

*STAMINA4Space:
Disruption and Value Creation from
Space Technology through
Data, Industry and People*

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2018 Philippine APEC Study Center Network

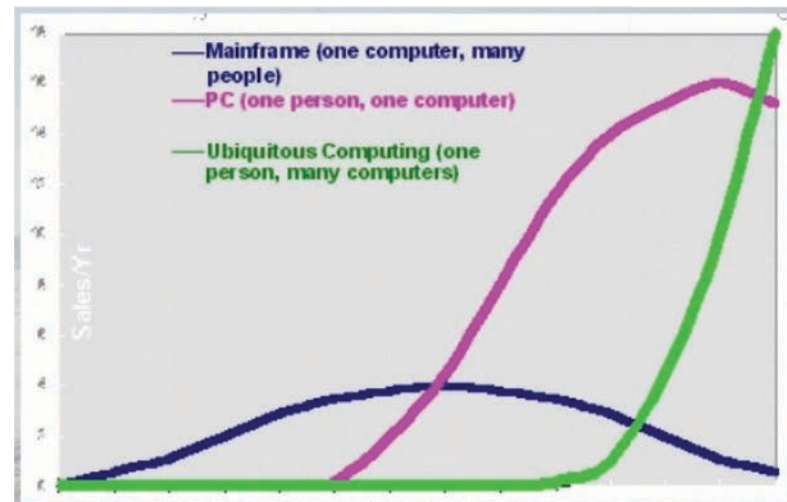
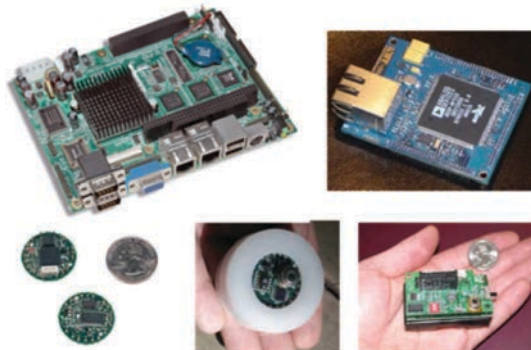
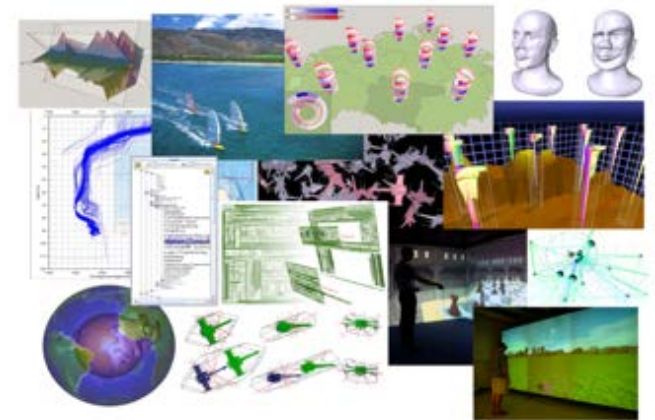
Regional Symposium on Disruptive Technologies:

Opportunities, Challenges and Risks

Michael Richartz Center, University of San Carlos Talamban Campus

23 January 2019

The Changing Face of Computing

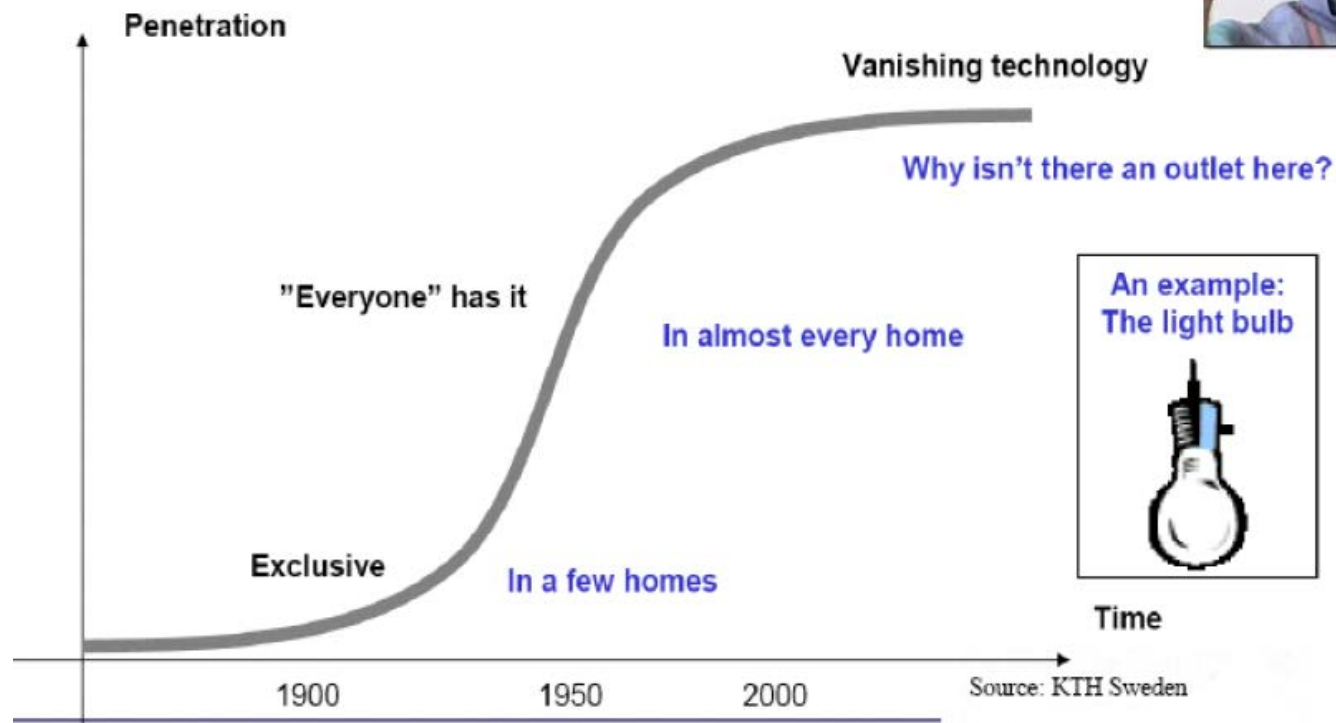


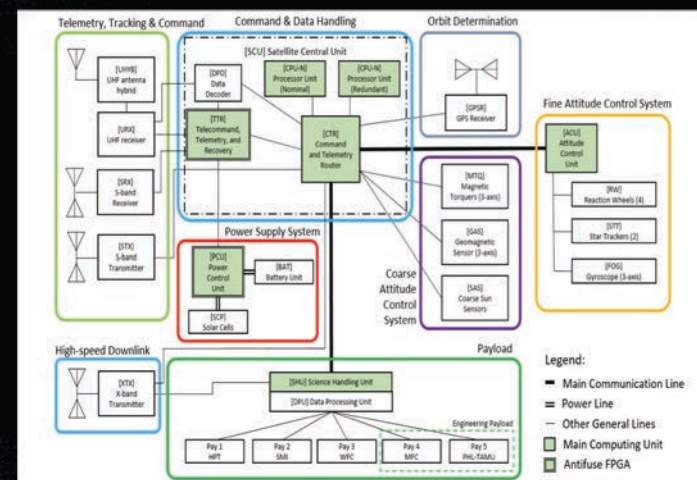
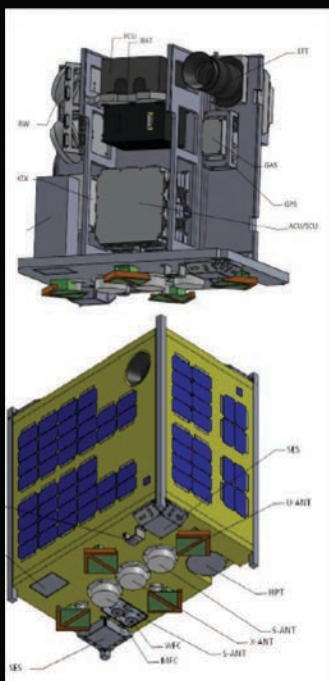
Going the Way of the Light Bulb



