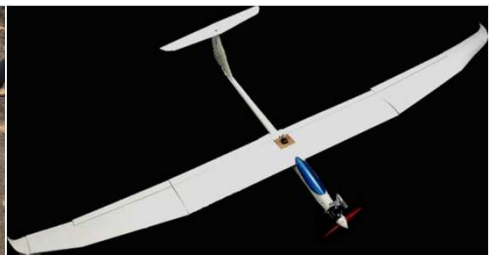
UAV- Based Imaging for Environmental Sustainabilitty- Flash Floods Control Perspective



Isola I. Ajibola and Shattri B. Mansor
Department of Civil Engineering
Universiti Putra Malaysia

Source of Data

1. Satellite Images
2. Aerial photographs
3. UAV images

Satellite Imaging

Advantages

- Large area coverage
- Not effected by air traffic restrictions
- Global

Disadvantages

- Cost
- Slow to Task
- Effected by cloud cover
- Low resolution (50 cm)

Aircraft

Advantages

- Large area
- High resolution (25cm – 100cm)
- Modular
- Proven Technology

Disadvantages

- Operating Cost
- Slow to task
- Limited Availability

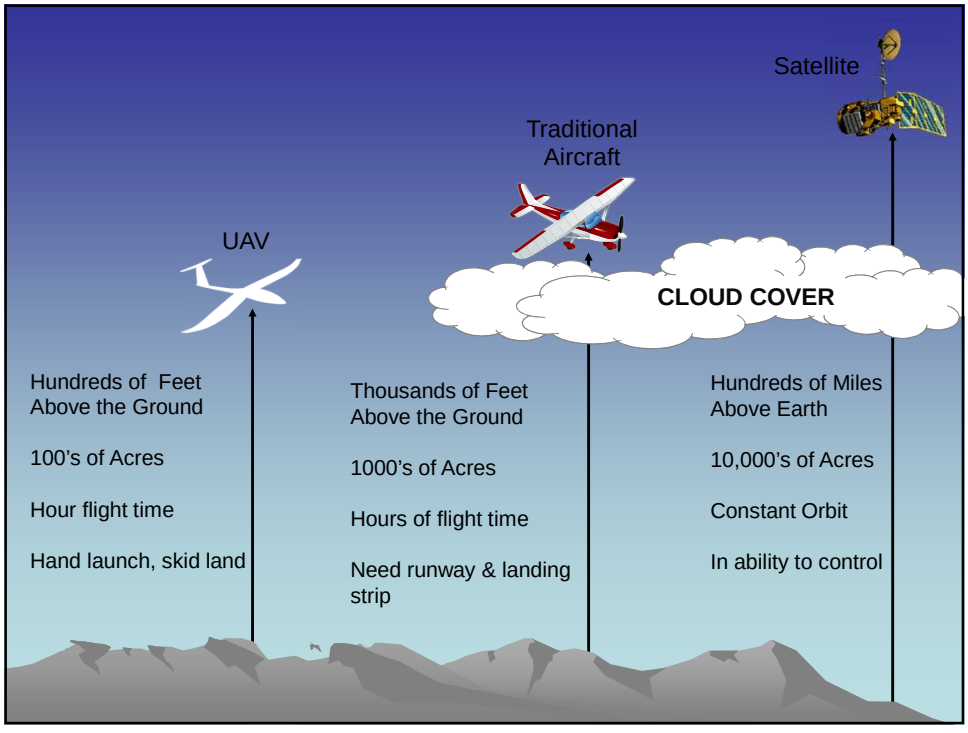
Micro UAV Imaging

Advantages

- Low Cost
- High resolution (6 – 10cm)
- Highly deployable
- Modular (Visual camera)
- Image on demand

Disadvantages

- Small coverage
- Security shipping and regulation applied
- No ortho
- No TIR capability

