THAILAND's Activities Contributing to GEOSS Implementation

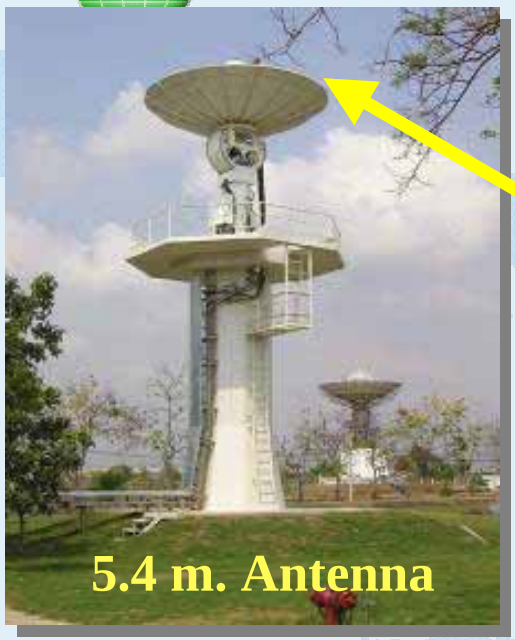
Dr. Thongchai Charuppat

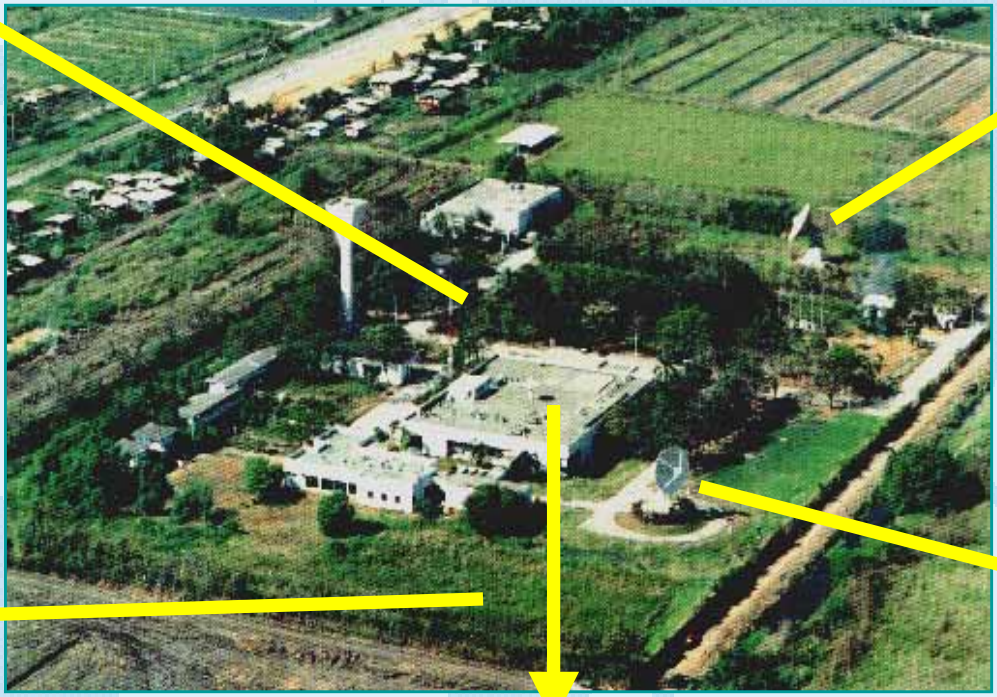
Director

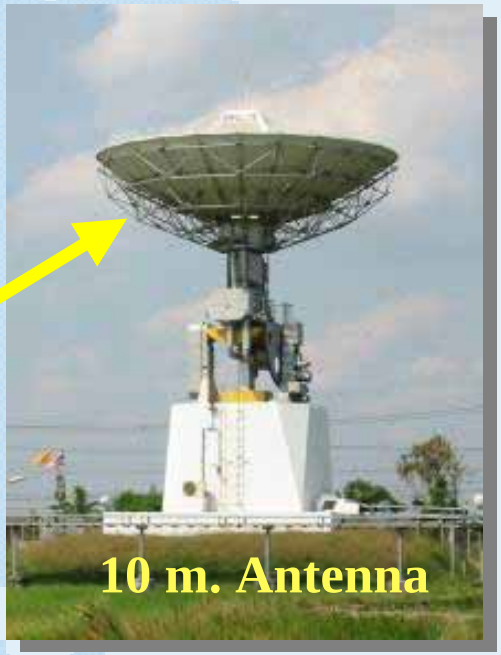
Geo-Informatics and Space Technology Development Agency (GISTDA)

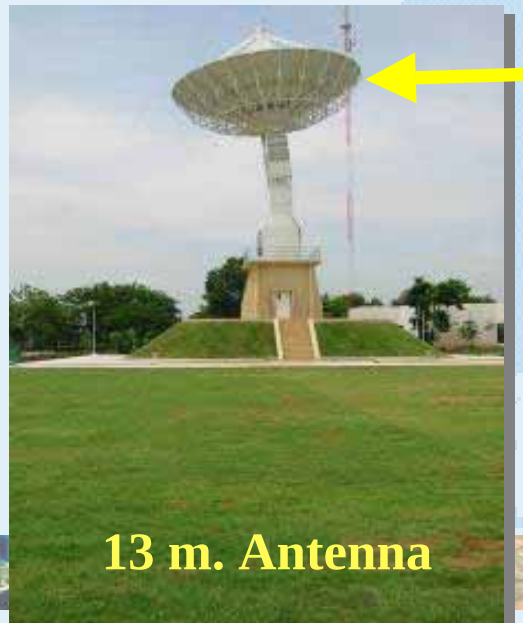
Ministry of Science and Technology, Thailand

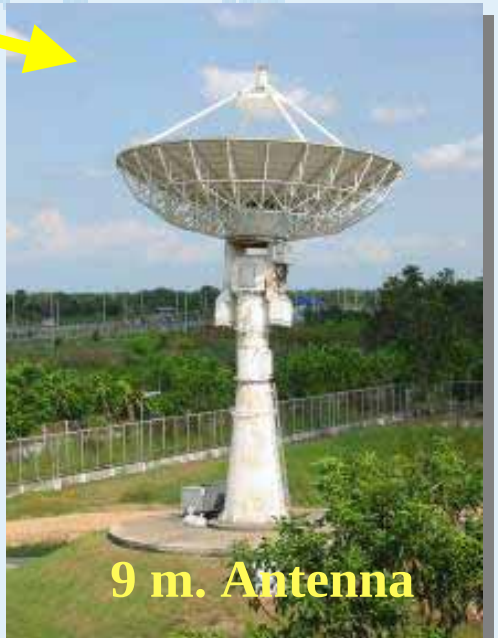
GISTDA Ground Receiving Station











Thailand Ground Station Coverage Circle

1. Malaysia
2. Singapore
3. Philippines
4. Indonesia
5. Brunei
6. Myanmar
7. Laos
8. Vietnam
9. Cambodia

10.Thailand
11.Bangladesh
12.India
13.Nepal
14. Sri Lanka
15.Phutan
16. Taiwan
17. South China
Hong Kong

EO Data Acquisition & Services

Current Status of Ground Receiving Station

- LANDSAT-5
- SPOT-2, 4 and 5
- RADARSAT
- ALOS *(Sub-node)*

Reseller : Aster, QuickBird and WorldView

Satellite Data in Archive:
LANDSAT, SPOT, MOS, ERS, JERS, ADEOS, RADARSAT, IRS, IKONOS

Applications of EOS Data in Thailand: Related to GEOSS

- **Because deforestation will cause floods, landslides and droughts.**
- **Moreover, forest fires and Tsunami will damage to biodiversity and natural resources.**
- **Therefore, Thailand uses data from Earth observation satellites to monitor deforestation and these disasters which will cause global change.**

Geo-Informatics and Space Technology Development Agency (GISTDA)
Ministry of Science and Technology, Thailand

Participating of Thai Agencies in GEOSS

- **Architecture and Data Committee (4)**
  - Thai Meteorological Department
  - Land Development Department
  - Kasetsart University
  - Geo-informatics and Space Development Agency
- **User Interface Committee (5)**
  - Thai Meteorological Department
  - Land Development Department
  - Office of the Permanent Secretary, Ministry of Agriculture and Cooperatives
  - Department of Disaster Prevention and Mitigation
  - Geo-informatics and Space Development Agency

Participating of Thai Agencies in GEOSS

- **Capacity Building Committee (1)**
  - Thai Meteorological Department

- **Science and Technology Committee (4)**
  - Thai Meteorological Department
  - Department of Disaster Prevention and Mitigation
  - Department of Fisheries
  - Geo-informatics and Space Development Agency

Thailand's Activities Related to GEOSS

Geo-Informatics and Space Technology Development Agency (GISTDA)
Ministry of Science and Technology, Thailand

1. Forest Types Classification

Tropical Rain Forest

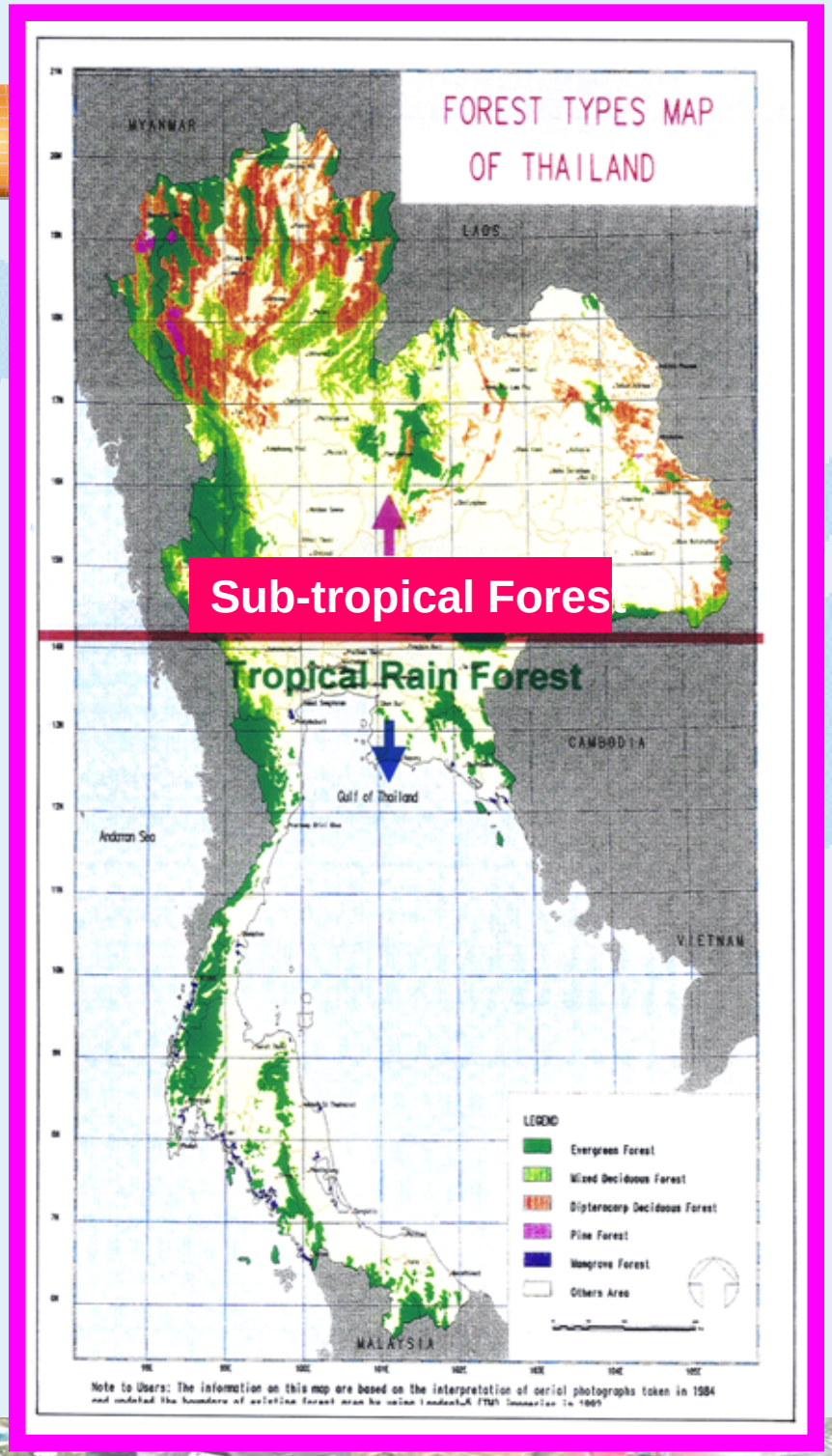
Pine Forest

Mixed Deciduous Forest

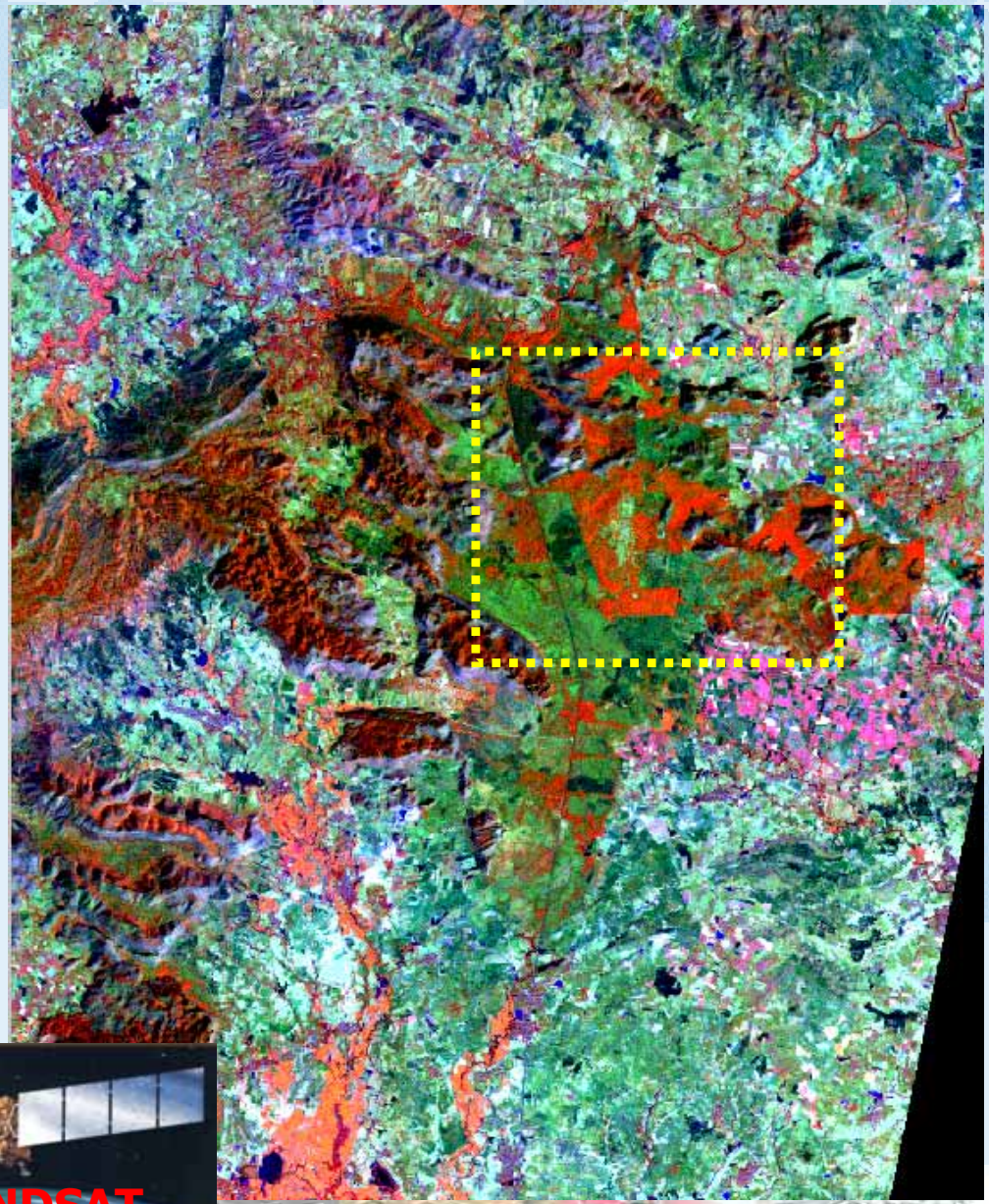
Dry Dipterocarp Forest

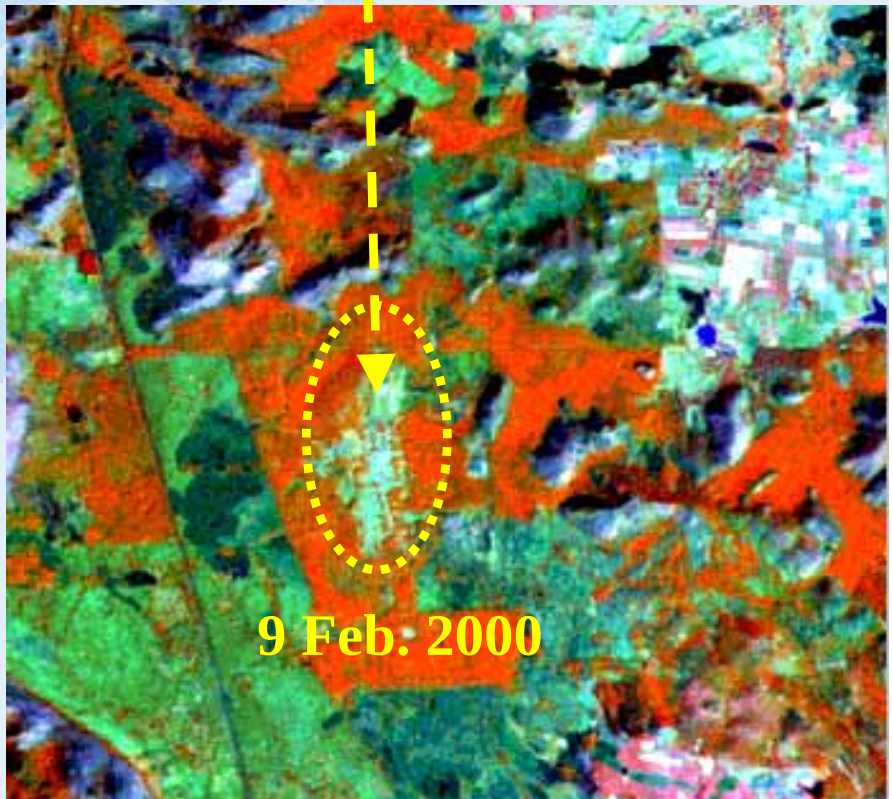
Mangrove Forest from Landsat-5 TM Data

Map Showing Forest Types of Thailand



2. Monitoring the Changes of Forest Area





Geo-Informatics and Space Technology Development Agency (GISTDA)

Ministry of Science and Technology, Thailand

Mangrove Deforestation

Landsat 1987

SPOT 1993

Landsat 1998

National Forest Policy

(Cabinet Resolution on 3 December 1985)

It declared that 40 percent of the country shall be kept under forest and divided as follows :-

Protection Forest

15 percent of the area shall be kept as protection forest for nature conservation, recreation and environmental quality protection.

Production Forest

25 percent of the country shall be designated as production forest for production timber and other forest products

In November 1988, the area of Phipun district in Nakhon Si Thammarat province in Southern Thailand, suffered seriously from flood and landslides after three days of heavy rain.

The Seventh National Economic and Social Development Plan (1992-1996)

The main objective of Thailand's forest policy, as stated in the Seventh National Economic and Social Development Plan, is to increase the forest area to 40 percent of the total land area and divided as follows :-

Protection Forest

25 percent of the area shall be kept as protection forest for nature conservation, recreation and environmental quality protection.