„The most profound technologies are those that *disappear*. They weave themselves into the fabric of everyday life until they are indistinguishable from it.“

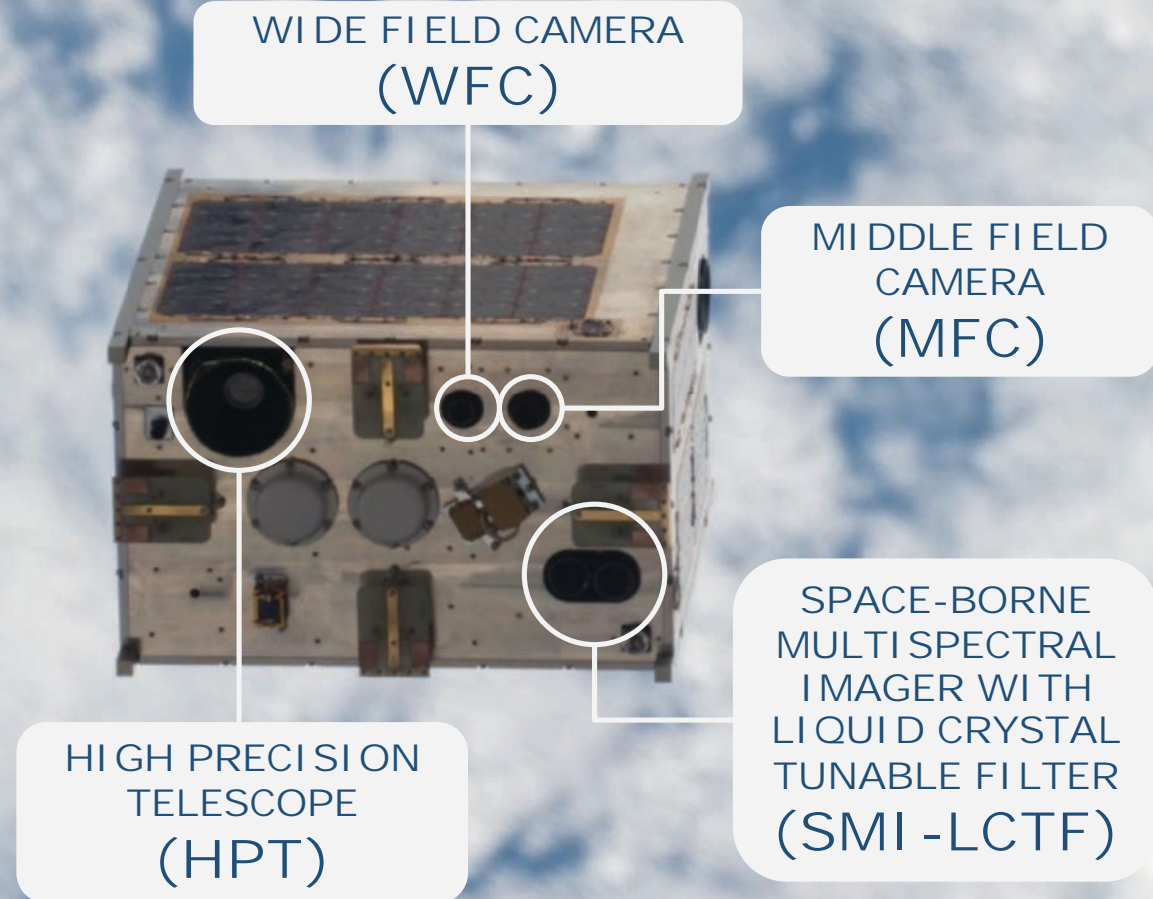
Mark Weiser (1952 – 1999), Xerox PARC





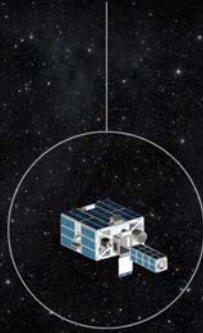
Diwata-1 Microsatellite Payload

CLASS: 50 kg Microsatellite
DIMENSION: 55 x 55 x 35 cm
INCLINATION: 51.6 degrees
ALTITUDE: ~420km
LAUNCH: 23 March 2016
RELEASE: 27 April 2016



THE FUTURE IS SMALL

PROX-1 will be Georgia Tech's first complete spacecraft, a fully functioning vehicle that will demonstrate automated trajectory control of one spacecraft relative to another.



GEORGIA TECH RESEARCHERS ARE DEVELOPING SMALL SATELLITES AND ADVANCED TECHNOLOGY FOR THE NEXT GENERATION OF SPACE EXPLORATION

BY JOHN TOON
PHOTOS BY ROB FELT



Increasing demand
for nano and microsatellites among
space new entrants
looking to find viable
beachhead strategy
for meeting
scientific earth
observation
needs,
capacity-building
objectives and expanding
space industry base
in a
cost-effective
manner.

16 Asian Institutions Team Up On Microsatellites

The Asian Micro-satellite Consortium seeks to promote standardization and data sharing among the nine member nations.

