



National SPace Organization

A center of innovation and excellence for space technology

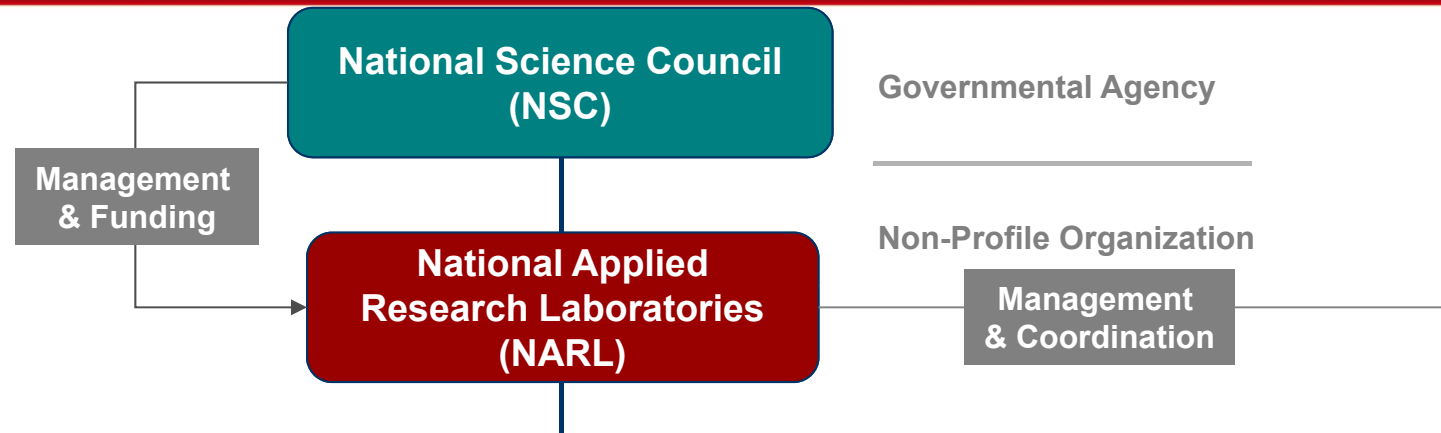
Ming-Chih Cheng

National Space Organization

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

www.narlabs.org.tw

Organization



**Earth sciences and environmental/
disaster mitigation technology**

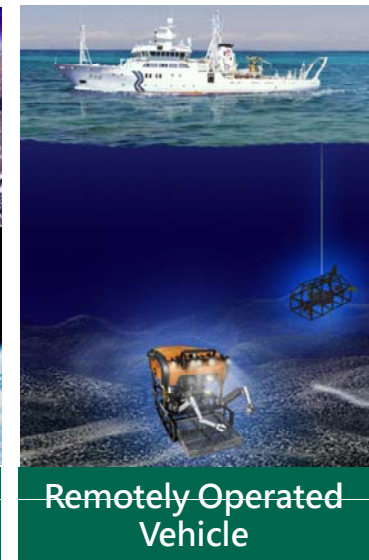
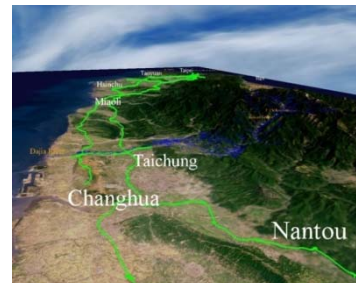
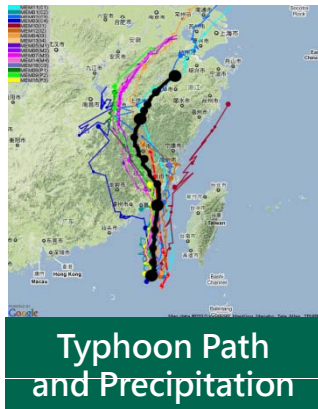
**Electronics,
information, communications**

Biomedical technology

NAR Labs Synergy in Disaster Reduction

NAR Labs
Commitment · Passion · Innovation

- Synergize capability & capacity within NAR Labs (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