Production Forest

15 percent of the country shall be designated as production forest for production timber and other forest products

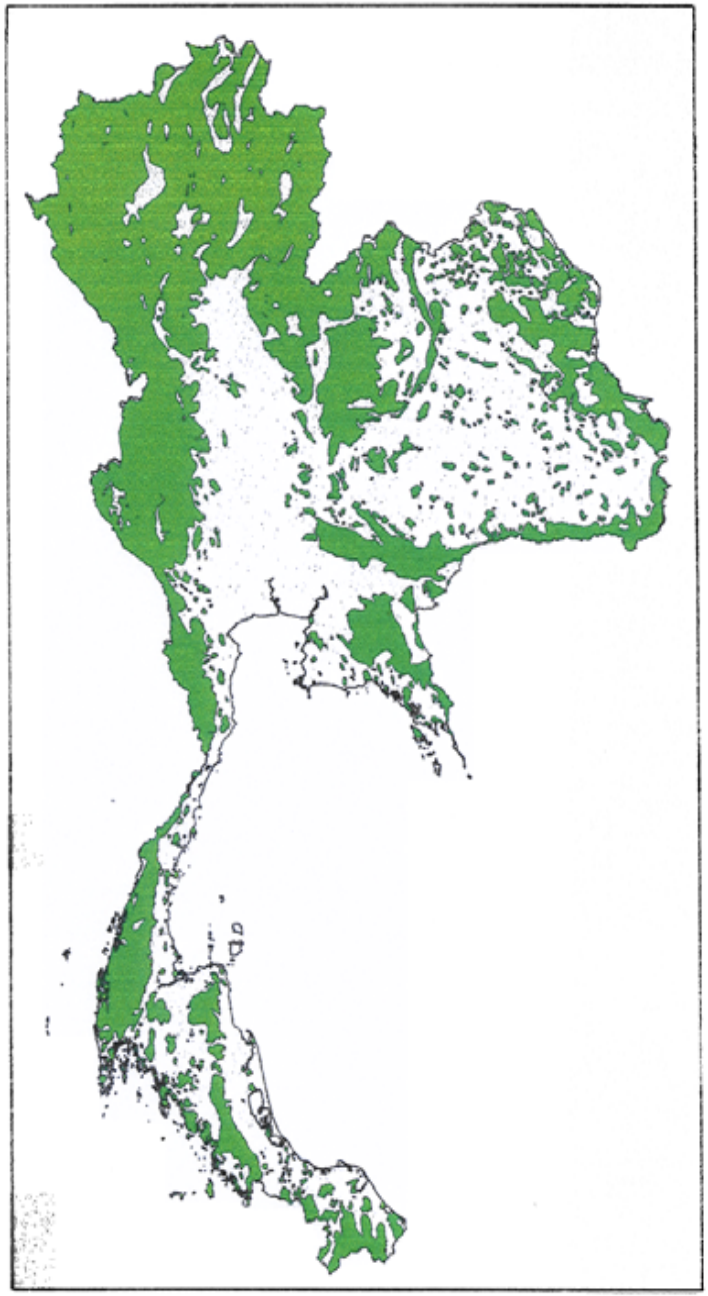
Thailand from Landsat-5 (TM) Satellite

EXISTING FOREST AREA OF THAILAND

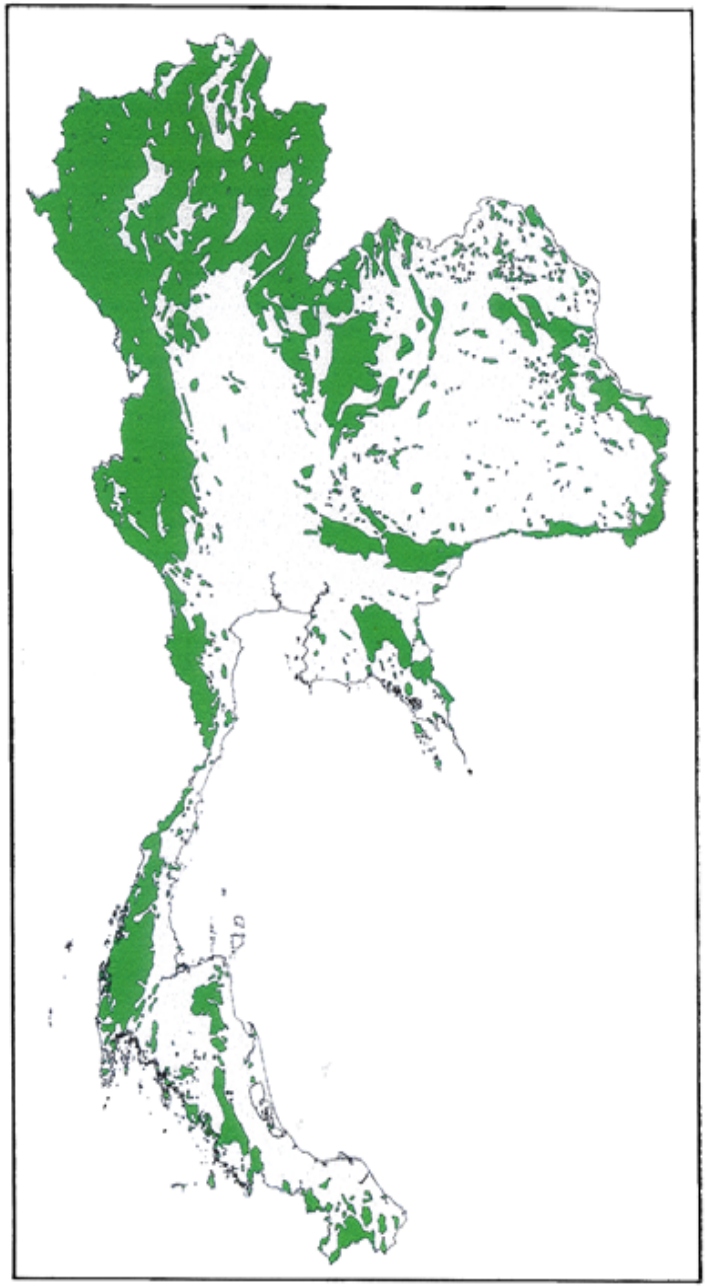
OVER THE PAST 37 YEARS (1961-1998)

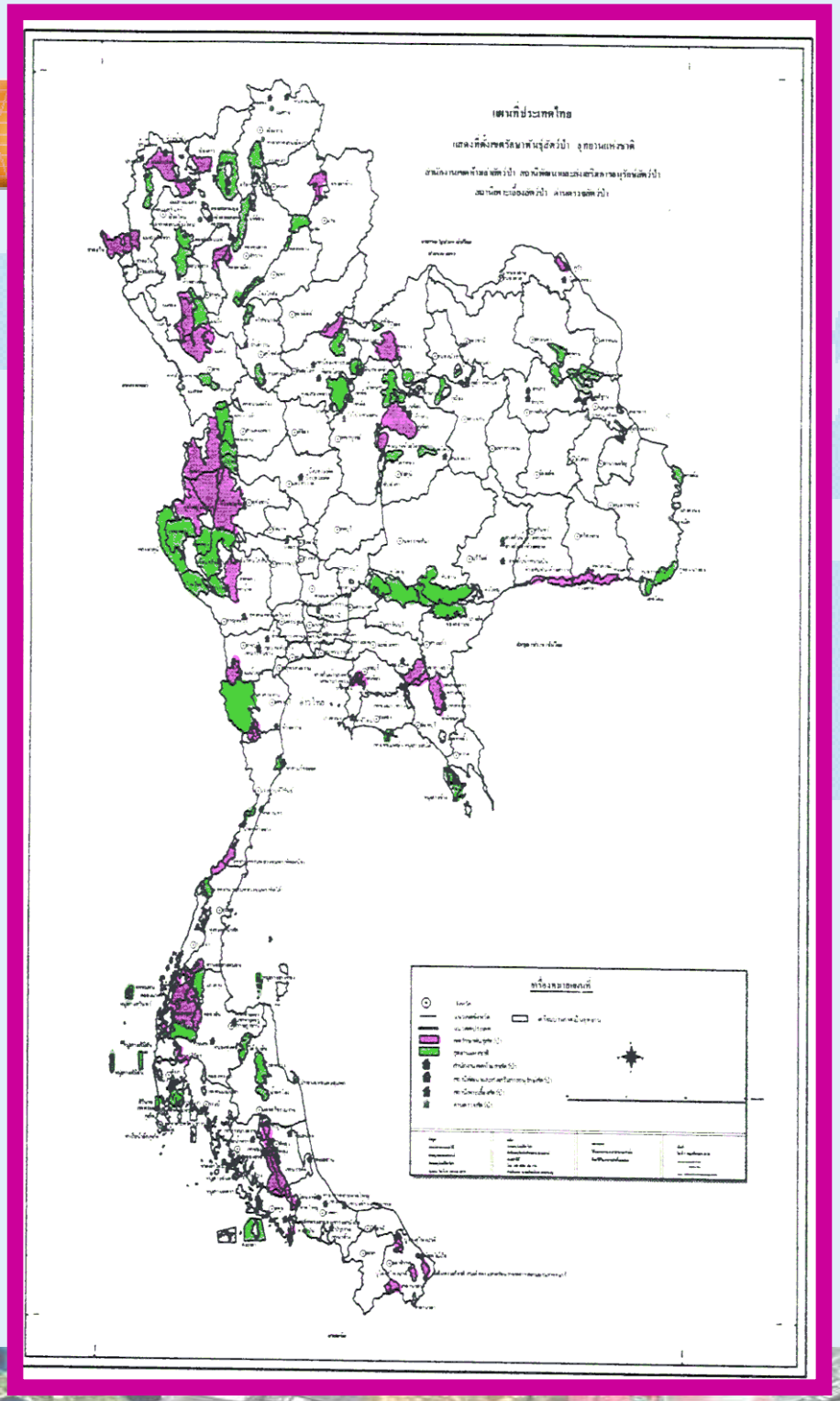
Year	Area (ha)	Percent
1961	171,017,812	53.33
1973	138,578,125	43.21
1976	124,010,625	38.67
1978	109,515,000	34.15
1982	97,875,000	30.52
1985	94,291,349	29.40
1988	89,877,182	28.03
1989	89,635,625	27.95
1991	85,436,284	26.64
1993	83,470,967	26.03
1995	82,178,161	25.62
1998	81,076,428	25.28

EXISTING FOREST AREA IN 1973



EXISTING FOREST AREA IN 1998

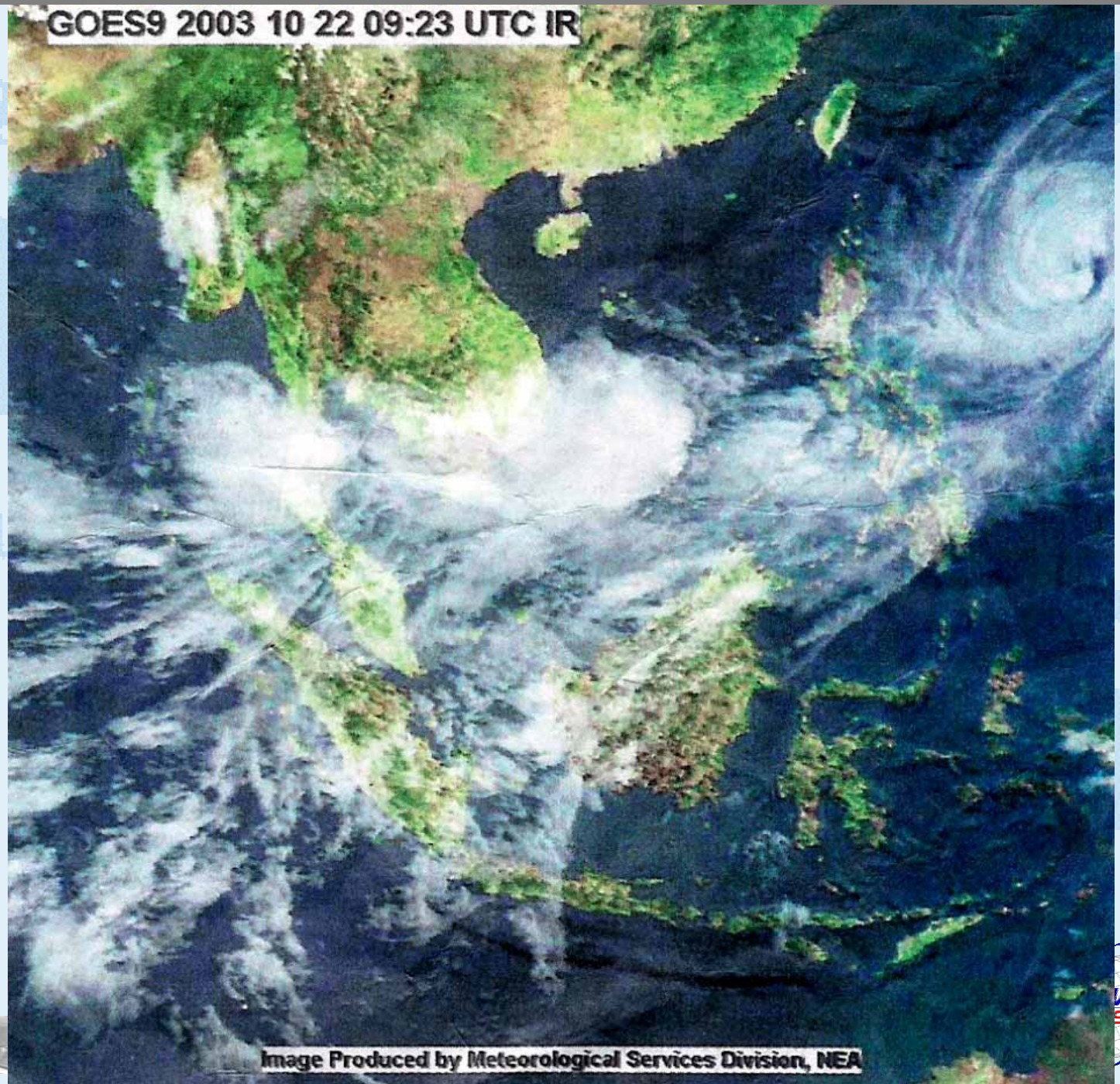


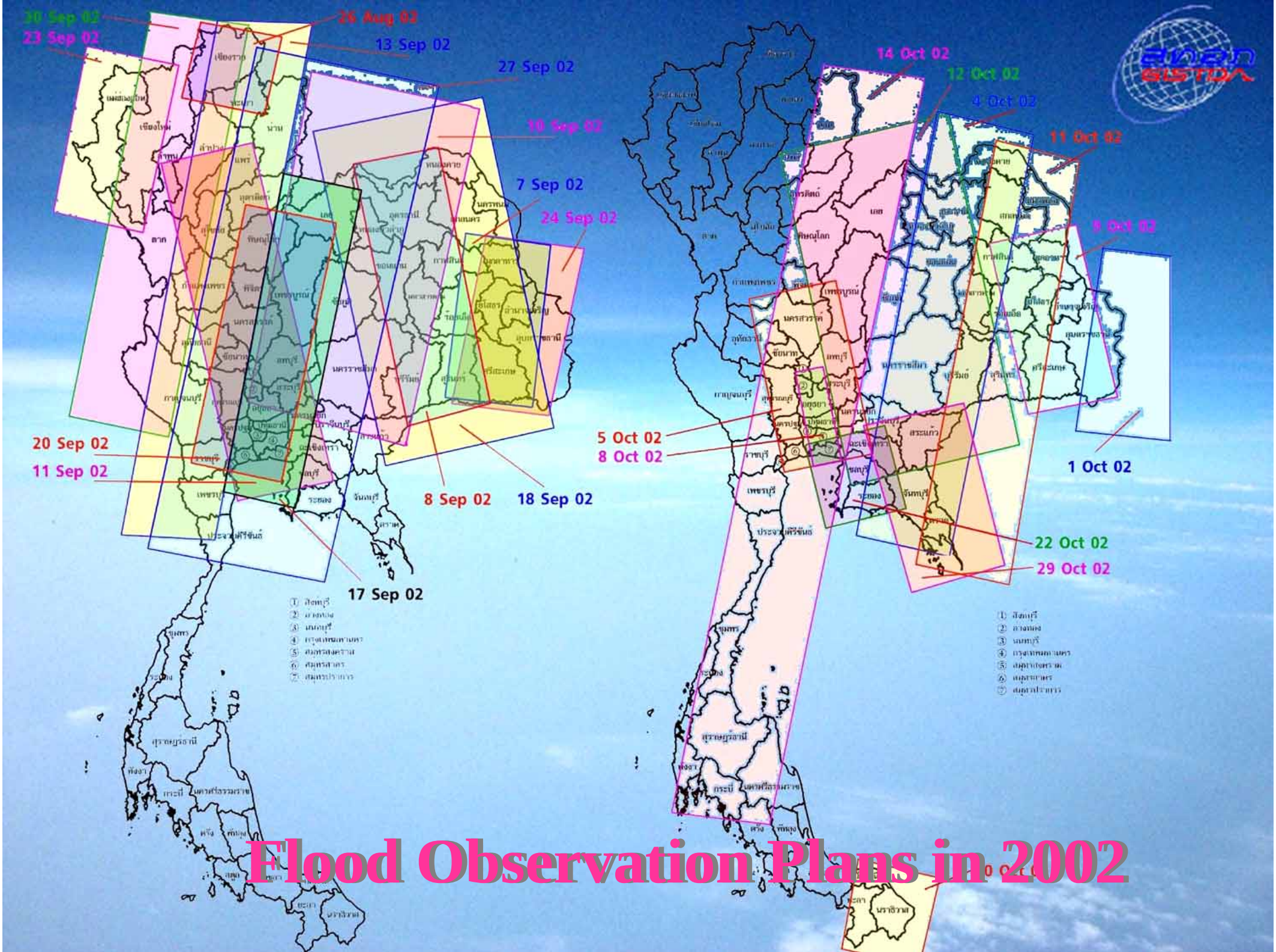


Conservation Forest in Thailand

- National Park
- Wildlife Sanctuary

3. Flood Monitoring




30 Sep 02
23 Sep 02
26 Aug 02
13 Sep 02
27 Sep 02
10 Sep 02
7 Sep 02
24 Sep 02
20 Sep 02
11 Sep 02
8 Sep 02
18 Sep 02
17 Sep 02
14 Oct 02
12 Oct 02
4 Oct 02
11 Oct 02
9 Oct 02
5 Oct 02
8 Oct 02
1 Oct 02
22 Oct 02
29 Oct 02
Flood Observation Plans in 2002