SHARE



EDITOR'S PICK



Asia's Rising Scientists: Shoko Takahashi

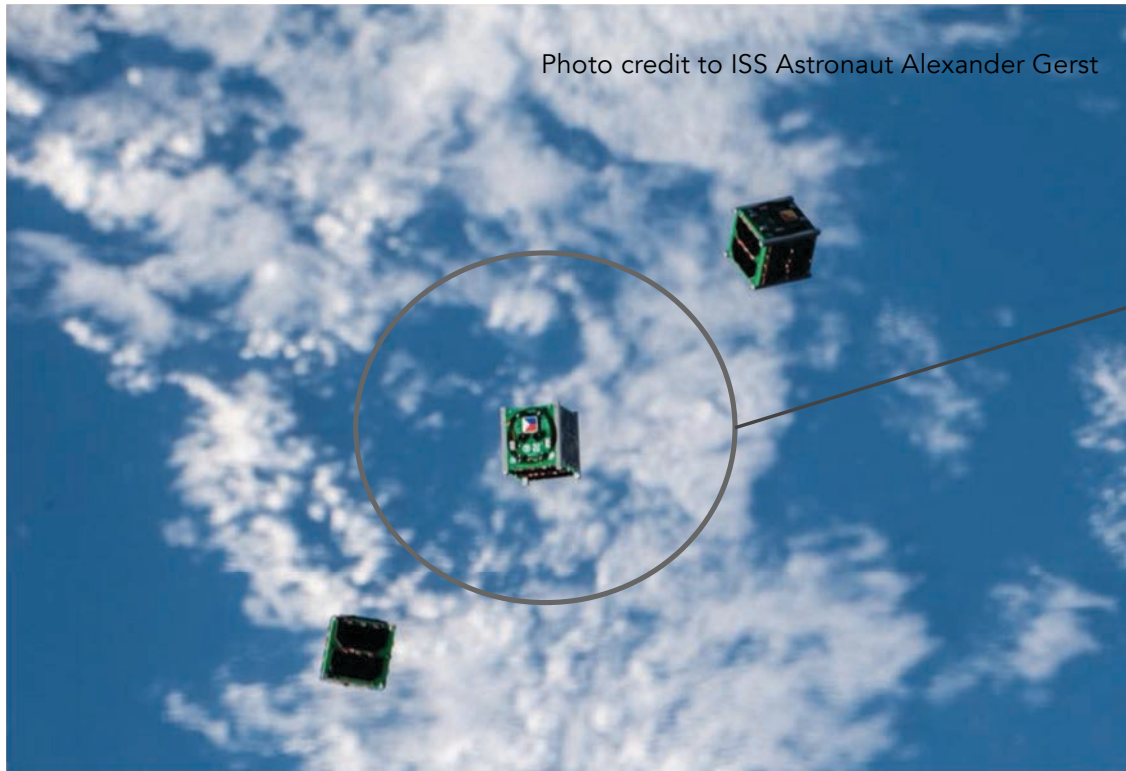


Sound Turns Surfaces Into Touchscreens (VIDEO)



| | |
|-------------|---|
| Bangladesh | Bangladesh Space Research & Remote Sensing Organization (SPARRSO) |
| Indonesia: | Indonesian National Institute of Aeronautics and Space (LAPAN) |
| | Agency for the Assessment and Application of Technology (BPPT) |
| Malaysia | Multimedia University |
| | University of Malaysia Sabah (UMS) |
| Mongolia | National University of Mongolia (NUM) |
| | New Mongol Institute of Technology (NMIT) |
| | German-Mongolian Institute for Resources and Technology (GMIT) |
| Myanmar | Myanmar Maritime University |
| | Myanmar Aerospace Engineering University (MAEU) |
| | University of Yangon (UY) |
| Philippines | Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST-PCIEERD) |
| Thailand | King Mongkut's Institute of Technology Ladkrabang (KMITL) |
| Vietnam | Vietnam National Satellite Center (VAST-VNSC) |
| | University of Science and Technology of Hanoi (VAST-USTH) |
| Japan | Tohoku University |
| | Hokkaido University |

Photo credit to ISS Astronaut Alexander Gerst



Maya-1 PH Cubesat

Maya-1 released from the ISS on
August 10, 2018

Mission:

Store-&-forward communications for
sensor networks

Example)

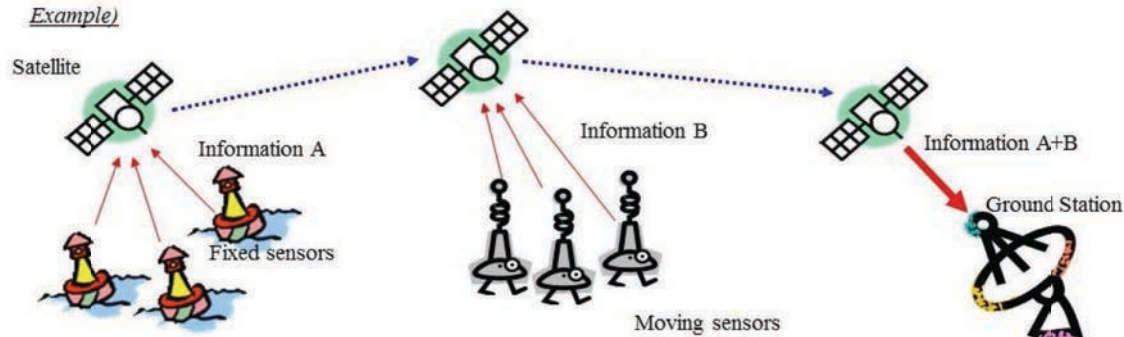


Fig.1 Concept of Store and Forward (S&F) Mission



The “Internet of Things” (IoT) is a
major theme of Industry 4,0 and a
major collaborative thrust in
APEC PPSTI.

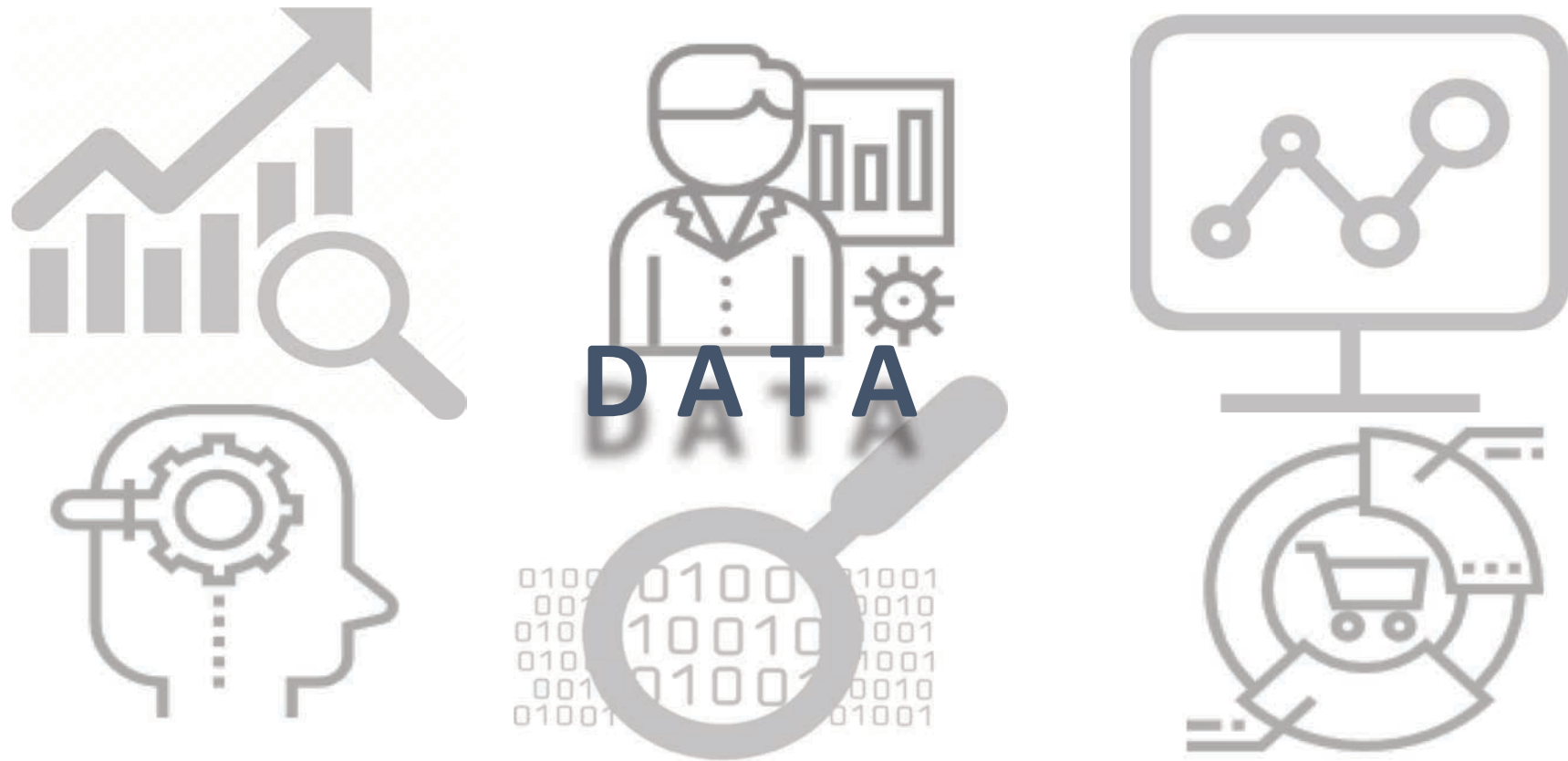
IoT in and from Space!