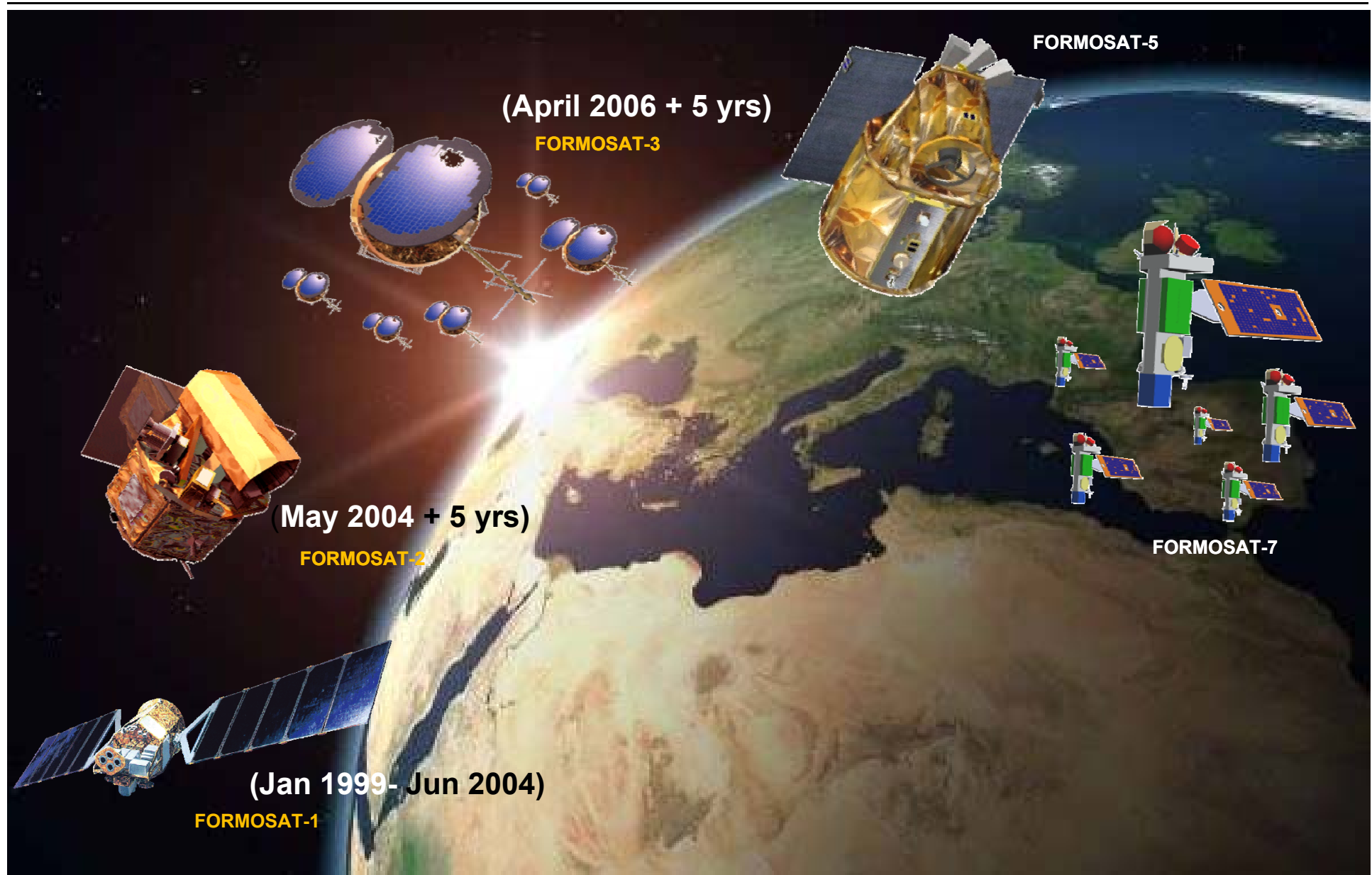
NAR Labs

承諾 · 熱情 · 創新

Satellite Programs

FORMOSAT Programs

NARLabs



NSPO Mid-term Plan



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

2016
1st Set Launch

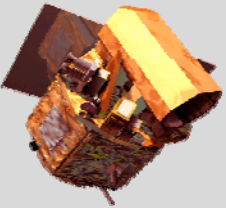


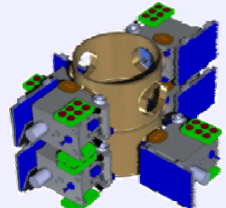



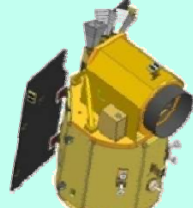

FORMOSAT-7

2018
2nd Set Launch

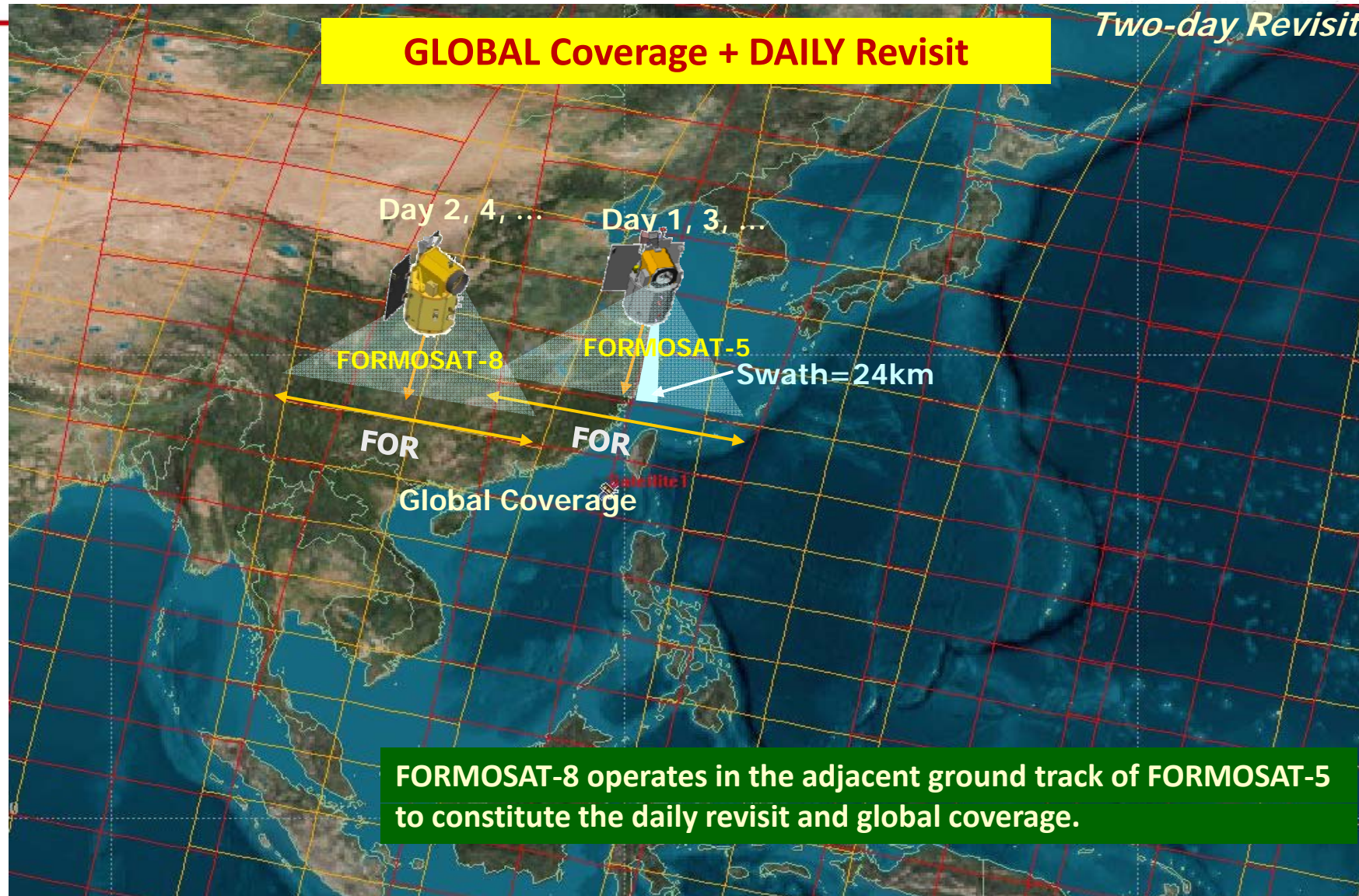
Atmospheric Soundings

- Weather Predication
- Climate Research
- Space Weather

Looking Forward

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

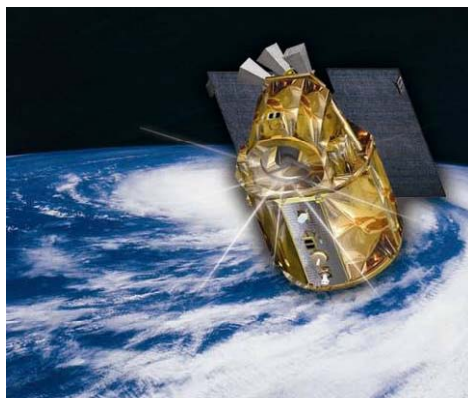
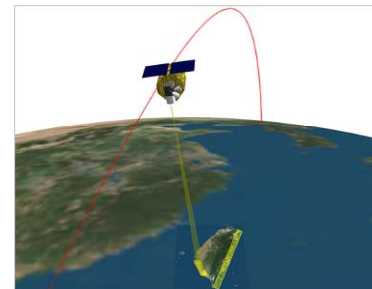
Formosat-5 & 8 Constellation



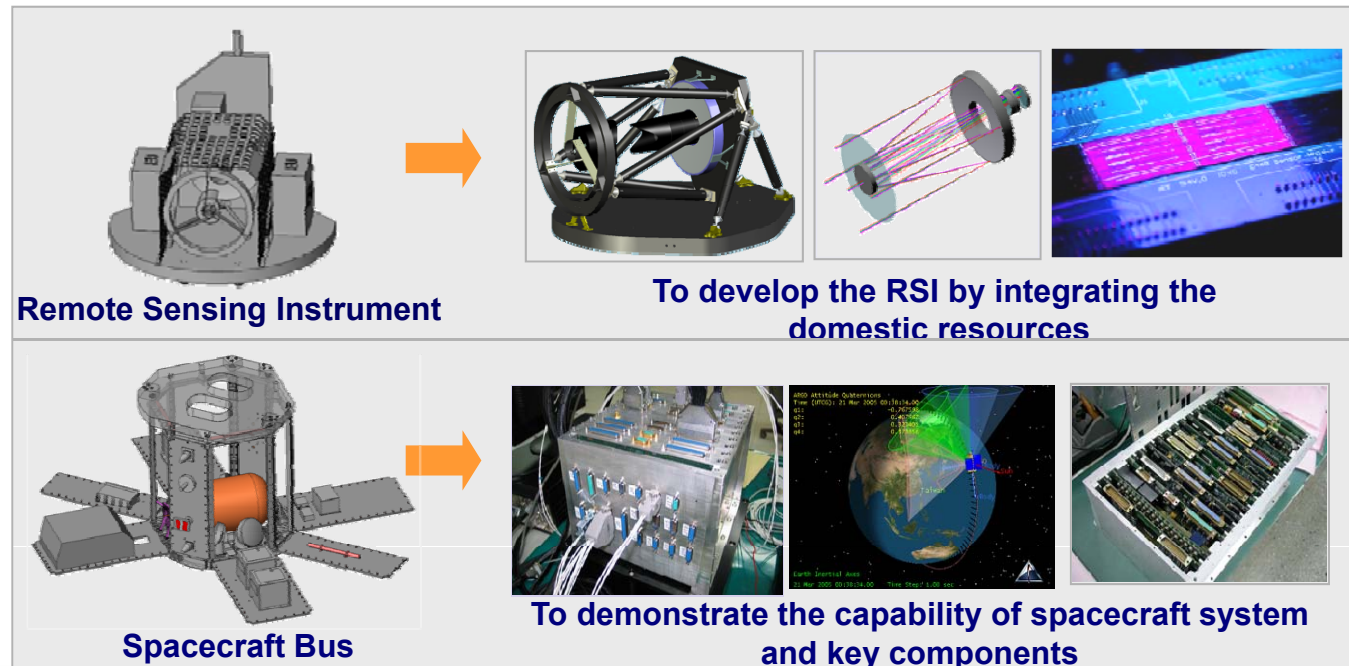
FORMOSAT-5 Program

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)



