SPACE TECHNOLOGY DEVELOPMENT IN VIETNAM 2014

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Vietnam Academy of Science and Technology (VAST)
OUTLINES

1. Satellite program of Vietnam
   1. VNREDSat-1 (VAST*) - Optical
   2. VNREDSat-1B (VAST) – Hyperspectral
   3. JV-Lotus1 & JV-Lotus2 – Radar

2. Applications of Space Technology

3. International cooperation of VNREDSat-1 for disaster management
VNREDSat-1
(VietNam small satellite for natural Resource, Environment & Disaster management)

Project Owner: VAST
Launch time: 07 May 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
All acquired images of VNREDSat-1 after 1 year operated

As of 31\textsuperscript{th} October 2014, VNREDSat-1 satellite has captured and downlinked:

- In total: 28285 scenes (14171 MS and 14114 PAN)
Acquired images of VNREDSat-1 in Vietnam

VNREDSat-1 satellite has captured and downlinked:

- In Vietnam: **13633 scenes** (6770 MS and 6821 PAN)
First images from VNREDSat-1
<table>
<thead>
<tr>
<th>City</th>
<th>Country</th>
<th>Date Acquired by VietNam Satellite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangkok (Thailand)</td>
<td></td>
<td>17/12/2013</td>
</tr>
<tr>
<td>Jakarta (Indonesia)</td>
<td></td>
<td>22/08/2013</td>
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<tr>
<td>Kuala Lumpur (Malaysia)</td>
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<td>28/06/2013</td>
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<tr>
<td>Manila (Philippines)</td>
<td></td>
<td>11/05/2014</td>
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<tr>
<td>Naypyidaw (Myanmar)</td>
<td></td>
<td>27/10/2014</td>
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<tr>
<td>PhnomPenh (Cambodia)</td>
<td></td>
<td>28/06/2013</td>
</tr>
<tr>
<td>Singapore (Singapore)</td>
<td></td>
<td>06/10/2013</td>
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<tr>
<td>Vientiane (Lao PDR)</td>
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<td>14/12/2013</td>
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</table>
Potential Applications of VNREDSat-1

Cartography
Agriculture
Forestry management
Environment surveillance: oil spill, pollution,
Coastal management
Ocean: water quality
Disaster management: monitoring, prediction,
early warning, recovery and rehabilitation.
VNREDSat-1B project (2014-2017)
Contractor: Consortium SpaceBel, Qnetic, Amo, CSL

- Finance source: Belgium ODA.
- Orbit characteristics: SSO, altitude ~600km
- Platform: Proba, highly flexible
- Compact Hyperspectral Imager Breadboard (CHIB)
- Number of spectral bands: 80-100
- Spectral range: 400 – 830nm
- On-board memory: 64 Gbits
- S-band: Telemetry and Telecommand
- X-band: image downlink, 32 Mbps
- Revisit time: 3 days
- Ground station located in Hanoi with 3-4 satellite contacts/day
- Wide swath width: 250-300 km
Project “Viet Nam Space Center”
Supported by Japanese ODA

Facility

International Guest house
Radar satellite projects (2014-2020) (in accompanied with VSC project)

• Finance source: Japan ODA
• JV-LOTUSat-1: Vietnam-Japan joint-development of a radar satellite (assembly in Japan), launched in 2017
• JV-LOTUSat-2: development of 2nd satellite, in parallel with infrastructure establishment for assembly and test in Hoa Lac, launched in 2020
• Training for satellite assembly, integration and testing will be performed in Hoa Lac after the infrastructure is completed.
• Instrument: X-band SAR
• Ground sampling distance: ~1m
• Total weight: <500kg
• Life-time: 5 years
• Dimensions: 2.6m x 3.5m x 3m
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.
NOAA Ground Receiving Station of STI-VAST

Facilities: Antenna & its control system; System for receiving and processing
Program for establishment of NOOA data base
Optical & Near-infrared spectrum of the young & old forests
VAST manufacture UAV & its application for monitoring forest fires, drought /flood, water quality, ship and oil spill, etc
STI design & manufacture the Reflect-Radiometer and use it for measuring the reflect spectrum of the natural objects
Establish the Spectral Library for typical natural objects of Vietnam
Vietnam participates in GEOGLAM initiative
(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
Red river delta study area
Nam Dinh, Thai Binh province

Geographic coordinates
UL: 20°46'24"N, 105°56'16"E, UR: 20°43'35"N, 106°40'44"E
LL: 19°53'03"N, 105°51'55"E, LR: 19°50'16"N, 106°36'40"E

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)
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).