The Philippines is not
really launching
satellites ...



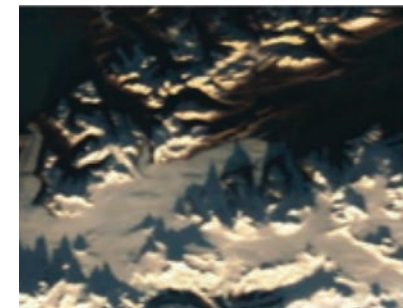
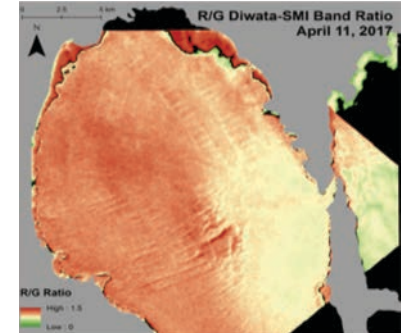
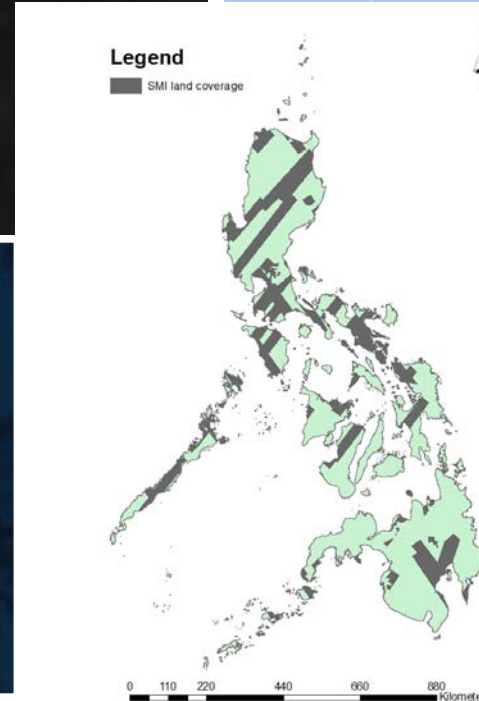
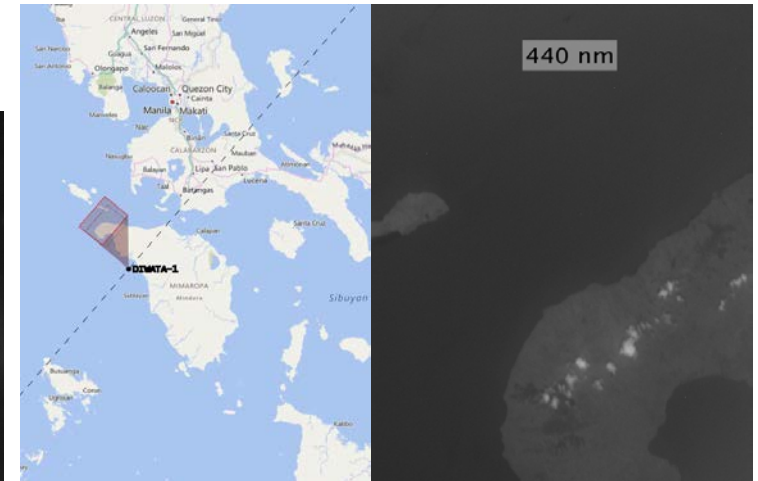
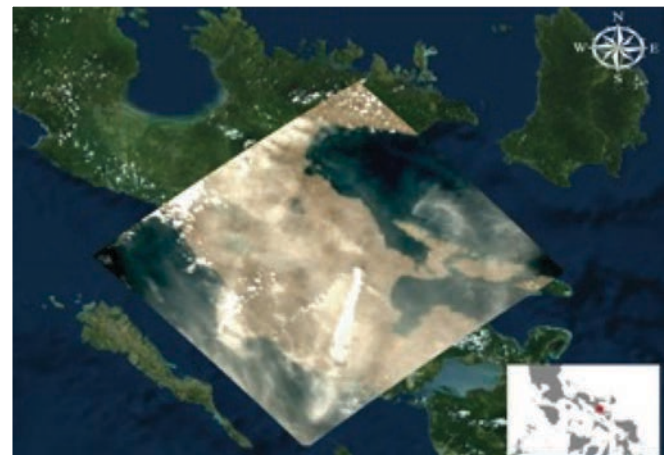
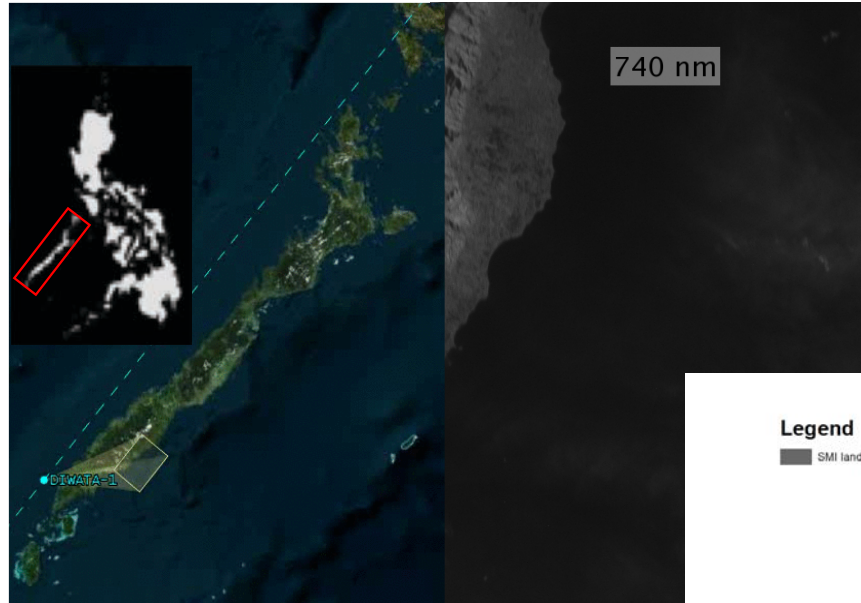
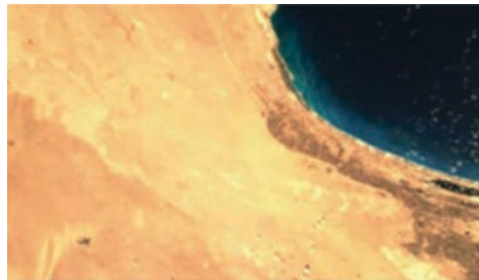
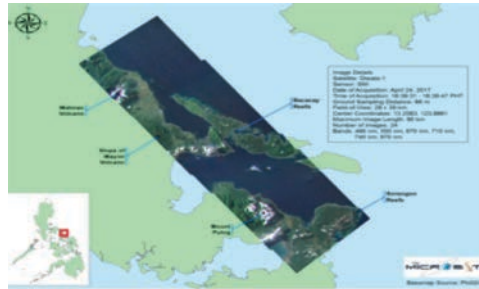
We are *putting computers in orbit.*

