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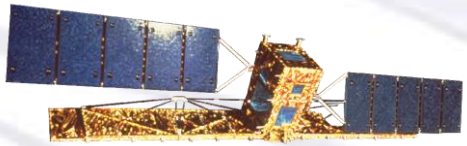

UAV-based Risk Reduction and Rapid Response System

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United Nations International Conference on Space-based Technologies for Disaster Risk Management - "Best Practices for Risk Reduction and Rapid Response mapping"
22-25 November 2011

Outline

1 Challenges to Risk Reduction & Rapid Response

2 UAV Solutions

3 An UAV-based Risk Reduction & Rapid Response Prototype System

4 Way Forward

5 Conclusions

Challenges to Risk Reduction & Rapid Response

Temporal Resolution

Very hard to be satisfied but it is a critical factor for risk reduction & rapid response. *(satellite revisit time, the time to acquire the first image of the disaster, … …)*

Uninterrupted Monitoring

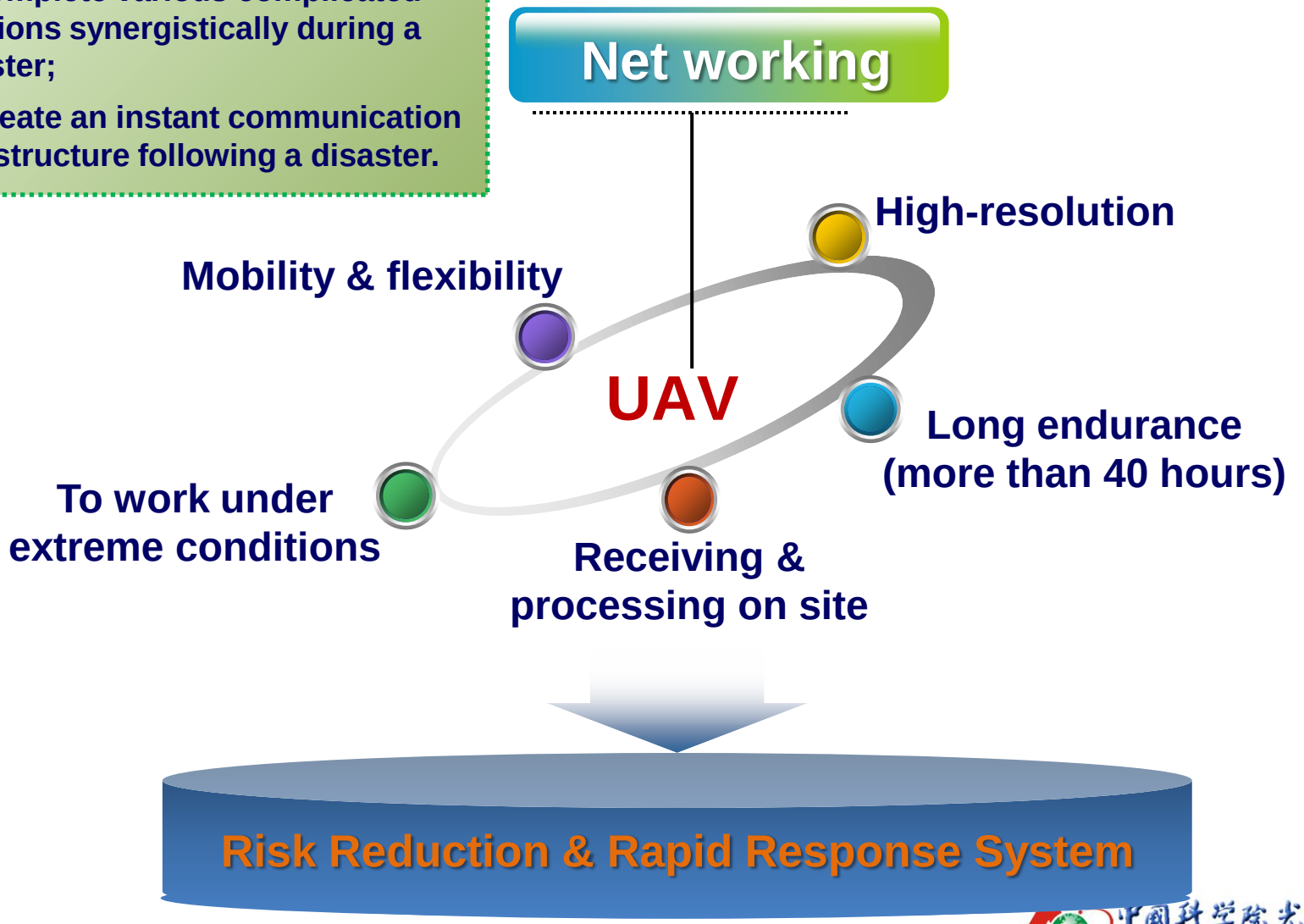
Very difficult to be implemented in a period of days. *(orbit limitation for satellite, tired or unbearable for Manned aircraft)*