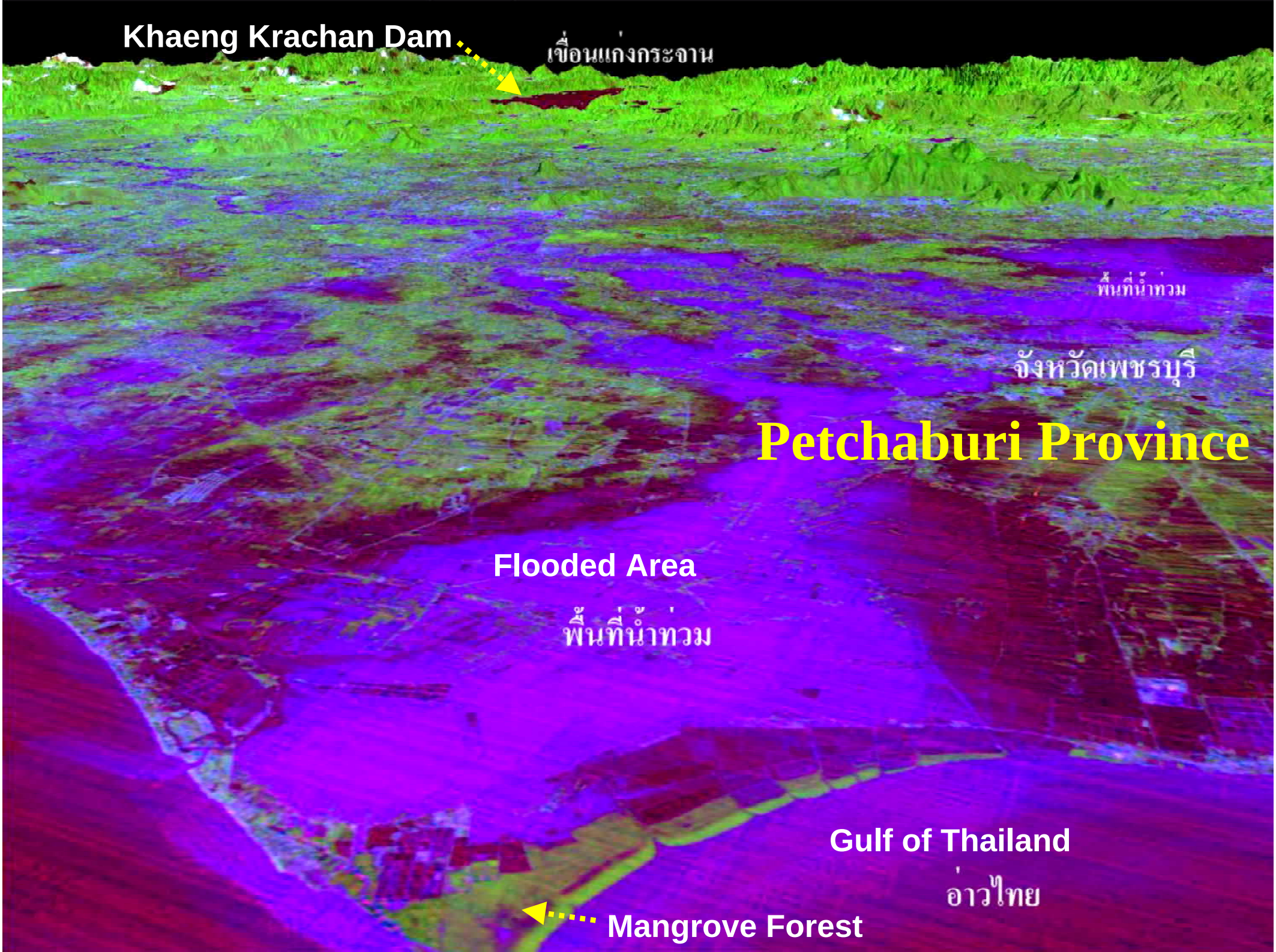
10 Sep 2002

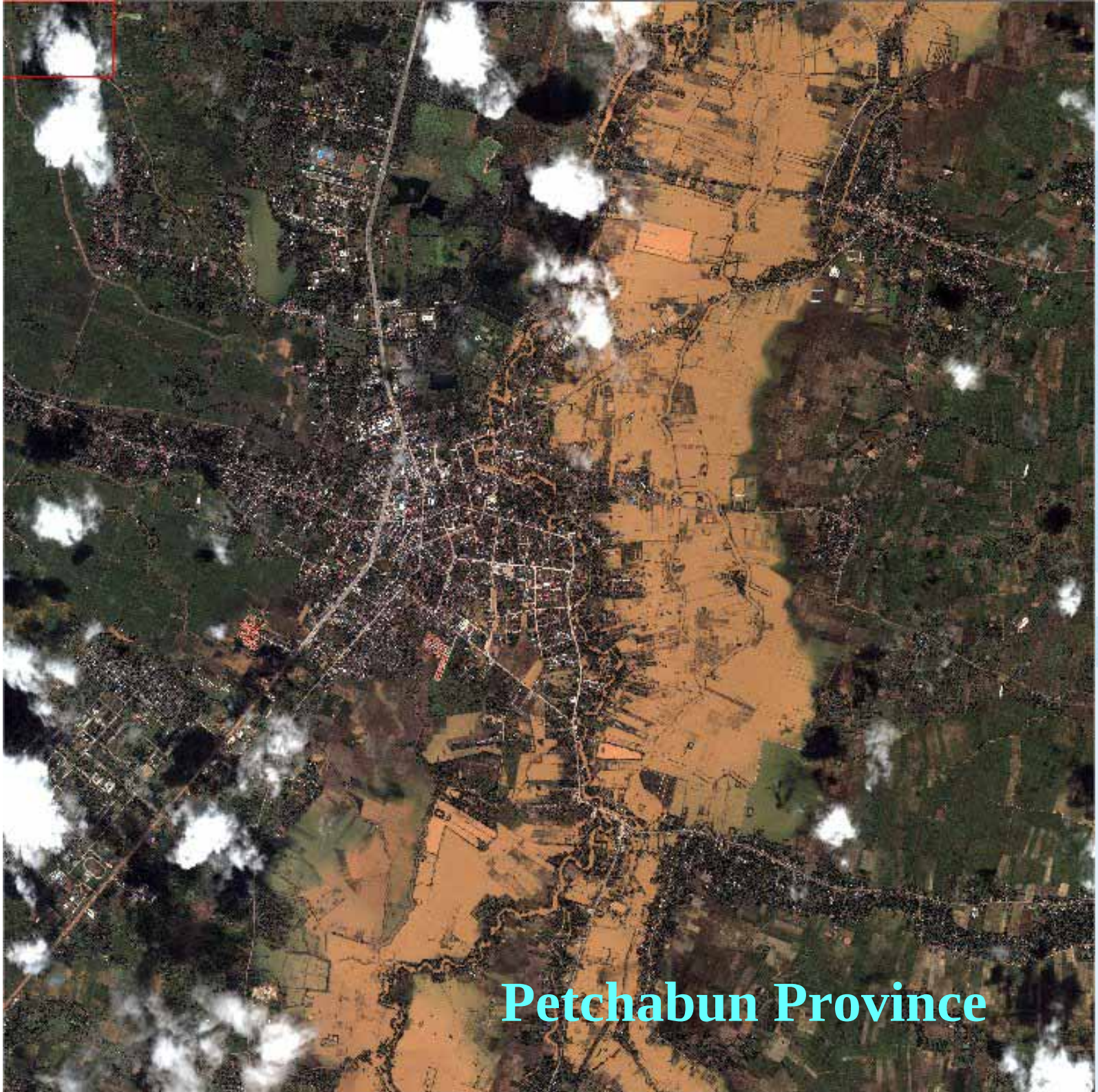
27 Sep 2002

14 Oct 2002

Multitemporal

Pasak Basin


Khaeng Krachan Dam
เขื่อนแก่งกระจาน
พื้นที่น้ำท่วม
จังหวัดเพชรบุรี
Petchaburi Province
Flooded Area
พื้นที่น้ำท่วม
Gulf of Thailand
อ่าวไทย
Mangrove Forest

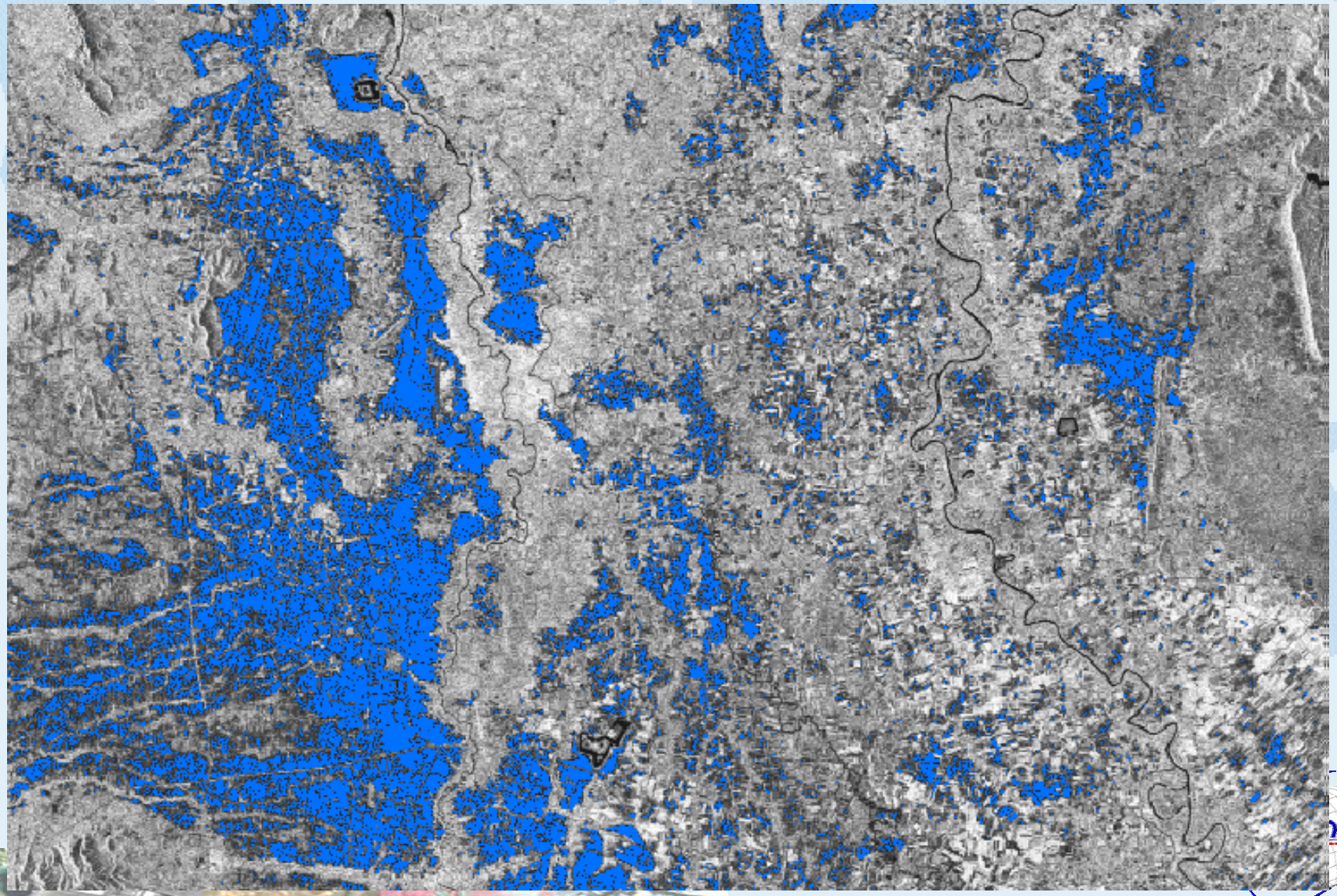

Petchabun Province


IKONOS

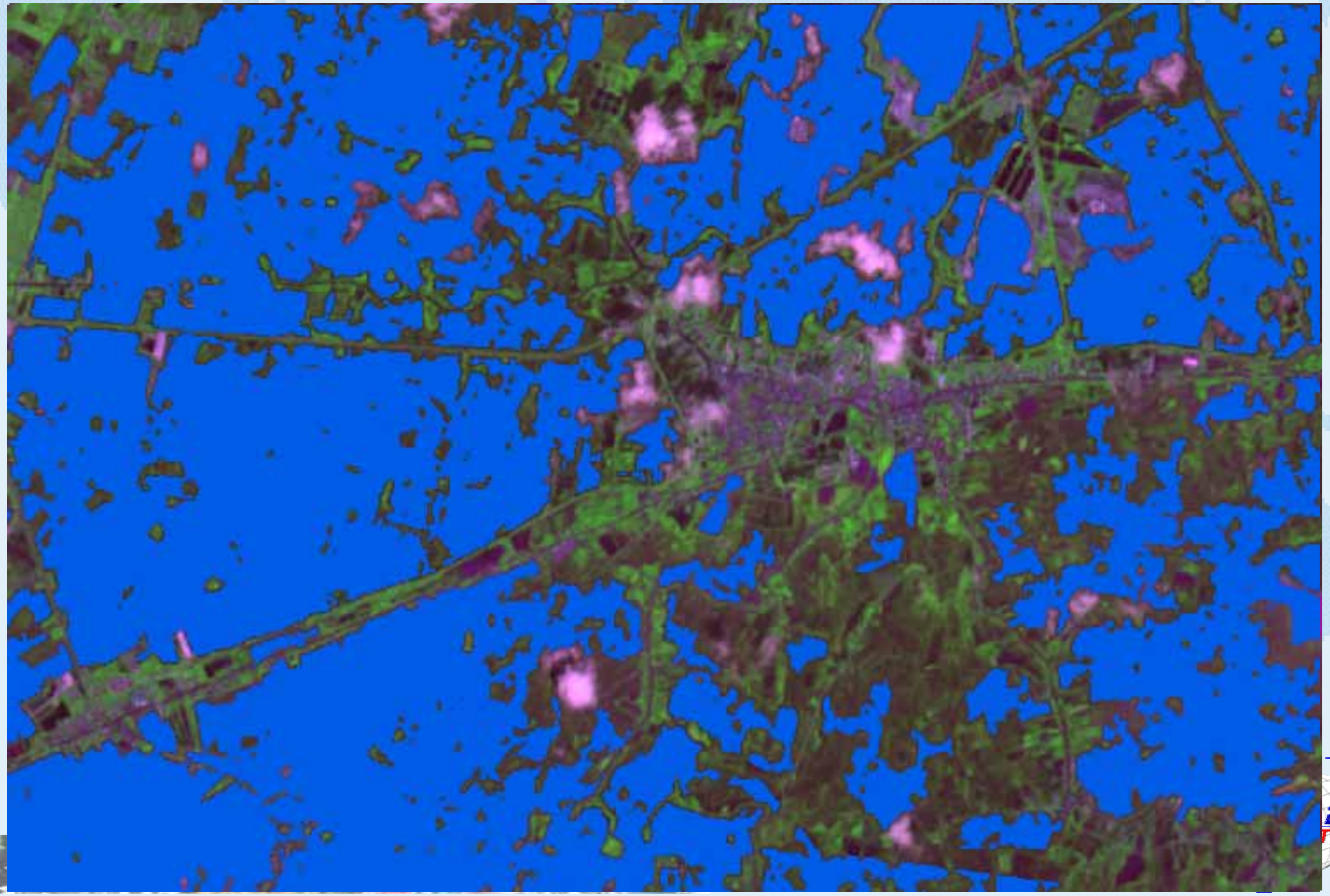
QuickBird Data on 18 September 2002

Phitsanulok Province

Using Radarsat Data for Monitoring Flood Area in Ang Thong, Central Thailand

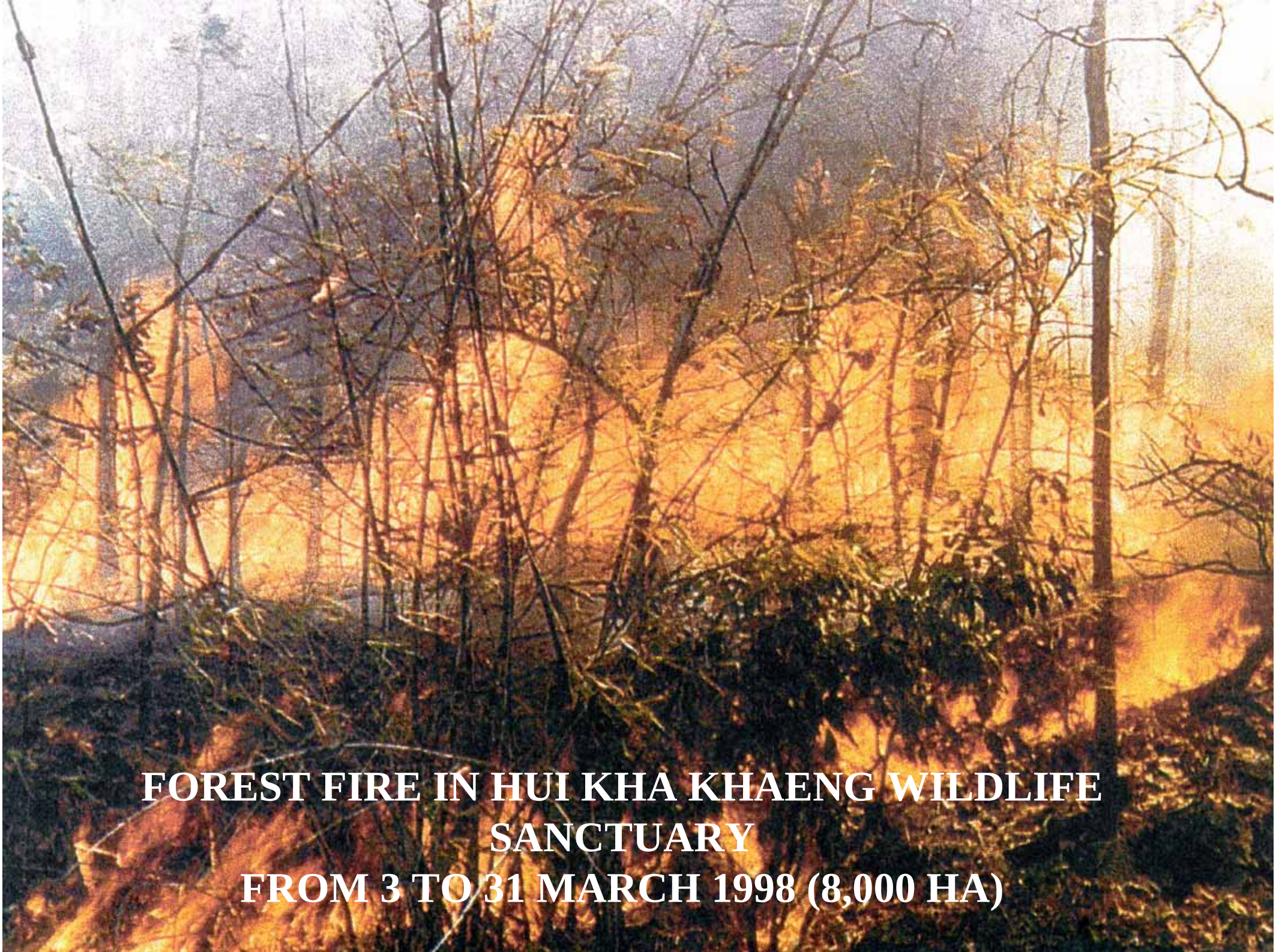


Using SPOT-5 Data for Monitoring Flood Area in Sukhothai, Northern Thailand



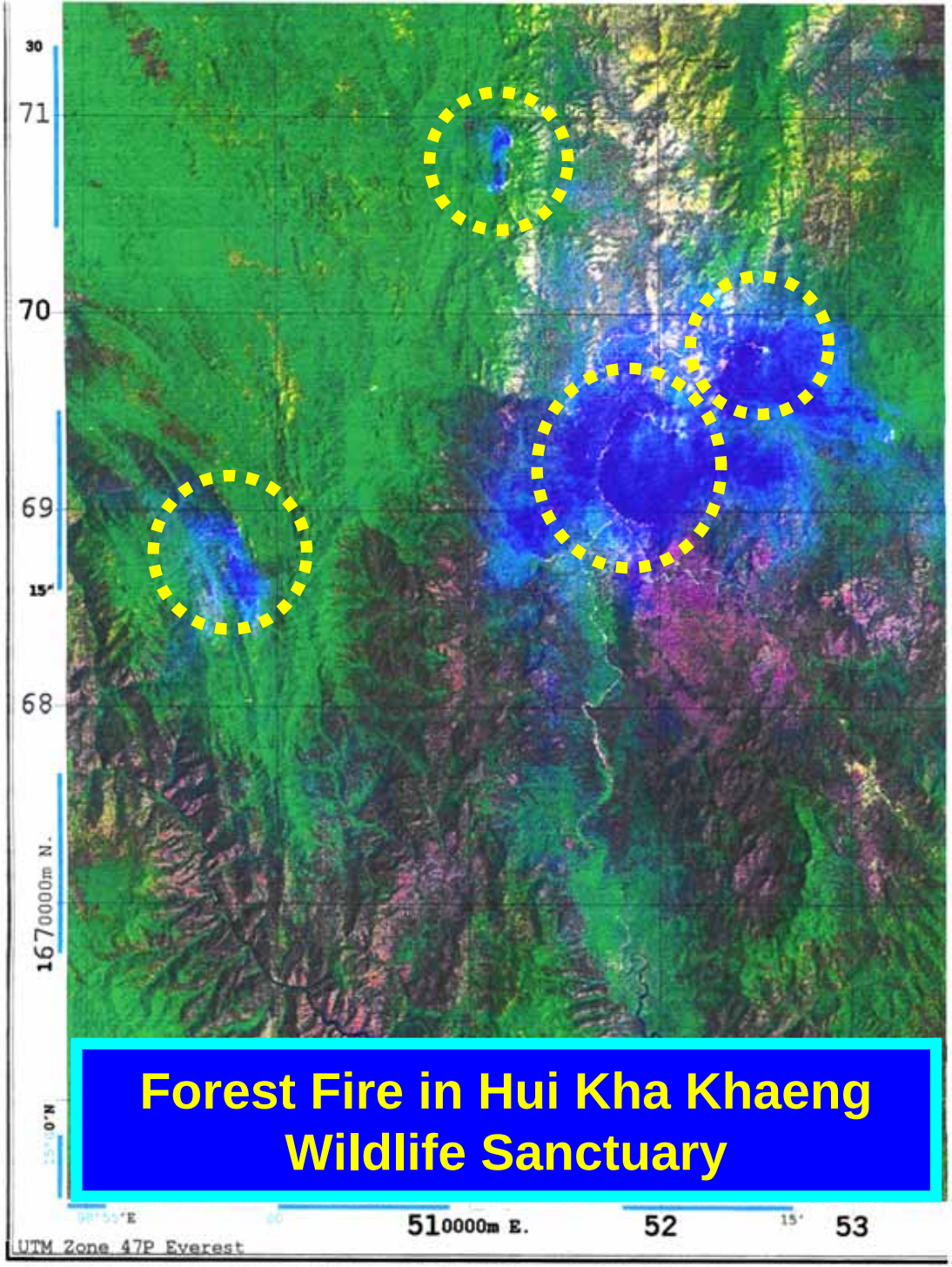
4. Landslide Monitoring

5. FOREST FIRES



FOREST FIRE IN HUI KHA KHAENG WILDLIFE SANCTUARY
FROM 3 TO 31 MARCH 1998 (8,000 HA)