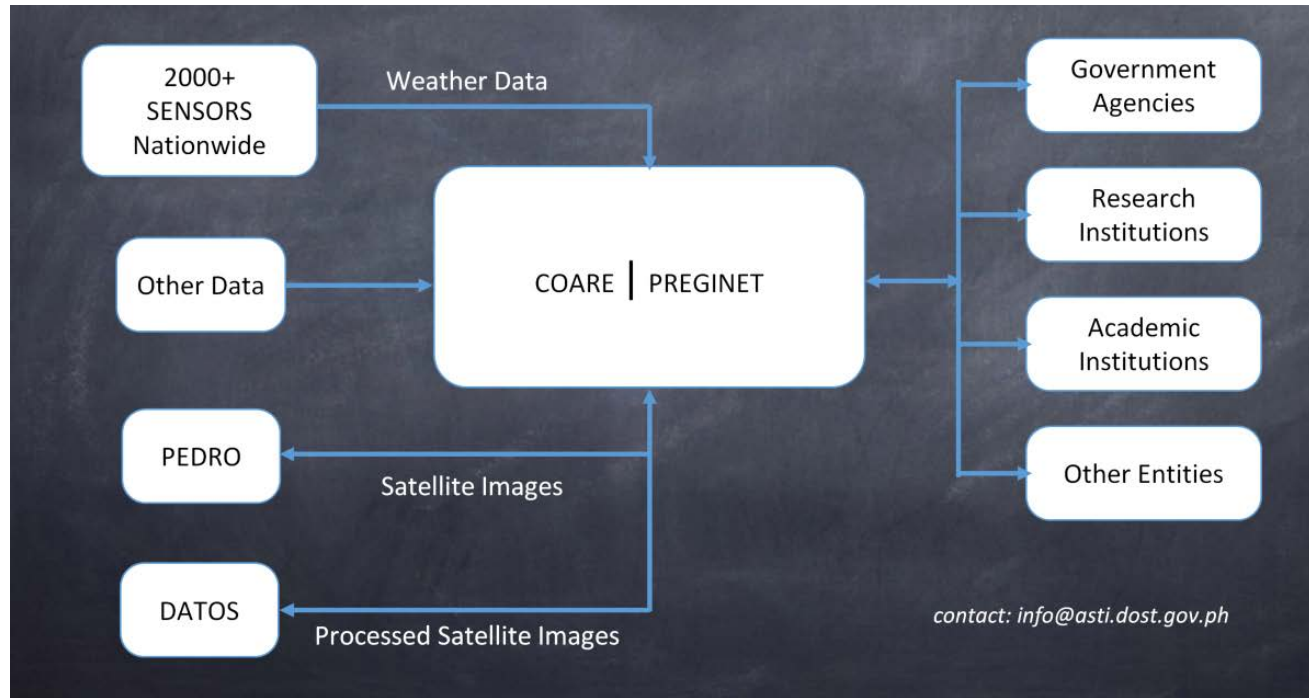
What on earth for?



Data for enabling evidence-based policies.
Data for enhancing productivity and inclusive innovation.
Data as fuel for the 4th industrial revolution.

<http://phl-microsat.upd.edu.ph/>





STORAGE SERVICE

Repository of scientific data.
Short- to long-term data archiving support.
Storage can handle large quantity of files (GB to TB).



SCIENCE CLOUD

Delivers cloud-based services to researchers and students.
Enables private sharing of data among specific groups.
Provisioning of Virtual Machines.



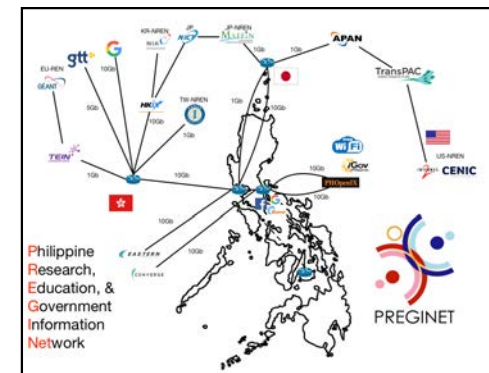
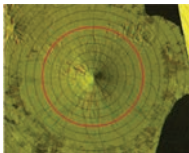
DATA CATALOG

Web portal for data gathering from CoARE research collaborations.
Publicly accessible data set.
Supports open data for research and decision-support purposes.



HPC

Processing of large data sets.
High-speed calculations and analysis.
3,120 cores with 10Gbps network speed.



PREGINET

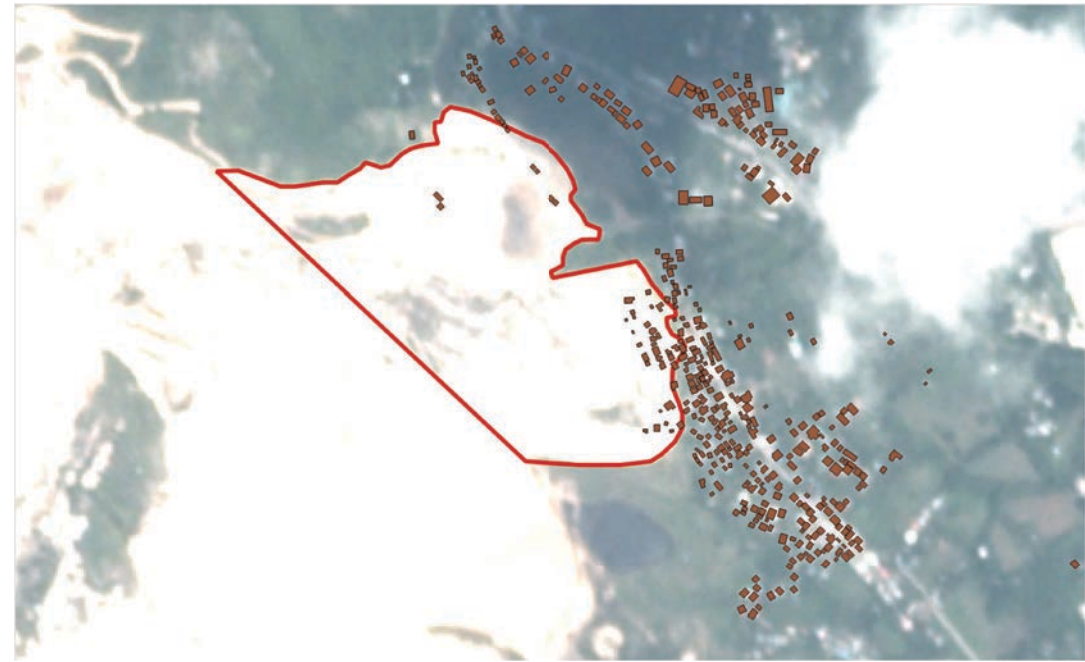
The Philippines' REN, connected to major international RENs (APAN, TEIN)

