SPACE TECHNOLOGY DEVELOPMENT IN VIETNAM 2014-2015

Assoc.Prof.Dr. Doan Minh Chung, Director
Space Technology Institute (STI)
Vietnam Academy of Science and Technology (VAST)
1. Develop & launch some communication satellites:
   - 2008: VINASAT-1 with 12 transponders;
   - 2012: VINASAT-2 with 24 transponders.
2. Develop & launch some EO satellites:
   - 2013: VNREDSat-1 optical 130 kgs; 2.5m PAN, 10m MS
   - 2018: JVLOTUS-1 radar 500kgs
   - 2020: JVLOTUS-2 radar 500kgs
   Planning VNREDSat-2 (optical; 1m) & VNREDSat-2B (hyperspectral)
3. Project “Vietnam Space Center” - Japan ODA
   - Build Space Center (Hoa Lac high tech. Park)
   - Develop & launch JVLOTUS-1; -2 radar;
VNREDSat-1
(VietNam small satellite for natural Resource, Environment & Disaster management)

Project Owner: VAST
Prime contractor: EADS Astrium
Launch time: 07/5/2013 at Kourou, France

Mission: Earth observation in PAN and 4 MS spectral bands
Revisit time: 3 days
Orbit characteristics: SSO, 680 km altitude
LTAN: 10:42 PM
Spatial resolution: 2.5m (PAN) and 10m (MS)
Platform: 600 mm x 570 mm x 500 mm
Total mass: ~130kg
Life-time: 5 years (guaranteed)

Imaging modes: single shot, scanning, stereo
Swath: 17.5 km
Strip length: 823 km (PAN + MS)
Number of acquired images per day: 100 scenes
Agility: +/- 35 degrees
As of 31st October 2015, VNREDSat-1 satellite has captured and downlinked:

- **In total: more than 42,000 scenes**
VNREDSat-1 satellite has captured and downlinked:
• In Vietnam: more than 23,000 scenes
Applications of VNREDSat-1 for disaster management

VNREDSat-1 image on 4/10/2013 over Nghe An prov. Flood for release water
Island BachLongVy_27092014  Island PhuQuy_03012014
VNREDSat-1 image, 09/08/2013 of the Hydro-power, Quang Nam prov.
Flood effected areas in Nghe An, Viet Nam on 04\textsuperscript{th} Nov 2013
Biggest flood for 40 years in Quang Ninh prov. Vietnam – 7/2015
Image of VNREDSat-1 captured flood in Quang Ninh prov. (7/8/2015)
Image of VNREDSat-1 captured flooding on Cam Pha city, Quang Ninh prov. in 7 Aug., 2015
INTERNATIONAL COOPERATION FOR
DISASTER REDUCTION THROUGH ESCAP NETWORK
Damages from Rammasun typhoon in Vietnam (N.2, 19/7/2014)

Lang Son’s Damage
460 billions VND
caused by flood

Dien Bien province (North Vietnam):
damage is about 35 billions VND (~ 35/21 = 1.7 Mill.USD)

Lao Cai province (North Vietnam) : damage is about 30 billions VND (~1.4 Mill.USD)
Results (Lao Cai, Nam Dinh - Thai Binh prov.)
SAR image of UNOSAT captured Quang Ninh – Hai Phong (3/8/2015) & flooding map built by STI-VAST (from call of ESCAP)
International cooperation of VNREDSat-1 for disaster management at UNESCAP

Image over Tacloban, The Philippines, on 15th Nov 2013

Flood areas on 18th Sep 2014

Srinagar_India

Muzaffargarh_Pakistan
VNREDSat-1 image captured the flood, landslides in Philippines (Typhoon Hagupit - N.5 (07/12/2014) from call of ESCAP)
Image VNREDSat-1 captured Volcano San Miguel, El Salvador - 01/01/2014
Image over center of Kathmandu, Nepal 04\textsuperscript{th} May 2015, after earthquake
VNREDSat-1 captured forest fires at Pateros, Washington, USA - 27/08/2015
VAST participates in GEOGLAM initiative with JAXA (Asia RICE – crop estimation and monitoring)