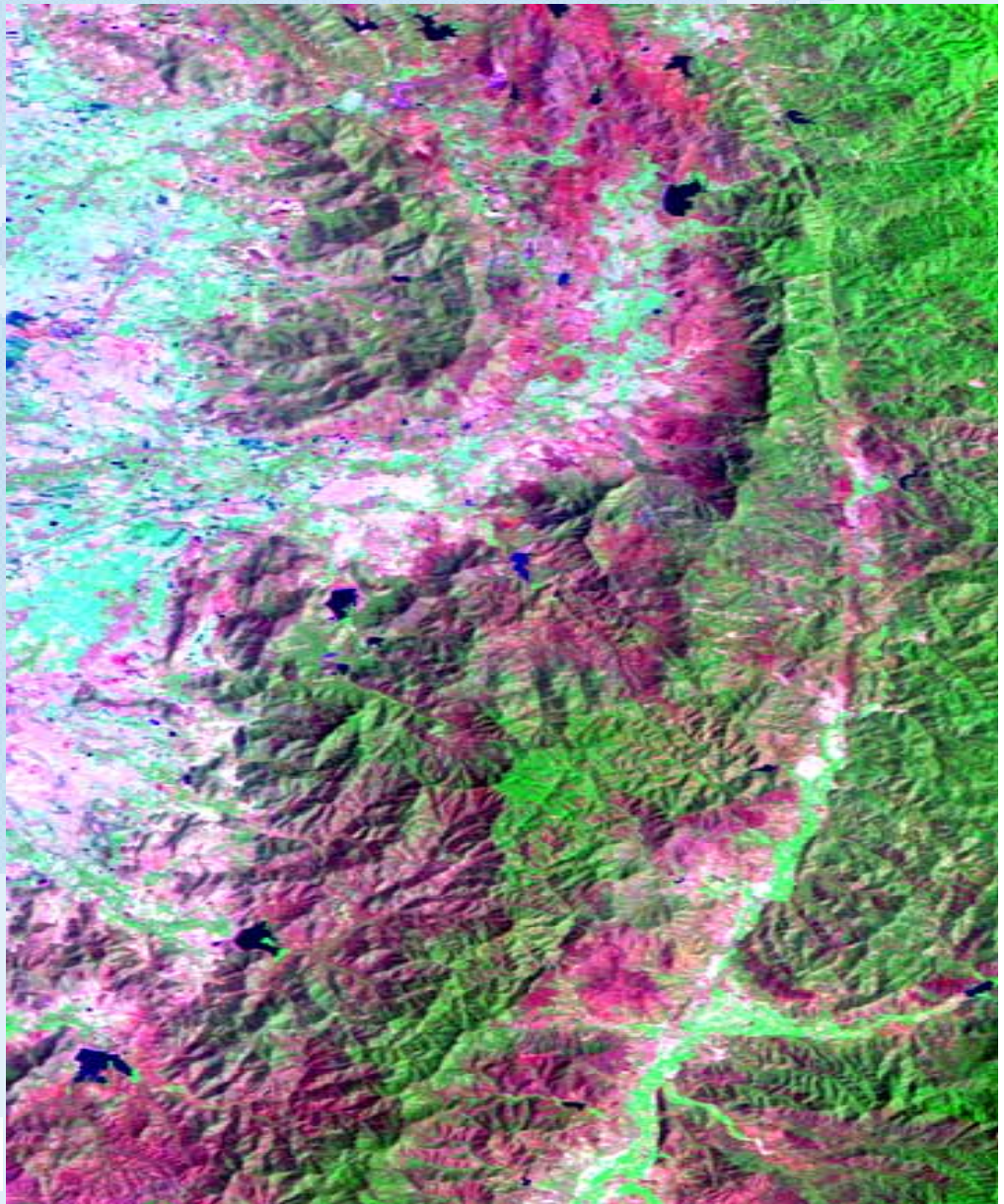
Landsat Data Showing Forest Fire Occurred at Doi Suthep National Park in Chiang Mai, Northern Thailand



HUAI KHA KHAENG WILDLIFE SANCTUARY:UTHAI

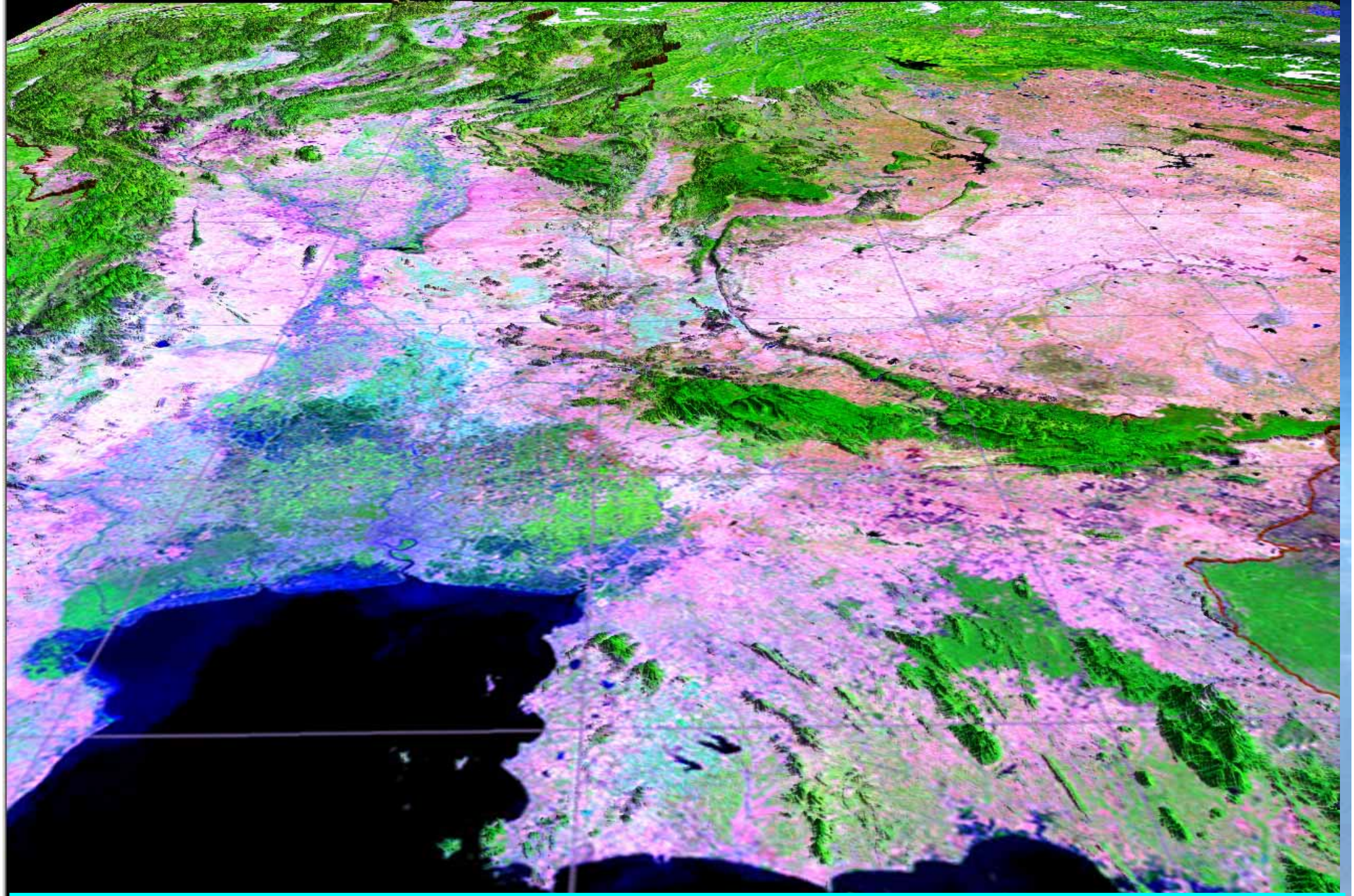
LANDSAT 5 TM DATA ACQUIRED ON 17 MARCH 1998

1:250 000 Scale



HELICOPTER CARRYING THE WATER POURING TO THE AREA WHERE FOREST FIRE OCCURRED

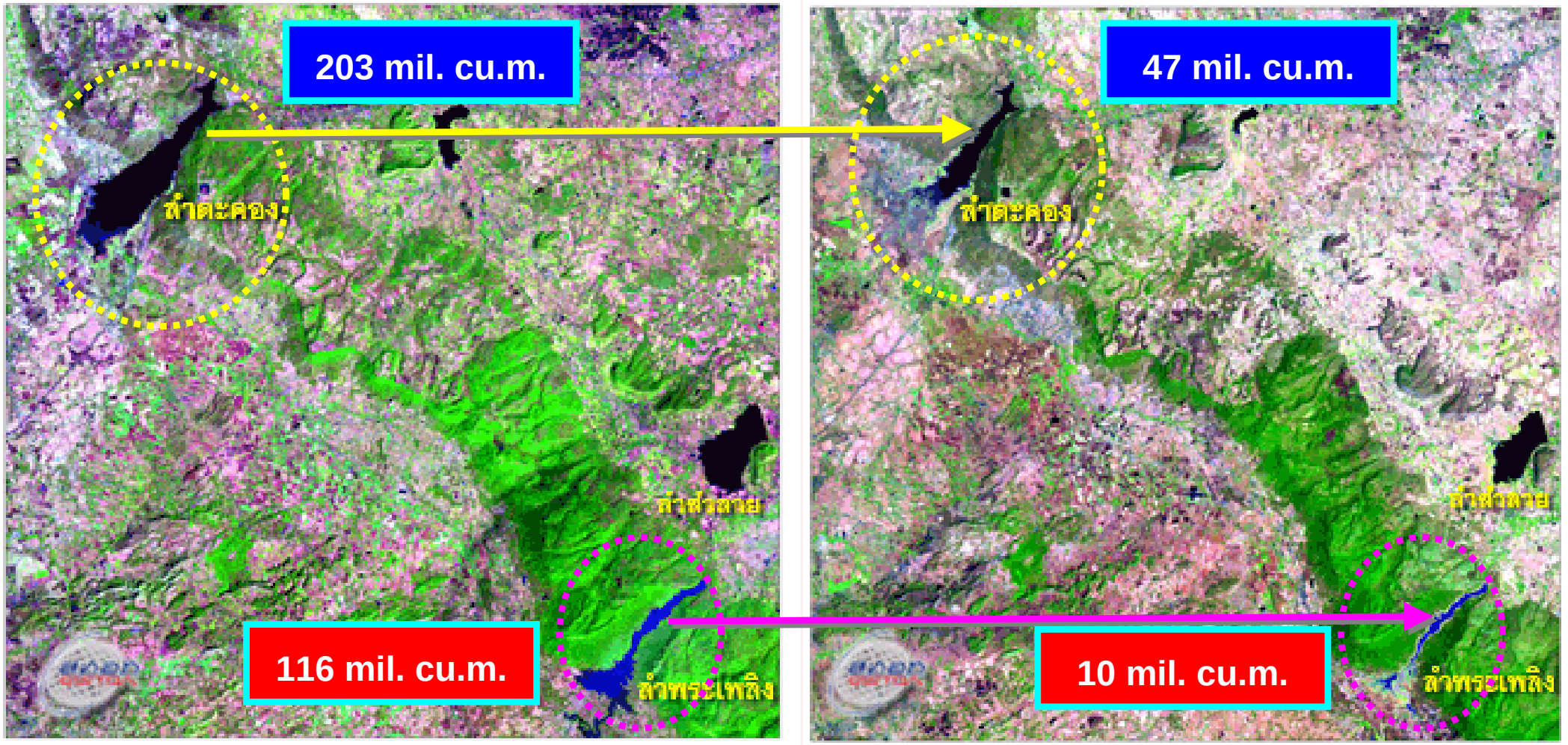
HELICOPTER CARRYING THE FIRE FIGHTERS TO THE AREA WHERE FOREST FIRE OCCURRED



6. Drought

27 September 2002

6 March 2005



Using Landsat-5 Data for Monitoring the Water Level in Lam Taklong and Lam Pha Phloeng Reservoirs in Nakhon Ratchasima, Northeastern Thailand

Geo-Informatics and Space Technology Development Agency (GISTDA)

Ministry of Science and Technology, Thailand

7. Tsunami

Before IKONOS Natural Color Image 24 January 2004 **After**

5

Patong Beach, Phuket Island before and after the Tsunami Impact

Patong Beach, Phuket Island before and after the Tsunami Impact

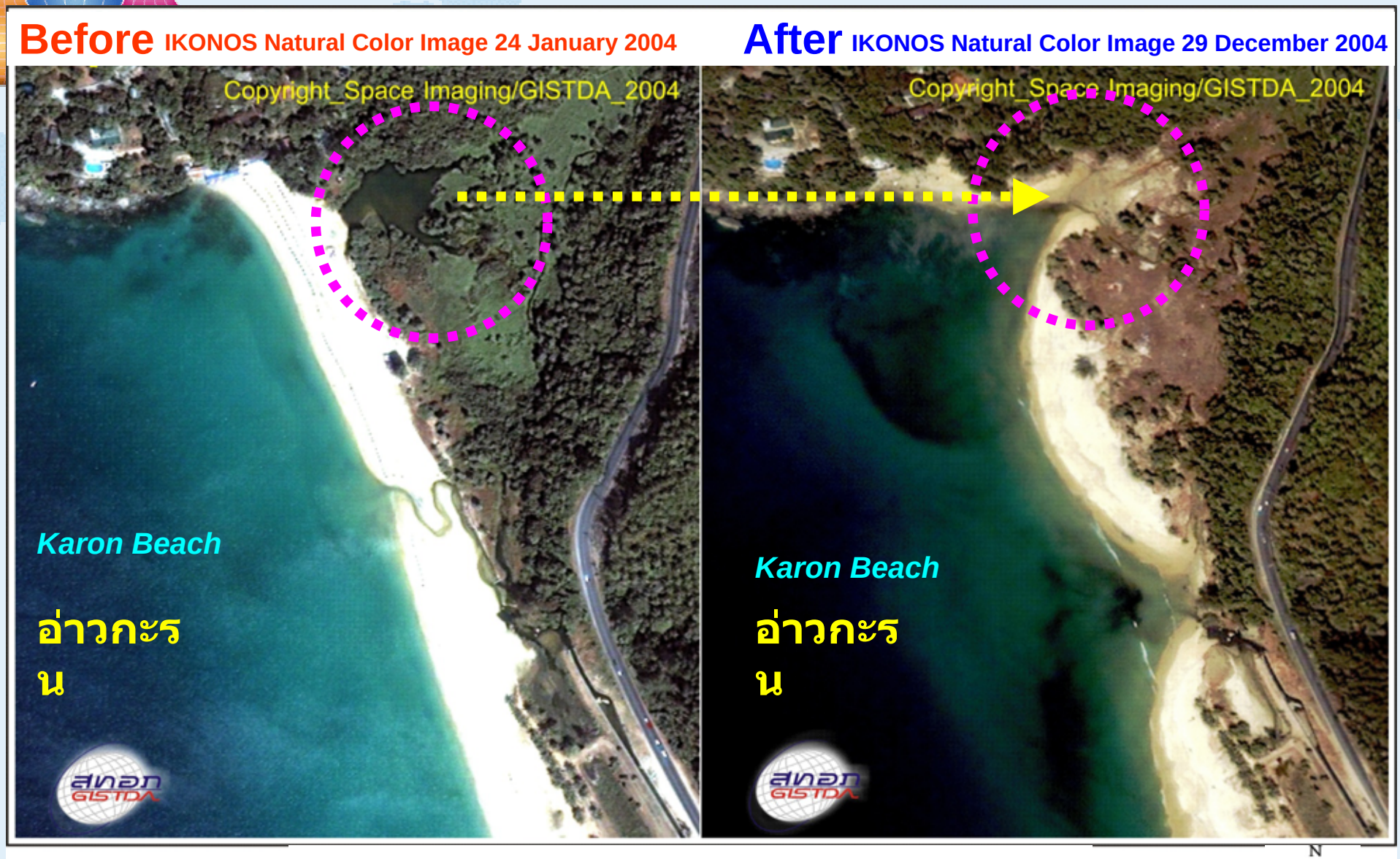
Before IKONOS Natural Color Image 24 January 2004 **After** IKONOS Natural Color Image 29 December 2004

1. โรงแรม ซีวิวปะตอง (SeaviewPatong)

Destroyed Areas, Buildings, Roads, Beaches, Port and Flooded areas Patong Beach, Phuket

N W E S

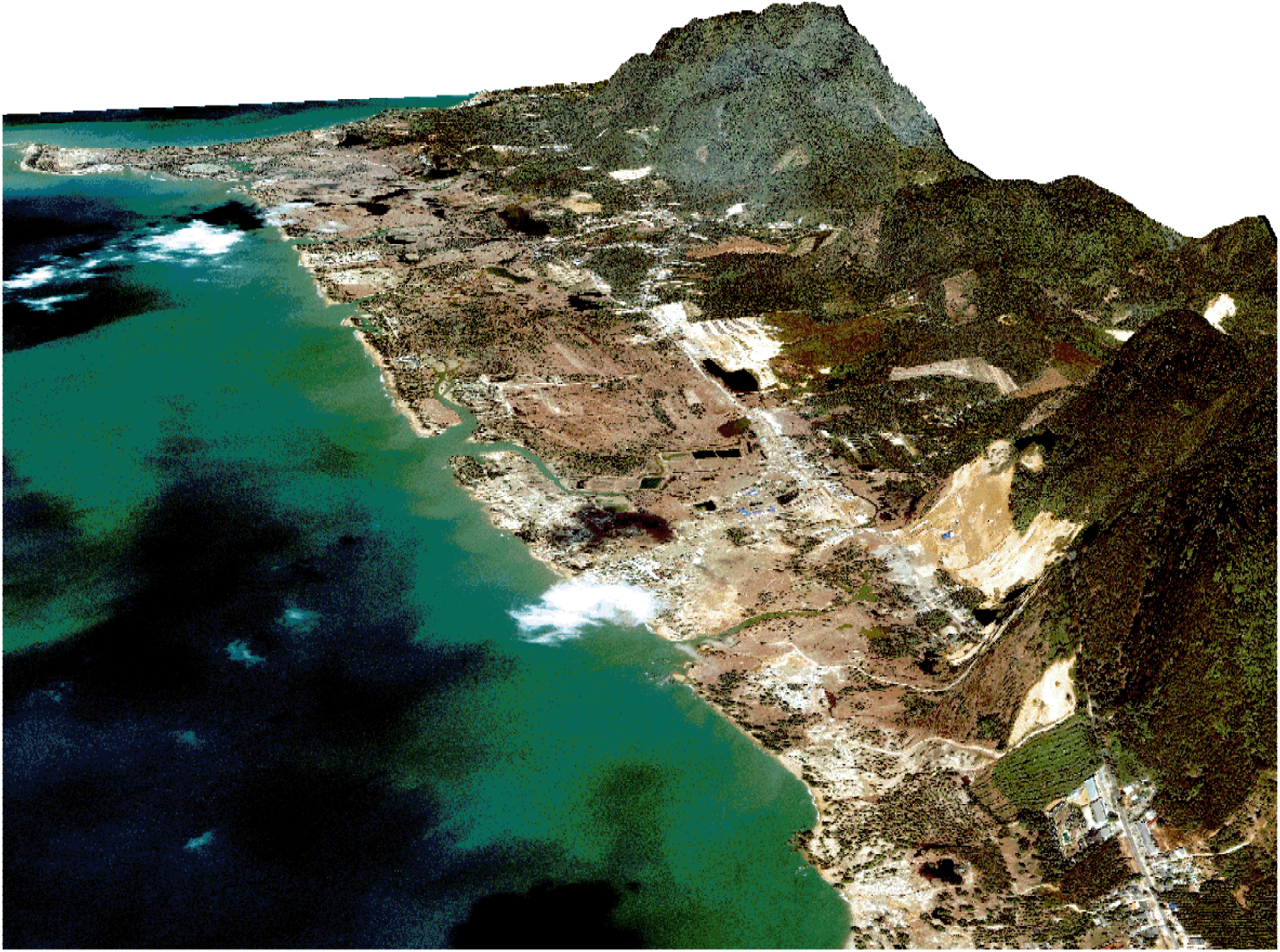
Karon and Kata Beach, Phuket Island before and after the Tsunami Impact