Naga, Cebu landslide delineation and building footprints mapping

These maps (among other geospatial data) were given to the OCD, Cebu Provincial DRRMO, Naga City Mayor's Office, and colleagues from UP Cebu

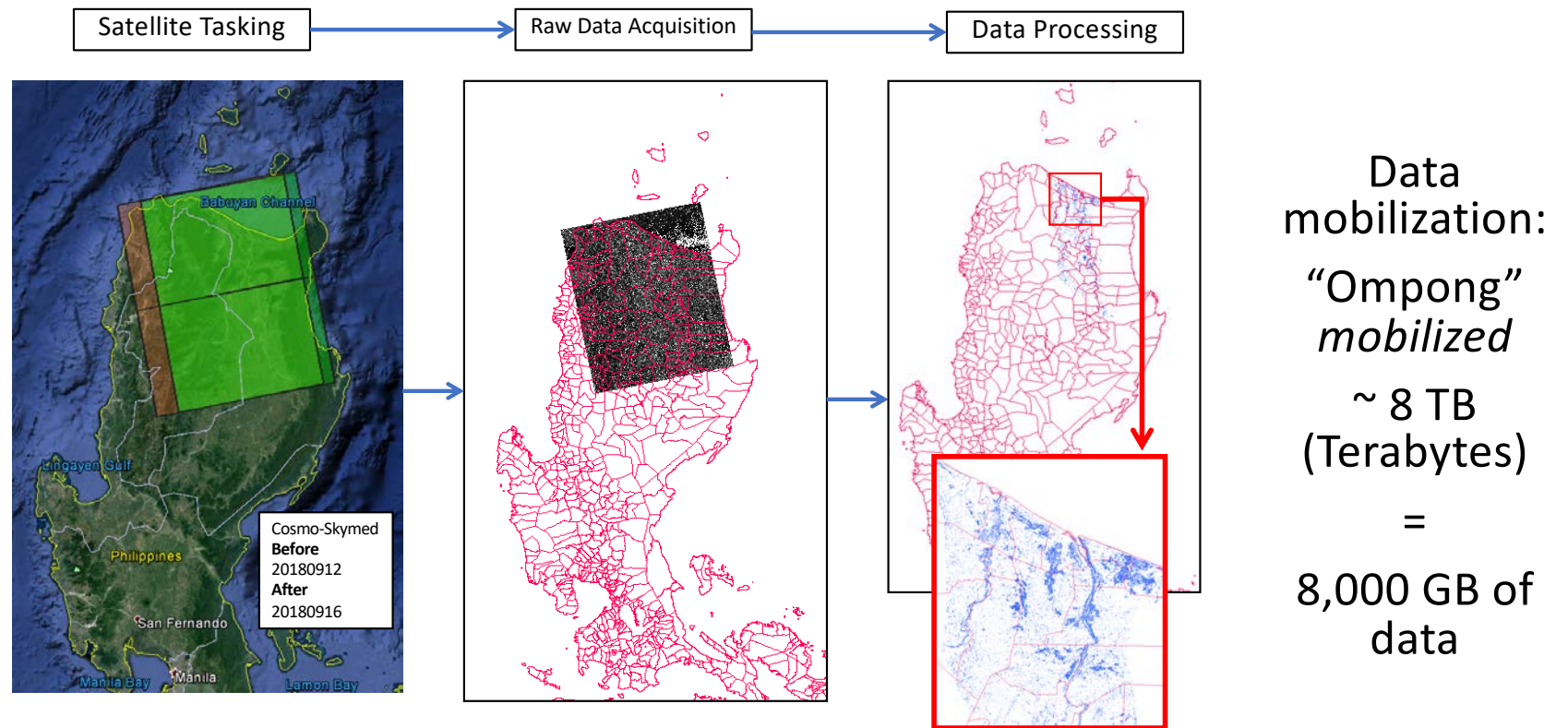


Based on Kompsat satellite image before the Naga, Cebu landslide event



Based on Planet satellite image after the Naga, Cebu landslide event (acquired 21 September 2018)













Data Mobilization for Typhoon Ompong

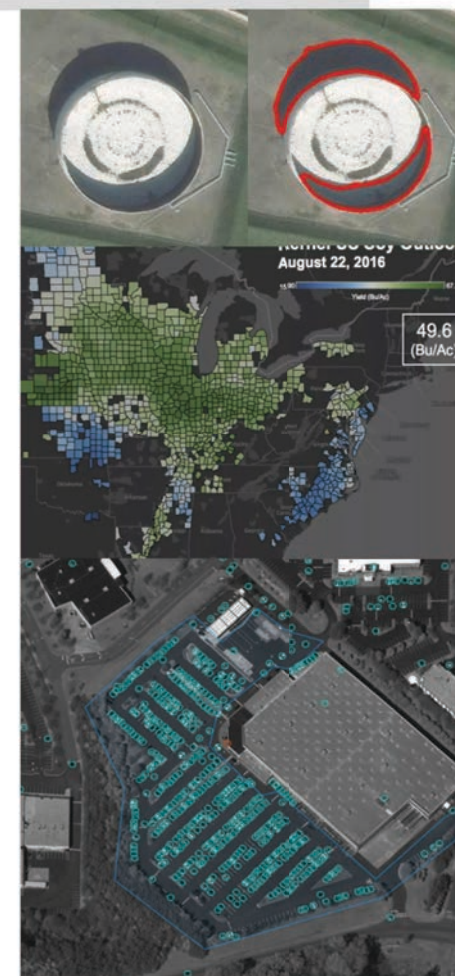


Data mobilization - a *new* way to categorize typhoons (and other natural disasters)

EO+ML FUNDING IS ON THE RISE

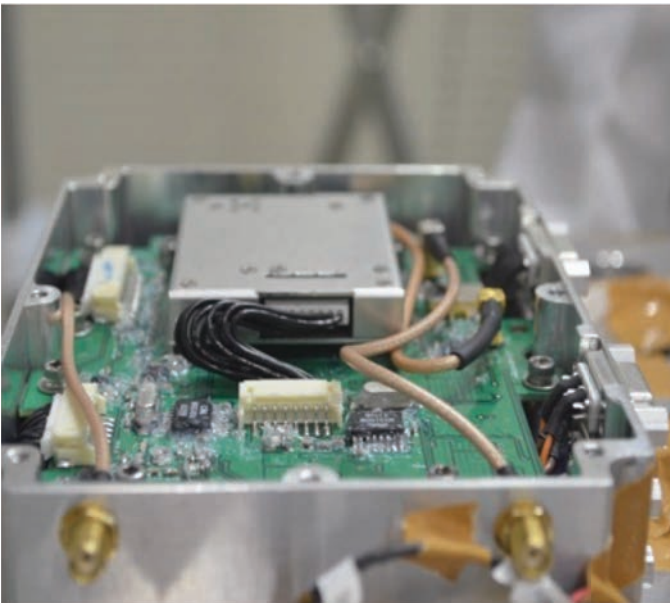
Data and research from the Skolkovo Foundation

