MicroDragon: a Vietnamese Ocean-observation Microsatellite Based on Hodoyoshi Architecture

Takashi HIRAMATSU, Seiko SHIRASAKA
(Keio University),
Sinichi NAKASUKA
(The University of Tokyo)
Outline

• Space Education Program (Vietnam-Japan)
• MicroDragon Satellite Overviews
• Conclusion
Space Education Program

• Four-year capacity building (2013/9-2017/9)
• 36 staff members from VNSC (Vietnam National Satellite Center) to study in Master program in Japan
• Develop a microsatellite MicroDragon (MDG)
Motivations

• Vietnam’s Space Technology Development Roadmap:
  – 1U CubeSat PicoDragon (2013 ISS)
  – 3U CubeSat NanoDragon (proj. 2016)
  – Small Earth Observation Satellite LOTUSat (proj. 2019)

• Advance in Technology from both development and utilization perspectives
MDG Project Context

- Mission (Imagers)
- Engineers (Students)
- Frequency Application
- Operations

Hokkaido University

- Mission (S&F)
- Attitude Determination and Control (ADCS)

Tohoku University

- Engineers (Students)
- Frequency Application
- Operations

Vietnam National Satellite Center

- Structure (STR)
- Thermal (THM)
- Environment Tests

Kyushu Institute of Technology

- Bus Integration
- Electrical Tests

The University of Tokyo

- Project Management
- Bus Development
- Rocket IF

Keio University

JAXA

Launch Service
(Innovative Satellite Technology Demonstration Program)
HODOYOSHI Evolution

HODOYOSHI-1
- ADCS Technology

HODOYOSHI-2
- Mission Payloads

PROCYON
- Improved software architecture

MicroDragon
- Mission Controller

HODOYOSHI-3
- BUS architecture
- Software architecture

HODOYOSHI-4

UNIFORM-1
## MDG Specs

<table>
<thead>
<tr>
<th>Size</th>
<th>approx. 0.5 m × 0.5 m × 0.5 m (stowed) approx. 1.4 m (SAP deployed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>approx. 50 kg</td>
</tr>
<tr>
<td>Orbit (Planned)</td>
<td>SSO 500 km&lt;br&gt;LTDN 9:30</td>
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<tr>
<td>ADCS</td>
<td>Three-axis Earth Pointing</td>
</tr>
<tr>
<td>EPS</td>
<td>Solar Cells&lt;br&gt;2x Solar Array Paddles (SAPs) + 5x Body&lt;br&gt;Mount Cells</td>
</tr>
<tr>
<td></td>
<td>Generation 100 W (max)&lt;br&gt;Consumption 50 W (avg)&lt;br&gt;Bus Voltage 28V (unreg) + 5V (reg)&lt;br&gt;Battery 5.8AH Li-ion</td>
</tr>
<tr>
<td>COM</td>
<td>S-band 4kbps (CMD)&lt;br&gt;S-band 4/32/64kbps (TLM)&lt;br&gt;X-band 10Mbps (Mission)</td>
</tr>
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The 7th Nano–Satellite Symposium, Kamchia, Bulgaria

MDG Missions

<table>
<thead>
<tr>
<th>Mission</th>
<th>Ocean Color Remote Senging (Hokkaido U) Store &amp; Forward (Tohoku U) Antimony Tin Oxide Coating Solar Cell (Kyutech) Atomic Oxygen Effect Characterization (Kyutech)</th>
</tr>
</thead>
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Student Research
Mission Payload: SMI

• Ocean Color Remote Sensing using Spaceborne Multispectral Imager
  – Multispectral Imaging using Tunable Bandwidth (based on RISING-2 & DIWATA-1)
  – From ocean color analyze the amount of alpha-chlorophyll from plankton
  – Applied for Marine Utilization
Mission Payload: TPI

- Aerosol Observation using **Triple Polarization Imager**

- Aerosol observation can be used for atmospheric correction of ocean color remote sensing

- May contribute to other applications
  - Global warming estimation
Mission: Store & Forward (S&F)

- Collect data from ground sensors
- Supplement Ocean Observation
- Possibility of other applications
  - Disaster Monitoring
- Potential Collaboration
  - S&F network with Hodoyoshi satellites
# Schedule

<table>
<thead>
<tr>
<th>MDG Development</th>
<th>FY27 (FY2015)</th>
<th>FY28 (FY2016)</th>
<th>FY29 (FY2017)</th>
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<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7</td>
<td>8 9 10 11 12 1 2 3</td>
<td>4 5 6 7 8 9 10 11 12 1 2 3</td>
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<tr>
<td>MDG Development</td>
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<tr>
<td>STM Design/Analysis</td>
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<tr>
<td>STM Test</td>
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<tr>
<td>EM(*)Dev・Test</td>
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<td>FM Design/Dev.</td>
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<td>CDR</td>
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<tr>
<td>Project End</td>
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<td>Launch</td>
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<td>Ops</td>
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Project Status

As of October 2016

• Bus Components Procurement – Completed
• Mission Payloads EM - Completed
• Structural Design – To be Completed by 2016
• Flight Software Development – Ongoing

Coming up Next

• Development of FM – Begin 2016
• Finish FM Test Campaign – Summer 2017
• Delivery to JAXA – End of 2017 (TBD)
Conclusion

• Vietnamese Young Engineers and Japanese University Researchers work together to develop a microsatellite
  – Assist Vietnam’s Strategy in Space Technology Development
  – Based on Flight-Proven Hodoyoshi Satellite Architecture
  – To be completed by Sept. 2017

• Expected to be a model case of Japanese international collaboration
  – Potential of Further International Collaboration Opportunities
  – Enhance Microsatellite Components Supply Chain
ベトナムの若手エンジニアと日本の大学研究者が協力してマイクロ衛星を開発中 – ミッションはベトナム沿岸の海洋観測 – 卫星は「ほどよし」系や「RISING」系の実績のあるバス・ミッション機器で構成

革新実証での打上げを目指し来年9月のプロジェクト終了までの完了を目指す

この成功を足がかりに海外へのキャパビル開と国内メーカー機器の需要拡大を狙う

THANK YOU