Extreme environments

Very dangerous. *(poison gas, nuclear leakage, volcanic eruptions, … …)*

UAV Solutions

- To complete various complicated missions synergistically during a disaster;
- To create an instant communication infrastructure following a disaster.



An UAV-based Risk Reduction & Rapid Response Prototype System --*Components*

A-type UAV

B-type UAV

Primary mobile station

Secondary mobile station

Command car

Comprehensive test vehicle

UAV carrier vehicle

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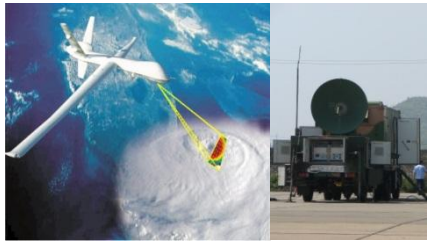
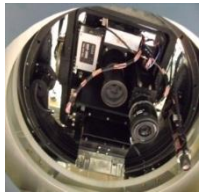
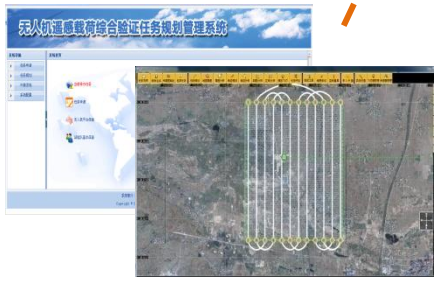
An UAV-based Risk Reduction & Rapid Response Prototype System --*Emergency procedures*



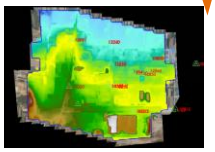
Flight platform & control system

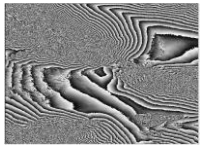


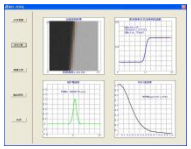
High accuracy standard payload systems



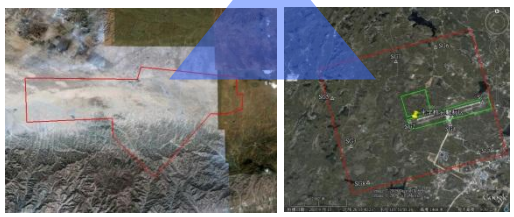
Mission planning and management system



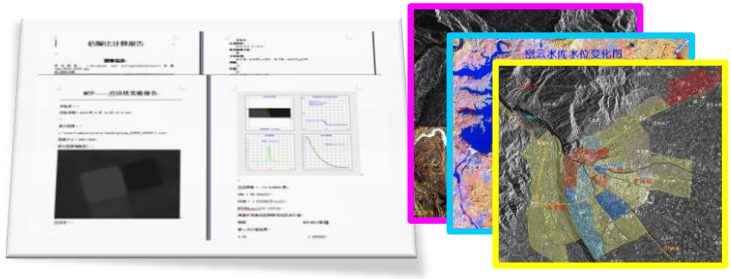




Data processing & analysis system



Disaster area



Disaster assessment report & product

Response & relief

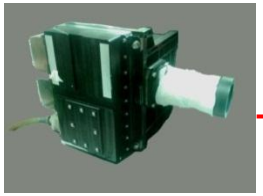
An UAV-based Risk Reduction & Rapid Response Prototype System --*System capacity*

Function

Synchronous acquisition of high resolution optical image, Pol-SAR or In-SAR image.