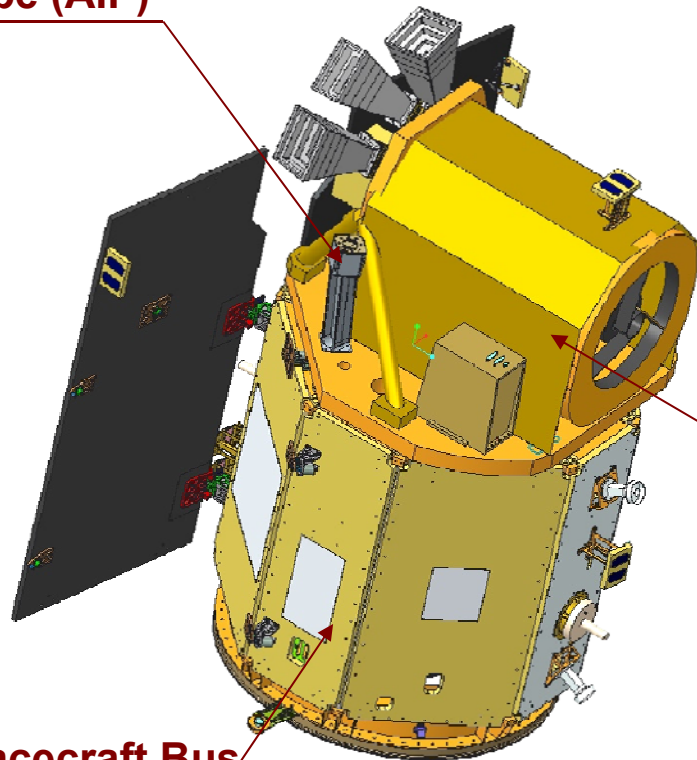
The Key System Specification



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

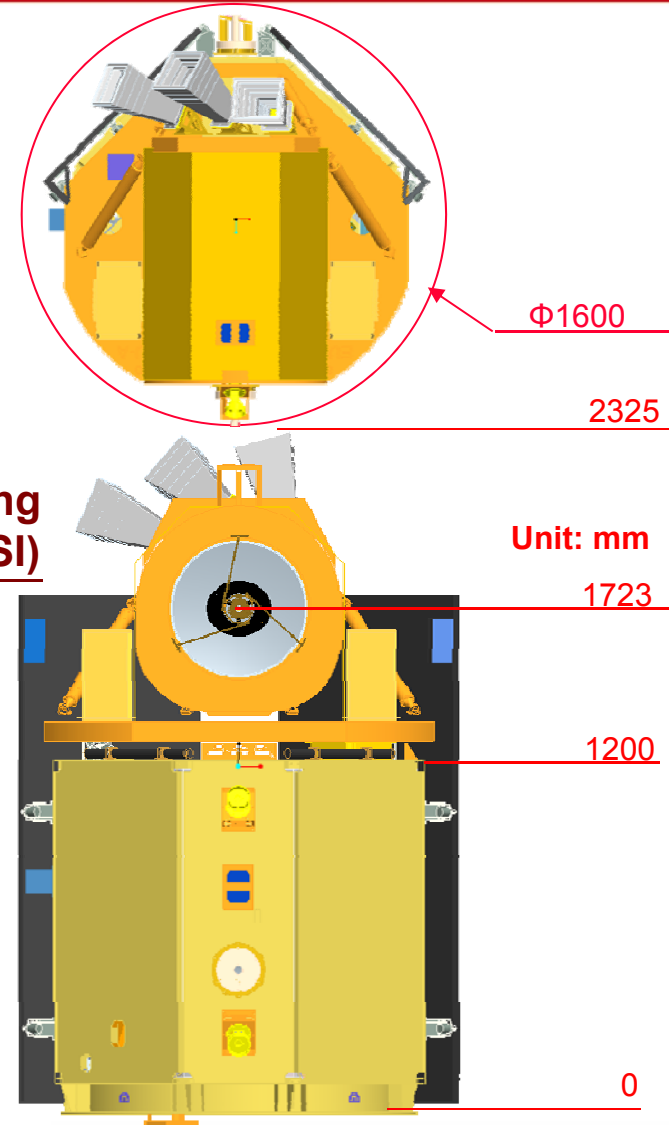
FORMOSAT-5 Configuration

Advanced Ionospheric Probe (AIP)

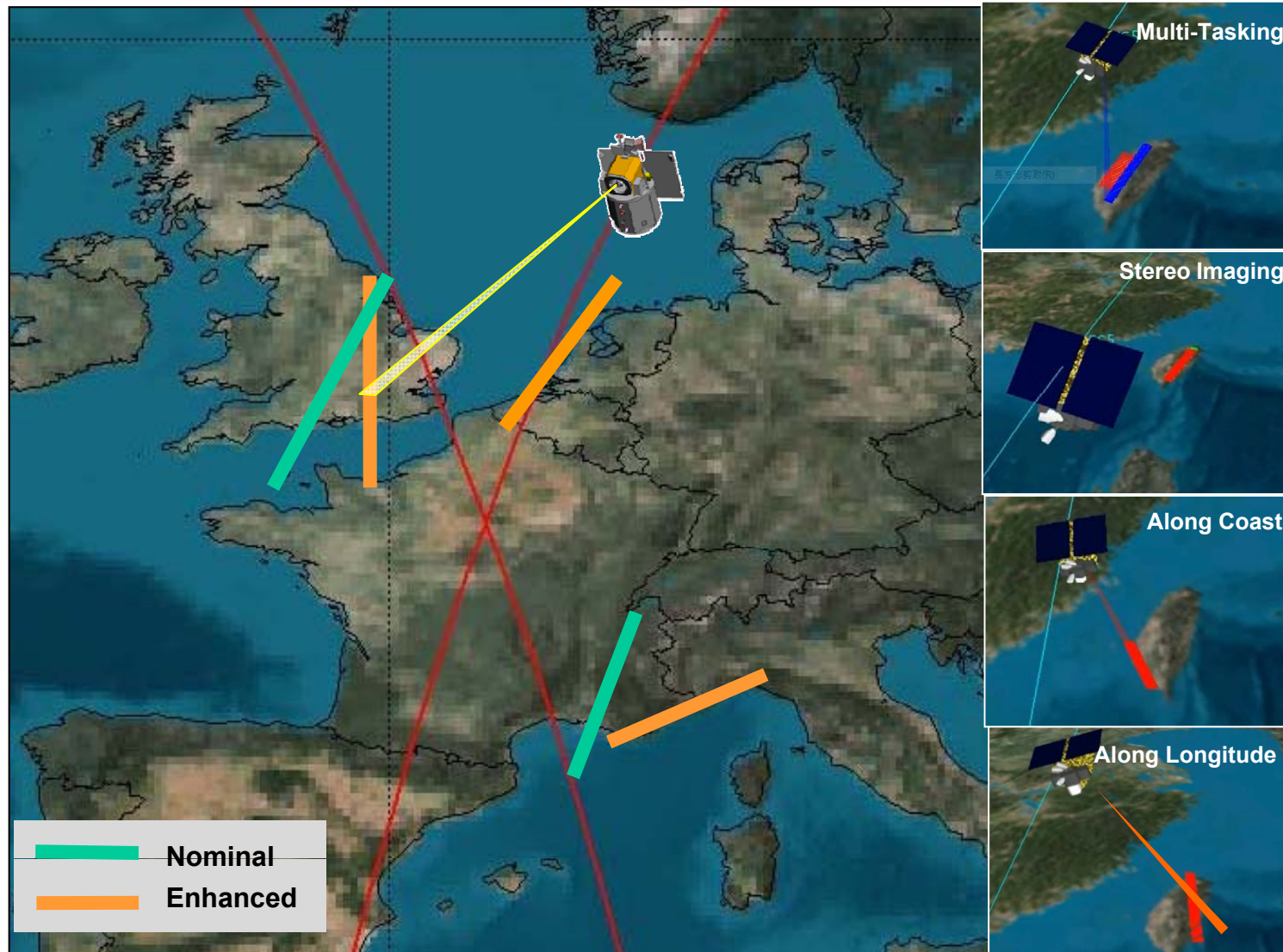


Spacecraft Bus

Remote Sensing Instrument (RSI)

