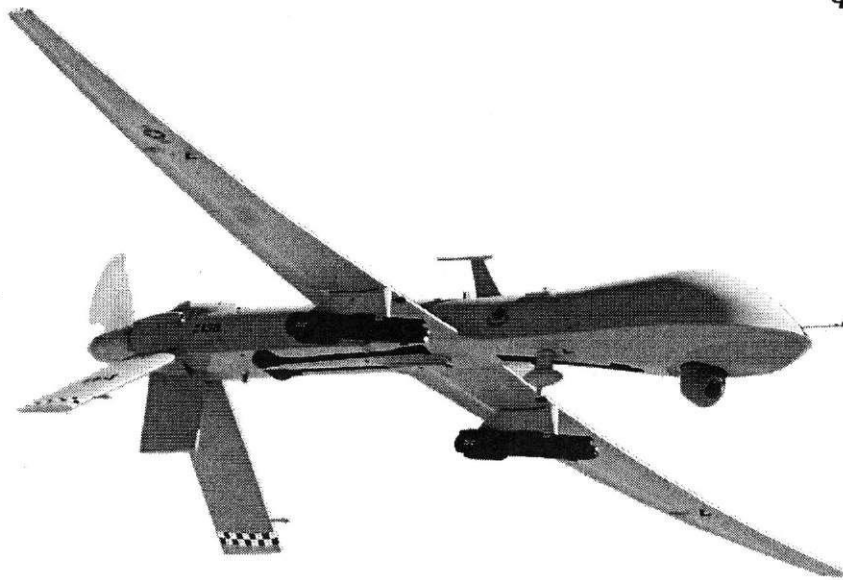


การสัมมนาหัวข้อ

# เทคโนโลยีอากาศยานไร้คนขับในประเทศไทย

## Technology of UAV and Drone in Thailand

- ชุดที่ 2 -



15 พฤษภาคม 2557

เวลา 13.00-16.30 น. ณ ห้องประชุม 212

ศูนย์นิทรรศการและการประชุมไบเทค บางนา กรุงเทพฯ

MTEC  
a member of NSTDA



จัดโดย

ศูนย์เทคโนโลยีโลหะและวัสดุแห่งชาติ (เอ็มเทค)  
สำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ  
กระทรวงวิทยาศาสตร์และเทคโนโลยี

ร่วมกับ

สำนักงานปลัดกระทรวงวิทยาศาสตร์และเทคโนโลยี  
กระทรวงวิทยาศาสตร์และเทคโนโลยี



## Siam UAV Industries

---

- Founded December 2003
- Autopilot software manufacturer/integrator
  - Autopilot with GPS-based Navigation
  - Autopilot with Vision-based Navigation
- Unmanned Aerial Vehicle Manufacturer
- Robot Manufacturer

## Significant Thai Clients

---

- Royal Thai Navy
- Royal Thai Armed Forces
- Geo-Informatics and Space Technology Development Agency (GISTDA)
- Hydro and Agro Informatics Institute (HAI)
- Ministry of Science and Technology (MOST)
- Department of Special Investigation (DSI)
- Civil Aviation Training Center (CATC)

## Our Vehicles

---

- Unmanned Aerial Vehicles
- Electric Fixed-Wing UAV:
  - eSUAV600
  - eSUAV700
  - Zephyr-1
  - Athena-1
- Electric Rotary-Wing UAV:
  - Boreas-1

## Our Vehicles

---

- Unmanned Aerial Vehicles
- Gasoline Fixed-Wing UAV:
  - Mercury-1 Half-Scale
  - Mercury-1 Full-Scale
  - Mercury-2
  - Apollo-1 (Jet fuel)

## Our Vehicles

---

- Unmanned Ground Vehicle
  - 6-Wheel Electric Ground Robot (Ares-1-6)
  - 8-Wheel Electric Ground Robot (Ares-1-8)
- Unmanned Surface Vehicle
  - Poseidon-1

## Representation

---

- Arcturus UAV – Unmanned Aerial Vehicle System (“UAS”)
- Cloudcap Technology – Autopilot System
- Cobham – Communications System
- CybAero – Rotary-Wing Unmanned Aerial Vehicle System
- FLIR – Thermal Camera
- General Atomics – UAS, building and maintaining military aircrafts
- L-3 Communications – Communications System
- Limbach Flugmotoren – Aircraft Engine
- Microhard – Communications System
- Mosaicmill – Mapping Software
- And more...