Performance

- Cruise time: >24h
- Practical ceiling:7 km
- Take-off conditions: airport runway , road



Hyperspectral imager

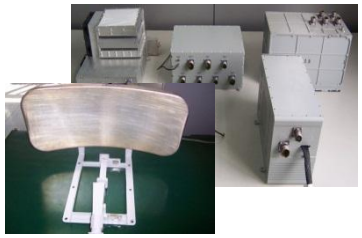
- Spectral range：400~1000nm
- Spectral resolution: 5nm
- Bands：128
- Spatial resolution：1.0m (H=5km)
- Swath width：1.0km (H=5km)

Wide-swath multi-spectral camera

- Spatial resolution：0.5m(Pan)/1.0m(MS) (H=5km)
- Bands：4
- Swath width：6.0km (H=5km)

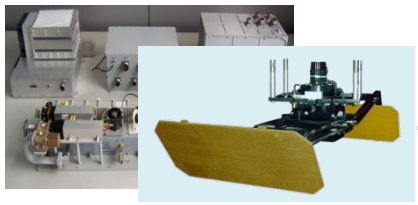
Area array camera

- Spatial resolution：1.0m(H=5km)
- Swath width：2.0Km (H=5km)



Polarimetric SAR

- Frequency Band: X
- Spatial resolution/Swath width/working distance (H=5km):
  0.3m/2.5km/12~15km
  1m/4km/15~20km
  3m/8km/20~30km
- Polarization: HH, VV, HV, VH



Interferometric SAR

- Frequency Band: Ku
- Spatial resolution: 1m(H=5km)
- Vertical accuracy: 2m~4m
- Horizontal accuracy: 5m~10m
- Swath width: 2km
- Working distance: 12km(H=5km)

An UAV-based Risk Reduction & Rapid Response Prototype System --*Example images*

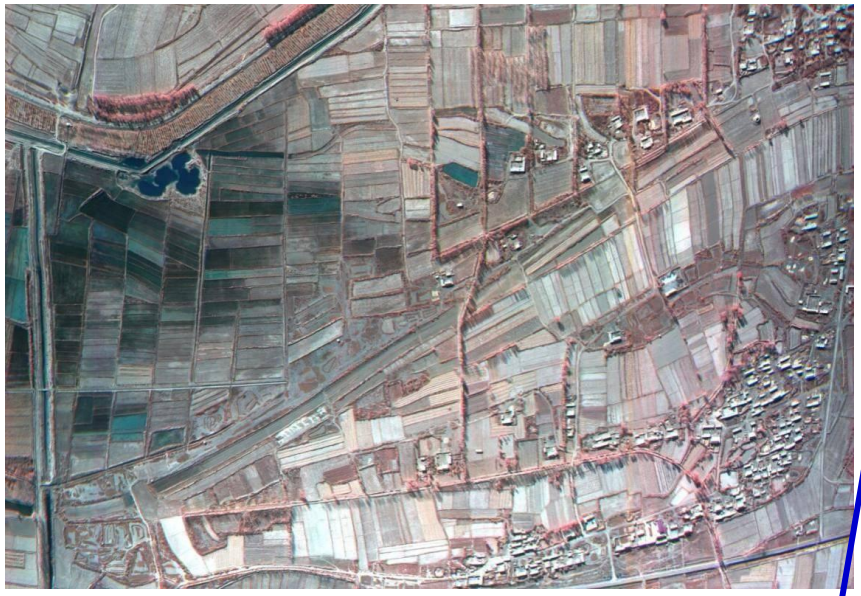


Image from wide-swath multi-spectral camera

Flood

Typhoon/Storm surge

Earthquake

Landslide & Mudslide

Fire

Snow

... ...