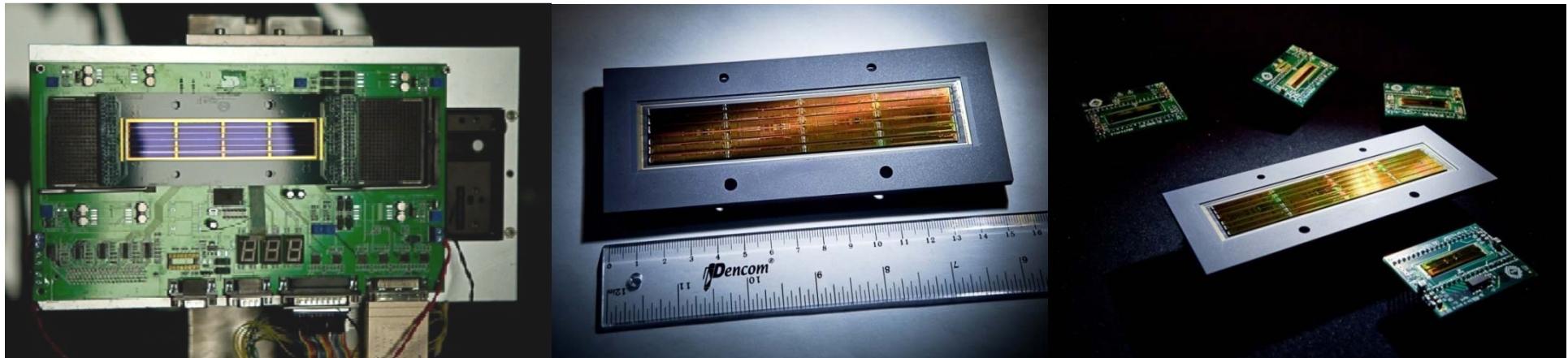


Smart Agility Capability



First HR EO Satellite Utilizing CIS

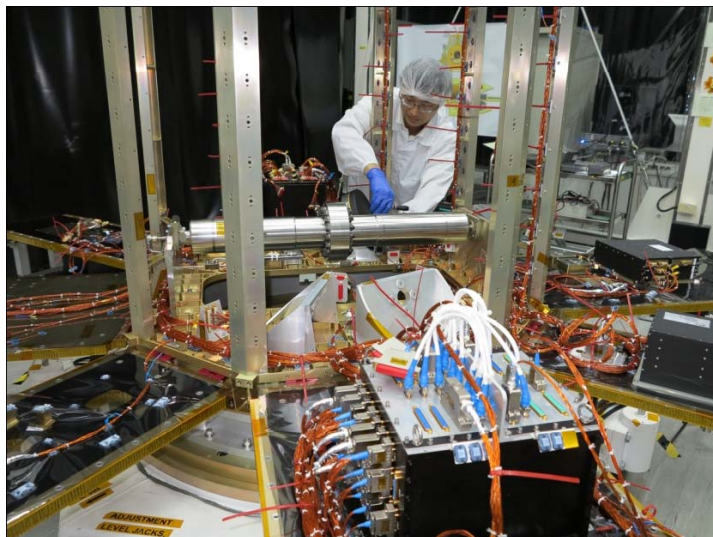
- Largest CMOS Single Chip in the World
 - 12 cm x 2.4 cm chip
 - PAN+4 MS bands
 - 12,000 10 μ m pixels (PAN); 6,000 20 μ m pixels (MS)
- FORMOSAT-5 will become the first high-resolution EO satellite utilizing CMOS-type image sensor.



Highlights on FORMOSAT-5

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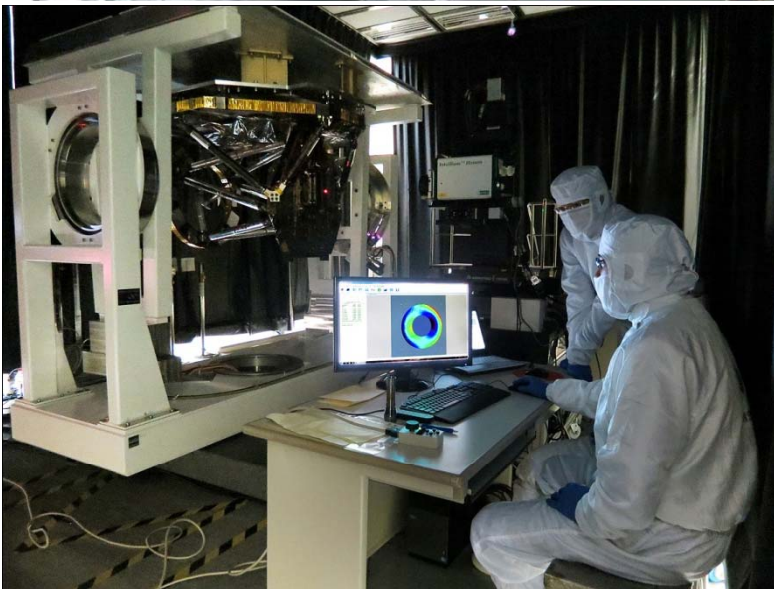
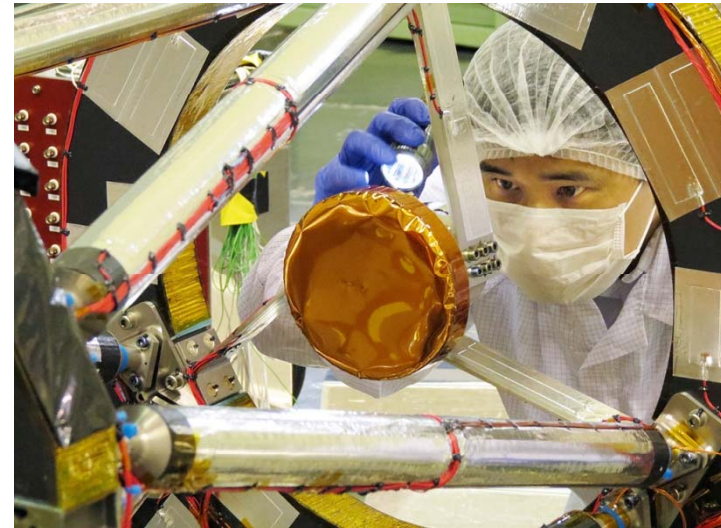
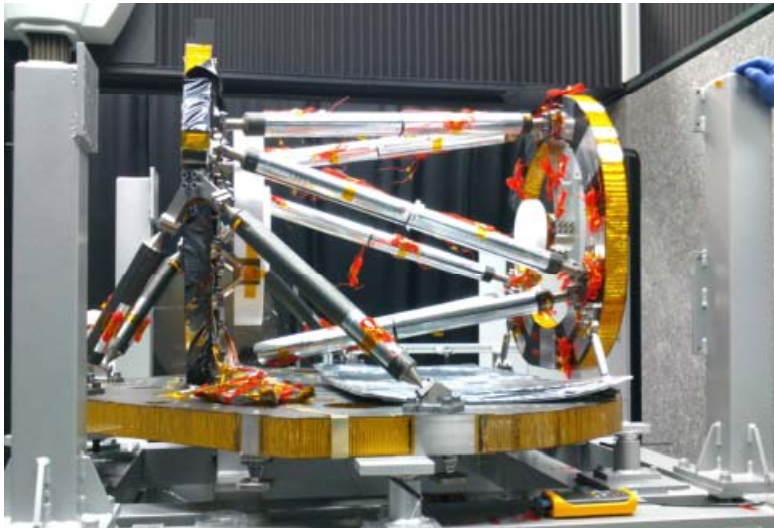
Commitment · Passion · Innovation



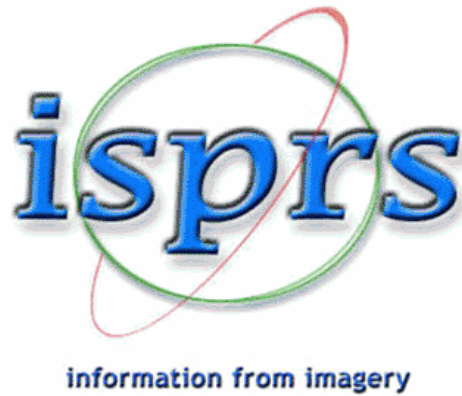
Highlights on FORMOSAT-5

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Educational Outreach



2012 太空科普活動

NSPO

福衛二號衛星影像應用研習營

活動日期: 05/26 - 05/27 (共2天) 人數限制: 30人
 06/02 - 06/03 (共2天) 30人
 參加對象: 高中職 活動費用: 免費
 報名期間: 即日起至05/18止