# UAV AND ROBOT FOR INSPECTION WORK

Peter Srivaree-Ratana @InterMach



Who We Are

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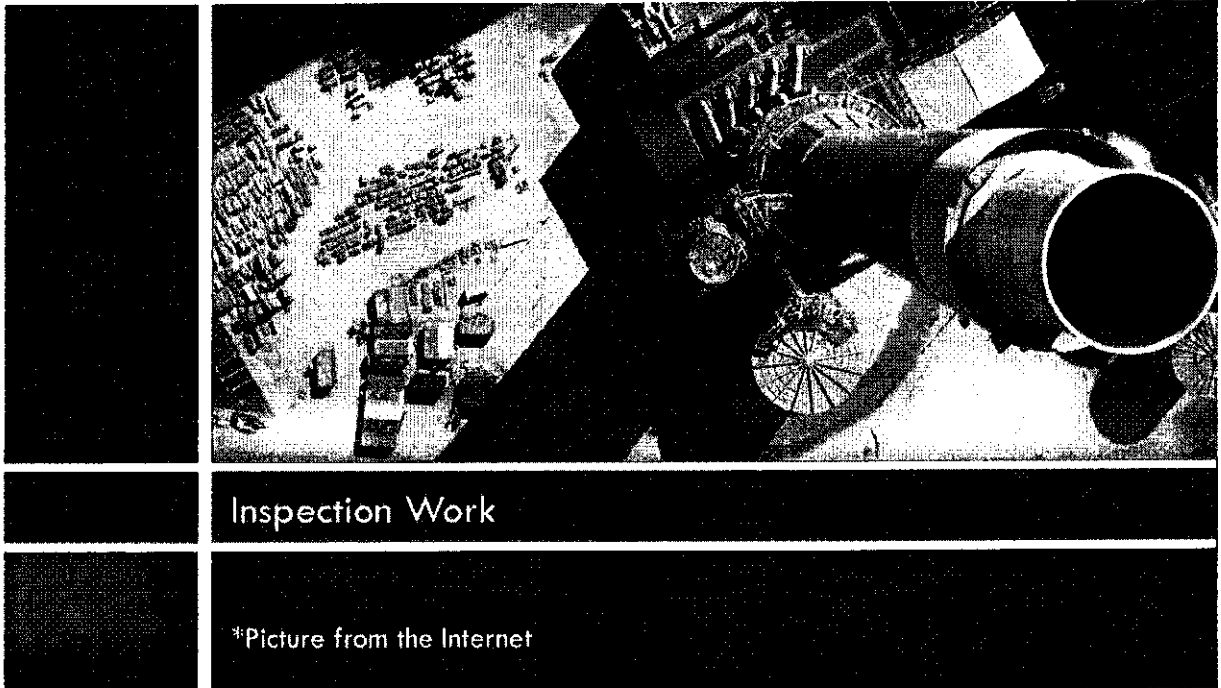
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Inspection Work