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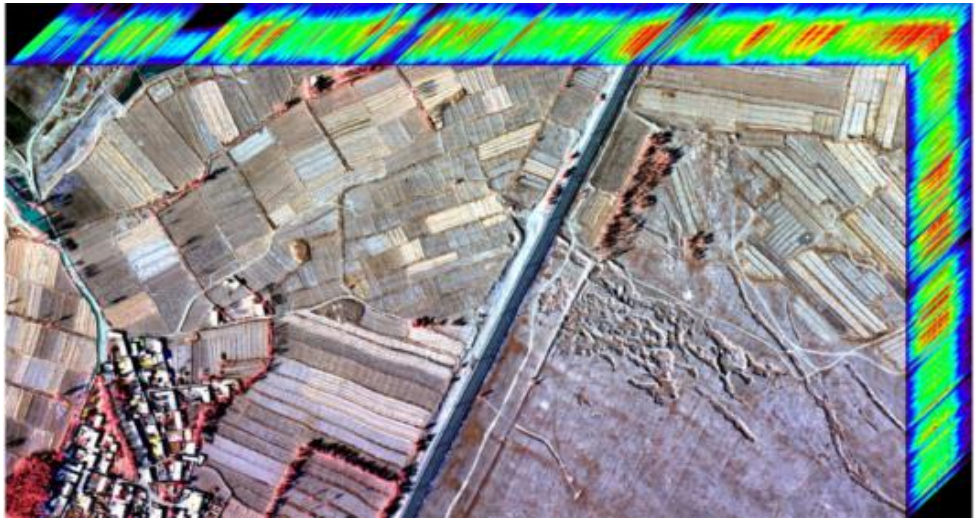
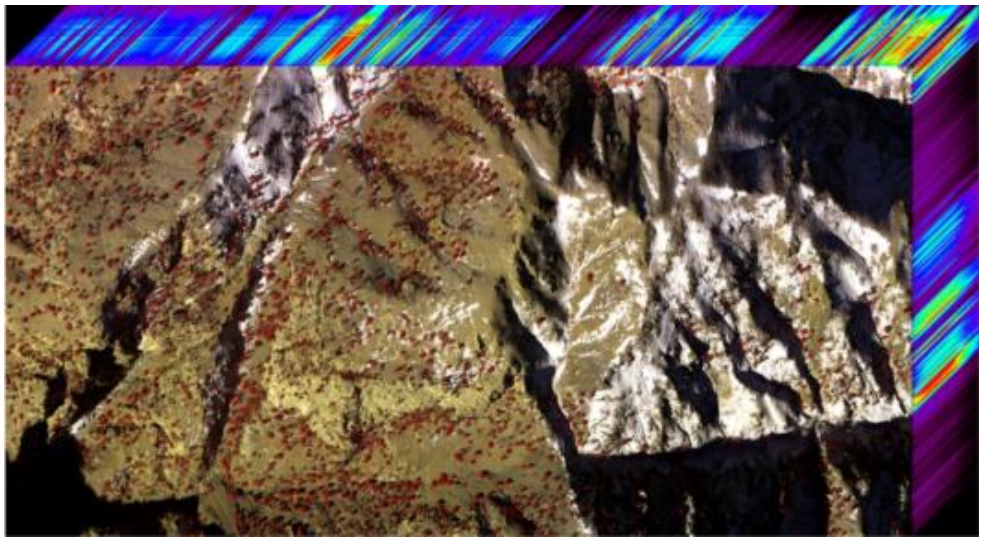
An UAV-based Risk Reduction & Rapid Response Prototype System --*Example images*





