THE UTILIZATION OF REMOTE SENSING AND GIS TECHNOLOGY IN VARIOUS APPLICATIONS FOR SUSTAINABLE DEVELOPMENT IN MALAYSIA

BY

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MALAYSIAN REMOTE SENSING AGENCY
Ministry of Science, Technology and Innovation (MOSTI)

9-12 SEPTEMBER 2008

UN/AUSTRIA/ESA SYMPOSIUM 2008 “SPACE TOOLS AND SOLUTIONS MONITORING THE ATMOSPHERE AND LAND COVER” GRAZ, AUSTRIA
PRESENTATION OUTLINE

INTRODUCTION

- MALAYSIAN REMOTE SENSING AGENCY
- OPERATIONALISATION OF REMOTE SENSING AND RELATED TECHNOLOGIES

MAIN FOCUS:

- HUMAN RESOURCE & INFRASTRUCTURE CAPACITY BUILDING
- APPLICATION DEVELOPMENT
- TECHNOLOGY DEVELOPMENT AND BASIC RESEARCH
- USER-SERVICES AND TECHNOLOGY PROMOTIONS

CONCLUSION
MALAYSIAN REMOTE SENSING AGENCY

✓ Formerly known as Malaysian Centre for Remote Sensing (MACRES) - established as an R&D centre in August 1988

✓ Upgraded to a department status with the new name; Malaysian Remote Sensing Agency, on 15 February 2008

✓ 250 staff including scientists, engineers and contract researchers.
WHERE ARE WE LOCATED

THAILAND

MALAYSIA

MALAYSIAN REMOTE SENSING AGENCY
KUALA LUMPUR

INDONESIA
QUICKBIRD PAN-SHARPEN 0.6m IMAGE OF REMOTE SENSING MALAYSIA

REMOTE SENSING MALAYSIA

UM/OPEN UNIVERSITY
OBJECTIVE

To develop remote sensing and related technologies applications for their operationalisation in user agencies for management of natural resources, environment and disasters, security, land and infrastructure development of the nation.
STRATEGIC FOCUS

- R&D (applications and technology development);
- Centralised remote sensing satellite image provider; and
- Technical advisory and technology promotion.
MECHANISM FOR OPERATIONALISATION OF RS AND RELATED TECHNOLOGIES

REMOTE SENSING DATA

VALUE-ADDED DATA

Acquire

Distribute

REMOTE SENSING DATA
VALUE-ADDED DATA

TECHNICAL ADVISORY SERVICE

APPLICATION PACKAGES AND METHODOLOGIES

USER AGENCIES

REMOTE SENSING MALAYSIA
- RS DATA PROVIDER
- R&D AGENCY

User Agencies
Input/Requirement

Develop/Adapt/Adopt

Technology transfer

(through collaborative projects, training, workshop, and research publications)
## TECHNICAL WORKING GROUP ON REMOTE SENSING

**Chairman:** Malaysian Remote Sensing Agency  
**Members:**

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<td>1.</td>
<td>EPU, Prime Minister’s Department</td>
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<td>National Security Council</td>
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<td>3.</td>
<td>Defence Geospatial Division, MINDEF</td>
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<td>Risik 3, MINDEF</td>
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<td>PDRM</td>
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<td>Department of Surveying and Mapping, Malaysia</td>
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<td>Department of Agriculture</td>
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<td>Department of Forestry</td>
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<td>Department of Fishery</td>
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<td>Department of Mineral and Geoscience</td>
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<td>Department of Public Work</td>
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<td>Department of Town and Country Planning</td>
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<td>Ministry of Housing and Local Government</td>
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<td>Ministry of Higher Learning</td>
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<td>18.</td>
<td>Sabah State Secretary Department</td>
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<td>19.</td>
<td>Chief Minister’s Department, Sarawak</td>
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<td>20.</td>
<td>Sarawak Land and Survey Department</td>
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<td>21.</td>
<td>National Space Agency (ANGKASA)</td>
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<td>Malaysian Meteorological Department</td>
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HUMAN RESOURCE AND CAPACITY BUILDING
MALAYSIAN REMOTE SENSING AGENCY - HQ