\*Picture from the Internet

## Typical UAV or Robotic Work

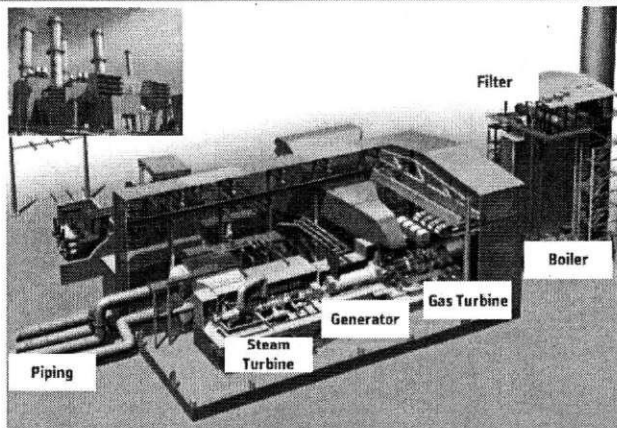
- Dull
  - Do everyday or do every week or do every month
- Dirty
  - Hazardous area, contaminated area
- Dangerous
  - War zone, radioactive zone

# Inspection Work Requirement

- Inaccessible area – turbine, small pipe, etc.
- Difficult to access space – chimney stock, etc.
- High efficiency and high reliability
- Outage time reduction
- Lifetime assessment -> Outage optimization

# Required Technology

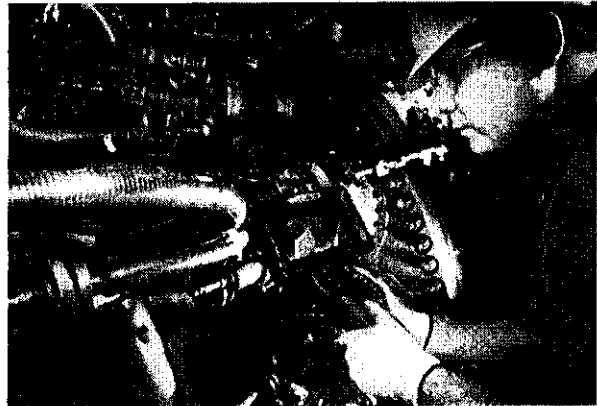
- Inspection technology
  - Non Destructive Testing (“NDT”)
- Mobile robot
  - Automation, navigation
- Data management
  - Data acquisition, integration, interpretation



# About Non Destructive Testing

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- Methods of detecting and evaluating flaws in materials with no deterioration to the structure
- Remote visual inspection is one of NDT method



## NDT in General

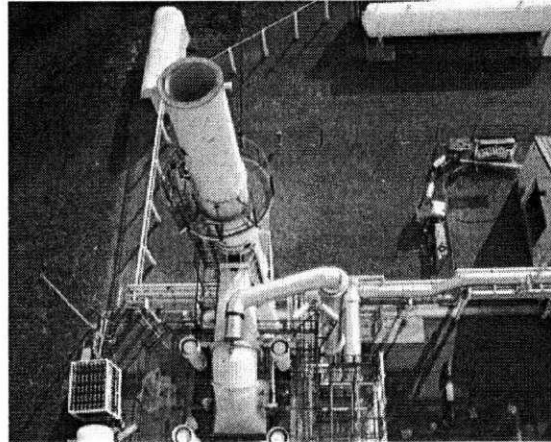
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- |                   |   |                      |
|-------------------|---|----------------------|
| □ Dye             | } | Detect surface flaw  |
| □ Electromagnetic |   |                      |
| □ Thermal         |   |                      |
| □ Ultrasonic      | } | Detect internal flaw |
| □ Radiographic    |   |                      |

## Missed Positive and False Negative

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- Missed defects
- Missed interpretation  
(good parts as defects)
- > Having the right crew,  
right equipment and  
experience is the key



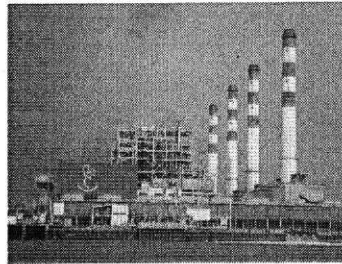
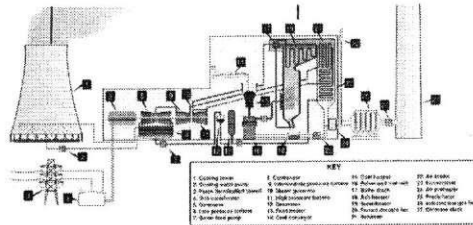
## Personnel

