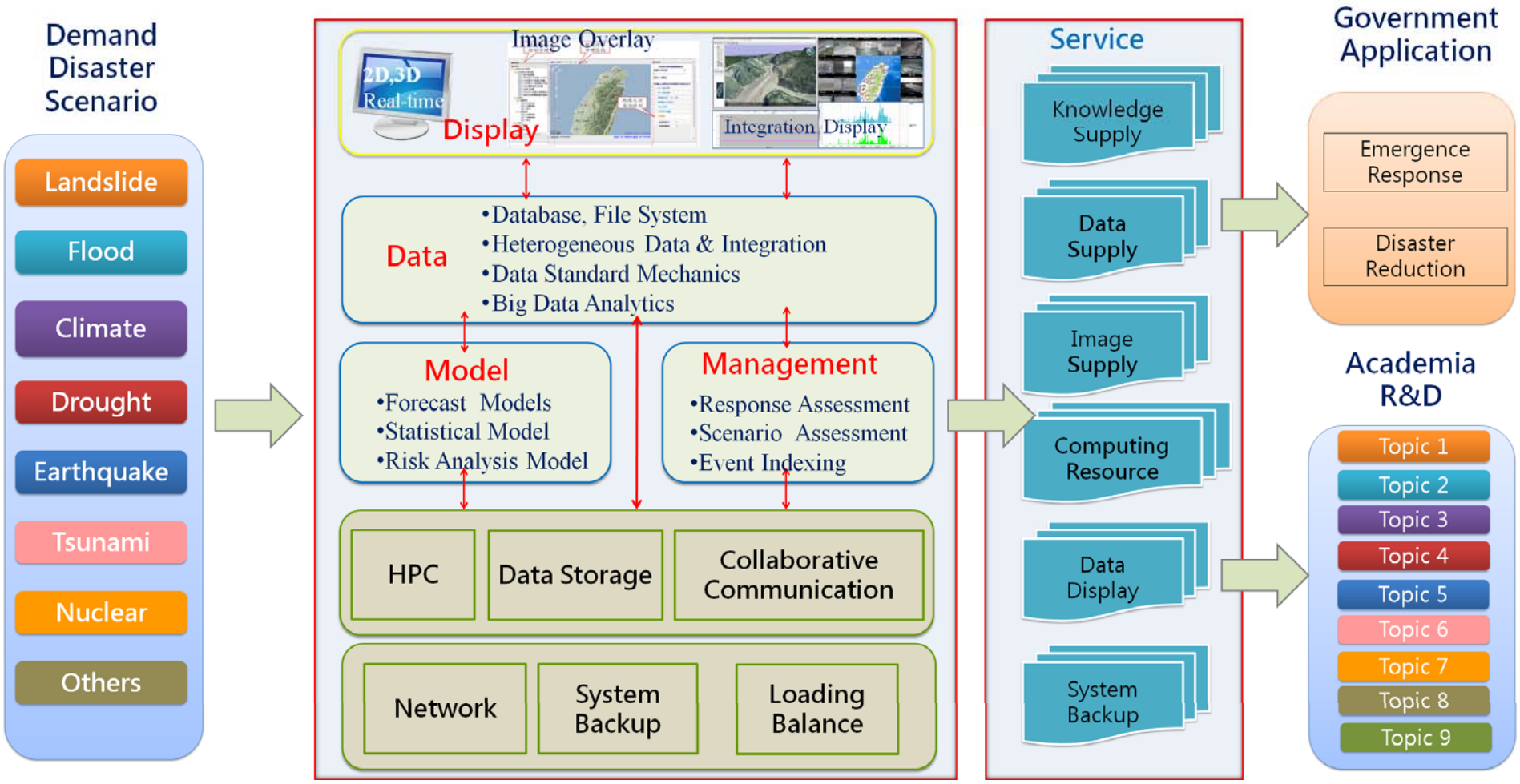
Disaster Management Information Platform

■ Scenario based Data-Model-Display-Management



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Concluding Remarks

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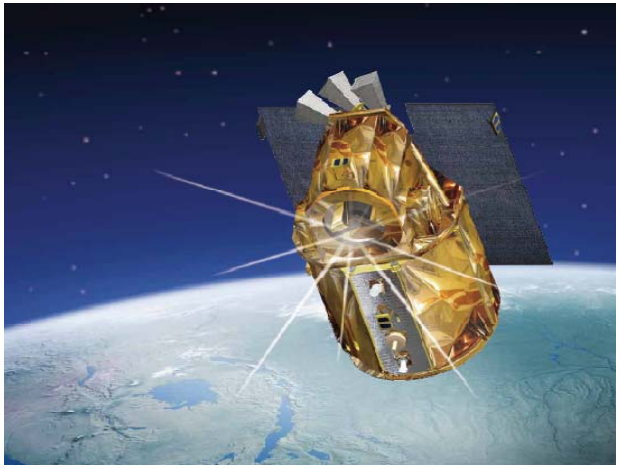
- NARLabs is committed to pursue a center of excellence and innovation for environmental observation and disaster mitigation/reduction technology
- NSPO to become one of the major contributors of the global space community by providing significant societal impacts, especially in supporting the Sentinel Asia
  - FORMOSAT satellites



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