全國高中職太空科技探索營

活動日期: 07/17-07/20 人數限制: 95人
 參加對象: 高中職 活動費用: 免收
 報名期間: 即日起至05/15止 (海峽兩岸地區)

福衛二號衛星影像地理應用小論文競賽

活動日期: 9月中旬 報名期間: 08/01-08/15
 參加對象: 高中職 活動費用: 免費
 獎勵內容:
 第一名: 壹萬元
 第二名: 壹萬元
 第三名: 伍仟元

2011 高中職應用衛星影像之論文比賽評審會議

相關資訊請向國家太空中心查詢 <http://www.nspo.nar1.org.tw/isseo/>



Milestones

- NARL changed her logo in 2013



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





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NAR Labs-NSPO

supports to

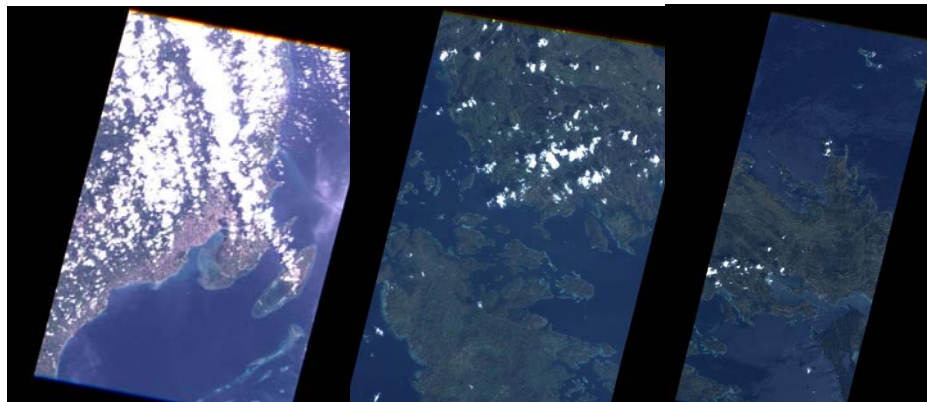
Sentinel Asia

NAR Labs-NSPO Supports to SA

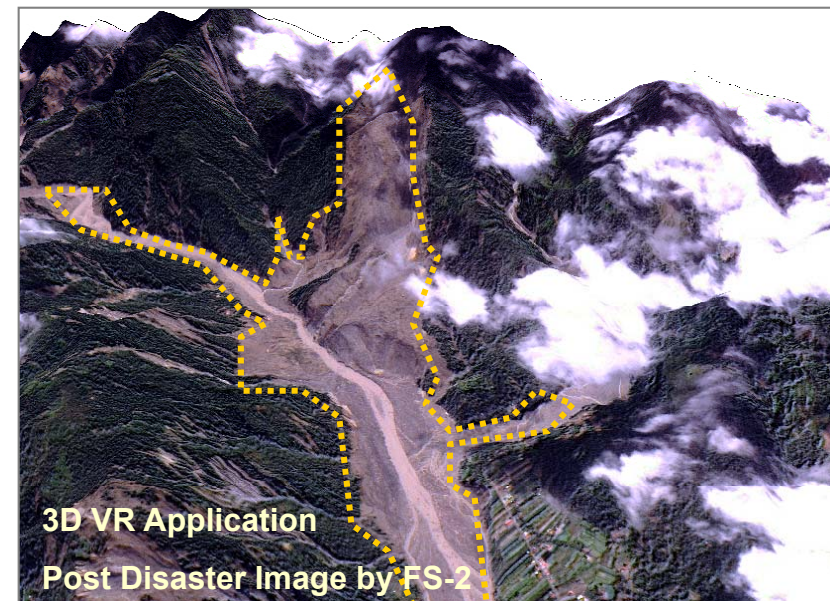
Disaster Type	2010	2011	2012	2013
Earthquake	0	5	3	0
Landslide	2	0	1	3
Tsunami	1	0	0	0
Volcano eruption	2	1	0	1
Flood	5	16	4	5
Flash flood	2	3	0	2
Others	1	0	7	2
Total	13	25	15	13



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



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



3D VR Application

Post Disaster Image by FS-2

Sentinel Asia Step3

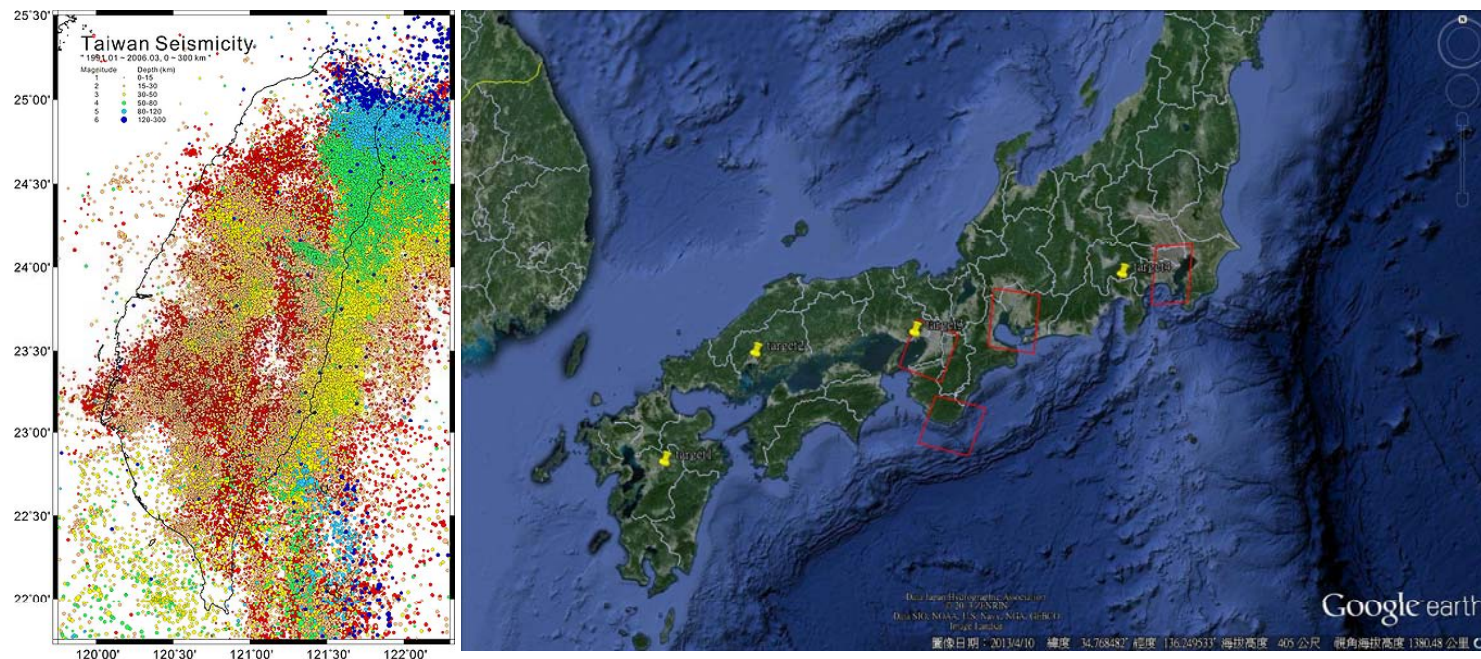
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Kaku, K. (2013), Sentinel Asia [PowerPoint slides]