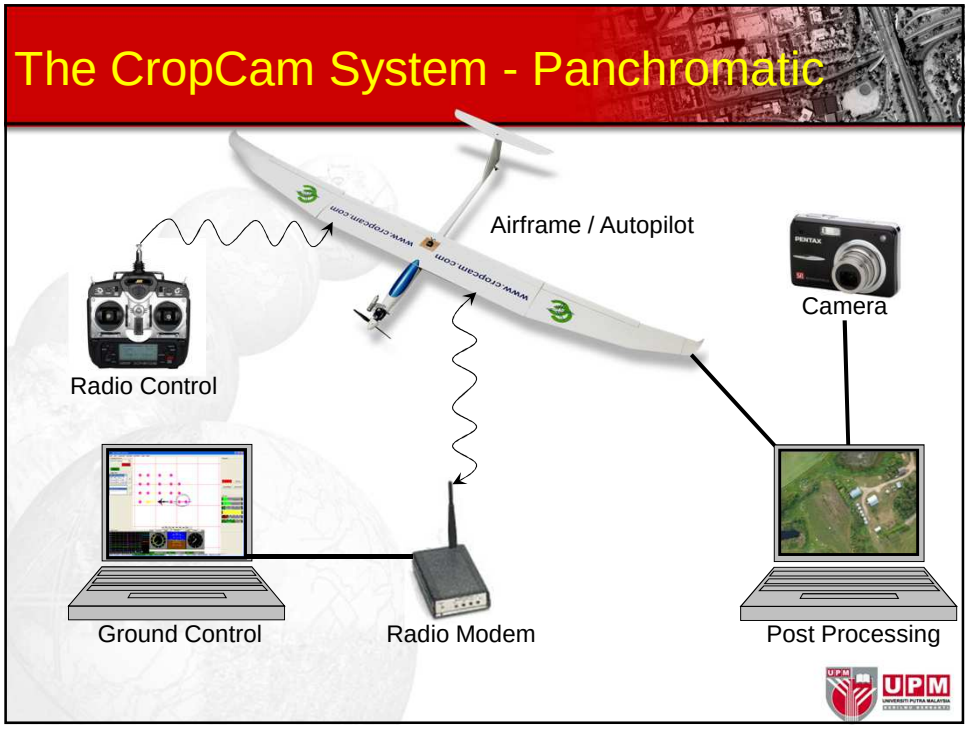


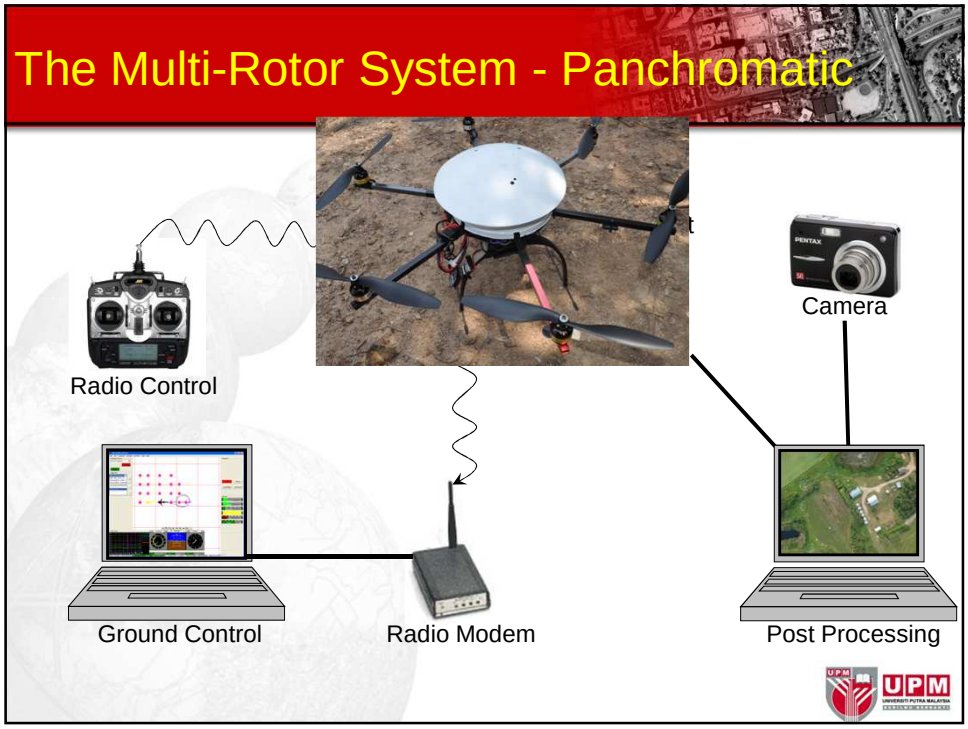
System Description- Aerial Platforms

Rotary six wing UAV (Hex*acopter)* 	**Diameter:** 60 cm **Height:** 35 cm **Flight duration:** 15 minutes **Coverage :** 70 hectares per flight **Available payload:** 800g **Altitude:** 10 - 500 m above ground **Weight:** 1.5 kg **Windspeed** : Below 15 knots **Main advantages:** Vertical take off and landing capabilities.
CropCam fixed wing UAV 	**Length:** 4 ft **Wing span:** 8ft **Weight:** 6 pounds **Flight duration:** 30 minutes **Coverage :** 250 hectares per flight **Flight speed:** 60km/h **Available payload:** 600g. **Weight:** 1.5 kg **Altitude :** 100 – 700 m **Wind speed** : below 25 knots

System Description- Sensors

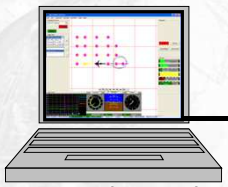
Visible sensor: **Canon PowerShot SD 780 IS digital camera**	**Resolution:** 12.1 Megapixels CCD sensor **Visible range:** (400-700 nm) (4000 x 3000 pixels) **Focal length:** 30-100 mm **Optical zoom:** 3x **Image capture rate:** 15 sec to 1/1500 sec **Filter:** NASTEX Lens filter (Magenta model NG680-TS)
Near Infrared (NIR) sensor: **Tetracam ADC**	**Resolution:** 3.2 megapixels CMOS sensor **NIR range:** *(520 -920 nm)* (2048 x 1536 pixels) sensitive to electromagnetic radiation between 520nm and 920nm. **Image capture rate:** 2 to 5 seconds per picture **Other key specifications:** Green, Red and NIR sensitivity with bands approximately equal to TM2, TM3 and TM4


