Philippine Space Agency
LCLUC Activities

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The Philippine Space Agency

Philippine Republic Act 11363 enacted on 08 August 2019, “An Act Establishing the Philippine Space Development and Utilization Policy and Creating the Philippine Space Agency, and for other Purposes”

**Mandate**

The PhilSA shall be the primary policy, planning, coordinating, implementing, and administrative entity of the Executive Branch of the government that will plan, develop, and promote the national space program in line with the Philippine Space Policy.
PHILIPPINES’ SPACE TECHNOLOGY DEVELOPMENT TIMELINE

**2013**
- National Space Development Program

**2014**
- Development of Diwata-1 Microsatellite

**2015**
- Philippine Ground Receiving Station received signals from Diwata-1

**2016**
- April 27, 2016: Diwata-1 was deployed from the International Space Station

**2017**
- October 29, 2018: Diwata-2 was launched via H-11A rocket in Japan

**2018**
- August 10, 2018: Maya-1 was deployed to space
- Development of Diwata-2 Microsatellite

**2019**
- August 8, 2019: Establishment of the Philippine Space Agency
- New space program for local capacity development

**2020**

**2021**
- Development of advanced satellite platform with multispectral imager

**2022**
Earth Observation Satellites: Data Provision

<table>
<thead>
<tr>
<th>Country</th>
<th>Class</th>
<th>Mass</th>
<th>Type</th>
<th>Dimensions</th>
<th>Payloads</th>
<th>Launch</th>
<th>Mission/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Korea</td>
<td>KOMPSAT 3:</td>
<td>Medium satellite</td>
<td>Optical high-resolution satellites</td>
<td>~980 kg</td>
<td>Advanced Earth Imaging Sensor System (AEISS)</td>
<td>17 May 2012, Tanegashima Space Center of JAXA, Japan</td>
<td>Earth observation continuity from the previous KOMPSATs Geographical Information Systems (GIS) Environmental monitoring</td>
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<tr>
<td>South Korea</td>
<td>KOMPSAT 3A:</td>
<td>Large satellite</td>
<td>Optical high-resolution satellites</td>
<td>&lt; 1,100 kg</td>
<td>Advanced Earth Imaging Sensor System-A (AEISS-A) &amp; Infrared Imaging System (IIS)</td>
<td>25 March 2015, Jasny Dombarovsky, Russia</td>
<td>Obtain infrared and high resolution electro-optical images for Geographic Information Systems (GIS) Environmental monitoring</td>
</tr>
</tbody>
</table>

Trivia

KOMPSAT 3 is a high-resolution earth observation satellite by the Korea Aerospace Research Institute (KARI) and funded by the Ministry of Education, Science and Technology (MEST). KOMPSAT 3 was launched in 2012 to continue the missions of KOMPSAT-1 and 2.

KOMPSAT 3A, launched in 2015, is South Korea's first satellite to have two imaging systems onboard. Its main mission is to obtain infrared and high resolution electro-optical images for Geographic Information Systems.

The PEDRO Center is subscribed to both satellites through Skymap Global Philippines.

Computer generated image of KOMPSAT 3. Retrieved from spacedata.copernicus.eu
PhilSA Flagship Initiatives

- *Mobilizing Satellite Images and Spaceborne Data* for National Security and Inclusive Development, Hazard Management, and a Digital Government and Economy

- *Building Satellites* as Vital Component of National Information Infrastructure
Satellite Data Mobilization

SATELLITE
GRS
INGESTED DATA

PRE-PROCESSING
RADIOMETRIC CORRECTION
GEOMETRIC CORRECTION
ATMOSPHERIC CORRECTION

POST-PROCESSING
ALGORITHM DEVELOPMENT
VALUE-ADDED PRODUCT

CALIBRATION and VALIDATION

ANALYSIS-READY DATA
Analysis Ready Data

Satellite Data Products

- Access to archived data: DIWATA-1/2
- Target imaging request from DIWATA-2

https://staging.stamina4space.upd.edu.ph
Analysis Ready Data: VHR

- National Government Agencies: 38%
- Academe: 17%
- Local Government Unit: 11%
- Civil Defense: 10%
- National Security: 24%

26,000 satellite images consuming roughly 12.55 TB worth of data

Agency: AFP, Aklan, BCDA, BU, Carigara, CBSU, COA, CVRDRC, DA, DATOS, DBM, DENR, DPWH, LGU, MOB, NAMRIA, NCAV, NDRRMC, NIA, NICA, NSC, PAGASA, PCEERD, PHIVOLCS, PNP, Silliman, SLSU, SFA, UP, UPD, UPLB, UPM, UR
Value-Added Products

- Flood-situation maps during typhoon monitoring
- Maps of drought-affected areas
- Earthquake damages and landslide extent
- Forest fire and urban fire extent
- Maps of fruit trees: mango, pili, and coconut
- Maps of major crops: rice, corn, and sugarcane
- Maps of fishponds, fish pens and fish cages

http://space.gov.ph/spacedata/project/datos
Detecting Built-up Areas

- Built infrastructures such as houses and buildings are identified using high-resolution images.
- Models using Artificial Intelligence (AI) can project future urban extent.
- Provides valuable information for Comprehensive Land Use Plan (CLUP) at Local Government Units.