SA Implementation

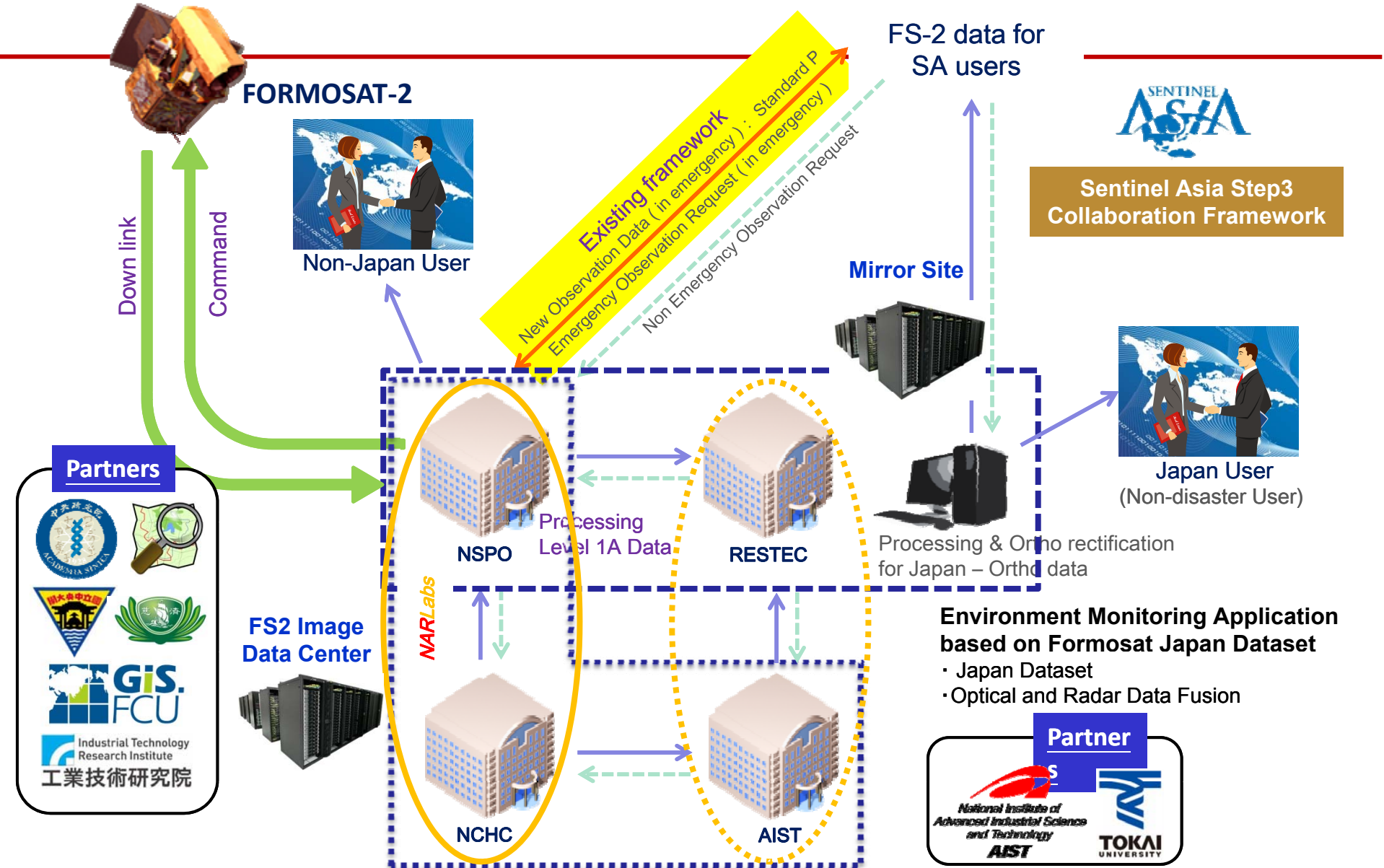
- In SA Step 3, proposing to extend observation supports by continuous monitoring by multi-sensors, incl. FORMOSAT-2
- For pre-identified disaster prone areas
- Optical/Radar image data fusion



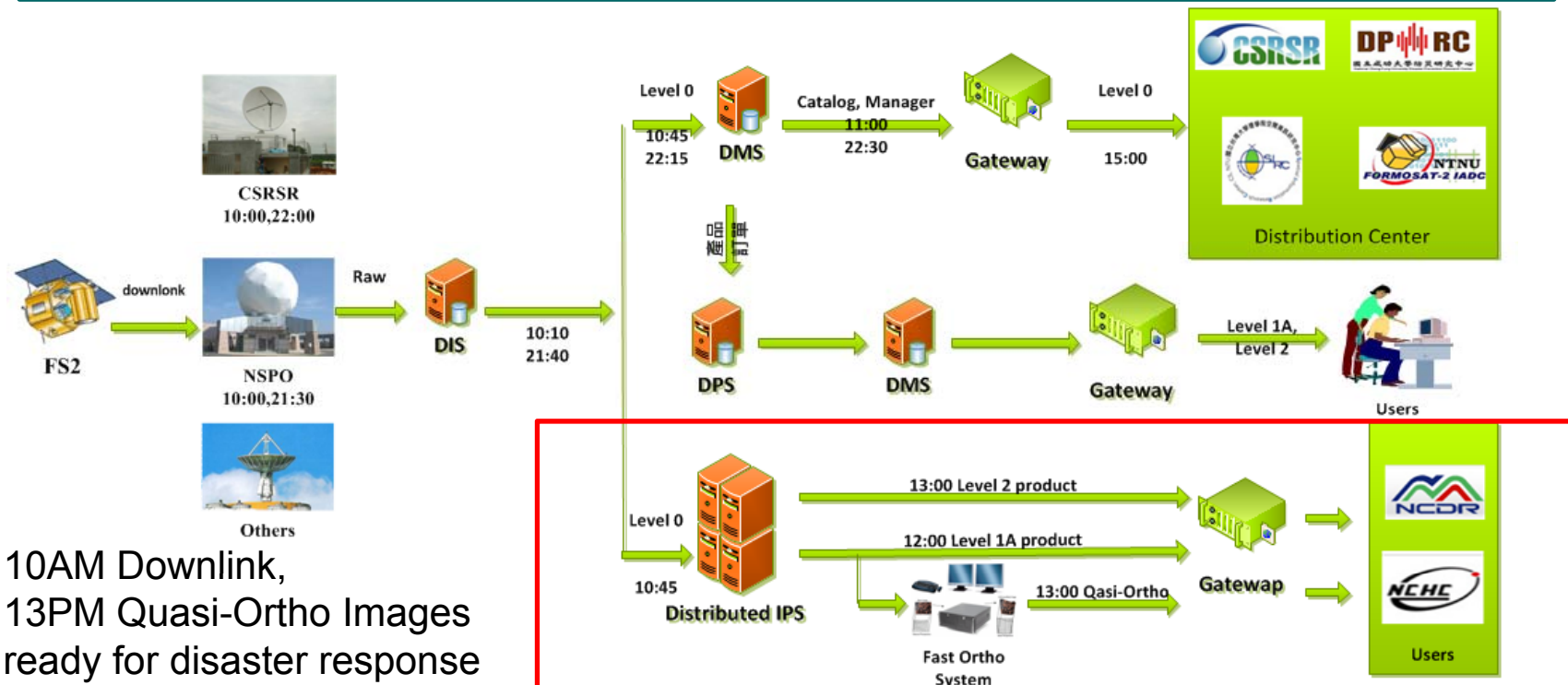
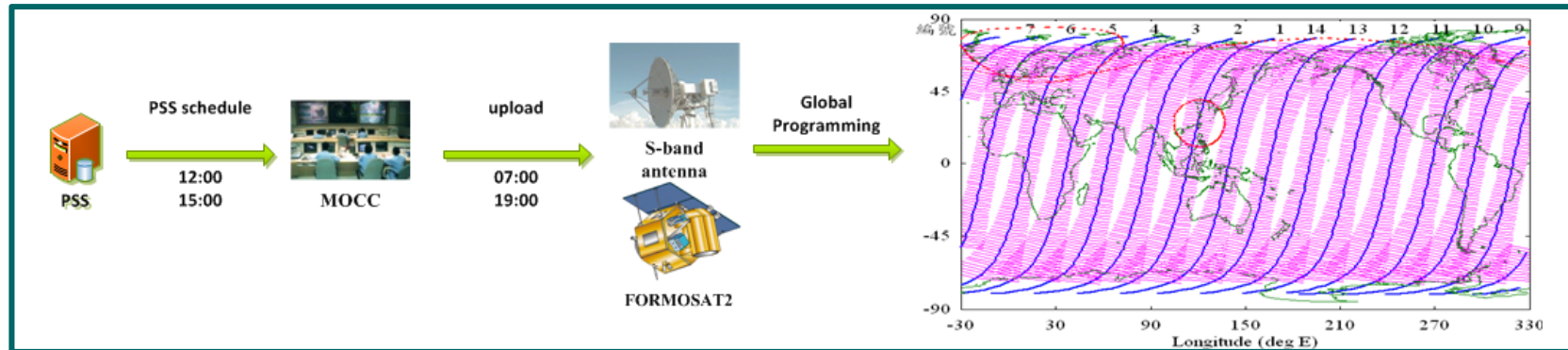
SA Collaboration Framework

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FORMOSAT-2 Disaster Response