The CropCam System - Panchromatic
Airframe / Autopilot
Camera
Radio Control
Ground Control
Radio Modem
Post Processing


The Multi-Rotor System - Panchromatic
Camera
Radio Control
Ground Control
Radio Modem
Post Processing

The Multi-Rotor System : Multi-spectral

Radio Control



Ground Control

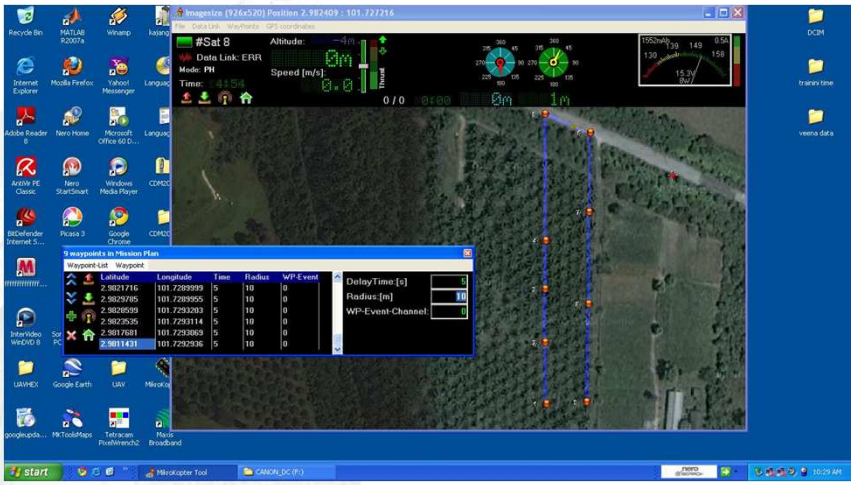
Radio Modem

Post Processing

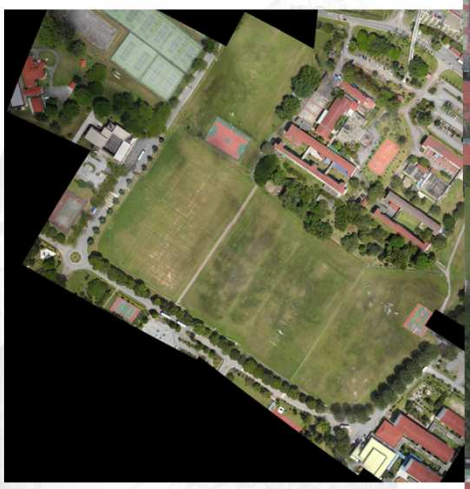
The CropCam System - Panchromatic

- Hand launched, fixed wing, civilian UAV
- Autonomously flies predefined flight patterns
- Currently acquires high resolution colour imagery