Destroyed Areas, Buildings, Roads, Beaches, and Flooded areas Patong Beach, Phuket

Coral Cape, Phang Nga Province before and after the Tsunami Impact

Before: IKONOS Natural Color Image 11 February 2001 **After:** IKONOS Natural Color Image 29 December 2004



THEOS

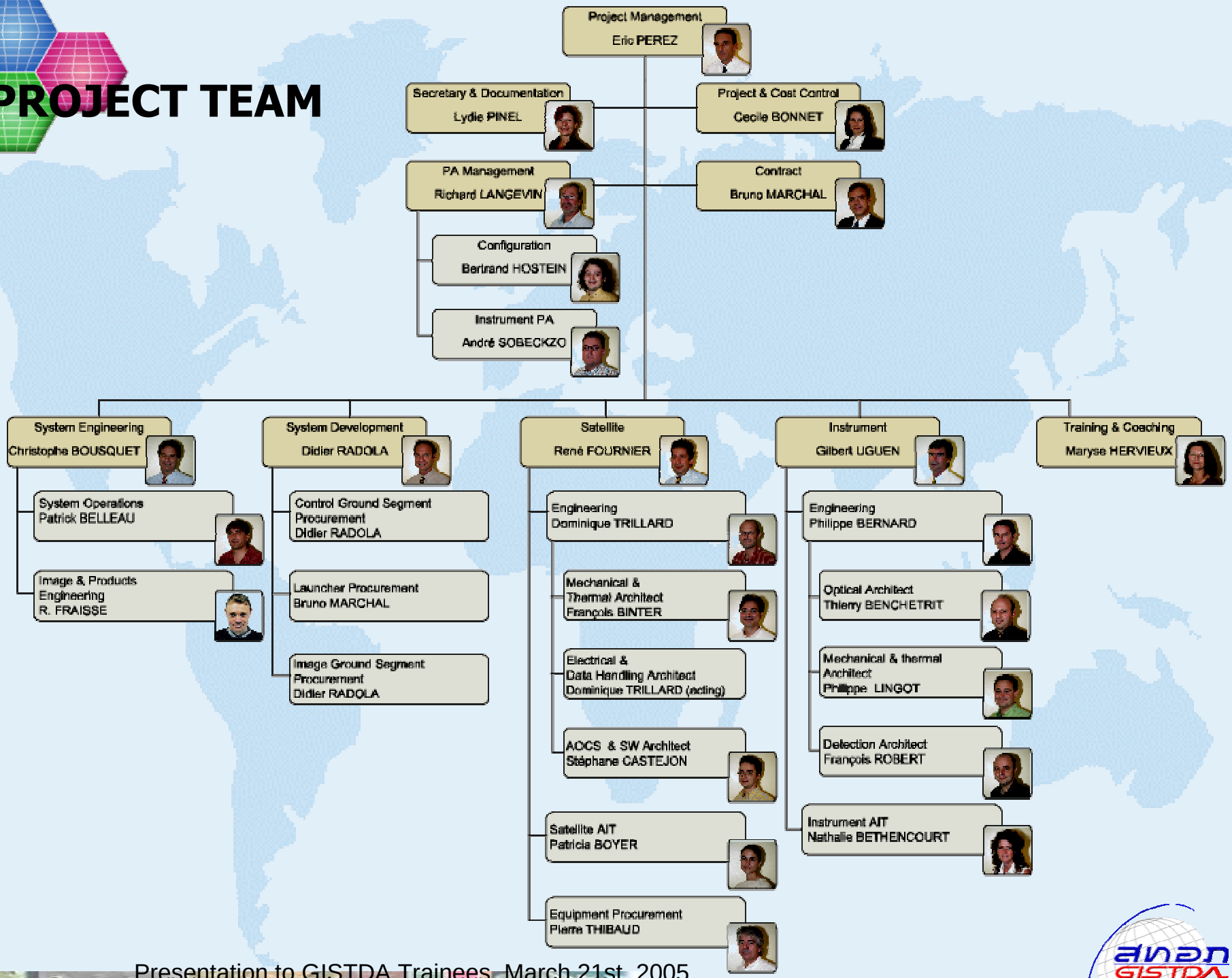
(THailand Earth Observation Satellite)

The First Earth Observation Satellite of Thailand

Signing Ceremony between GISTDA and EADS Astrium Company for Developing THEOS Satellite on 19 July 2004, Regency Room, Oriental Hotel, Bangkok

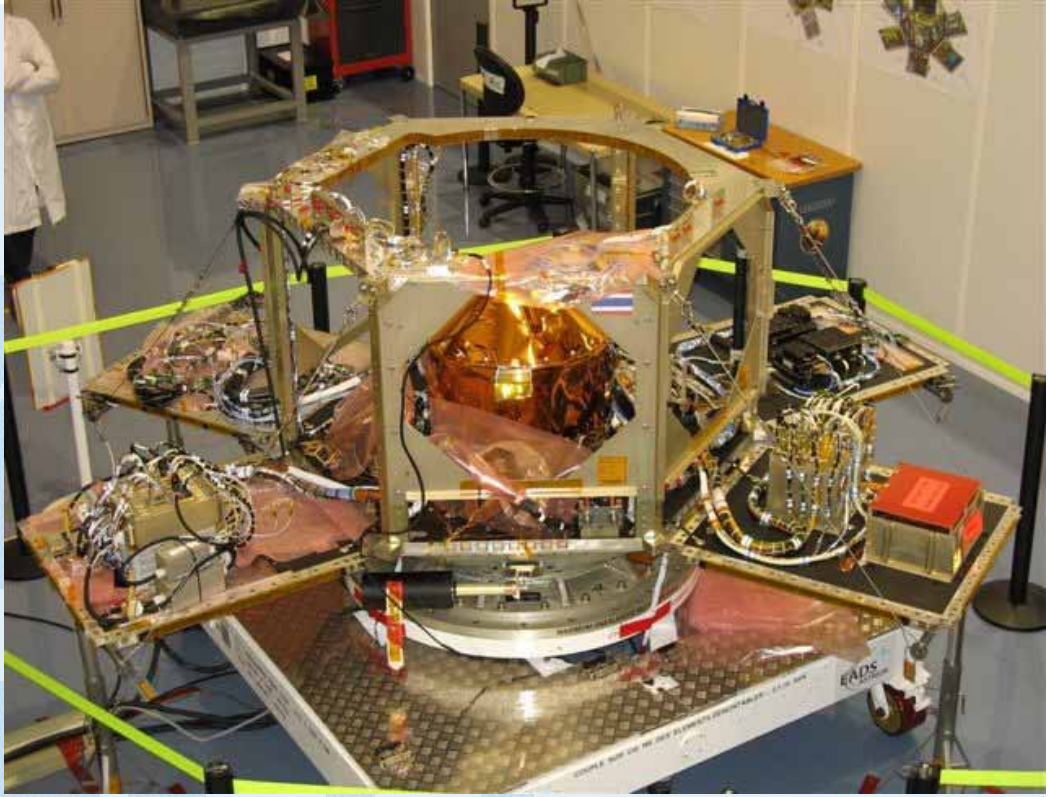
THEOS TEAM

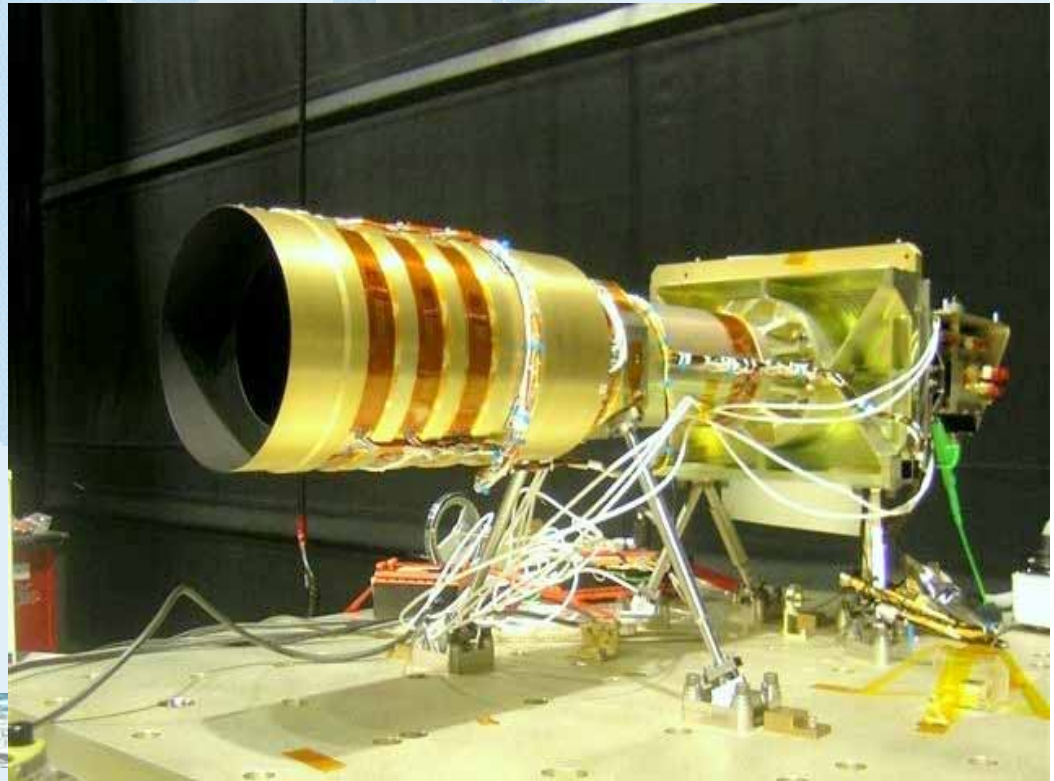
PROJECT TEAM

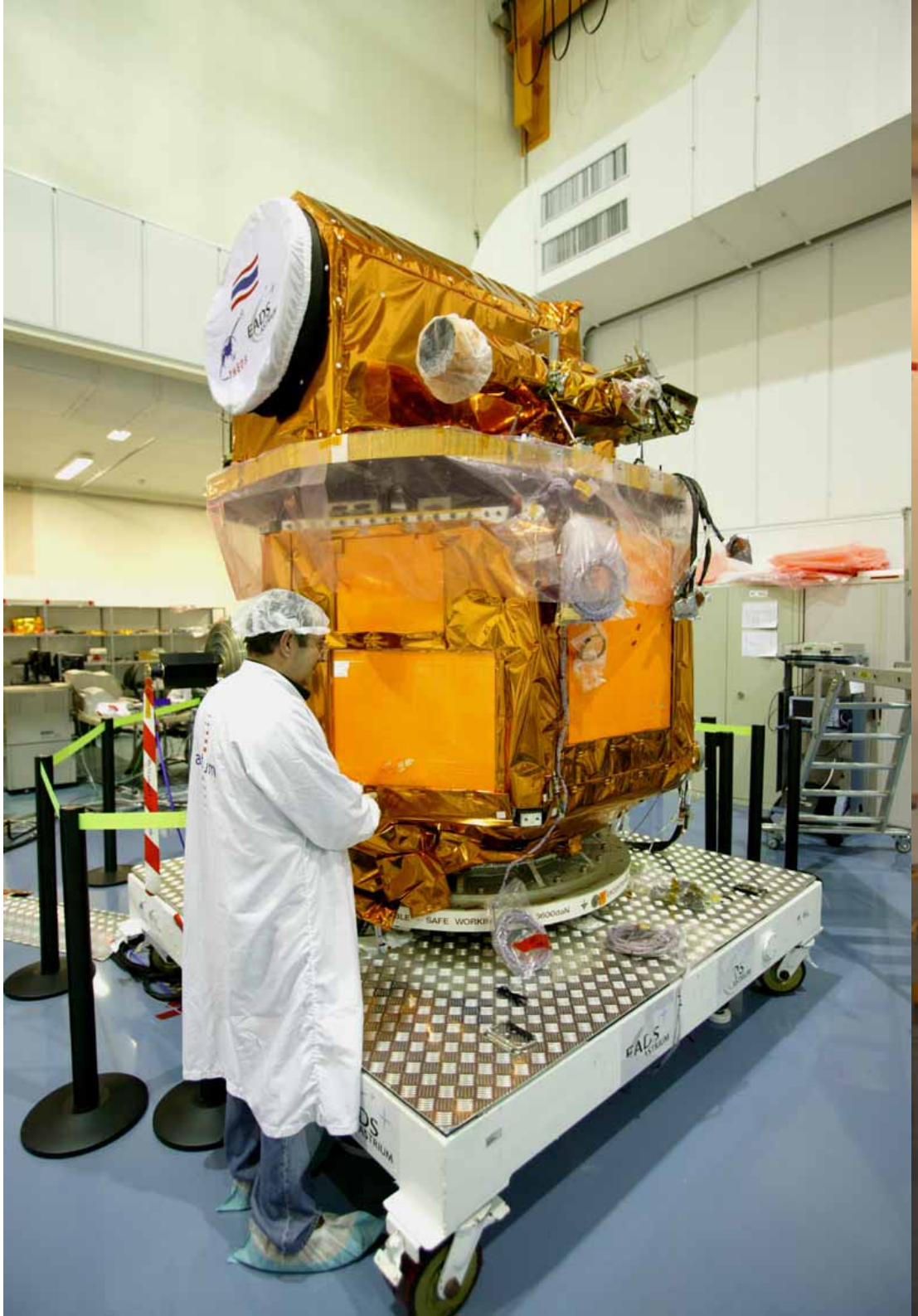


GISTDA-ASTRIUM THEOS Team

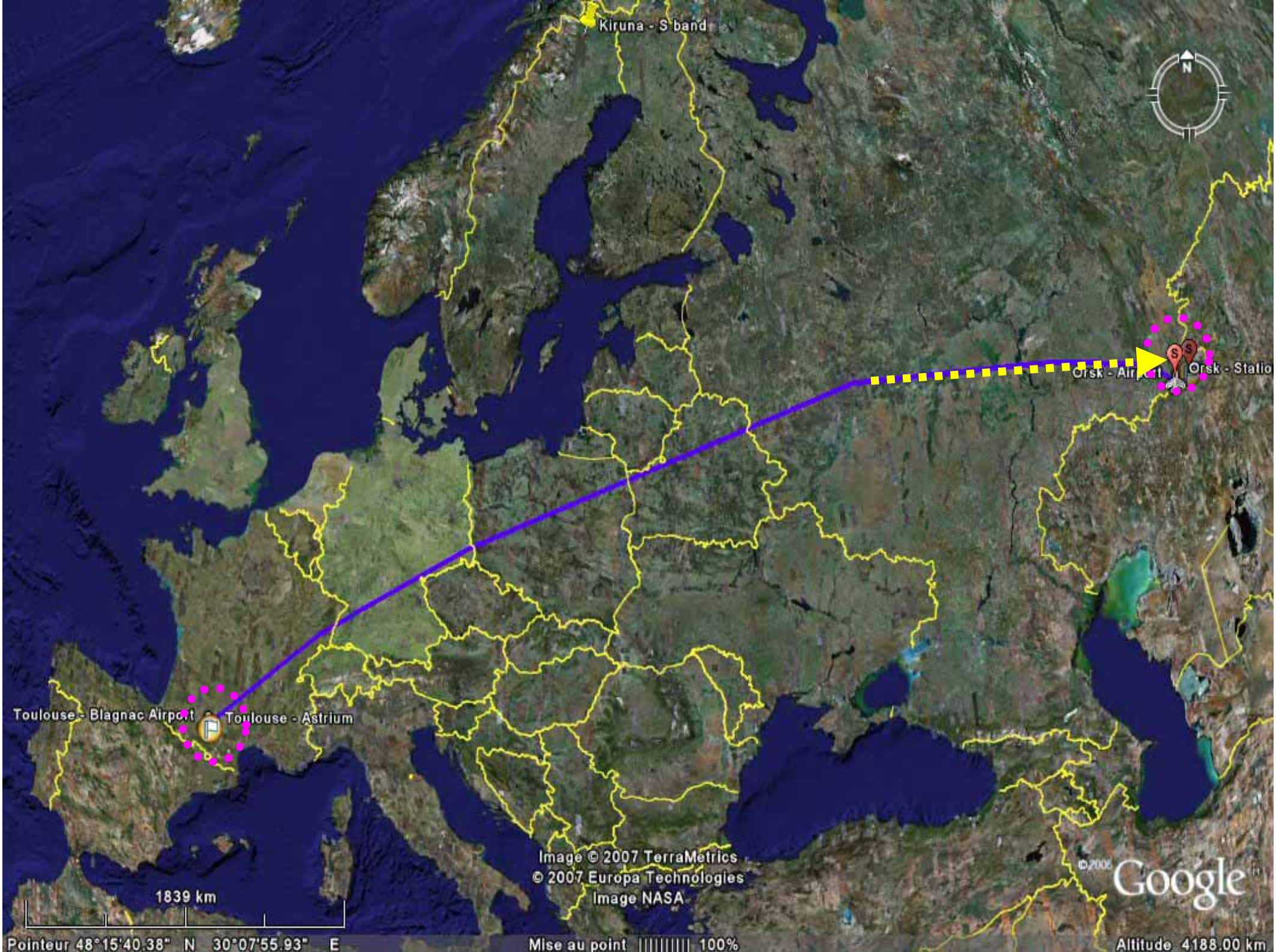

Leica


EADS

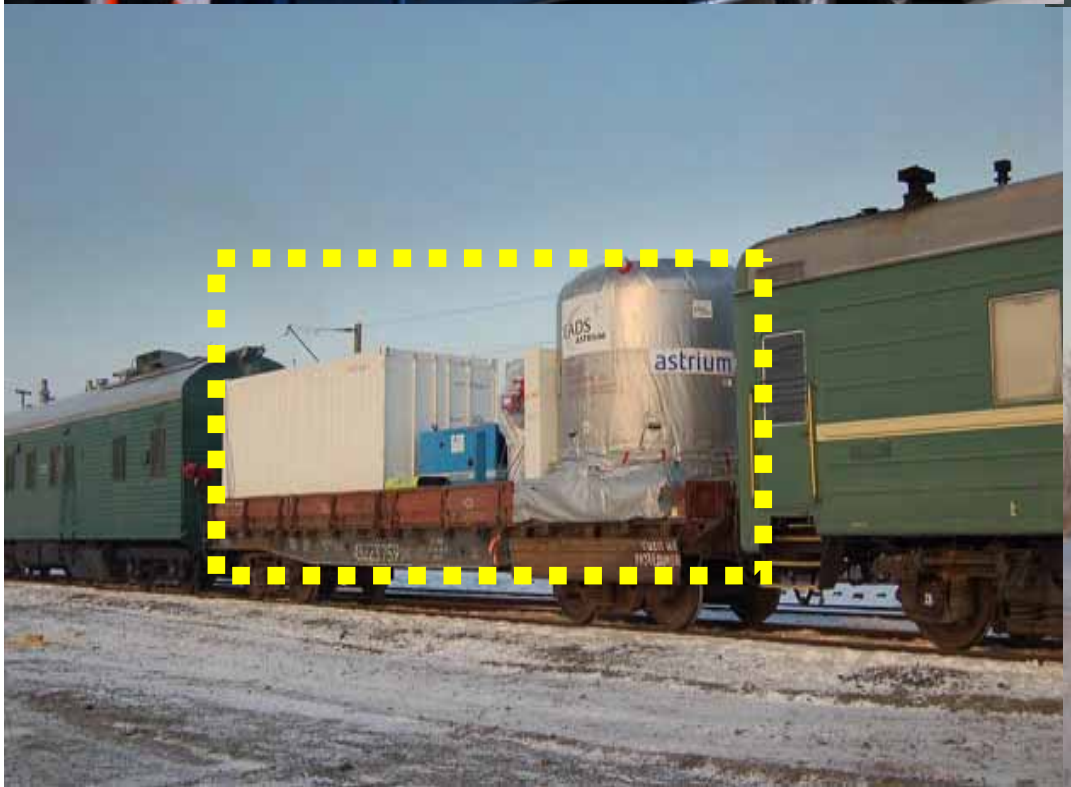





EADS
ASTRIUM
EADS
astrium


Kiruna - S band
Orsk - Airport
Orsk - Statio
Toulouse - Blagnac Airport
Toulouse - Astrium
Image © 2007 TerraMetrics
© 2007 Europa Technologies
Image NASA
1839 km
Google
Pointeur 48°15'40.38" N 30°07'55.93" E
Mise au point 100%
Altitude 4188.00 km