1988 - 1995

1999 - PRESENT

OPERATIONS ROOM

LIBRARY

TRAINING FACILITIES

WORKSTATION

DATA CHAMBER

VITUAL REALITY

OPTO-CHEMICAL LABORATORY

ANECOIC CHAMBER

MOBILE SCATTEROMETER
GROUND RECEIVING STATION
Temerloh, Pahang

RECEIVES SATELLITE DATA FROM SPOT, RADARSAT, NOAA, MODIS AND IRS-P4 (OCM)
MARSA GROUND RECEIVING STATION (MGRS) – 2500 KM RADIUS COVERAGE
SOFTWARE DEVELOPMENT

SIPS - Spatial Information Processing System

Views DataUtility Registration EnhanceMent Interpretation DTM ModelBase GIS Mapping VirtualReal Help

SIPS
VERSION 1.0

MALAYSIA CENTRE FOR REMOTE SENSING

USER MANUAL FOR SPATIAL INFORMATION PROCESSING SYSTEM (SIPS)
USER-SERVICES
AND
TECHNOLOGY PROMOTIONS
DATA PRODUCTS AND SERVICES

- MULTI RESOLUTION IMAGERY TO MEET MULTISCALE NEEDS (FROM 0.6 m to 1 km)
- STANDARD AND VALUE-ADDED DATA PRODUCTS
- PHOTOGRAPHIC PRODUCTS
- CUSTOM ACQUISITION VIA SATELLITE PROGRAMMING SERVICES
TRAINING/ PROMOTIONS/ SEMINAR

Malaysian Remote Sensing Agency (REMOTE SENSING MALAYSIA)
Ministry of Science, Technology and Innovation (MOSTI)
http://www.remotesensing.gov.my  Tel: 603-26973400  Fax: 603-26973350
INTERNATIONAL COLLABORATORS

Australia (ACRES, CSIRO, UNSW)
Canada (CCRS, CSA)
China (NRSCC, CSDA, IECAS, SITP, BNU)
European Space Agency (ESA)
France (CNES)
India (IRSA, ISRO)
Indonesia (LAPAN)
Japan (JAXA)
Singapore (CRISP)
South Africa (NCSR)
Sweden (SSC)
Thailand (GISTDA)
The Netherlands (ITC)
UK (NRSC)
United States (NASA, JPL, MIT, UCLA, USGS, UTA)
Vietnam (NCNST, HIO)
REGIONAL REMOTE SENSING DATA SHARING

MACRES PROVIDE REMOTE SENSING DATA TO LAPAN, INDONESIA TO SUPPORT RECONSTRUCTION OF:

- YOGJAKARTA EARTHQUAKKE IN 2006
APPLICATION
DEVELOPMENT
NATIONAL PROGRAMME ON SPACE TECHNOLOGY DEVELOPMENT AND APPLICATIONS

USER SEGMENT

APPLICATIONS DEVELOPMENT
- REMOTE SENSING (Earth Observation)
- REMOTE SENSING MALAYSIA/NOD
- METEOROLOGY
  MALAYSIAN METEOROLOGICAL DEPARTMENT
- COMMUNICATIONS
  MINISTRY OF ENERGY, WATER AND COMMUNICATION
- GLOBAL POSITIONING SYSTEM AND NAVIGATION
  REMOTE SENSING MALAYSIA/JUPEM
- SPACE SCIENCE
  ANGKASA

GROUND SEGMENT

Airborne System

Data Reception

Processing

SPACE SEGMENT

Satellite System

TECHNOLOGY DEVELOPMENT
- SATELLITE DESIGN AND INTEGRATION
  ATSB
- SENSOR / PAYLOAD DEVELOPMENT
  REMOTE SENSING MALAYSIA/ATSB
- ATTITUDE & ORBIT CONTROL
  ATSB
- TRACKING, TELEMETRY AND COMMAND
  ATSB
REMOTE SENSING – APPLICATIONS