VAST's rice crop shape file

1. Red river delta (Thai Binh prov.) – Space Technology Institute – VAST

2. Mekong river delta (Long An prov.)/ Institute of HCM Geography & Natural Resource – VAST
There are 2 crops/year – SUMMER & SPRING (7 & 9 months)

- Sowing - Transplanting Vegetative phase (May-June, October-November)
- Tillering vegetative phase (July-August, December-January)
- Flowering reproductive phase (September-October, March-April)
- Mature grain ripening phase (October-November, May-June)
SAFE initiative
Rice crop monitoring in Mekong Delta, Vietnam

Previous projects
1. Rice & Mangrove monitoring in Southern Vietnam - RICEMAN
   - TerraSAR-X & ENVISAT-ASAR data, 2010-2011
   - Rice mapping: Single-date mapping algorithm
   - Yield estimation model: Statistical model.
2. Rice crop monitoring using new generation synthetic aperture radar (SAR) imagery
   - ENVISAT-ASAR data, 2007-2008
   - Rice mapping: Single-date mapping algorithm
   - Yield estimation model: Statistical model.
3. Utilisation of SAR data for rice crop monitoring
   - ERS2-SAR data, 1997-1998
   - Rice mapping: Temporal change measurement
   - Yield estimation model: Agro-meteorological model (AMM).
4. Other projects in the Mekong and Red River Delta

Current project
- Rice crop monitoring in the Mekong Delta, Vietnam - SAFE
  - Rice mapping
  - Yield estimation model
Data set: ALOS-PALSAR, 2010

PALSAR image in AW 2010 crop (06 Nov 2010)
Data set: CSK, 2013-2014

Accuracy assessment of estimated production for AW 2013 crop at Chau Thanh and Thoai Son district using three-date polarisation ratio (HH/VV) of CSK.

```
y = 0.9788x + 181.2
R^2 = 0.9429
```

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<tr>
<th>Commune Name</th>
<th>Estimated production (ton)</th>
<th>Agency data (ha)</th>
<th>Percentage error (%)</th>
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<td><strong>269,555</strong></td>
<td><strong>270,949</strong></td>
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Experiments with UAV for measuring of the water reflect spectrum from that use physical models to estimate the water quality
APPLICATIONS OF SPACE TECHNOLOGY
National Research Program on Space S&T - VAST

26 Projects approved in the period 2013-2015
Budget ~ 104 bil. VND ~ 5 mil. USD

- Small satellite, GNSS, GRS technologies.
- Applications of RS, GIS, GPS and communication satellite for economic development; natural resource, environment and disaster monitoring, transportation, sea navigation;
- Fabrication equipments and low cost meteorological ground receiving station.
- Fundamental research for space technology applications (medical-biology in space; material science in space environment).
- Launcher rocket technique.
Applications of VNREDSat-1 for mapping land cover in Hue old city of World culture heritage conservation
Applications of VNREDSat-1 for disaster management
Space Technology Development (GNSS, Launcher, Receiving station)
Applications of VNREDSat-1 image and UAV for establishment the 3D multi-scale topography data base

Using VNREDSat-1 & UAV to establish the 3D map of the border Vietnam-Cambodia, Vietnam-Lao with scale 1:1,000,000 for Asia Pacific scale, 1:50000 for whole country scale, 1/25,000; 1/10,000 (from border line to each other 3 km).

UAV image with 0,10m resolution and Digital Surface Map (DSM)
Establish 3D multi-scale map using VNREDSat-1 & UAV

For Water system (Chủ đề thủy hệ)

For Topography (Chủ đề địa hình)

For infrastructure & habitants (Chủ đề dân cư cơ sở hạ tầng)

For transportation (Chủ đề giao thông)

For border (Chủ đề địa lý địa giới)

For surface coverage (Chủ đề phủ bề mặt)
3D-map of Hanoi area made from UAV image
Research and estimation of the geological hazards at Hydropower lakes and transport roads of the North west region of Vietnam using VNREDSat-1 image & GIS

Landslides & mud flash flood at Ta Khoa on VNREDSat-1 & field trip photo
(Trượt lở và lũ bùn đá tại Ta Khoa trên ảnh VNREDSat-1 và chụp tại thực địa)
Physical Model of the Satellite Launcher TV-01 made in Vietnam

- Structure of the VN Launcher TV-01:
  - Controlized, 2 floors, carrier 70-75 kg;
  - First floor carrier: ~ 50 kg;
  - Diameter of the Launcher body ~ 200 mm;
  - Launcher length ~ 2000 - 2500 mm.