Flight Planning/ On screen display



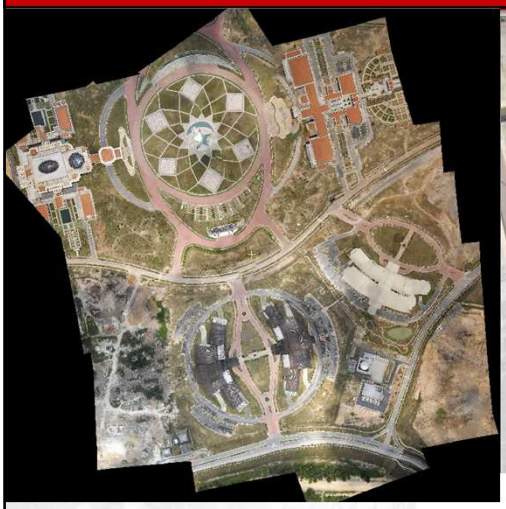
UPM KMR

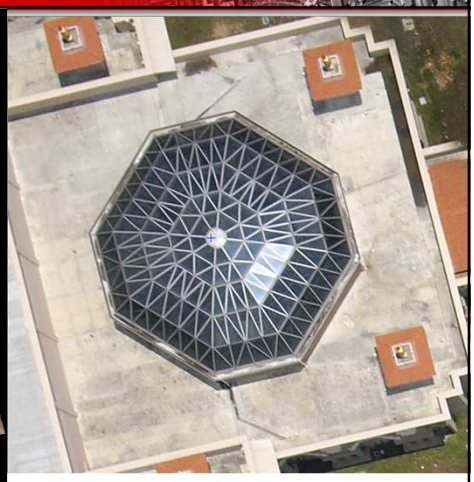


UTM, Skudai, Johor

DangaBay, Johor

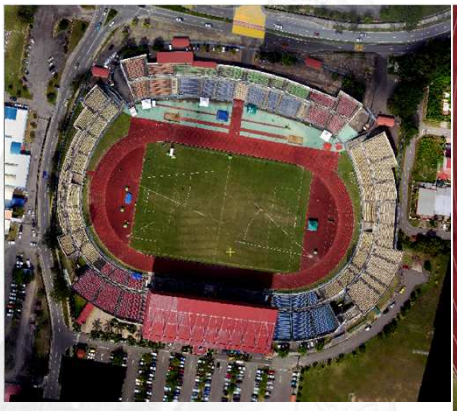
New Admin Centre, Johor

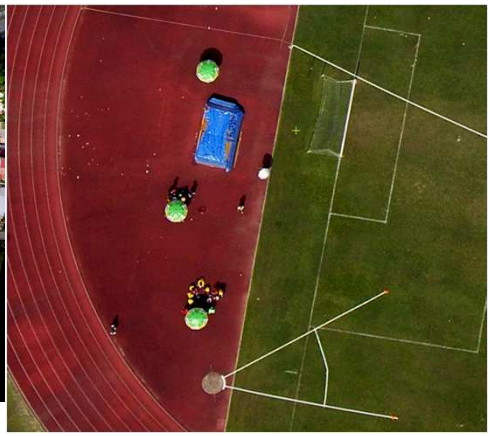




Penang Bridge, Penang

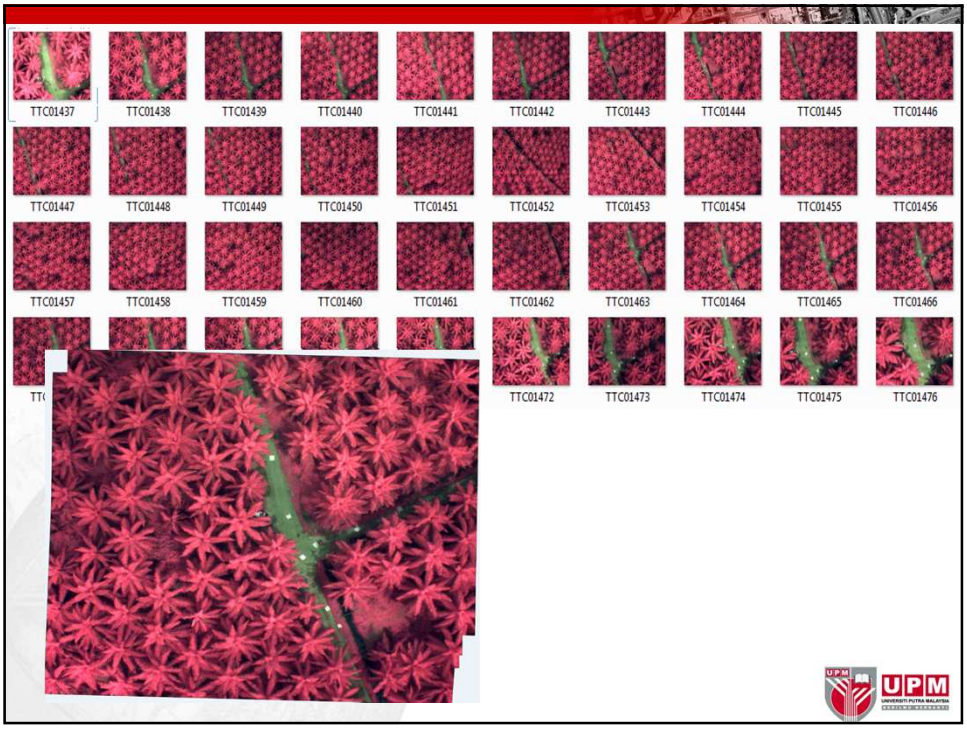
Likas Stadium, Kota Kinabalu, Sabah





Sebangkat Island, Semporna, Sabah

Image from Altitude 200M



Remote Sensing Technology Already Use to Monitor Various Natural Disasters


Fire


Drought


Landslide

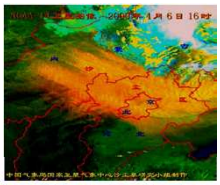

Typhoon/Storm

Marine Disaster

Flood

Plant Insect

Dust Storm



DISASTERS MONITORING

- **Natural Disasters (especially flood) :**
  - appear suddenly
  - develop fast
  - affect large area
- **it is difficult to be monitored by conventional way**, which cause problem to prevent disaster and disaster relief

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The Four-part Disaster Cycle

- **Mitigation.** Long-term efforts to prevent hazards from becoming disasters or make them less damaging. These include structural measures such as creating flood levees or reinforcing buildings, as well as non-structural measures such as risk assessment and land-use planning.
- **Preparedness.** Planning for when disaster strikes, including developing communication strategies, early warning systems,
- **Response.** Implementing plans after a disaster. This includes mobilising emergency services, coordinating search and rescue, and mapping the extent of the damage.
- **Recovery.** Restoring an area, often through rebuilding and rehabilitation, then returning to mitigation measures.