EADS


astrium


GEIST
MAN


EADS
EADS
SPACE
EADS
ASTRIUM
EADS
ASTRIUM

Yasny Launch Site in Russia

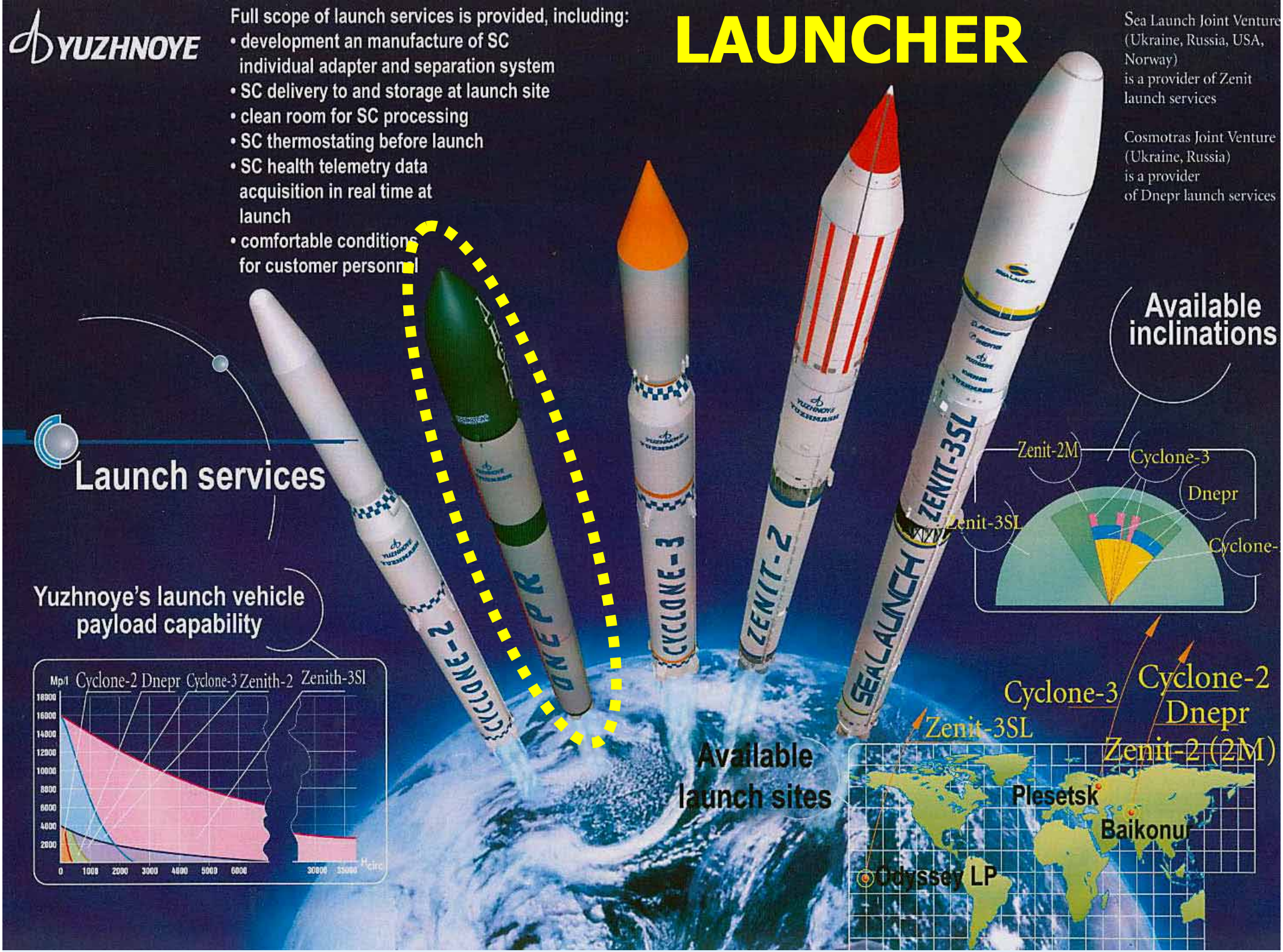
YUZHNOYE

LAUNCHER

Full scope of launch services is provided, including:
- development an manufacture of SC individual adapter and separation system
- SC delivery to and storage at launch site
- clean room for SC processing
- SC thermostating before launch
- SC health telemetry data acquisition in real time at launch
- comfortable conditions for customer personnel

Sea Launch Joint Venture (Ukraine, Russia, USA, Norway) is a provider of Zenit launch services

Cosmotras Joint Venture (Ukraine, Russia) is a provider of Dnepr launch services



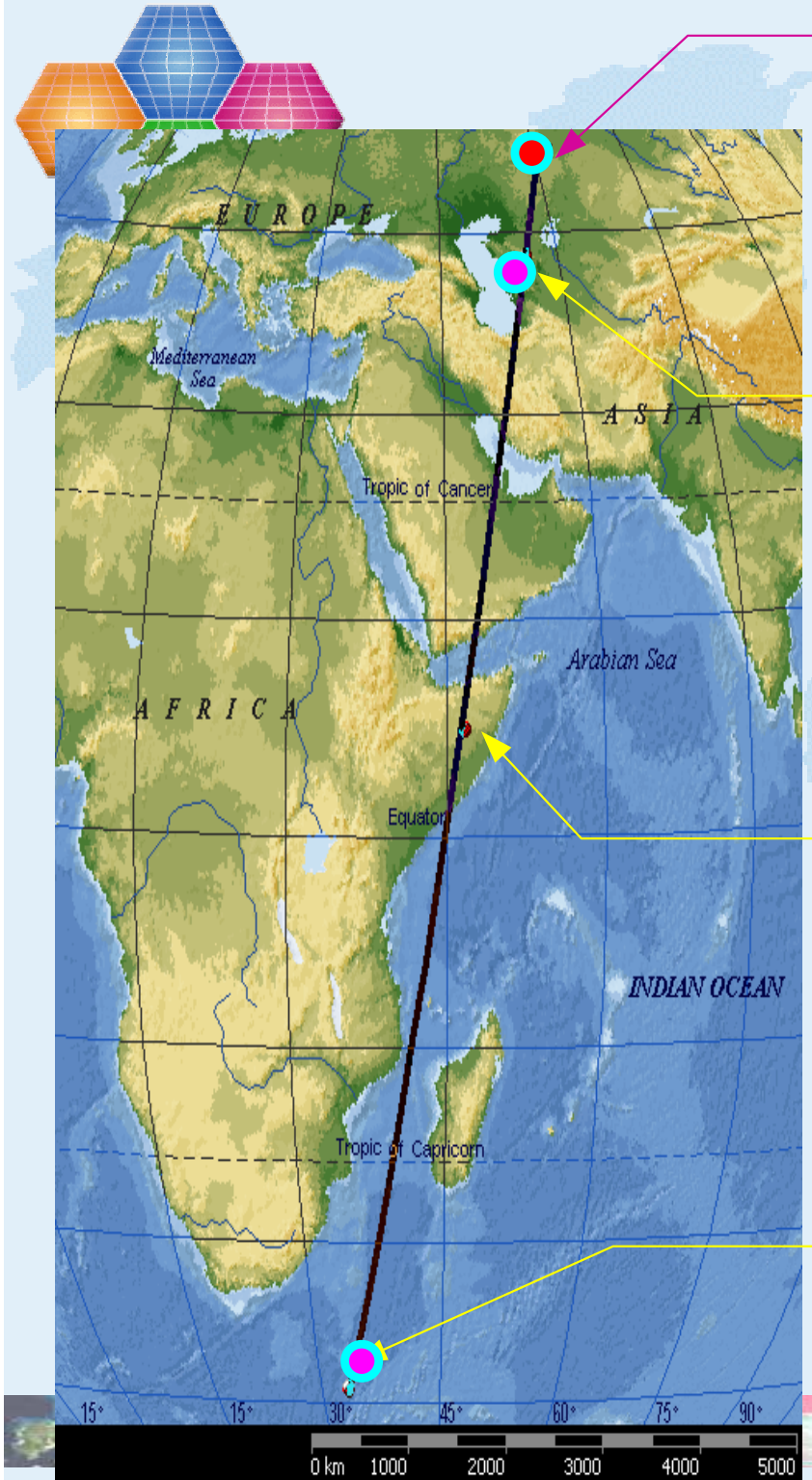
Launch services

Available inclinations

Yuzhnoye's launch vehicle payload capability

Available launch sites

THEOS Launch



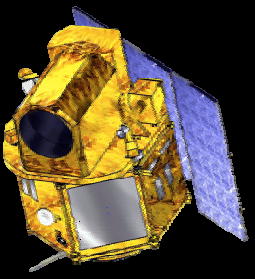
Yasny
Launch point

1st stage impact area

SC separation

2nd stage impact area

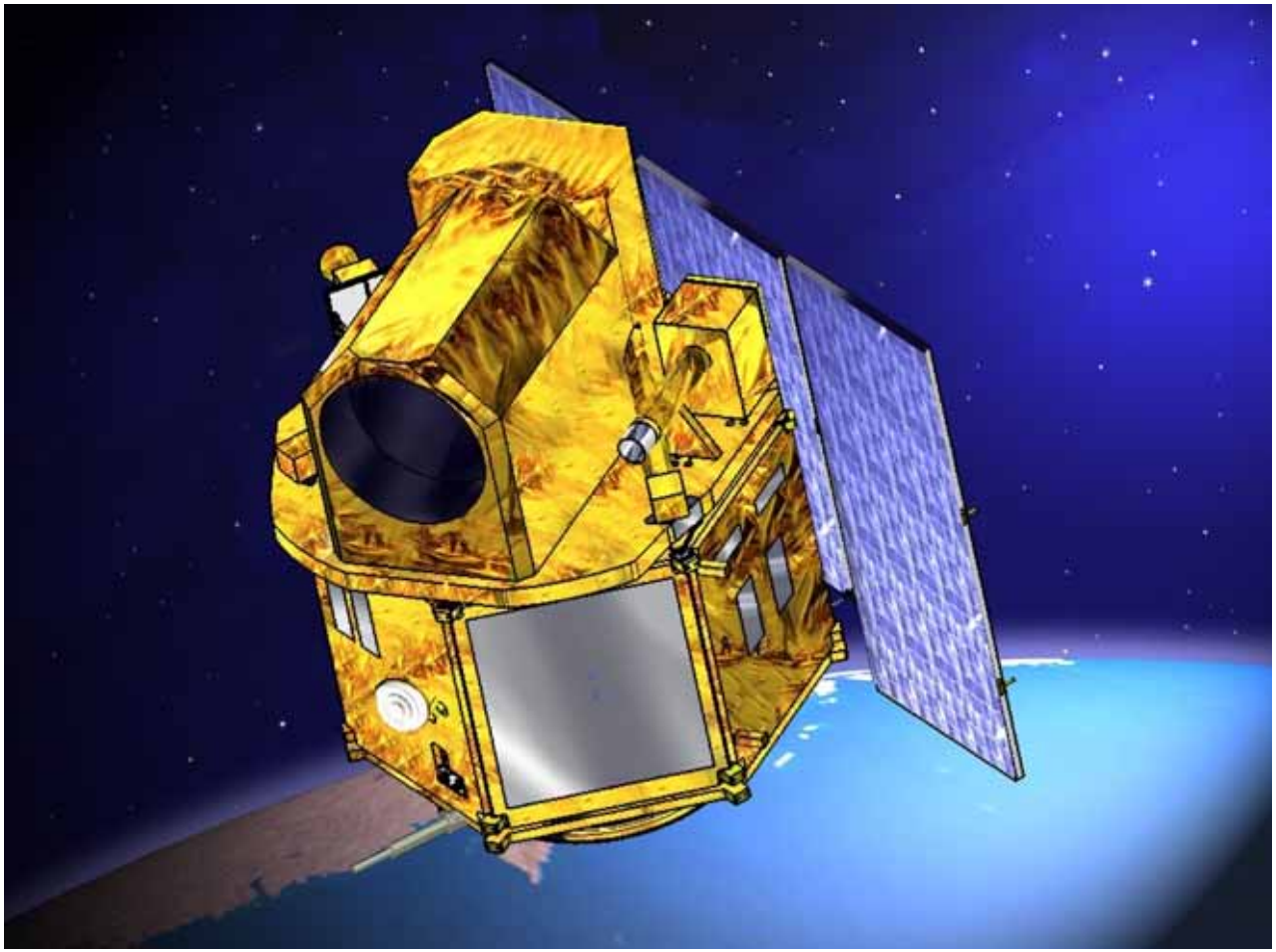
- **Launch Vehicle DNEPR**
- **Launch Site: Yasny, Russia**



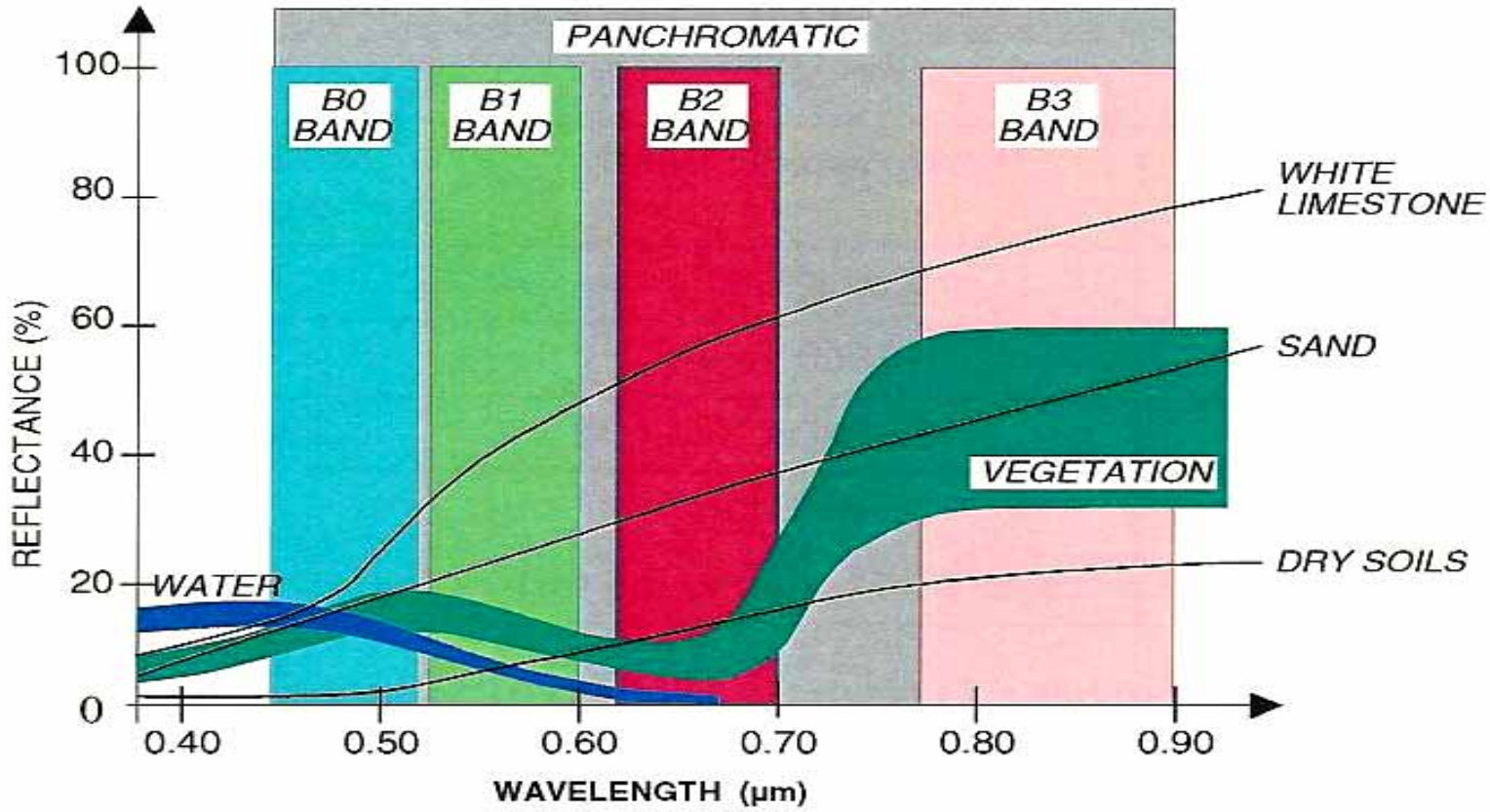
THEOS

(THailand Earth Observation Satellite)

Characteristics of THEOS Satellite



- **Mass: 750 kg.**
- **Orbit: Sun Synchronous**
- **Altitude: 822 km.**
- **Inclination: 98.7**
- **Repeat Cycle: 26 days**
- **Mean Local Time: 10.00 a.m.**
- **Payload:**
  - Panchromatic telescope
  - Multi-spectral camera
- **On-board Memory: 51Gb**
- **Mission Data: X-band Link**
- **TT&C: S-band Link**
- **Attitude Orbit Control and Orbit Determination:**
  3-axis stabilized, Star Tracker, Gyro, GPS, Magnetic Torque, Sun Sensor
- **Design Life Time: 5 Years**
- **Launch Date: Mid 2007**



THEOS SPECTRAL BANDS

Name	Description	Spectral Bandwidth (TBC)
PAN	Panchromatic	0.45 to 0.90 µm
B0	Multispectral / Blue	0.45 to 0.52 µm
B1	Multispectral / Green	0.53 to 0.60 µm
B2	Multispectral / Red	0.62 to 0.69 µm
B3	Multispectral / Near Infra-Red	0.77 to 0.90 µm

Table 4.1/A : Spectral Performances

Multispectral Image (Medium resolution)

Panchromatic Image (High resolution)

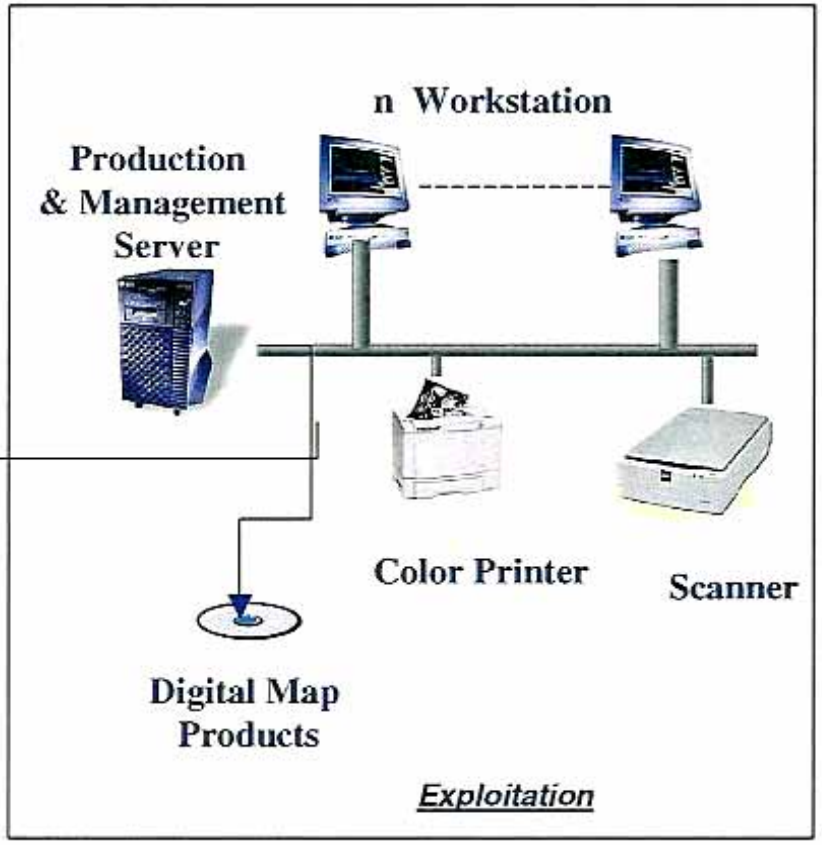
Pan Sharpening Process

Pan Sharpened Image (High resolution)