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- International standard for NDT operators
  - Level 1,2,3
- Typical Level-2 certification is required for NDT operator
- ISO 9712

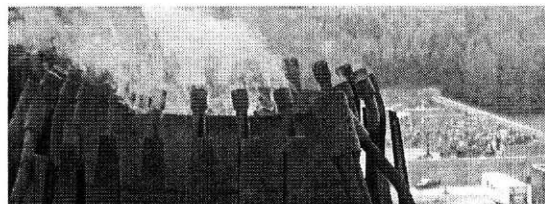
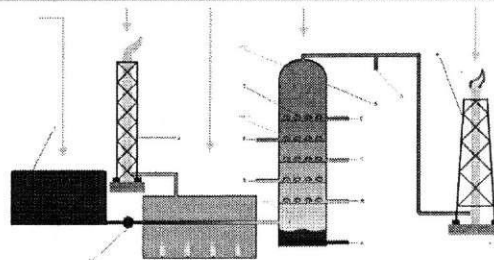
# UAV Inspection for Power Plant

- Cooling tower
- Chimney stack
- Pipeline
- Pylon
- (Termination tower)
- Unit transformer



# UAV Inspection for Refinery

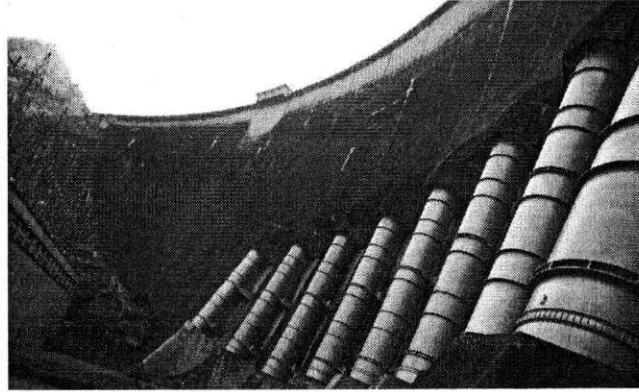
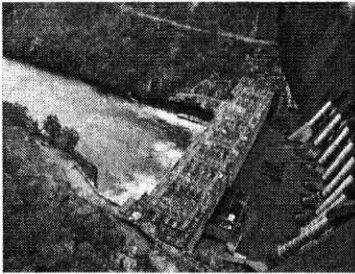
- Flare system
- Chimney stack
- Reactor/column
- ...



## UAV Inspection for Hydro Power Plant

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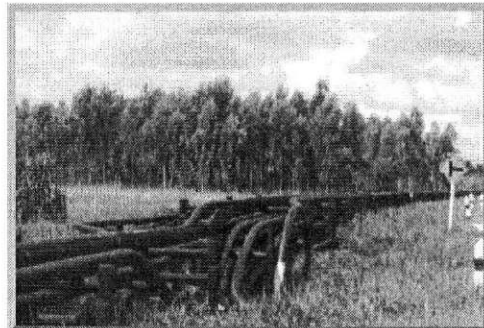
- Dam
- Water intake/outtake



## UAV Inspection for Pipeline

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- Pipeline monitoring together with GIS integration and spatial database





Services Part of the Work

\*Picture from the Internet

## Challenges

Inspection business

- Extremely conservative, highly regulated
- No robotics expert

UAV challenges

- Zero failure tolerance
- Hazardous environment
- How to make it easy to operate





# Risk and Myth

## Risk

- No laws mean not allowed? or not permitted?
- Is it really easy to ask for forgiveness than approval?
- Liabilities

## Myth

- I fly over my own property, I own my airspace
- I hire someone to fly over my property in my "airspace"



# Risk: No Law Aspect

- US FAA prohibit all commercial aspects of UAV, our DCA may follow US FAA
- ICAO has published Annex 2 but DCA has not implemented
- Sense-and-Avoid capability is a must for UAV but SAA is not built yet.