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FLOODS

25 April 2007 Kota Tinggi

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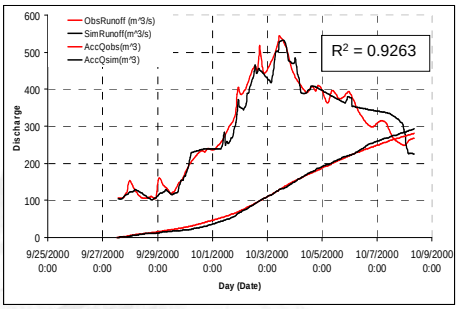
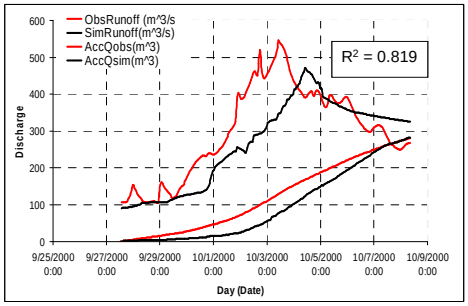
BERILMU BERBAKTI
a world leader in new tropical agriculture


UPM cipta sistem amaran banjir
R&D
PENYELIDIK Universiti Putra Malaysia (UPM) berjaya mencipta sistem amaran banjir terkini yang menggunakan teknologi satelit dari Jepun iaitu Geostationery Meteorology Satelite (GMS) dan berupaya menghantar data digital radiometer resolusi tinggi atau Advanced Very High Resolution Radiometer (AVHRR) ke stesen penerimaan satelit di Institut Teknologi maju (ITMA).
Data yang diperoleh itu diterjemahkan dalam bentuk imej radiasi dan selepas melalui proses tapisan serta ujian klasifikasi, data berkenaan mampu mengenal pasti suhu dan formasi awan mengikut jenis, ketinggian dan peadaan.
Maklumat berdasarkan data itu mampu menganggarkan jumlah taburan hujan yang akan turun di kawasan terbabit dan peredaran bagi menghadapi kemungkinan banjir dapat disebarluas kepada pihak yang terbabit.
Malah daripada jumlah taburan hujan itu juga, sistem berkenaan berupaya mengenal pasti kelurusan kawasan tertentu yang dijangka akan mengalami banjir."
Sistem amaran banjir yang berjaya merakit pingat emas pada Ekspo Teknologi Malaysia 2006, Februari lalu diketuai Ketua Laboratori Permodelan Spatial dan Berangka, ITMA, Prof Dr Shattri Mansor dan dibantu penyarah Fakulti Kejuruteraan UPM, Prof Madya Dr Ahmad Rodzi Mahmod, Dr Abdul Halim Ghazali serta Lawal Billa.
Shattri berkata, sistem amaran banjir ini telah diuji di Sungai Langat, Selangor dan ternyata mampu memberi amaran banjir secara lebih tepat dan cepat.
Sambil menjelaskan sistem amaran banjir ini sudah lama dilaksanakan di negara ini, beliau berkata, sistem sedia ada kurang tepat kerana sukar dalam memproses data.
PENEMUAN TERKINI: Dr Shattri menunjukkan imej data taburan hujan di kawasan tertentu.
UPM cipta
stem amaran banjir berasaskan satelit
Oleh KHAIRUNNISA SULAIMAN
KEADAAN cuaca yang tidak menentu kini menyebabkan perubahan cuaca ketara mengakibatkan hujan lebat, ribut, petir dan paling terkini banjir besar yang melanda Shah Alam di Selangor baru-baru ini.
Banjir besar yang melanda bandar tercanggih itu pada 26 Februari lalu membuka mata masyarakat bahawa bukan satu sistem amaran awal tsunami saja yang penting tetapi sistem amaran juga diperlukan bagi menghadapi banjir kilat.
Malah sebelum ini Shah Alam tidak pernah menghadapi masalah banjir besar seperti yang sering terjadi di Kuala Lumpur.
Walaupun tidak berlaku korban jiwa tetapi cuba bayangkan kerugian yang dialami oleh penduduk di kawasan berkenaan apabila air banjir naik terlalu cepat.
Walaupun kejadian berkenaan tidak dapat dielakkan tetapi sistem amaran awal banjir amat penting bagi membolehkan penduduk berada atau berpindah ke tempat yang lebih selamat bagi mengelakkan nyawa terkorban dan kerugian harta-benda.
Ramalan banjir menggunakan kaedah melihat telah dilaksanakan di beberapa
DR. SHATTRI MANSOR
Early Warning System

Rainfall runoff simulation

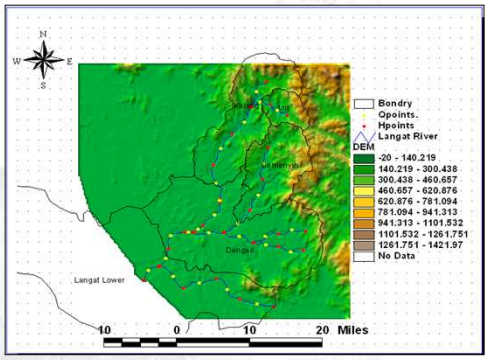


Rainfall-Runoff and Accumulated Discharge (Calibration for Observed Data)

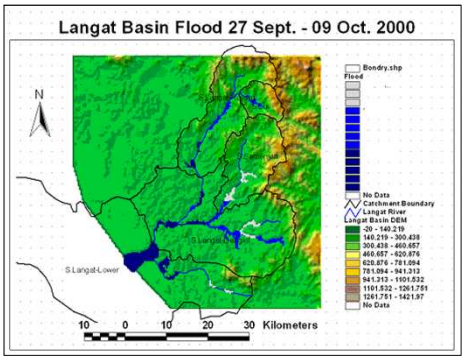


Rainfall-Runoff and Accumulated Discharge (Calibrationfor QPF Rainfall)