WATER
- Potential Drinking Water Zones
- Command Area Management
- Reservoir Sedimentation

FOREST, ENVIRONMENT, BIO
- Forest Cover & Type Mapping
- Forest Fire and Risk Mapping
- Biodiversity Characterisation
- Environmental Impact Studies

AGRICULTURE & SOIL
- Crop Acreage & Production Estimation
- Soil & Land Degradation Mapping
- Watershed Development
- Horticulture Mission for North-East

WEATHER & CLIMATE
- Extended Range Monsoon Forecasting
- Ocean State Forecasting

MILITARY & SURVEILLANCE
- Intelligence
- Mapping & Rescue Planning

LAND
- Landuse/Land Cover Mapping
- Wasteland Mapping
- Urban & Geological
- Large Scale Mapping

OCEAN
- Potential Fishing Zone (PFZ)
- Coastal Zone Mapping

DISASTER SUPPORT
- Flood Damage Assessment
- Forest Fire
- Land Slide Hazard Zonation
INTEGRATED GEOSPATIAL DATABASE AND PLANNING SYSTEM (IGDP SYSTEM)

- **Natural Resources Management**
  - National Biodiversity Database Development
  - Monitoring of Environmentally Sensitive Areas
  - Highlands and Islands Monitoring
  - Logging Monitoring
  - Ground Water Potential Zoning
  - Mineral Potential Zoning

- **Agriculture**
  - Precision Farming for Paddy and Oil Palm
  - Rice Yield Prediction
  - Rubber Replanting
  - Fishing Zone Identification

- **Disaster Management**
  - Forest Fire
  - Flood
  - Landslide
  - Tsunami

- **Environmental Health and Epidemic Diseases**

- **National Security and Sovereignty**
MONITORING ENVIRONMENTALLY SENSITIVE AREA

- Reservoir
- Irrigation
- Recreation

Pontian Dam
Ground Water Potential Zoning

Base Layers:
- Geomorphology
- Lithology
- Slope
- Rainfall
- Lineament
- Elevation

GWP Model

\[ \bar{S} = \frac{\sum_{i}^{n} S_{ij} W_i}{\sum_{i}^{n} W_i} \]

Legend:
- Very High
- High
- Medium
- Low
- Very Low

20 10 0 20 kilometers
BIO-D LANDSCAPE DATABASE

Marine

Mangrove

Coastal

Forest/Mountain

Inland Waters

Agriculture
NADDI: HOTSPOTS INFORMATION SYSTEM
DETECTION AND MONITORING

15 JAN 1998

15 FEB 1998

23 MAC 1998

30 MAC 1998

FIRE EVOLUTION – MIRI, SARAWAK
DETECTION AND MONITORING

OPEN BURNING DETECTED BY SPOT 5
ON THE 15 JAN 2005
HIGHLAND MANAGEMENT

MONITORING DEVELOPMENT ACTIVITIES IN HIGHLANDS

LANDSLIDE HAZARD MAP FOR:
- LANDUSE PLANNING
- DISASTER RISK REDUCTION

IKONOS Image Satellite of Hill View (20.11.2002)

Landslide Photograph at Kg. Pasir (30.05.2006)
COASTAL EROSION AT KUALA TERANGGANU
– USING IKONOS IMAGE (1 M)

Aerial photograph 1995
Ikonos 2000
Shoreline from aerial photo and Ikonos image

Combined shoreline map
Eroded area at Sg. Terengganu estuary
3-D TSUNAMI INUNDATION MAP (BALIK PULAU)

Inundated areas

Areas with property damage
9 months before licensing

3 months after licensing

6 months after licensing + contour and river cannel

LOGGING MONITORING
ENCROACHMENT OF SEMENYIH CATCHMENT AREA
OBJECTIVE:

To increase crop production through the use of integrated remote sensing, GIS, GPS and sensor technologies incorporating advanced agronomic and farming practices, whilst maintaining the quality of the environment.