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

Multi-sensor Scheduling

- **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

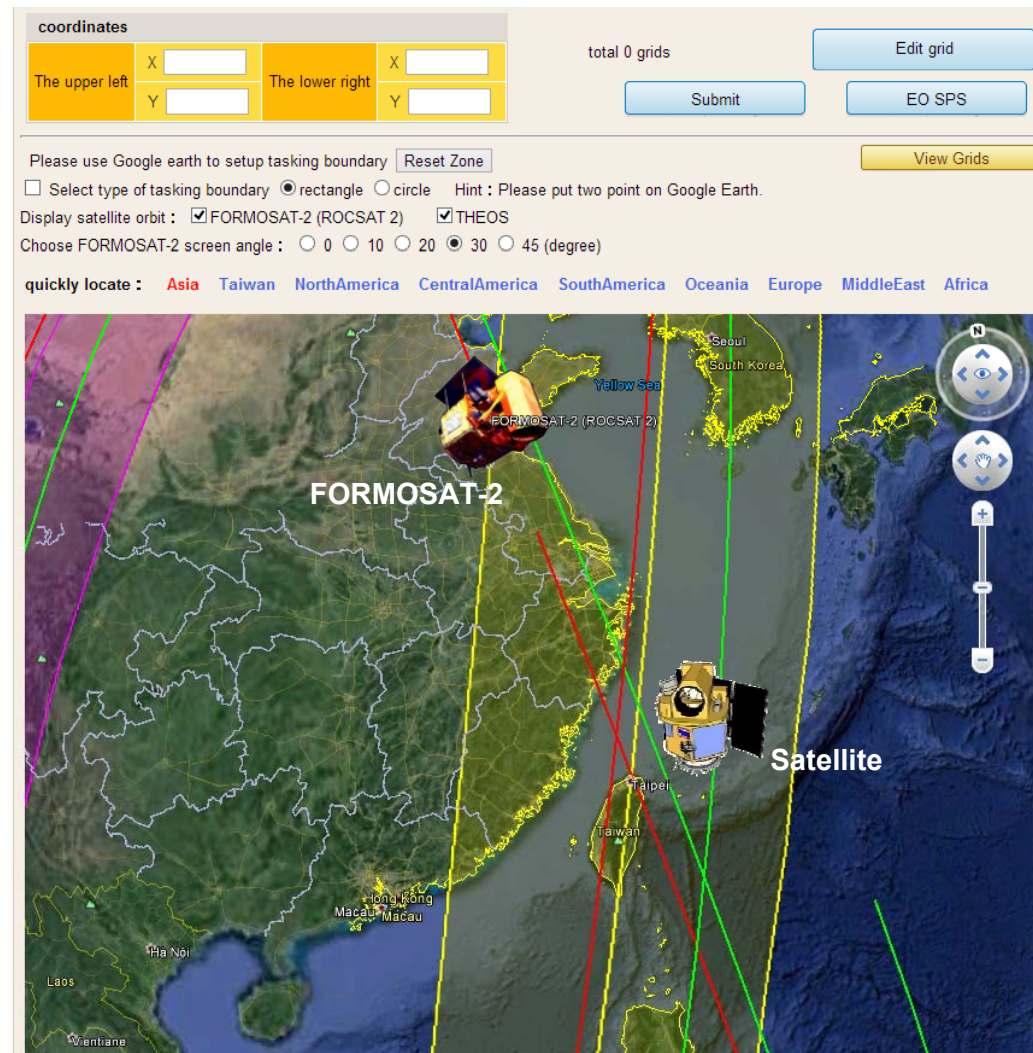
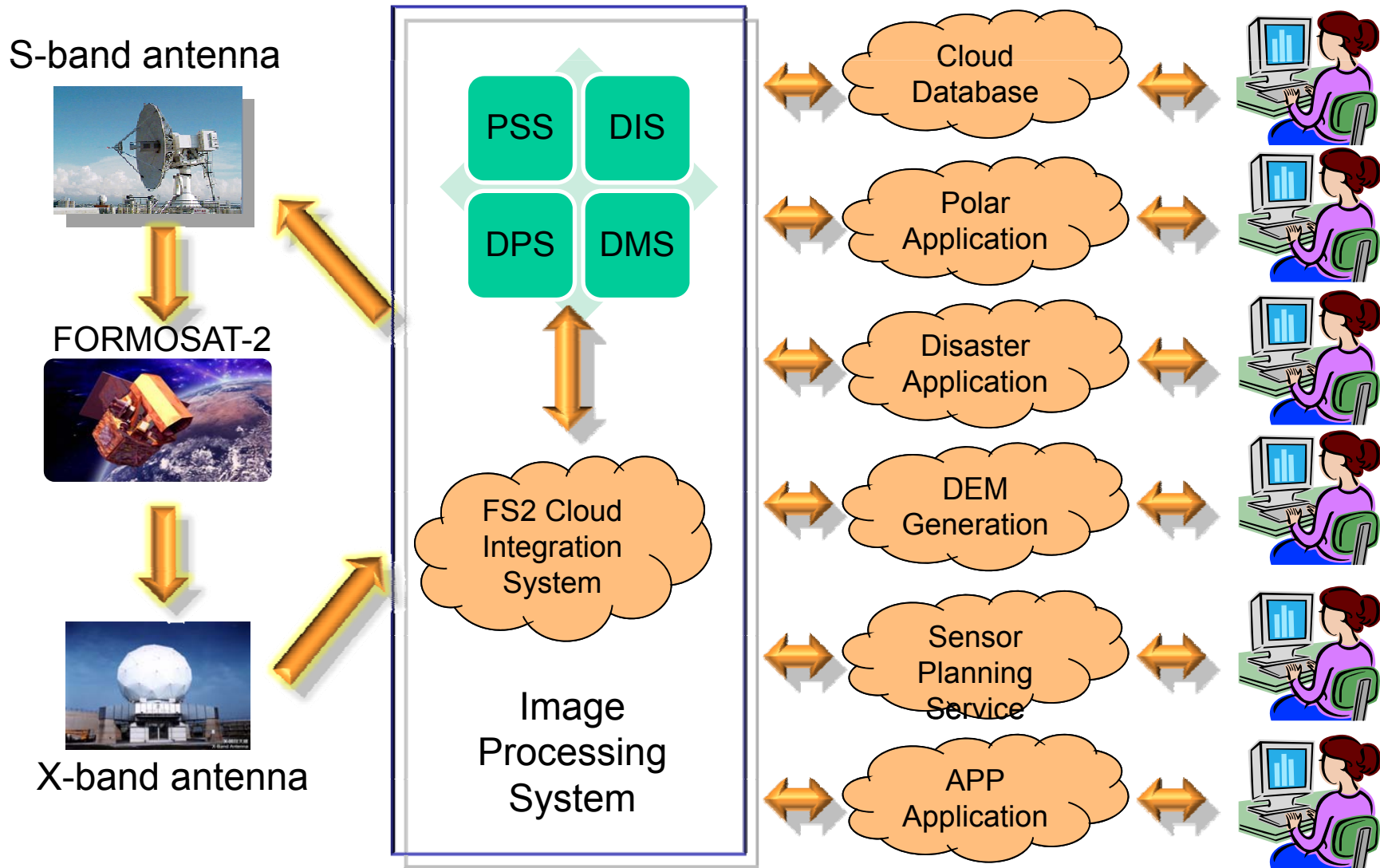
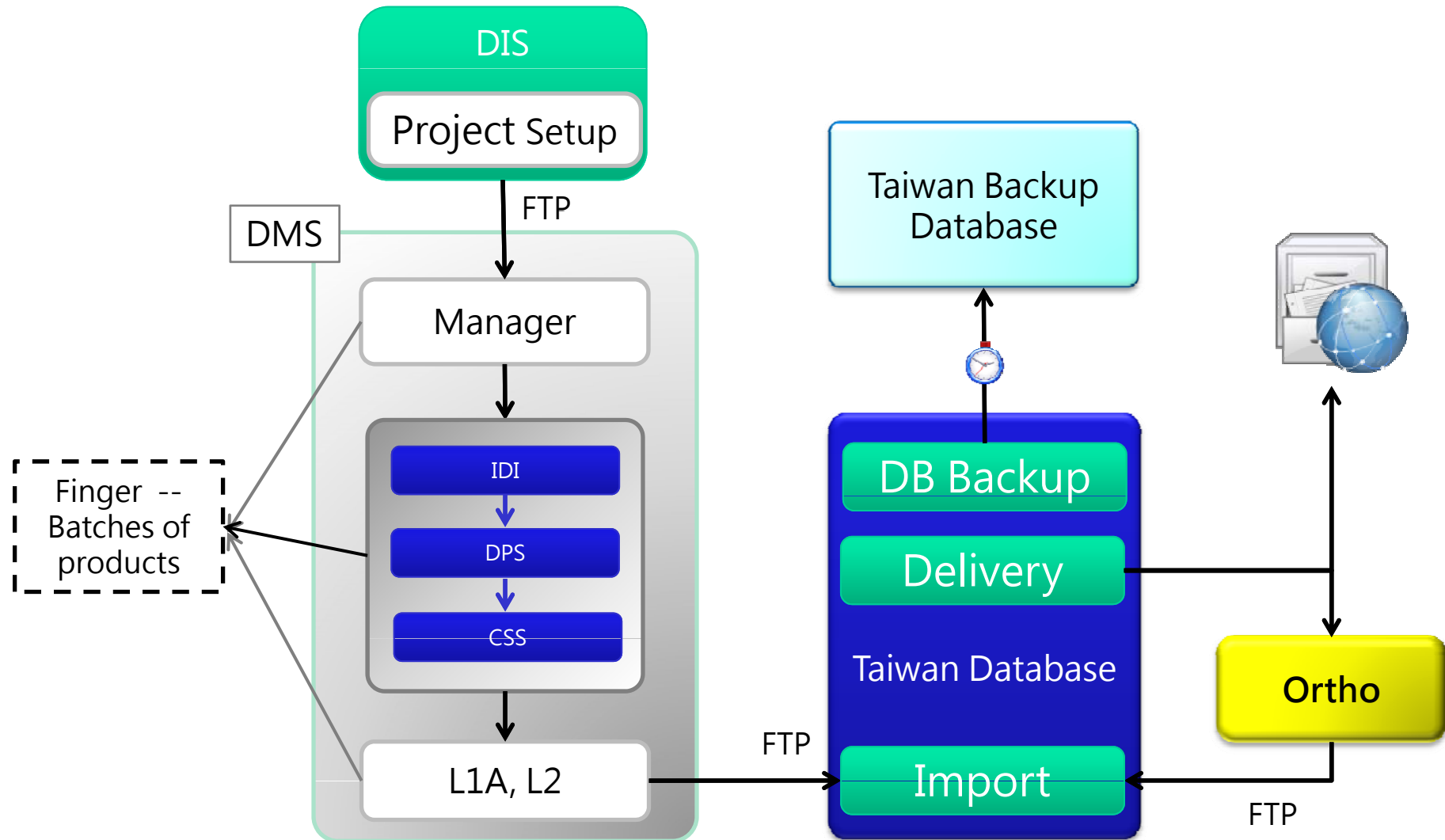