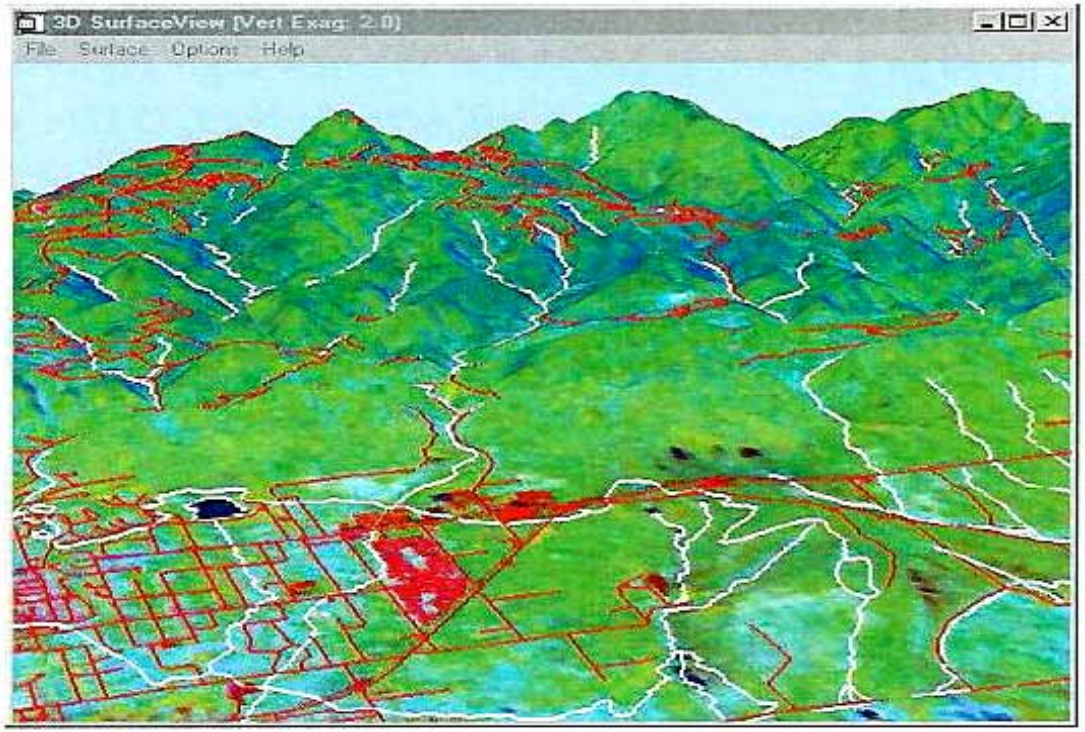
ILLUSTRATION OF THE PAN SHARPENING PROCESS

The PAN sharpening technique allows the production of very detailed coloured images (with representative colors thanks to the choice of the 4 MS bands)

Section 1 : System Presentation
Chapter 7 : THEOS Image Ground Segment



Typical IGS-Exploitation hardware configuration

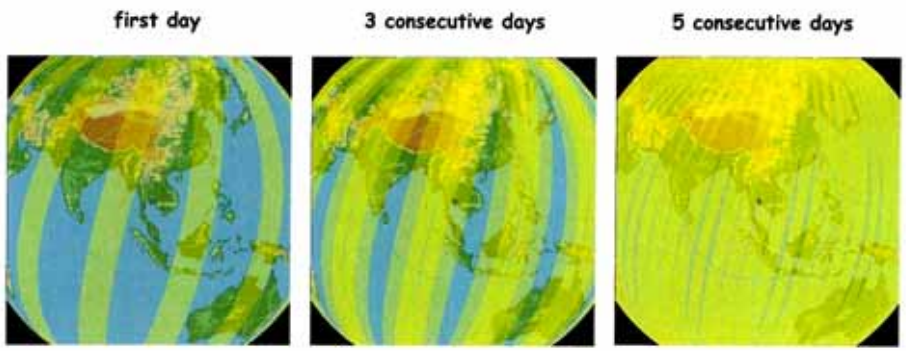


Example of DTM generation

System Performances - Accessibility

ASTRIUM

- Full accessibility in less than 5 days with up to 30° roll angle
- Accessibility is only 3 days for 80% of the area



THEO.PS.00084.T.ASTR

[29]

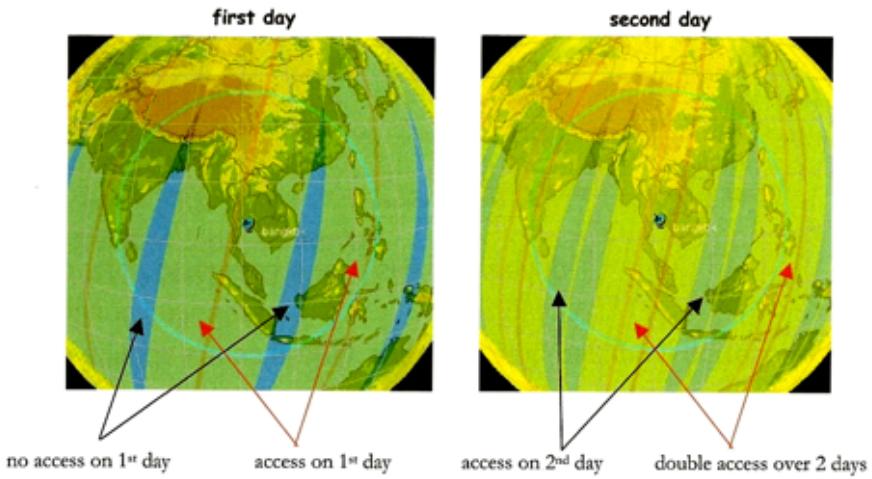
30 ° roll angle

Revisit 5 days

System Performances - Accessibility

ASTRIUM

- Full accessibility in less than 2 days with up to 50° roll angle
- Accessibility is only one day for 90% of the area



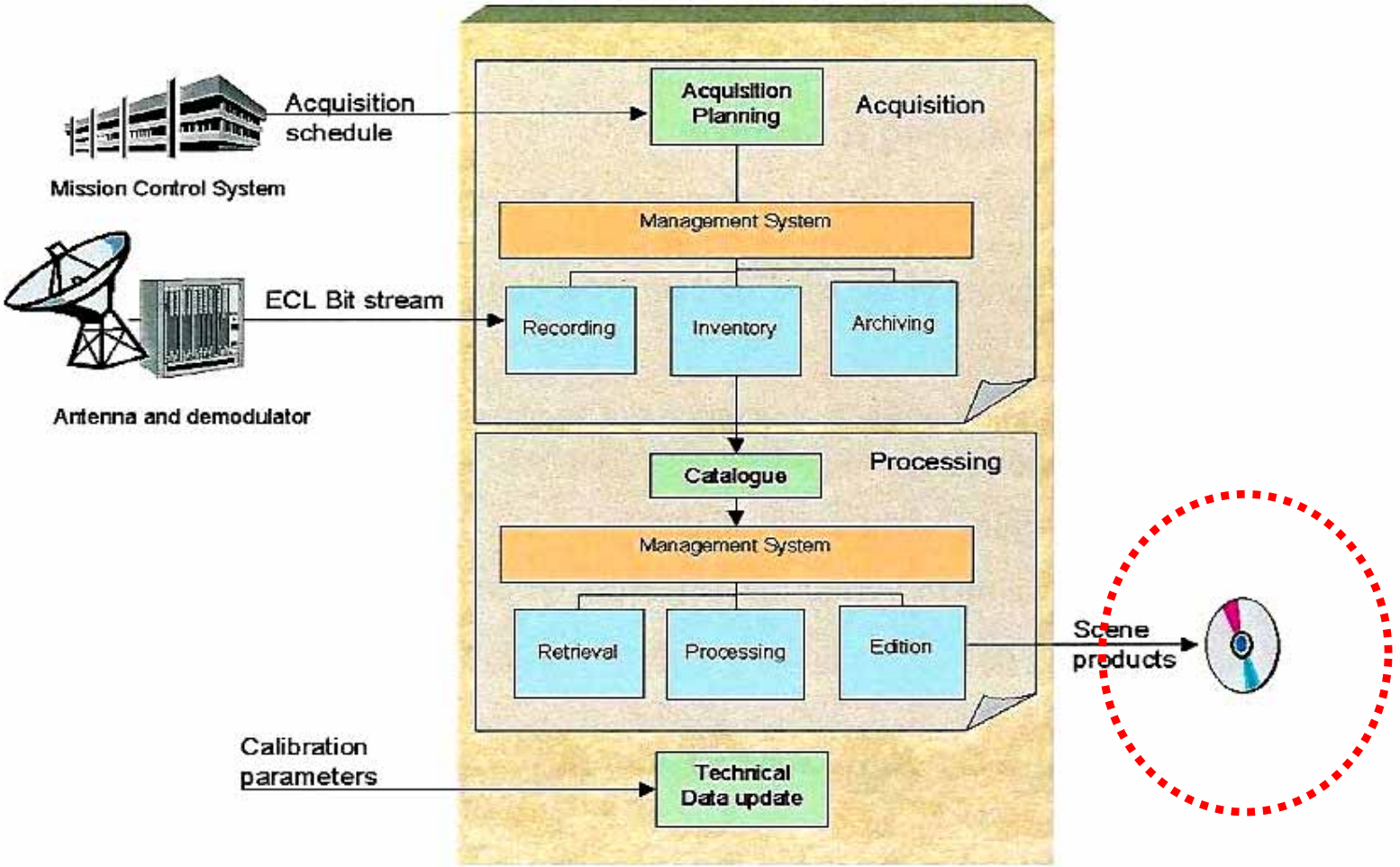
THEO.PS.00084.T.ASTR

[28]

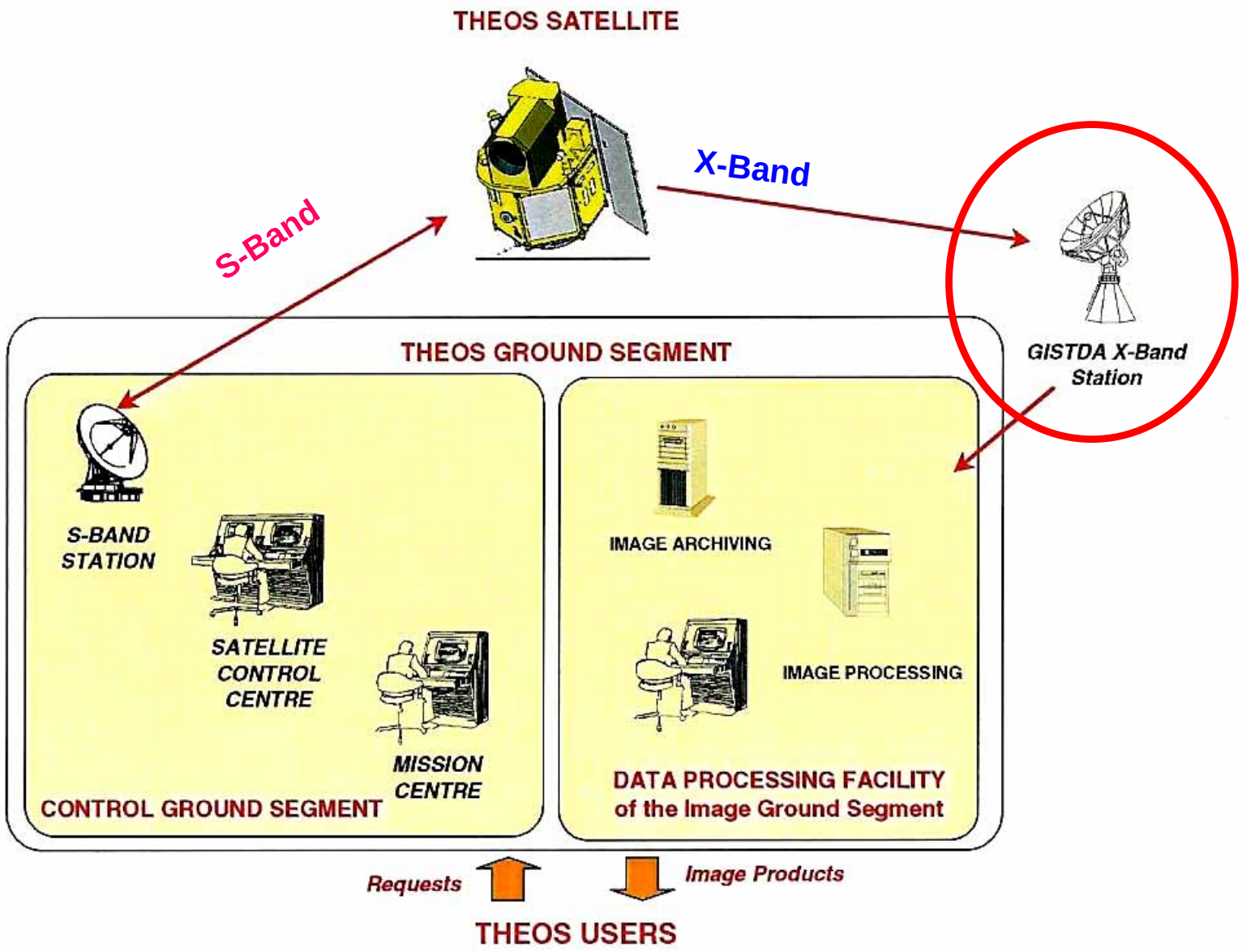
50 ° roll angle

Revisit 2 days

Section 1 : System Presentation
Chapter 7 : THEOS Image Ground Segment



TYPICAL IGS-DPF FUNCTIONAL ARCHITECTURE OVERVIEW



THEOS Ground Segment in Thailand

THEOS Ground Segment : IGS Ground Receiving Station in Bangkok

THEOS Image Ground Segment installed at Thailand Ground Stations Compound, Lad Krabang, Bangkok.

IGS Installation completed. Acceptance test completed on Jan 26, 2007.

Suvarnabhumi Airport

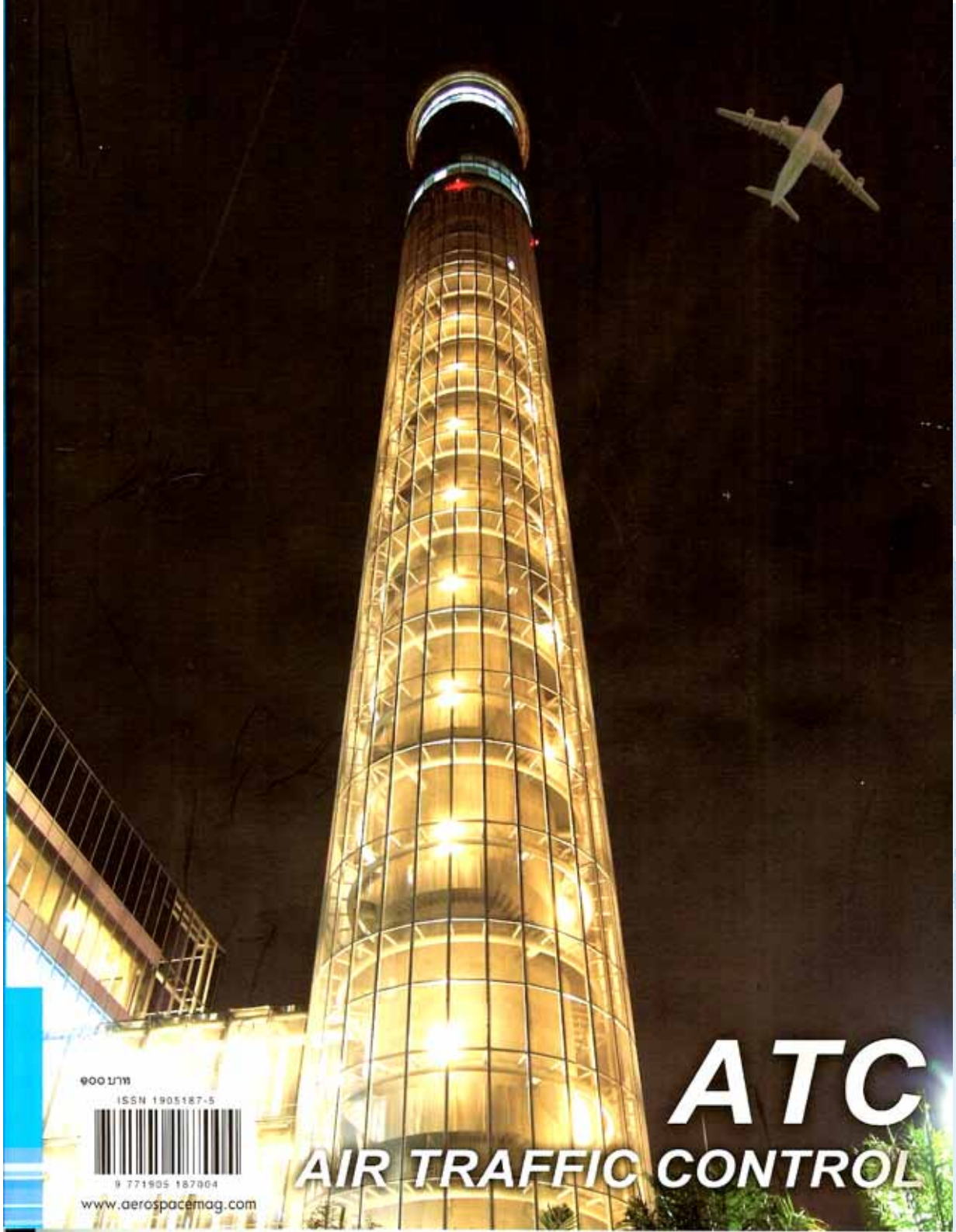
เปรียบเทียบพื้นที่ก่อสร้างสนามบินสุวรรณภูมิ จ. สมุทรปราการ