TECHNOLOGIES INVOLVED

- Remote sensing, satellite navigation system
- Computer Geographical systems
- Automatic yield recording systems
- Automatic soil sensor
- Variable Rate Technology
- Advanced agronomy
- Advanced farm management

“RIGHT INPUT, RIGHT TIME, RIGHT PLACE AND RIGHT AMOUNT”
RICE PRECISION FARMING
Components and Agencies Involved

1. a) Soil mapping (DOA)
b) Soil Fertility Mapping (UPM)

2. Yield mapping (Yield Sensor/GPS) (UPM, MARDI, DOA)

3. Advanced Rice Technology (MARDI)

4. Remote Sensing (Satellite and Airborne) (RS Malaysia)

5. Water Management (SCADA system) (DID, UPM)

6. Integrated Pest Management (Early warning system) (DOA)

7. Nutrient Management (MARDI, RS Malaysia)

8. GIS Analysis and DSS (UPM, RS Malaysia)

9. Variable Rate Technology Application (UPM)

10. Farm Managers (DOA, IADP NWS)
OIL PALM PRECISION FARMING

Mapping *Ganoderma Disease*

`DETECT GANODERMA DISEASE`

Disease and every single palm stand can be monitored. The area covered by a specific type of disease can be measured, and buffer zones can be created. The early warning system can be implemented.
RICE MONITORING & YIELD PREDICTION SYSTEM USING MICROWAVE REMOTE SENSING AND GIS

SATELLITE DATA ACQUISITION & DIGITAL IMAGE PROCESSING

RADARSAT SATELLITE

PADDY GROWTH STAGES

MACRES HQ, KUALA LUMPUR

MULTI-TEMPORAL RADARSAT DATA OF MADA AREA

MODELLING

RICE YIELD PREDICTION MODEL

YIELD PREDICTION

MAPPING

• Cadastral Information
• Paddy Schedule
• Irrigation Schedule
• Lot Number

LEGEND

- Phase I Planting
- Phase II Planting
- Phase III Planting
- Non-paddy vegetation
- City

LEGEND

- 0 - 3 ton/ha
- 3 - 4 ton/ha
- 4 - 5 ton/ha
- 5 - 6 ton/ha
- 6 - 7 ton/ha

GEOGRAPHIC INFORMATION SYSTEM
FISHING ZONE IDENTIFICATION

Observers onboard commercial fishing vessels
*(Instantaneous Oceanographic, Biological & Catch Data)*

Independent Boat Survey
*(Sea Truth Data)*

Fishing Zone Map

GIS Analysis

FISHING ZONE IDENTIFICATION MODEL

Satellite Images
*(MODIS, OCM, AVHRR etc.)*

Phytoplankton & Chlorophyll a

Sea Surface Temperature

Wave Spectra

Communication
- email via Satellite Phone & Onboard Navigational Software
- Hard Copy
Remote sensing and spatial analysis (GIS) are used in identifying environmental factors such as temperature, precipitation, vegetation, and landuse patterns affecting public health and occurrences of epidemic diseases.
HAZE INTENSITY MAP OF SO2 USING BAND 1 OF NOAA AVHRR DATA IN KLANG VALLEY

(2 SEPTEMBER 1998)

(3 NOVEMBER 1999)
INTEGRATED ISLANDS MONITORING

Layang - Layang

Building on the reef
CONCLUSION

REMOTE SENSING AND GIS TECHNOLOGY BECOME MORE RELEVANT NOWADAYS

THE INVESTMENT IN THIS TECHNOLOGY IS VERY HIGH

TARGET TO OPTIMISE THE USE OF REMOTE SENSING DATA TO USER AGENCIES AND BENEFIT TO THE POPULATION IN MY COUNTRY
THANK YOU

Website http://www.remotesensing.gov.my