Flood Map

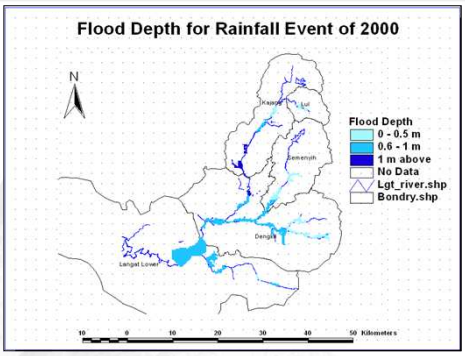


Integration of Hydrological Simulation Results with DEM

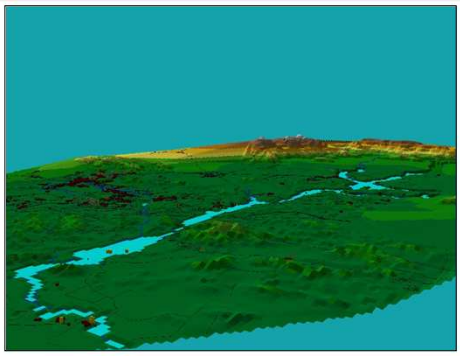


Flood Areas for the Simulation Period

Flood Map



Flood Depth Map



3D Perspective of Flood Inundation

Orthorectification from UAV Images

Camera Calibration Files

UAV Images

GPS Log Files

Ensomosaic / Agisoft

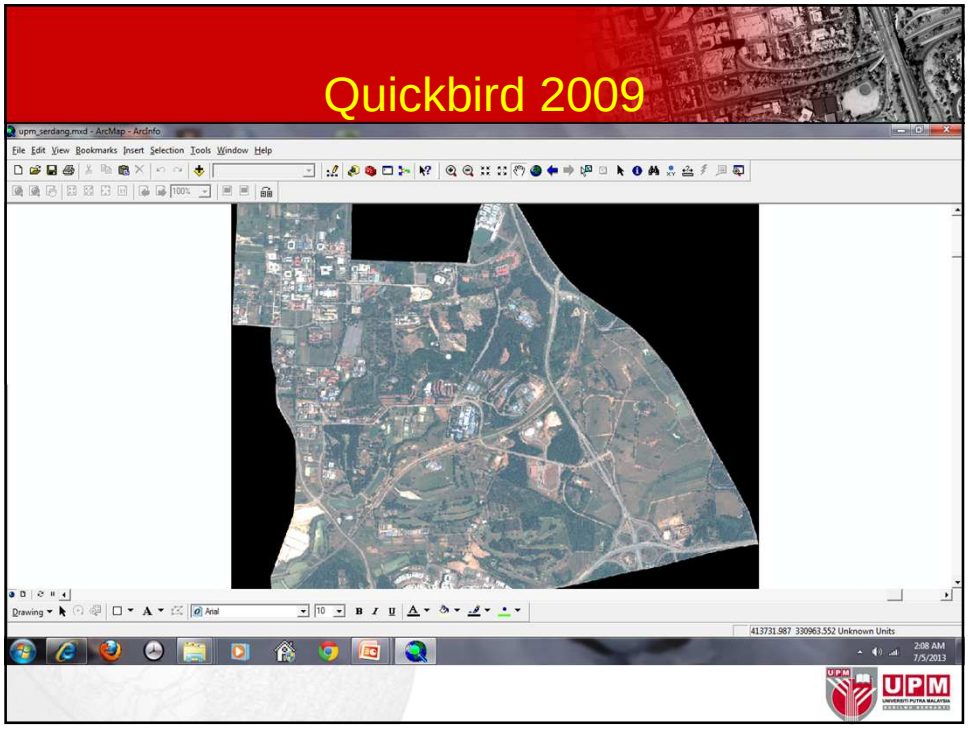
Triangulation
1. Auto Tie points
2. Manual tie points
3. GPS (optional)