Source: Our Place in Space, 2020
Rapid Disaster Response

- Database of building footprints generated using AI and high-resolution images
- Overlaid image shows the extent of landslide that engulfed houses
- Critical information are produced in a timely manner

Source: Our Place in Space, 2020

Before

After Landslide

Satellite: KOMPSAT-3
Accessed via: DOST-ASTI
Capture date: 21 September 2018
Payload: Optical
Resolution: 0.5 m
Basemap: ESRI (Pre-landslide)
Updating Land Cover Maps

- Deep learning methods and automated systems are developed for land cover classifications
- In partnership with NAMRIA*, different models were created for each class and were later merged to create a land cover map

*NAMRIA – National Mapping and Resource Information Authority

Source: Our Place in Space, 2020
Identification of Fruit Trees

According to the Department of Agriculture, the volume of production and yield of mango have significantly deteriorated over the years. Despite hectares of mango farms around the country, there is no sufficient data on mango tree inventory. With the available image processing techniques and Earth observation data from DOST-ASTI, a rapid inventory of mango trees in a given area as well as assigning their geographic coordinates for ground-truthing is now possible.

In an ongoing collaboration with the Bataan Peninsula State University, DOST-ASTI employs this research for the province-wide Mango Detection Project of Bataan (for inventory and potential damage assessment).

Source: Our Place in Space, 2020
Regional Analysis: Urban Sprawl

1. Satellite: Rapid Eye
   Accessed via: DOST-ASTI
   Capture date: 10 February 2013
   Payload: Optical
   Resolution: 5 m
   Basemap: PhilGIS, Google Earth

2. Satellite: Rapid Eye
   Accessed via: DOST-ASTI
   Capture date: 10 February 2017
   Payload: Optical
   Resolution: 5 m
   Basemap: PhilGIS, Google Earth

3. Multi-temporal Optical Imagery
   Satellite: Landsat 8
   Capture date: Whole year predictions (2013 and 2016)
   Accessed via: DOST-ASTI

Source: Our Place in Space, 2020
Regional Analysis: Mapping of Major Crops

- Crops are identified by monitoring its growth stages using time series analysis of images.
- Inventory, monitoring, and yield projection of high-value crops such as rice, corn, and sugarcane are of utmost importance in the Philippines.

Source: Our Place in Space, 2020
Agricultural Drought Monitoring

Actual drought damages in Occidental Mindoro
Reforestation and Deforestation

Source: Perez, et al. Forests, 2020
Forest Fire: Extent and Impact

Assessing Forest Fire Damage

Rapid detection of affected areas in Kabayan, Benguet. The image shows potentially burnt areas in Barangays Adaoay, Anchokey, and Kabayan Barrio in Kabayan, Benguet. The fire extents are detected by analyzing change in vegetation (NDVI) from Planetscope Images captured from 28 January and 22 February 2020.

NDVI or Normalized Difference Vegetation Index (NDVI) is an index used as an indicator to determine features in an image with live green vegetation because vegetated areas have high values of NDVI. A drastic change (drop) in the NDVI values indicates activities contributing to the death or removal of live green vegetation.

Satellite: Planetscope
Accessed via: DOST-ASTI Center
Capture date: 28 January to 22 February 2020
Resolution: 3m
Basemap: OpenStreetMap

Identifying other affected areas in Benguet using Diwata-2

In the same event mentioned previously, Diwata-2 was used to identify other areas in Benguet that were affected. Approximately 2,714.59 hectares were burnt, excluding other possibly undetected areas covered by clouds and their shadow. Affected areas include Itogon, Bokod, Kabayan, Kibungan, and some parts of Tuba. Maps like these, made using Support Vector Machine (SVM) and Burned Area Index (BAI), can be used to complement other data used by agencies tasked with post-disaster assessment and rehabilitation.

Satellite: Diwata-2
Accessed via: STAMINA4Space
Capture date: 29 February 2020
Payload: Spaceborne Multispectral Imager (SMI)
Overlaid on an RGB basemap, using Support Vector Machine (SVM) and Burned Area Index (BAI)

Source: Our Place in Space, 2020
PhilSA Flagship Initiatives

- Mobilizing Satellite Images and Spaceborne Data for National Security and Inclusive Development, Hazard Management, and a Digital Government and Economy

- Building Satellites as Vital Component of National Information Infrastructure
Advanced Satellite Platform with Multispectral Imager

- **Multiple imaging bands** to generate key geophysical parameters for agricultural monitoring and assessment

- Imaging in **Aerosol/Coastal band** for coastal environment monitoring

- **Wide swath coverage at high resolution** for disaster response and other land applications
Concluding Remarks

• While the Philippine Space Agency is only recently established and is building from ground up, it is not starting from scratch.

• A number of space science and technology applications (SSTA) activities have been pursued as project-based initiatives leading up to the establishment of the PhilSA, which produced emergent technological capabilities and infrastructure for the PhilSA to build on.

• LCLUC activities focused on developing operational workflows for applications that cater to the needs of various government agencies through the use of AI and VHR images for local analysis and time series of optical and SAR imagery for regional analysis.

• PhilSA’s succeeding programs aim to institutionalize, operationalize and sustain these activities.
Acknowledgement

The PhilSA envisions a Filipino nation bridged, uplifted, and empowered through the peaceful uses of outer space.

We will promote and sustain a robust Philippine space ecosystem that adds and creates value in space for and from Filipinos and for the world.

References:

Thank you very much!

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