## Risk: Easier to ask for Forgiveness?

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- Not really. Go back to the Aviation law and Defense-related law about operating unauthorized plane
- Out-of-sight operation is very much illegal

## Risk: Liabilities

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- Scenario 1. Big UAV could cause death and property damages if crashed
  - Operator and owner are 100% liable
  - 8-rotor approx. 12 kg, 200m height crash, 180km/h terminal velocity
- Scenario 2. Big UAV crash into Oil Refinery and cause 2-day outage (@200M per day), 400M loss



# Myth: I Fly Over My Airspace

- Not true. Some areas, your airspace ends just top of your roof. Check the facts!
- I hire someone to fly in my airspace -> both you and the hired company are breaking the law (check the area)

**Airspace at-a-Glance**

**Communication Requirements and Weather Minimums**

Features	Class A	Class B	Class C	Class D	Class E	Class G
400' Altitude	400' (Class A)	400' (Class B)	400' (Class C)	400' (Class D)	400' (Class E)	400' (Class G)
Required Pilot Certificate	Instrument	Instrument	Instrument	Instrument	Instrument	Private
See Also Class	None	None	None	None	None	None
400' Minimum Ceiling	5,000'	3,000'	2,000'	1,000'	1,000'	1,000'
400' Minimum Visibility	3 miles	3 miles	3 miles	3 miles	3 miles	3 miles
400' Cloud Clearance	500' above, 200' below, 200' horizontal	500' above, 200' below, 200' horizontal	500' above, 200' below, 200' horizontal	500' above, 200' below, 200' horizontal	500' above, 200' below, 200' horizontal	500' above, 200' below, 200' horizontal
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## How to Limit Risk?

No law:

- Get authorization from appropriate agencies
- Operate the aircraft in visual line-of-sight (low altitude) and short distance from the operator
- Check the area for possible problem
- Never fly above people, highway, or buildings

## How to Limit Risk?

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### Liabilities:

- Reliable platform
- Insurance
  - Authorized platform, licensed operator, licensed pilot
- The skilled crew
- Maintenance

## What's Next?

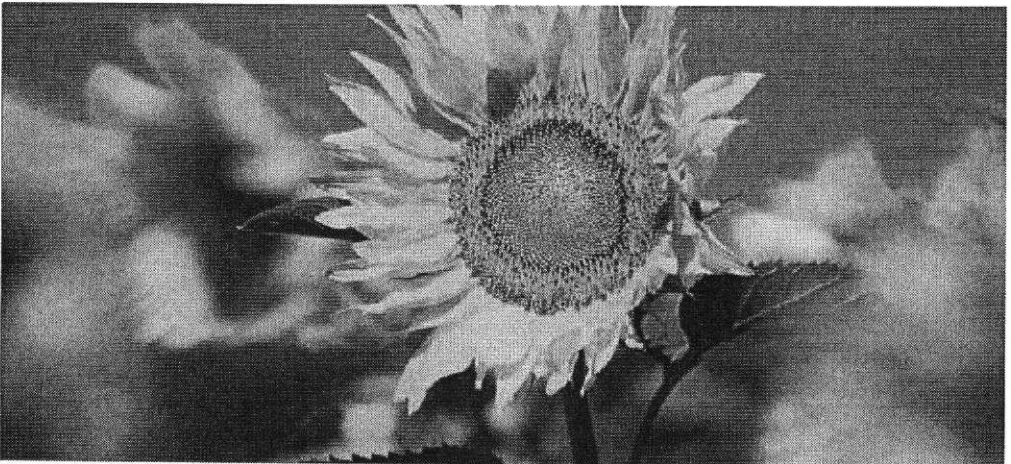
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- A group of services companies
- Develop a good industry with good performance first not "price" first
- Pricing strategy that works for everyone
- Create basic group insurance for the industry



Thank you for listening...

Any questions?



Backup Slides