Image Processing System



System Automation



Disaster Response Mobile Platform

Commitment · Passion · Innovation

福衛二號總是第一個出現在災區上空的台灣人，默默地擔任救災急先鋒八年了！

福衛二號

歷久彌新，請繼續守護台灣



福衛二號
福衛二號是台灣首顆自主遙測衛星，是由台灣國家太空中心所研發，於2004年發射升空。由於軌道高度可達到南北極點，為當今世界上唯一可對全球任何地方每天兩次的遙測衛星。具有日再訪能力，每日可對同一地區進行約攝之遙測頻率，對於災區，災情持續觀察與災後復原，能滿足環境監控、國土規劃、土地管理以及時空資訊之緊急救援等多次應用。

逢甲大學GIS中心與國家太空中心及工研院共同發展了福衛二號雲端資料平台，一旦接到災情的通知，便火速飛往災區上空拍照，能夠在24小時內完成基本的影像處理，並經過雲端資料平台供應給Ushahidi及SAHANA志工平台使用，讓災區的實況以最快的方式傳遞出去！



使命：最短時間義務提供災區影像

這是一項極具意義的工作：別人不願做的「義務提供」，我們來做！於災後第一時間拍攝衛星影像，傳至雲端平台上義務提供國際使用！

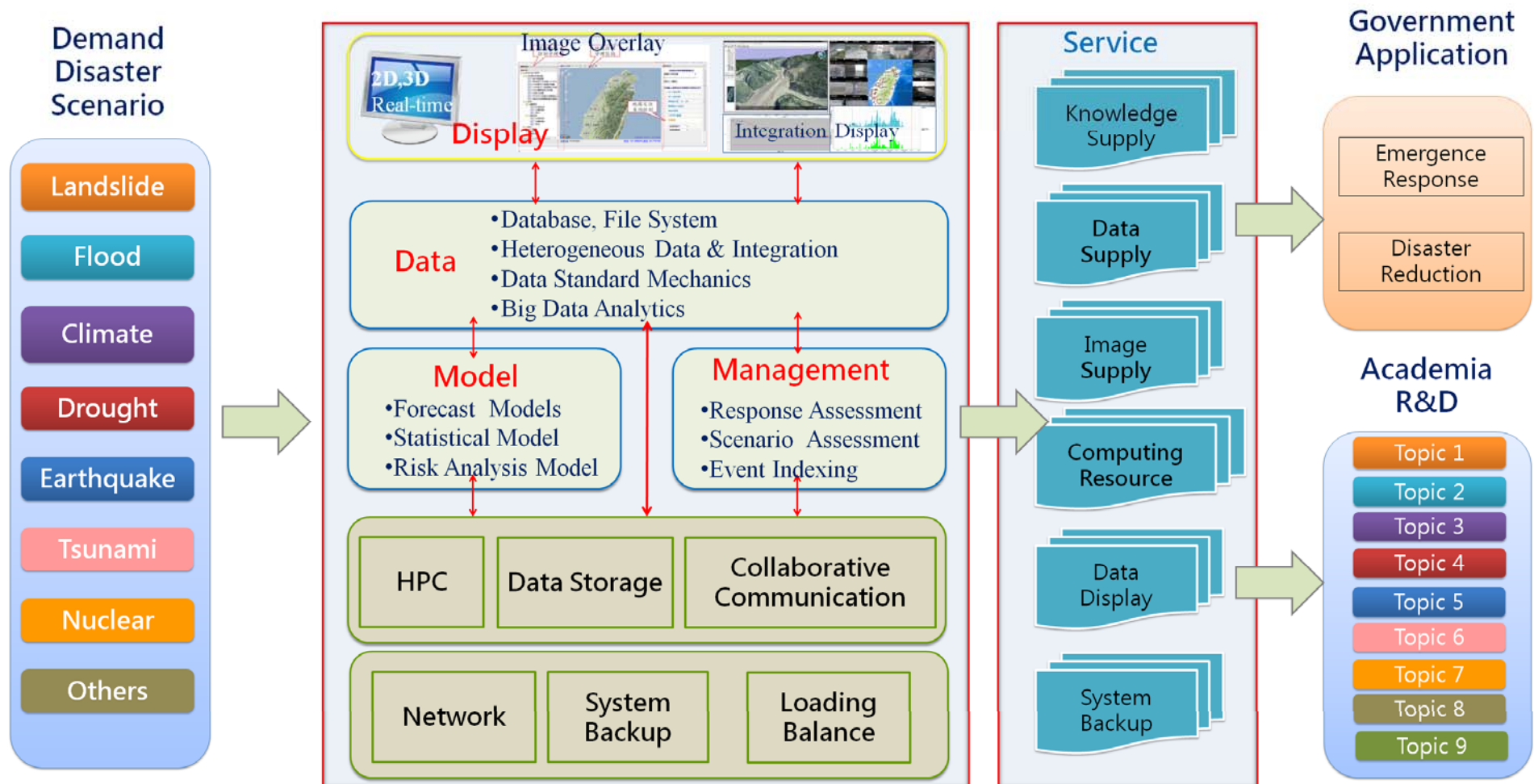
目前世界上有兩大「志工型災害管理平台」開放架構：「SAHANA」及「Ushahidi」，其中一項功能可讓各地志工通報災情，回報坐標位置及災情描述，並顯示於地圖中以提供情報，但是，其地圖中的衛星影像十分匱乏，所以，我們義務提供了災後衛星影像，更加完整該地圖災情資訊！

此外，我們也開發了行動版APP，讓位於災區的志工及國際搜救隊伍，可透過行動裝置獲得所在地的災後衛星影像。



Disaster Management Information Platform

■ Scenario based Data-Model-Display-Management



Concluding Remarks

- NAR Labs 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