13 ธันวาคม 2545

13 December 2002

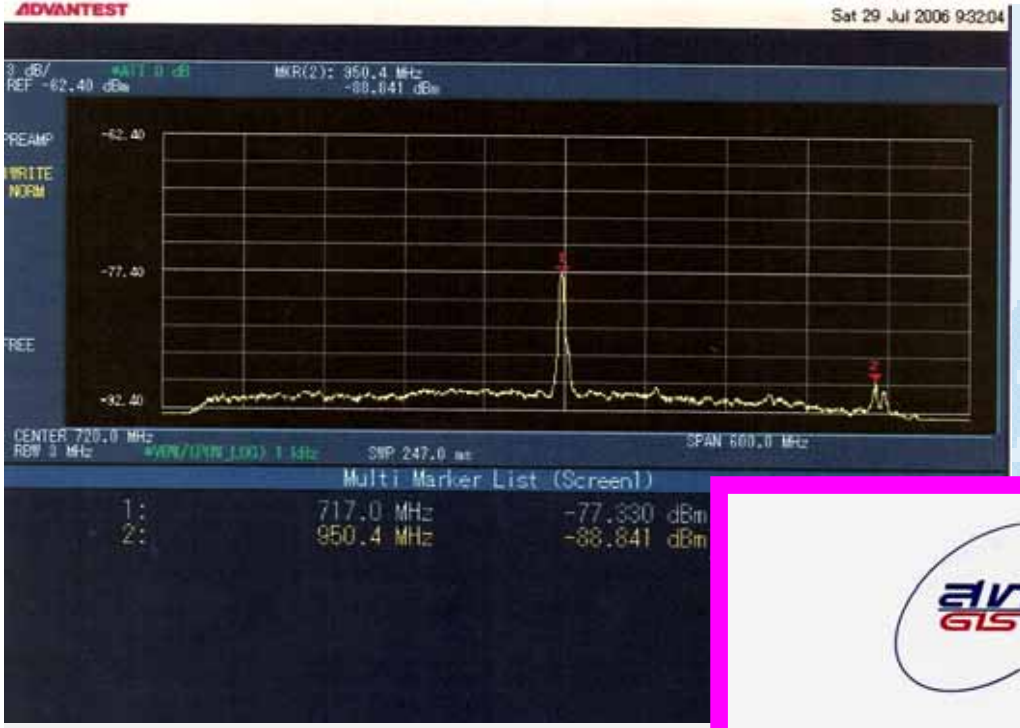
4 ธันวาคม 2546

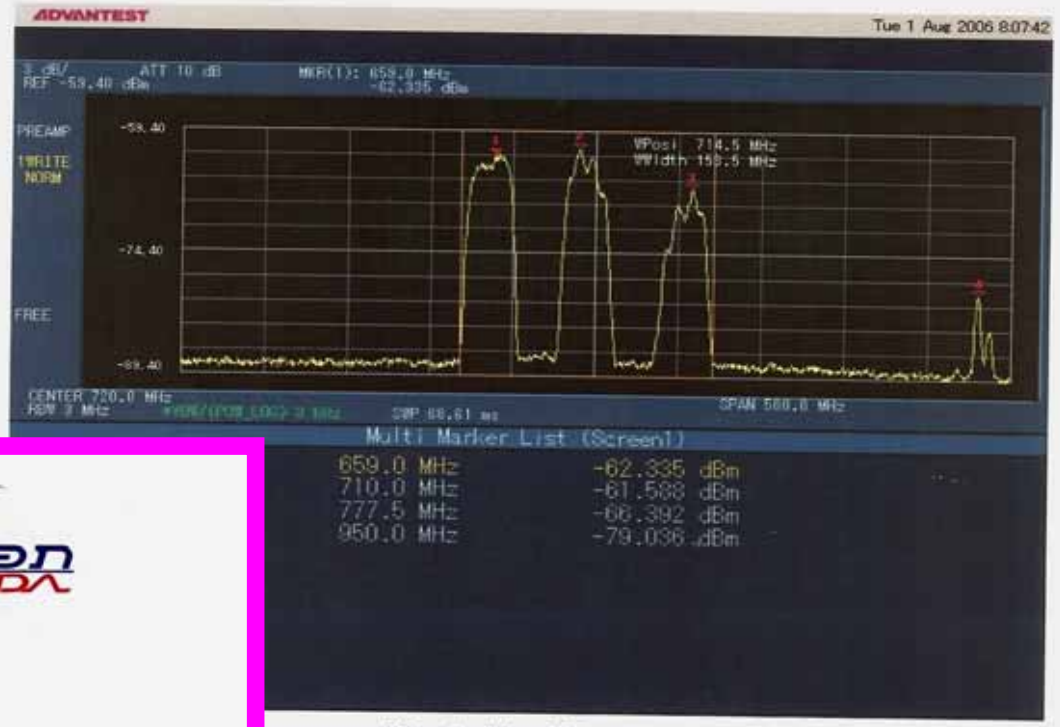
4 December 2003



The height of air traffic controller at Suvarnna Bhumi Airport is 132 m.

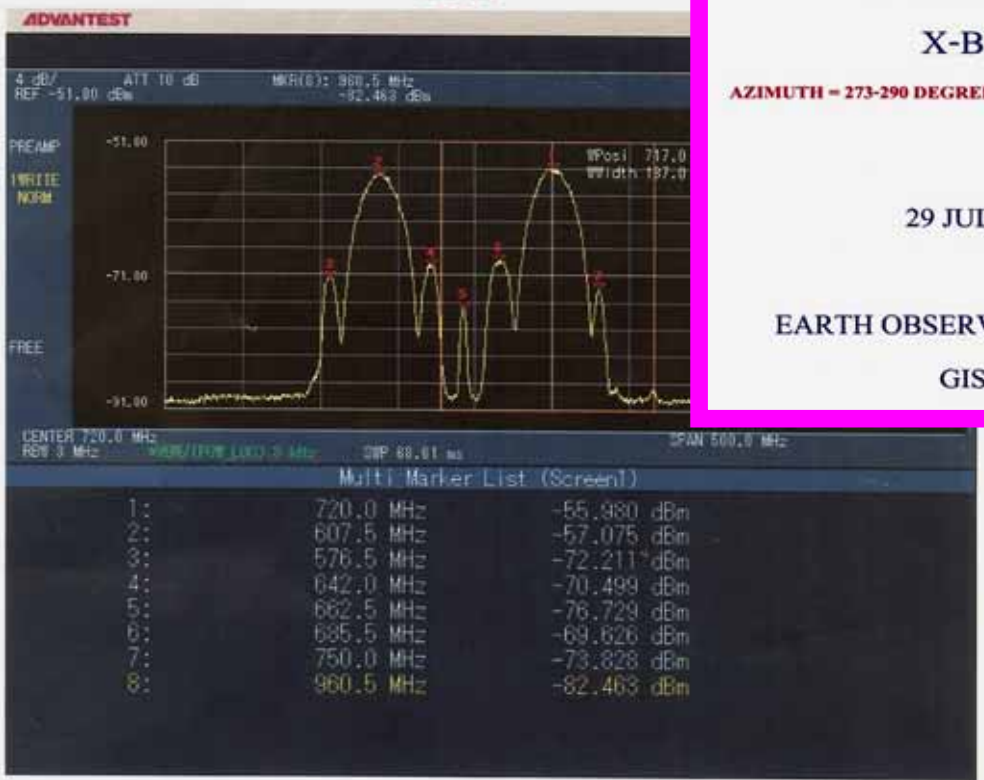
The radar signal from this tower interferes the system at Lad Grabang Ground Receiving Station for receiving the data from satellites

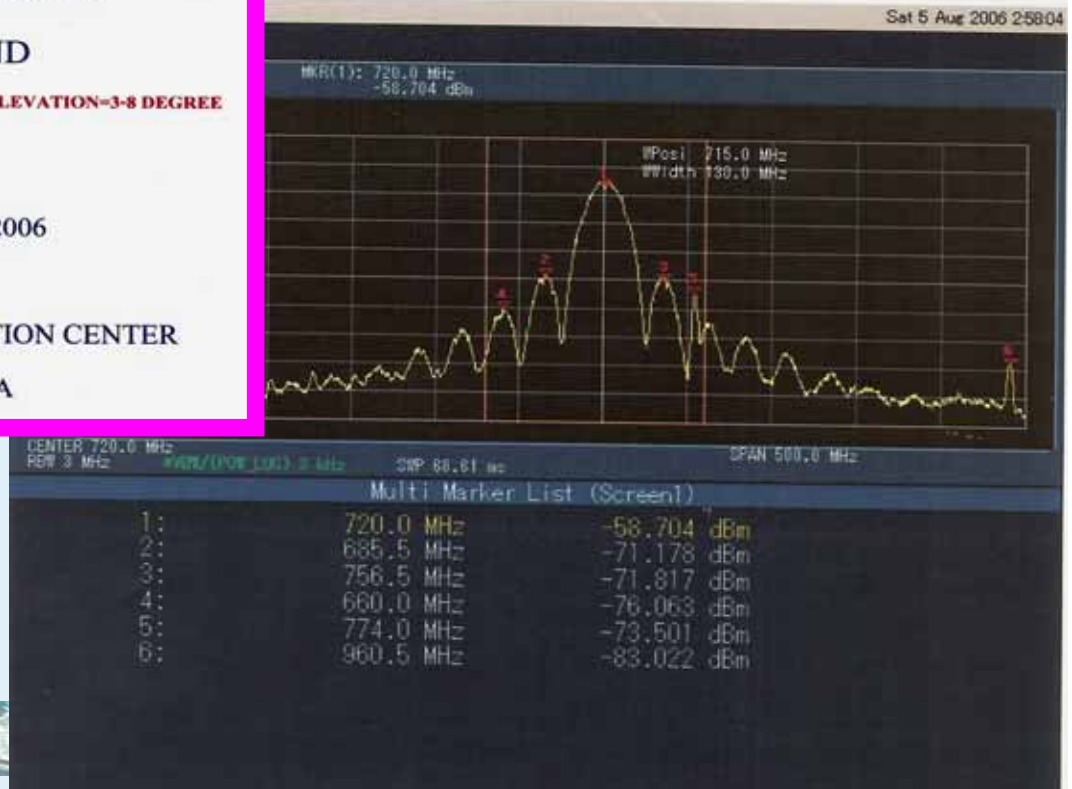




EL = 0 AZ = 327

SPOT 5





INTERFERENCE

X-BAND

AZIMUTH = 273-290 DEGREE ELEVATION=3-8 DEGREE

29 JULY 2006

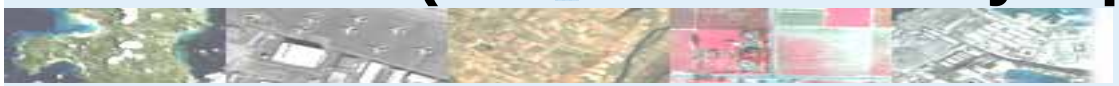
EARTH OBSERVATION CENTER

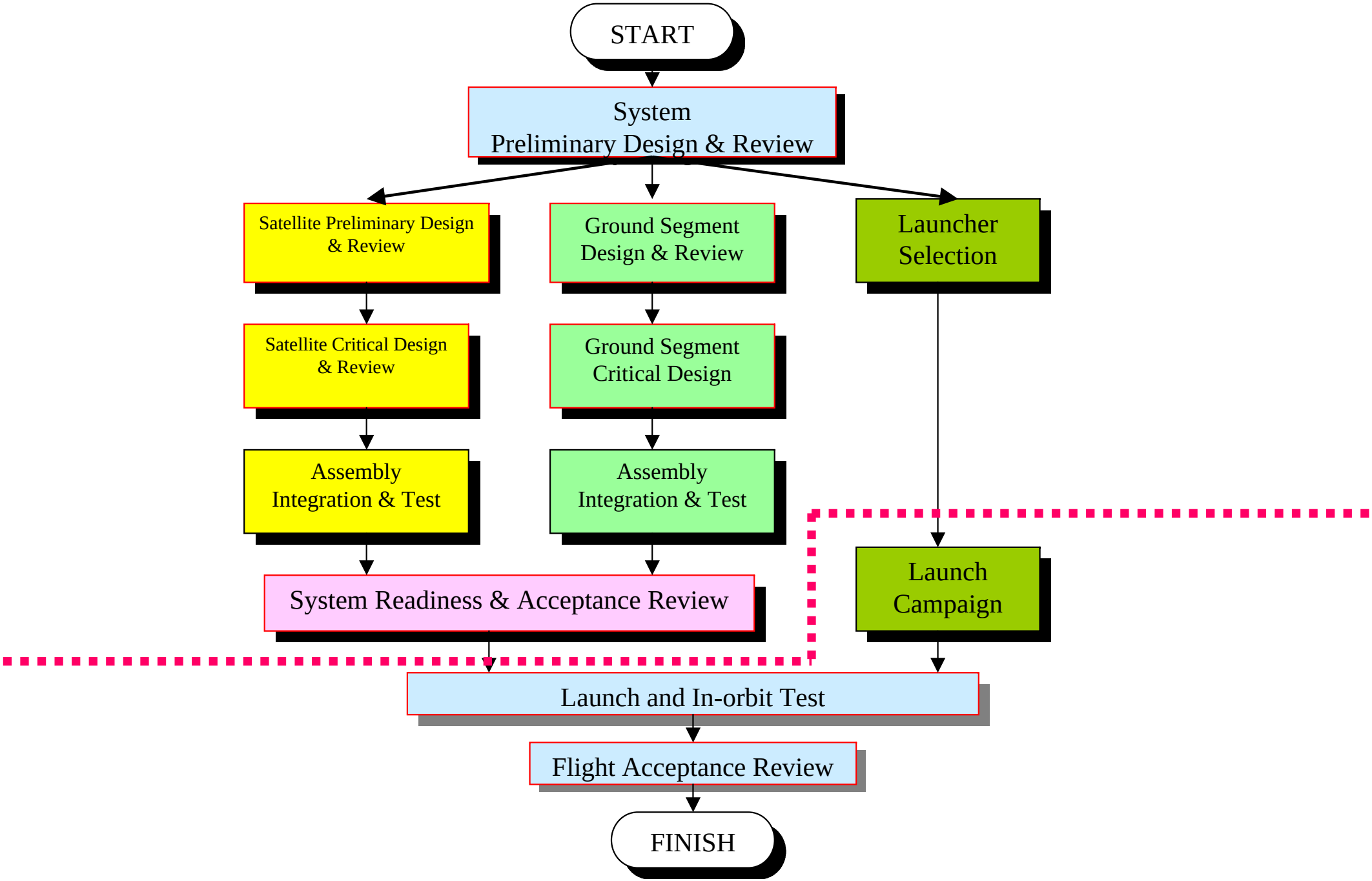
GISTDA

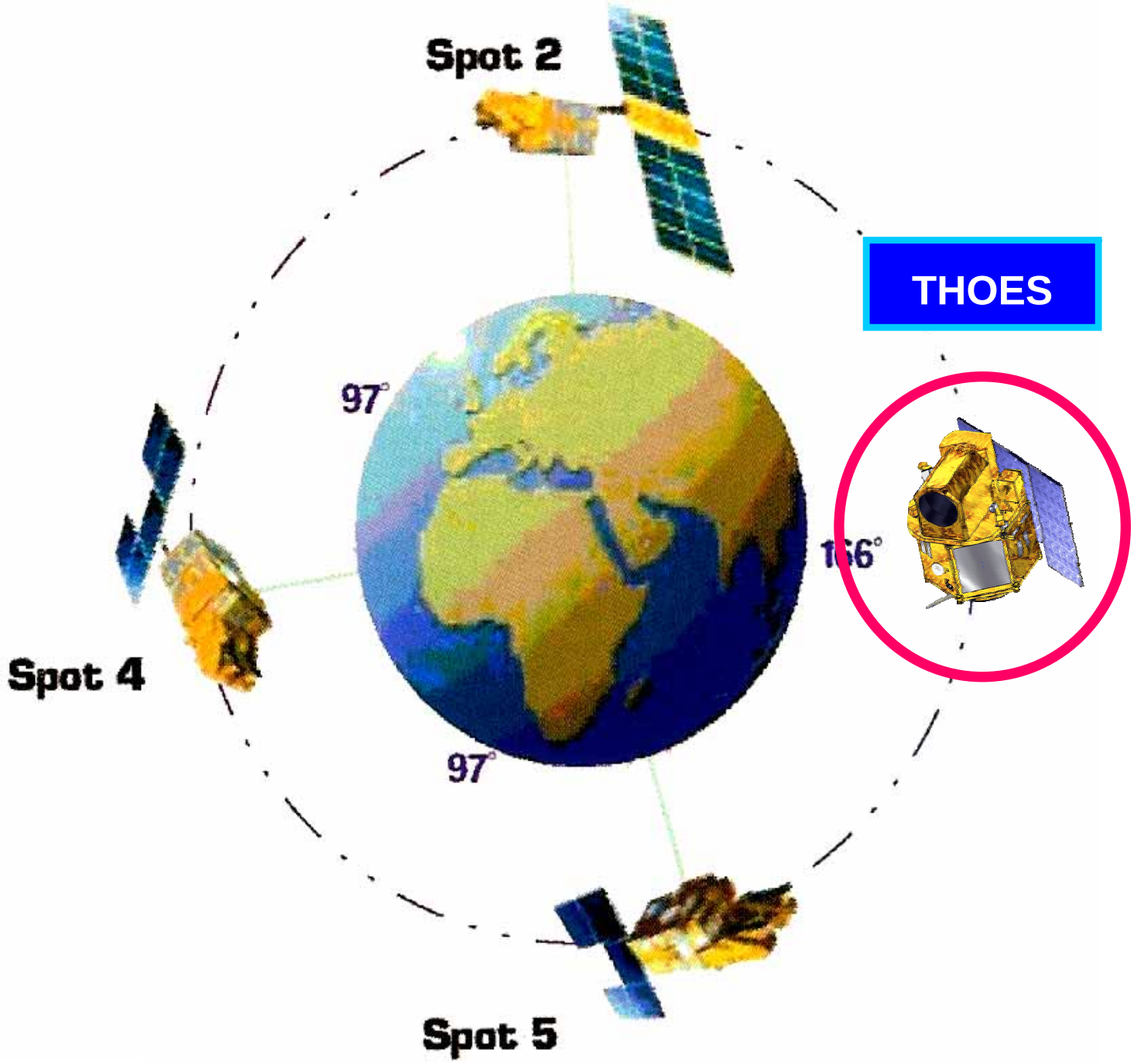
THEOS GROUND CONTROL STATION
SRI RACHA, CHOLBURI, THAILAND

Operational Qualification

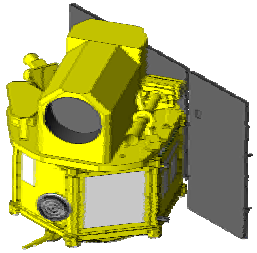
- Nominal Operation
- Anomaly Recovery Operation
- LEOP (Launch and Early Operations Phase) Operation



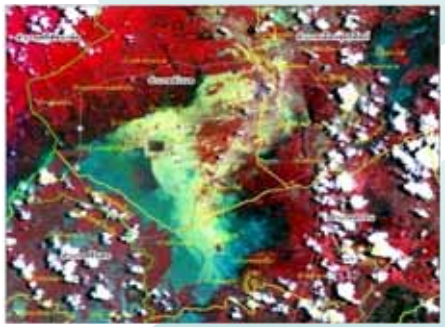

START
System
Preliminary Design & Review
Satellite Preliminary Design
& Review
Ground Segment
Design & Review
Launcher
Selection
Satellite Critical Design
& Review
Ground Segment
Critical Design
Assembly
Integration & Test
Assembly
Integration & Test
System Readiness & Acceptance Review
Launch
Campaign
Launch and In-orbit Test
Flight Acceptance Review
FINISH


Spot 2
THOES
97°
166°
Spot 4
97°
Spot 5

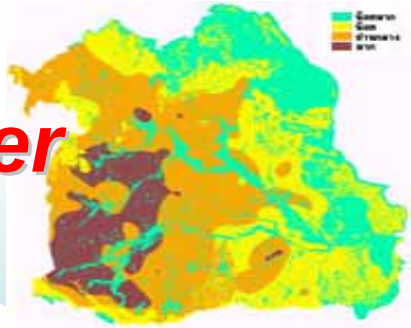
THEOS Data for Implementing GEOSS's Activities



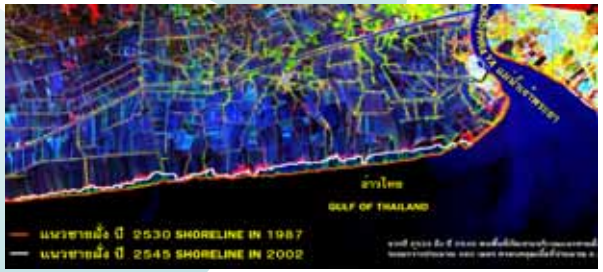
EOS Applications on Disaster



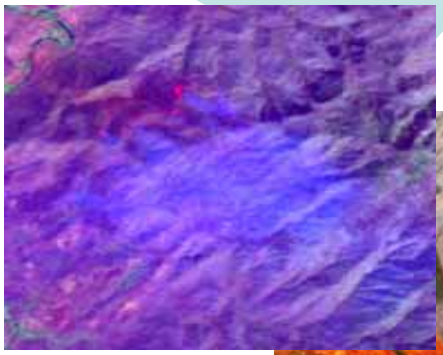
Flood



Drought



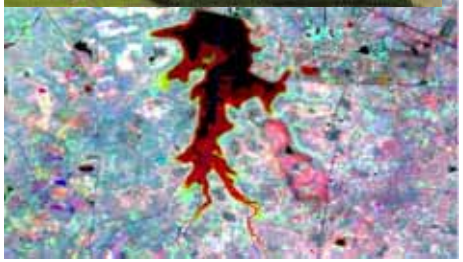
Coastal



Forest Fire

Water Resources

Land Slide



Tsunami

Thank you for Your attention

Website of GISTDA :
http://www.gistda.or.th

Geo-Informatics and Space Technology Development Agency (GISTDA)
Ministry of Science and Technology, Thailand