History of the project
- 2013 June: Approved;
- 2013 July: Kick-off meeting;
- 2013 Dec: SAFE Workshop
- 2013 Dec-2014 Apr: Monitoring 2nd crop.
An Giang (Thoai Son & Chau Thanh districts)

Field samples: 40
Check points:
   40 rice points,
   24 non-rice points
International cooperation in disaster management (through Vietnam typhoon Rammasun 7/2014, China Earthquake, India & Pakistan flood, Indian cyclones)

- Vietnam as member of UNESCAP has contacted with RESAP members for imageries before & after Rammasun typhoon:
  UNESCAP requested RESAP members providing satellite images to VN including RISAT-1, RADARSAT, UNITAR/UNOSAT, ROSCOSMOS, GISTDA (attachments)
  - Vietnam cooperated with UNESCAP in providing VNREDSat-1 image for regional disasters in 2014

- 19/7/2014: Rammasun typhoon N.2 stroke Vietnam;
- 10/8/2014: Ludian Earthquake in China;
- 16/9/2014: Kaelmagi typhoon N.3 - Vietnam
- 15/9/2014: Flood in India & Pakistan
- 15/10/2014 Indian cyclones
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)
Typhoon Kalmaegi (No.3) struck Vietnam in the evening of 16/9/2014 (22h, Quang Ninh prov.).
Vietnam has sent a request for satellite imagery to UNESCAP's support.

7:00AM, 17/9/2014: Hai Phong prov. is suffered by heavy flooding; Lang Son prov. is suffered by flash flood.
Typhoon Sinlaku - N.4 struck Vietnam (29/11/2014)
19:30pm struck coastal zone of prov. Binh Dinh – Phu Yen
Results (Lao Cai, Vinh Phuc prov.)
Results (Nam Dinh – Phu Tho – Vinh Phuc prov.)
TerraSar-X & Theos

MAPPING AT REGION OF NAM DINH - PHU THO - VINH PHUC PROVINCE, VIETNAM
International cooperation of VNREDSat-1 image for disaster management

Image over Tacloban, Philippines, 15th Nov 2013

Flood areas on 18th Sep 2014

Srinagar_India

Muzaffargarh_Pakistan
VNREDSat-1 image for cyclones in India (10/2014)
Cooperation with JAXA for disaster management
Kick-off workshop on utilization of remote sensing & GIS for disaster management – Sentinel Asia Mini-project – 10/2014 (JAXA-AIT-STI-DMC)

JAXA: Dr. Naoto Matsuura
AIT: Dr. Lal Samarakoon
DMC: Dr. Hoang Van Thang – Dir. Water Management Dept., Vice-Minister MARD
STI: Dr. Doan Minh Chung, Dir. STI

will sign MOU for cooperation.
Operating schema

NCHMF: National Center for Hydro-Meteorology Forecast; DMC: Disaster Management Center; CCFSC: Central Committee for Flood & Storm Control
The 3\textsuperscript{rd} Asian Workshop on Earth observation satellite & ground station experts exchange – VAST/MONRE/AIRBUS D&S – Hanoi, 13-14/11/2014
Pico dragon satellite

- Manipulated by young Vietnamese researchers.
- Hardware, Shaking test and temperature test in Japan.
- Purpose:
  - Testing satellite communication
  - Monitoring space environment

<table>
<thead>
<tr>
<th>Satellite Name</th>
<th>PicoDragon</th>
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<tbody>
<tr>
<td>Overview</td>
<td>Tokyo Univ. / VNSC / IHI Aerospace</td>
</tr>
<tr>
<td>Size</td>
<td>10x10x10cm (1U)</td>
</tr>
<tr>
<td>Mission</td>
<td>Capturing images of Earth in several mode</td>
</tr>
<tr>
<td></td>
<td>Image Processing Function</td>
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</tbody>
</table>
PICO Dragon developed by VNSC was released successfully on Nov. 18th, 2013.
2. Space Seeds Experiment 2014

- **Resource**: SSAF-2013 remained seeds
- **Participants**: more than 200 pupils at the age of 6th grade, secondary school.
- **Objective**:  
  - Scientific research skills: simple description and discussion  
  - Team work spirit: collaboration and working in team
Remained seed from SSAF-Distribution to pupils for experiments, 2014

Keeping in Humidifier

Distribution to pupils for experiments, 2014
Parabolic Flight Experiment

Parabolic flight contest in Vietnam: June 2013

Collaboration between JAXA, VAST, STI, UET
The interaction of smartphone’s Gyroscope and Accelerometer in microgravity condition
World Space Week 2014

- Secondary pupils
4. Space painting

- Space Painting Contest was organized for secondary students.
High school competition
THANK YOU FOR YOUR ATTENTION!

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