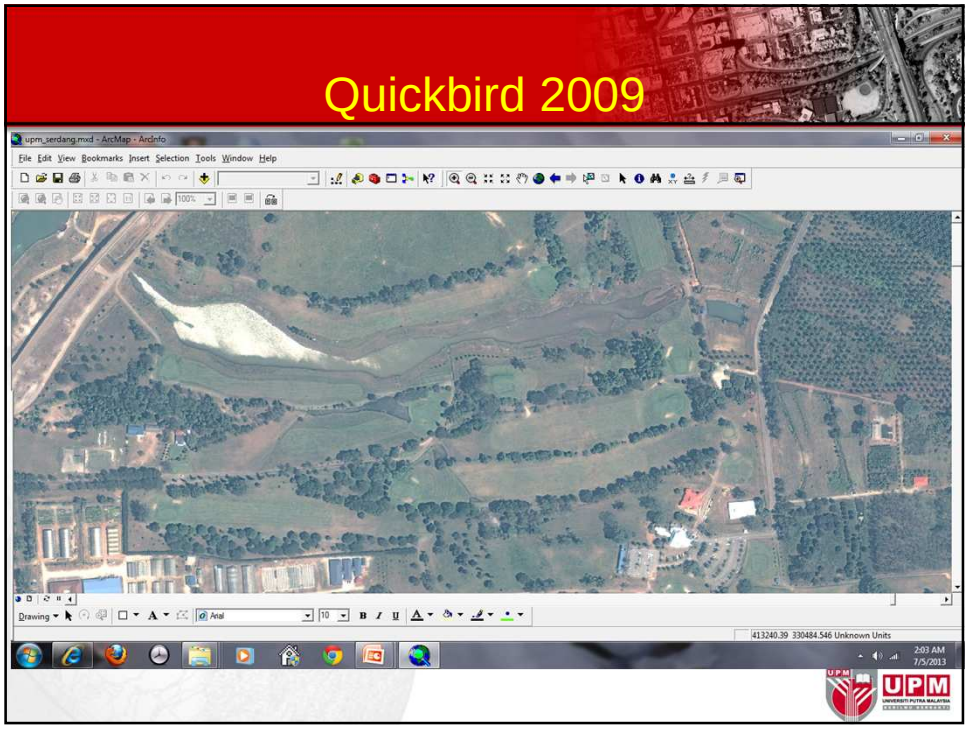
DEM extraction

Orthorectification

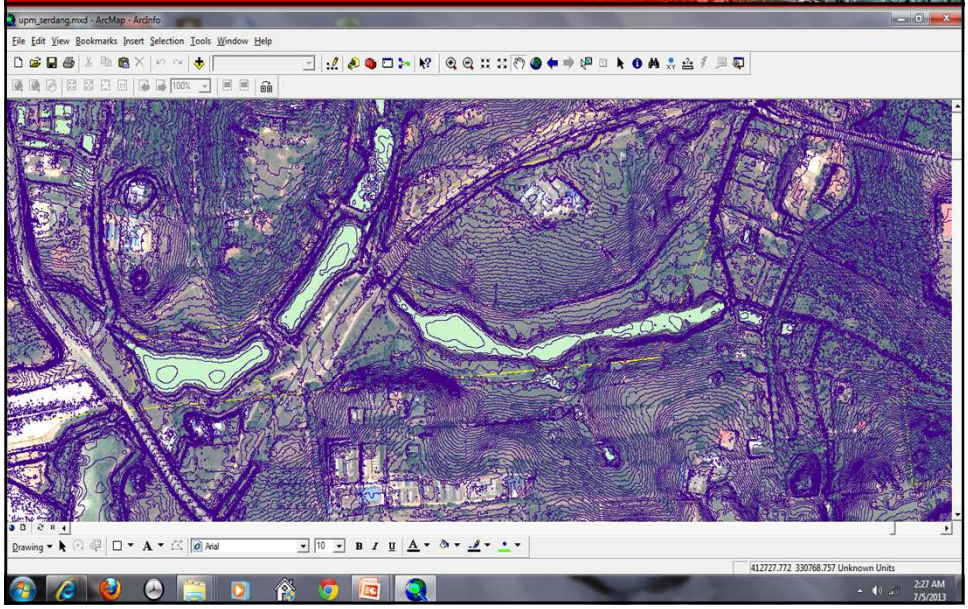
Mosaicking

Output

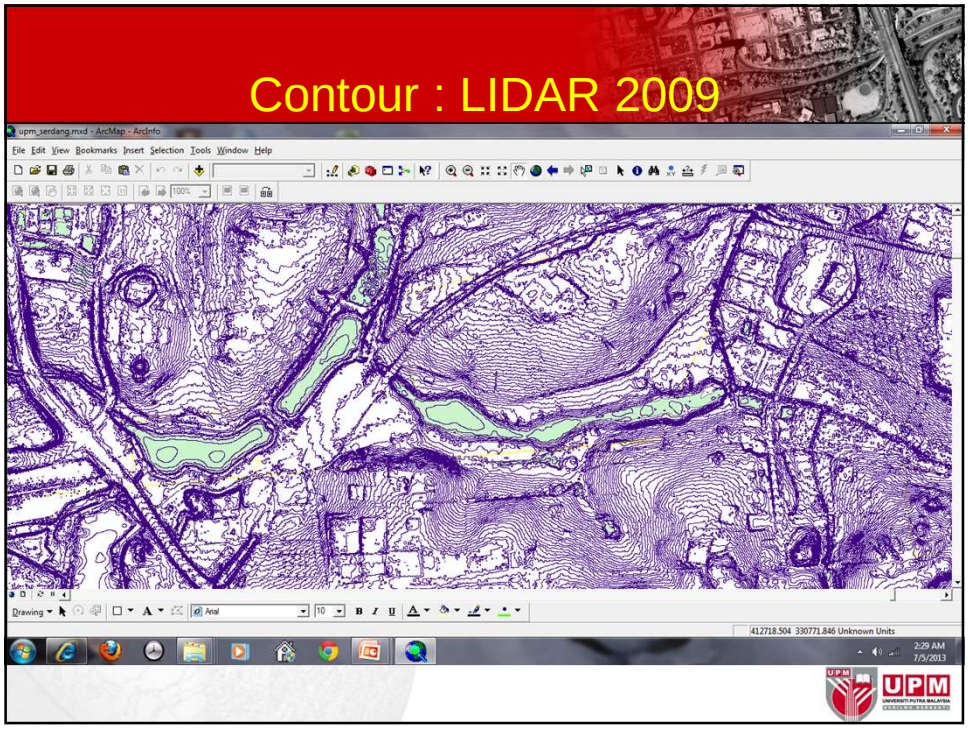

Quickbird 2009


Quickbird 2009

Contour : LIDAR 2009

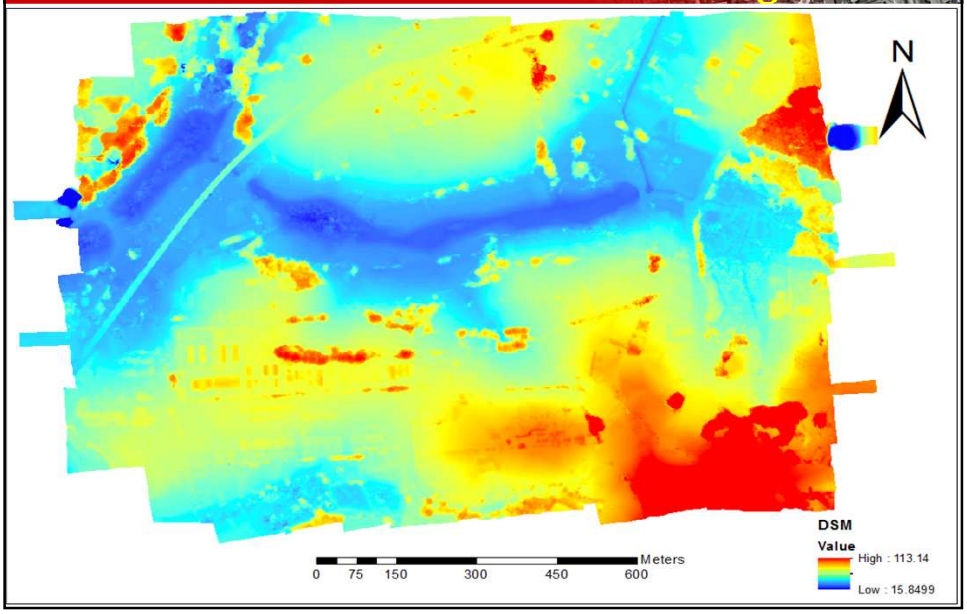


Contour : LIDAR 2009

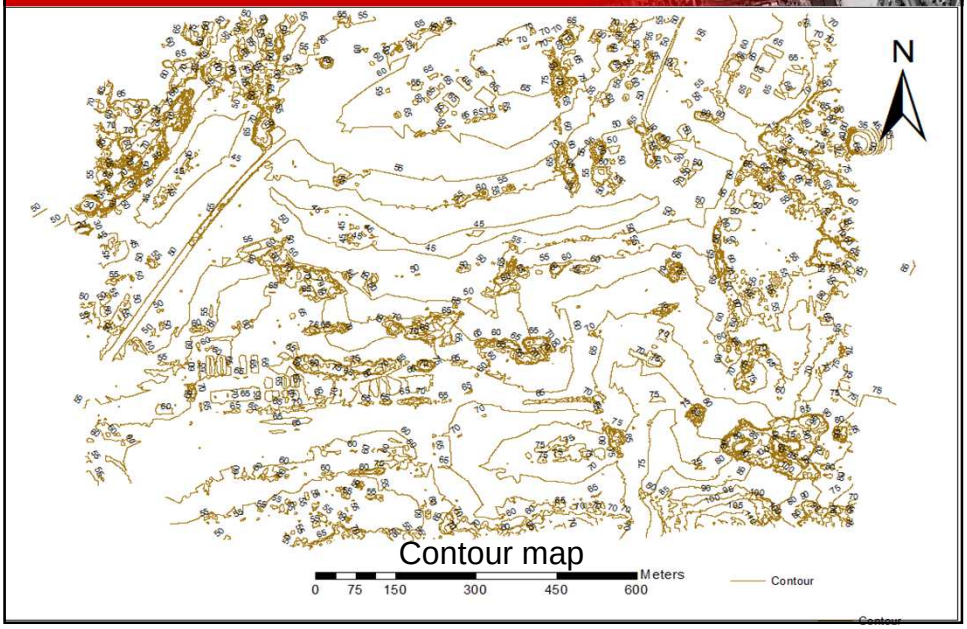


Orthophoto : UAV images 2013

Results : DSM from UAV images



Results : Contour from UAV Images



Summary

- ✓ Image on demand
- ✓ Mitigation, Preparedness, Response, Recovery
- ✓ Mapping of small area
- ✓ Inaccessible area
- ✓ Disaster area
- ✓ 250 hectares per flight
- ✓ Higher accuracy (cm?)

Q & A??

For further information please contact:

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43400 UPM Serdang
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