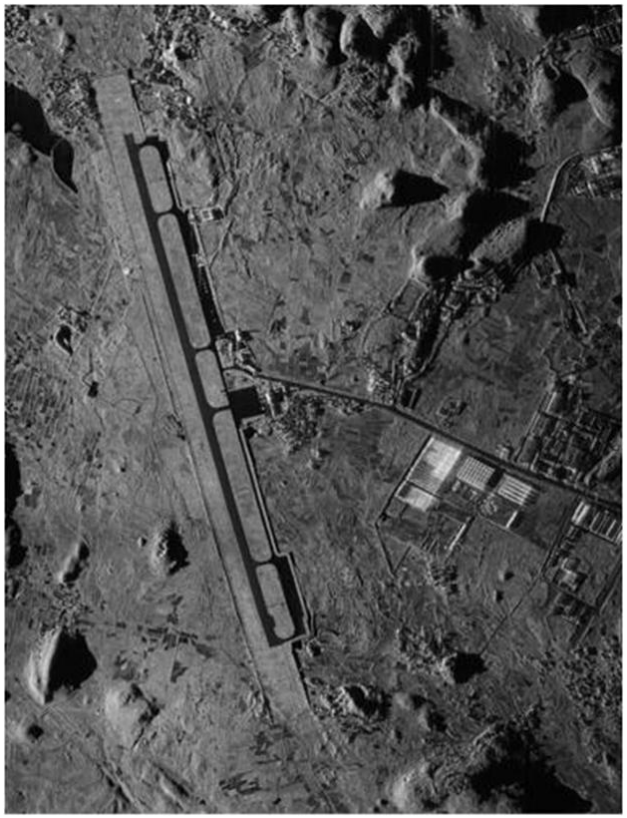
Hyperspectral data cube from hyperspectral imager

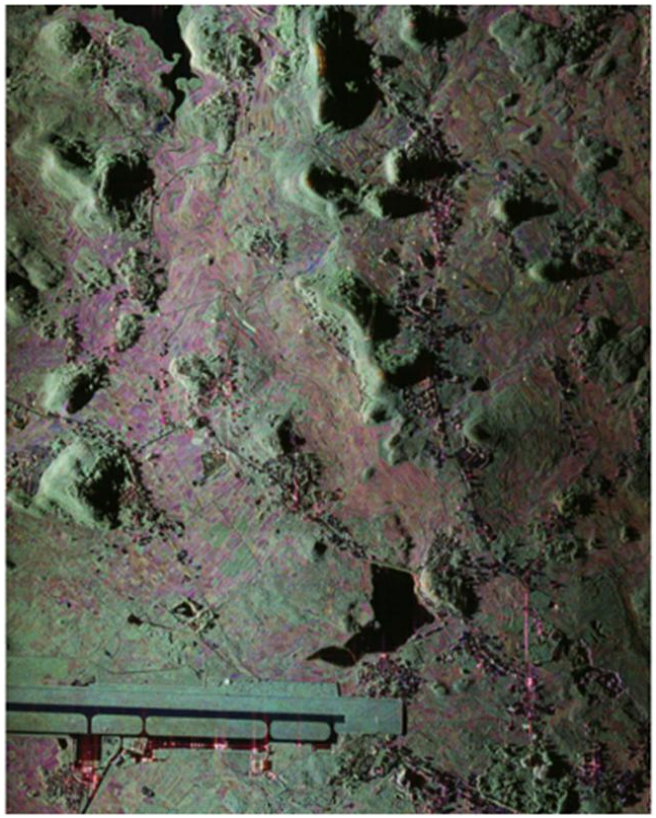
Water pollution

Diseases and insect pests, freeze injury

... ...