- Orbit of the Launcher TV-01
  - At the site, TV-01 was launched vertically, after 4-6 s, it changed direction by the time about 0.5 – 1.5 s as the figure.
**Test of the Launcher TV-01**

- **Orbit of the Launcher TV-01**

At the site, TV-01 was launched vertically, after 4-6 s, it changed direction by the time about 0.5 – 1.5 s as the figure.
- Design and manufacture 3 passive microwave radiometers (L, C, X bands).
- Utilizations of MW radiometers and passive MWRS methods to determine SMC, biomass, SST, SSS, etc.
- Conduct and promote Space education for junior students and children (water rocket, space poster competitions, etc.)

Data process in the Microwave Laboratory

To measure soil moisture content (SMC) on crop fields

To determine biomass on corn field

Software for RDM data receiving and processing
Aerial remote sensing for soil moisture mapping

Assembly Radiometers on helicopter

Aerial Remote Sensing for soil moisture mapping

Registered TB over rice field in 60 minutes
Vietnam Space Center Project

Fund: Japanese ODA & Vietnam

Duration: 2012 - 2021

Executing Agency: VNSC

- AIT facilities for small satellites.
- Satellite operation center
- S & X-band ground station
- R & D facilities
- Public education in space

Capacity Building for Satellite Development

- 2 SAR EO satellites
- Utilization of satellite image data
Space Application Center

- Location: Ho Chi Minh city
- Project duration: 2016 - 2020
- Executing Agency: VNSC

Focus areas:

- Regional and international space applications
- Ground station with satellite image processing and data analysis system
- Satellite imagery database
- Technology transfer
Facilities for Space Science and Public

- **Location:** Nha Trang & Hoa Lac
- **Project duration:** 2014 - 2016
- **Executing Agency:** VNSC

**Facilities**
- 12m-planetarium in Hoa Lac and 9m-planetarium in Nha Trang
- Two 50cm optical telescopes in Hoa Lac & Nha Trang
- Space museum in Hoa Lac

*Equipments from Marcon Telescope (Italy)*
“Made-in-Vietnam” Satellites
(VAST/VNSC)

- 2011 Start
- 2013 (1 kg)
- 2013-2017 (50 kg)
- 2015-2016 (6-10 kg)
- 2018-202(600 kg)

Satellites:
- PicoDragon
- NanoDragon
- MicroDragon
- JVLOTUSat-2
Cooperation with JAXA for disaster management
JAXA-VAST-WRD – 01/9/2015

JAXA: Dr. Chu Ishida, Director DRR
DWR: Dr. Hoang Van Thang – Vice-Minister of MARD
VAST/STI: Prof. Duong Ngoc Hai, Vice-President of VAST

signed MOU in 01/9/2015
MAIN CONTENTS OF MOU BETWEEN JAXA-VAST-WRD

1. Cooperate on sharing historical and current satellite data and imagery for disaster prevention, gradually developing a national database of satellite data for disaster prevention in Vietnam.

2. JAXA will provide free or in accordance with agreement on satellite image data, satellite data from Sentinel Asia as request of Vietnam Directorate of Water Resources (WRD) for disaster and reduction in Vietnam with the technical support of VAST. And VAST will provide satellite data of VAST as VNREDSat to Sentinel Asia - 3 when disasters occur.

3. Strengthen the capacity of the agencies of Directorate of Water Resources and of Vietnam Academy of Science and Technology (like Institute of Space Technology) for the application of remote sensing and GIS technology for disaster prevention

4. Build and implement cooperative projects of applications of RS, GIS for disaster prevention. JAXA will provide technical support to WRD và VAST in those projects.

* 10/2015 VAST HAS REGISTERED TO JOIN THE SENTINEL ASIA AS DPN AND DAN & ACCEPTED!
THANK YOU FOR YOUR ATTENTION!