| Use case | Required imagery GSD (m) | Extracted features | Other data sources | Customers | Companies |
|--|--------------------------|---|-----------------------------------|---------------------------------|---|
| Retailers' profits prediction | 0,3 – 1 | Number of cars on the parking lots | Socioeconomic, "Wall Street" data | Finance, "Fortune 500" |  Orbital Insight  SPACE_KNOW  RS Metrics |
| Yield prediction | 5-25 | NDVI | Soil-related data, Weather | Agriculture, Finance, Insurance |  telluslabs  Descartes Labs |
| Oil inventory estimation | 0,3 – 1 | Oil tanks locations and shadows | ... | Finance, O&G, Government |  Ursa  SPACE_KNOW  Orbital Insight |
| Estimation of economic activity | 0,3 – 1 | Construction rates, car/ship/aircraft count, nighttime luminosity, etc. | ... | Finance, Government |  Orbital Insight  SPACE_KNOW |
| Poverty prediction | 0,3 – 1 | ..., Nighttime luminosity | ... | Humanitarian |  Orbital Insight  SPACE_KNOW |

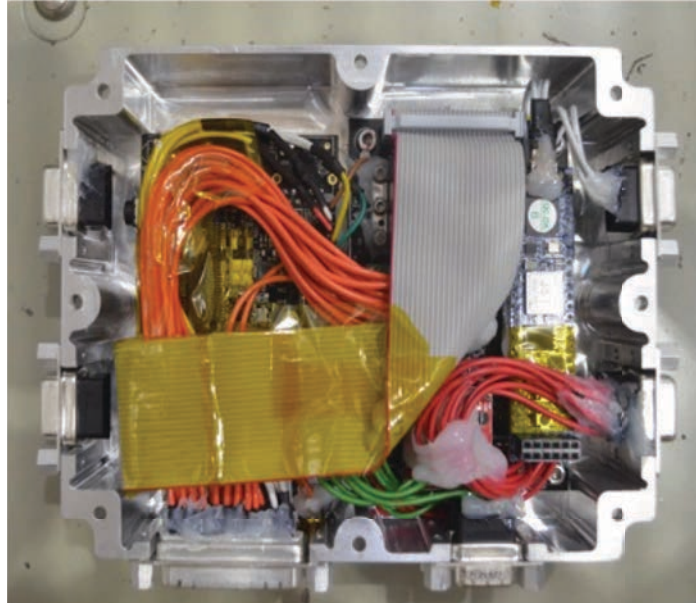


Not Just About the *Data*. Developing a Local *Industrial Base*.

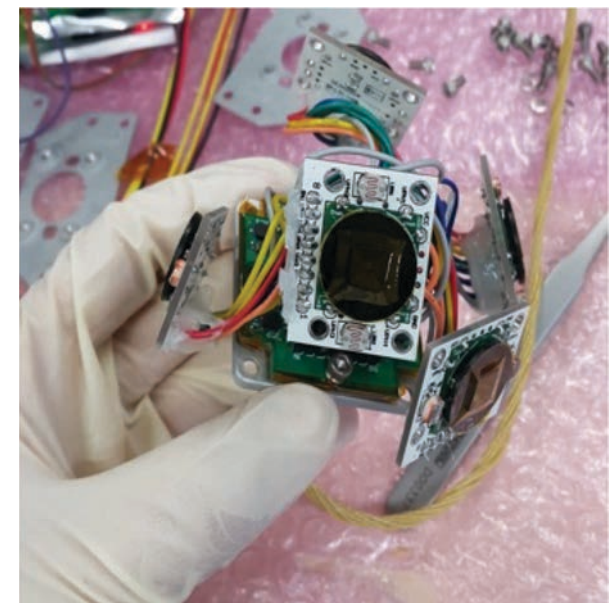
Locally-developed Experimental Modules to fly with Diwata-2



Amateur ("Ham") Radio Payload



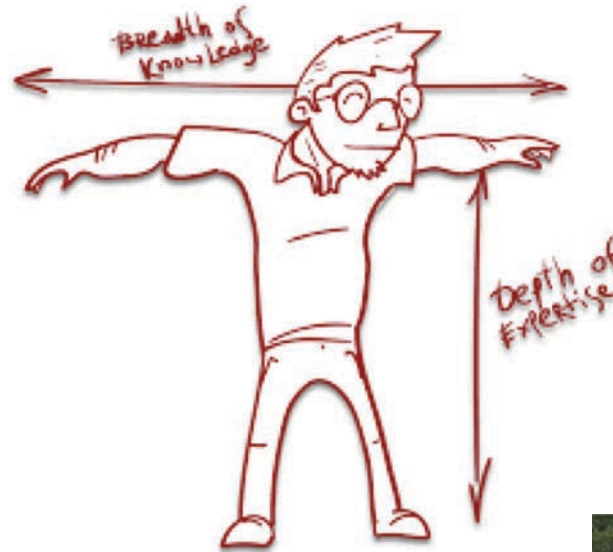
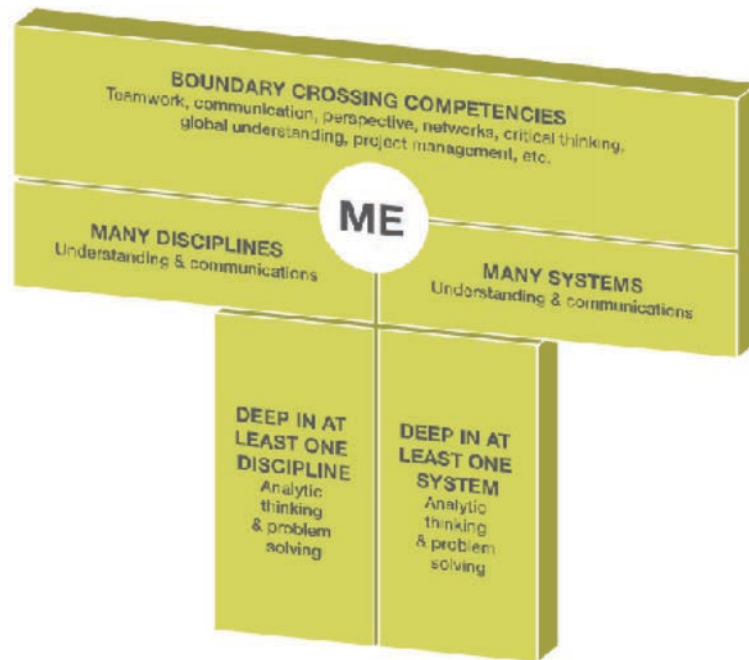
Attitude Control Unit (ACU-Ex)



Sun Aspect Sensor (SAS-Z)

Aerospace and aeronautics sub-systems Electronics and semiconductors Space-grade materials

When we build satellites, we also build *People*.



T-shaped people have a principal skill that describes the vertical leg of the T — they're mechanical engineers or industrial designers. But they are so ***empathetic*** that they can branch out into other skills, such as anthropology, and do them as well."