An UAV-based Risk Reduction & Rapid Response Prototype System --*Example images*





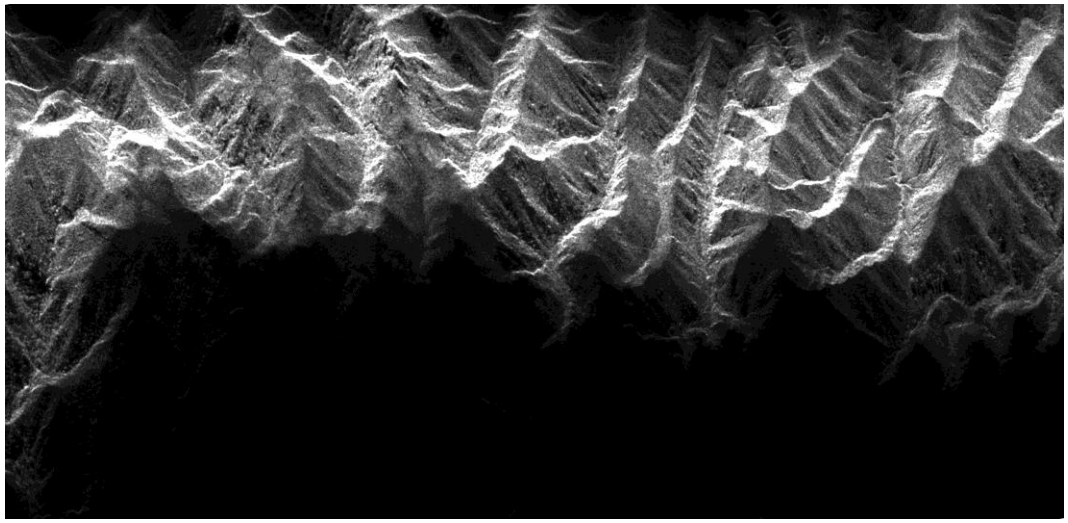
Polarimetric SAR image

Flood

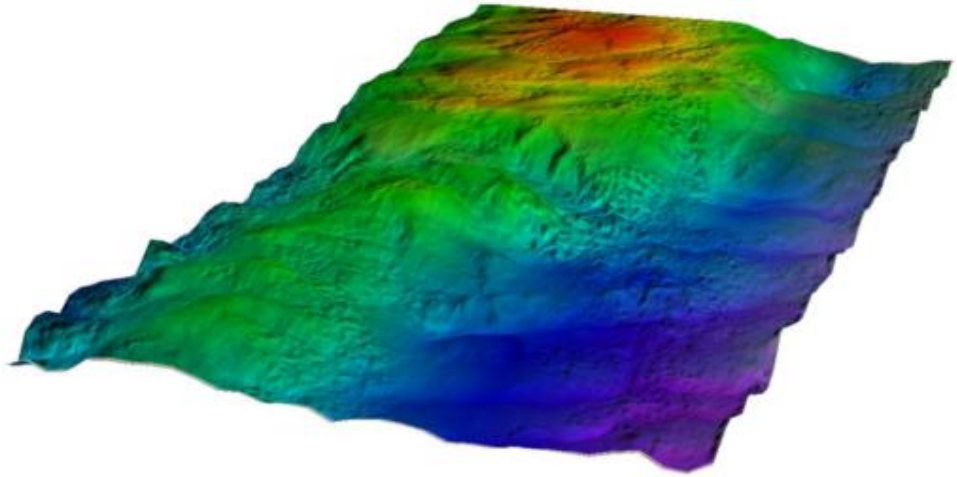
Landslide & Mudslide

... ...

An UAV-based Risk Reduction & Rapid Response Prototype System --*Example images*



Intensity image from Ku-band In-SAR system



DEM extracted from Ku-band In-SAR images

Geological disasters

Urban Subsidence

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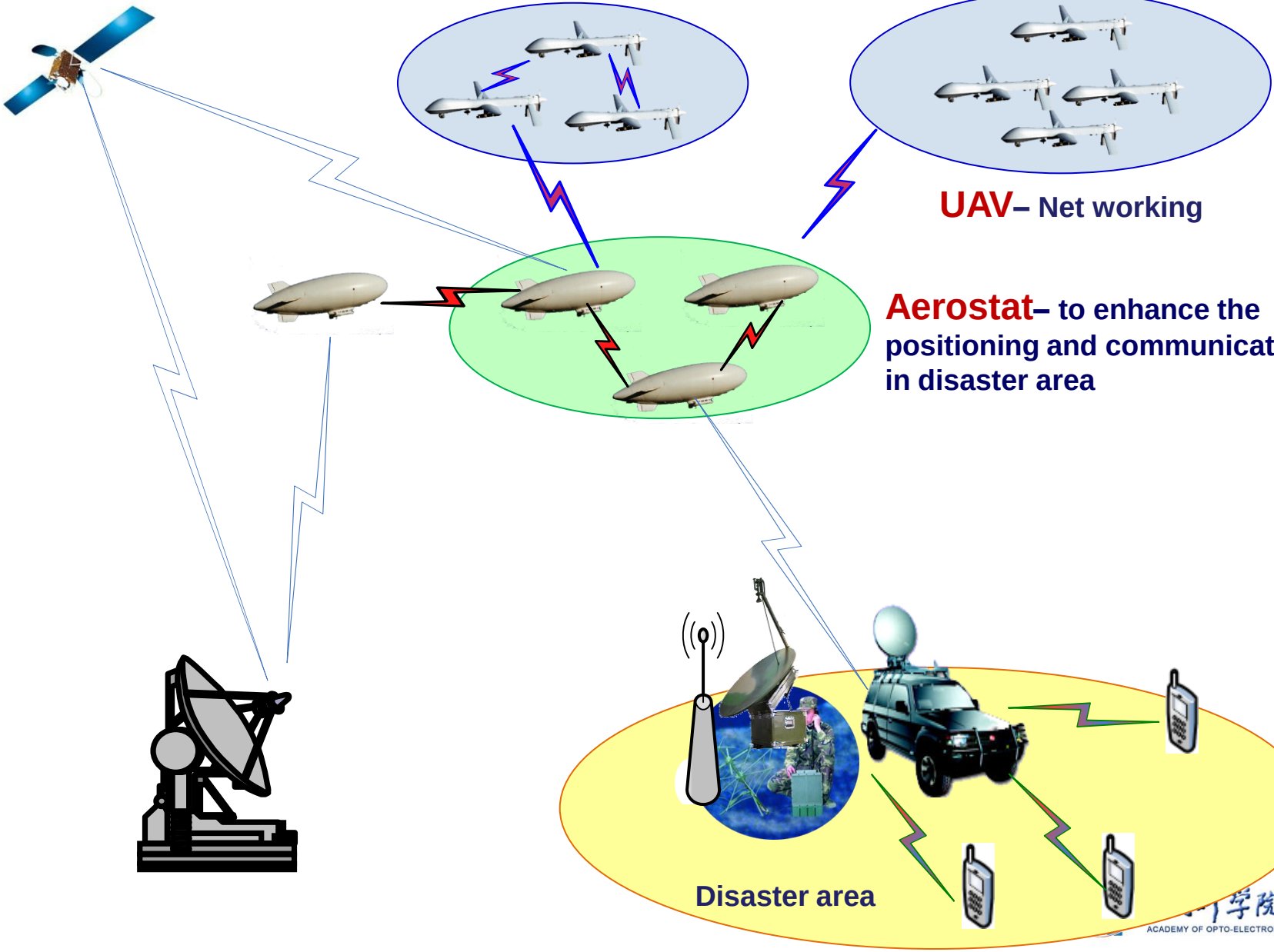
Way Forward



Conclusions

UAV-based Risk Reduction & Rapid Response System

- To meet time-sensitive and high-resolution needs of emergency response and disaster relief
- To monitor continuously
- To work under harsh environment

Risk reduction and rapid response is not just “Image” but a “reality”. UAV-based Risk Reduction & Rapid Response System shall be an effective technical means in our real life.


Thanks