Tim Brown, CEO and president of IDEO



Electrical, electronics, mechanical engineers →
Systems Engineers

Remote sensing scientists → **Data Scientists**

NANO, KAYA MO?

Design, Build and Launch a NanoSat in Space

Apply for STeP-UP Scholarship

Space Science and Technology Proliferation through University Partnerships (STeP-UP) is a DOST-funded project implemented by the UP Electrical and Electronics Engineering Institute in partnership with the DOST-Science Education Institute.

- ❖ Open to All Faculty affiliates of any secondary or tertiary academic institution
- ❖ Must be committed to pursue full time MS/MEng Electrical Engineering study in UP EEEI
- ❖ Must be committed to return to his home institution upon completion of the program

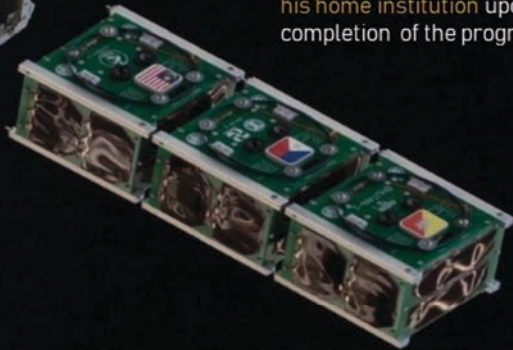


Photo credit to ESA/A. Gerst

STEP-UP scholarships

<https://m.facebook.com/PHLMicrosat/posts/2145415042384270>

<http://newsbytes.ph/2018/10/18/dost-up-open-scholarships-on-nanosatellite-engineering-program/>

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Home / E-Learning / DOST, UP open scholarships on nanosatellite engineering program

DOST, UP open scholarships on nanosatellite engineering program

Posted on October 18, 2018

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The government has opened scholarship applications for the nanosatellite engineering track at the College of Engineering of the University of the Philippines-Diliman.

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Building an *Enabling Environment* for Inter-disciplinary R&D

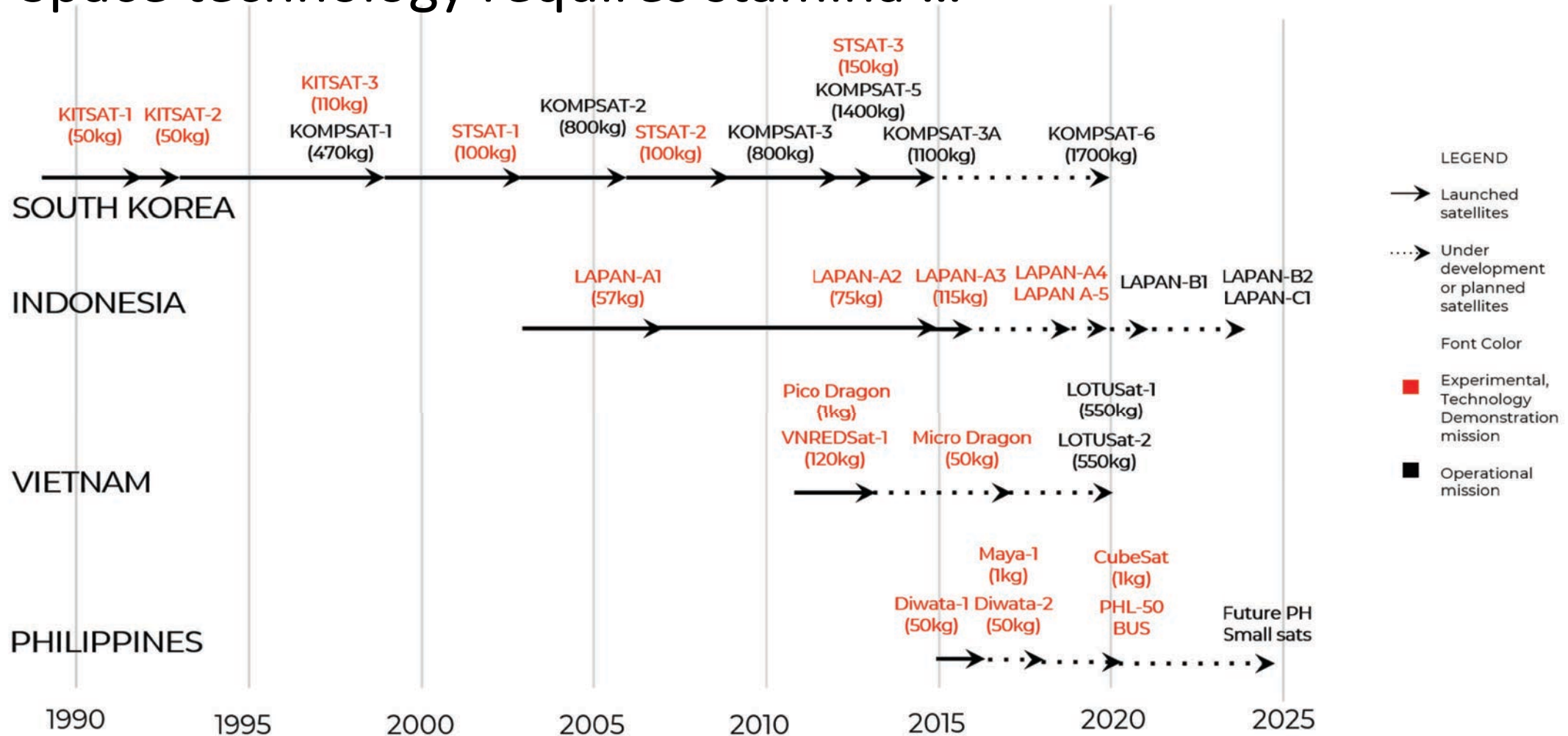
Rethinking the way we build our spaces.

University Laboratory for Small Satellites and Space Engineering Systems (ULyS3S)

To house small satellite development and testing activities, including a Full Anechoic Chamber, which will support studies on RF/microwave communication systems



Space technology requires stamina ...



Takeaways

- Computing becomes pervasive
 - Powerful computers becoming more and more embedded in the environment
- Embedded computers are “vanishing”
 - Profound technologies that “disappear into the fabric” of everyday life
 - Computers and data become fused into physical processes, into infrastructure – cyber-physical systems
- We are putting computers in orbit (... for data).
- A data-driven society that values:
 - Scientific measurements that enable discovery and better understanding of our environment
 - Evidence-based policies and intervention for more relevant and responsive programs in addressing disaster mitigation and climate change
 - Fostering Inclusive innovation for a knowledge-based economy
- Data for tackling *information poverty*
- Data that *fuels the FIRE*

Takeaways

- Not just about *data*, but also for *industry-building*
 - Building components of satellites involve technologies that span many applications
 - Many commercial (and now mundane) technologies originated from innovations borne out of space technology research
 - Making things work in a harsh environment, ensuring reliability and repeatability, low maintenance
- Also about building *people*
 - Interdisciplinary S&T innovation needed to address more complex problems and create societal impact
 - Building satellites require highly trained RSEs in various disciplines – *T-shaped people*
 - T-shaped people use new knowledge in multiple ways across institutions, disciplines and borders
- We need an army of highly trained T-shaped RSEs



Thank you



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