Space Technology Applications Roadmap

R&D Technology

Earth Observation Applications

- SAR and AIS applications for terrestrial applications and maritime surveillance
- Develop Earth Observation solutions for public services:
- Develop applications using other various available satellite data (i.e. Jason, Sentinel 4, Suomi, MODIS – Aqua and Terra, Hyperspectral EO)
- Complementation of various remote sensing technologies to be used for indoor and underground applications
- Develop EO Data Cubes for Big Data Analytics and Management of EO data
- Development Earth Observation Application Products from the Open Data Cube addressing Sustainable Development Goals and contributing to Global Policy Frameworks
- Develop applications for space-based quantum sensing and computing

Satellite Development

- Localization of bus platform and payload development for small satellite
- Invest in research related to smaller satellite manufacturing (mechanical systems, structural dynamics, ground test and surface systems)
- Development and launch of nanosatellite for education and technology proliferation (Maya satellites):
- Development and launch of 100-150 kg satellite (Multi-spectral Unit for Land Assessment) in space
- Develop mission partnerships >300kg satellite: Telecommunications satellite ; and Satellite broadband internet
- Develop operational application-specific 100-300kg satellite: Infrared and Video Imaging; and Microwave (SAR)

Satellite Communication and Navigation

- Development of Global Satellite Navigation Systems (GNSS) applications
- Develop GNSS-based indoor location technologies (i.e. High-sensitivity GPS, Assisted GPS, Indoor GPS tracking)
- Development of High-Altitude pseudosatellite (HAPS) as a new platform for telecommunications networks and remote sensing
- Develop space-based secure quantum communication (i.e. Quantum computing and communications via nanosatellites)
- Conduct research on Small satellite for IoT applications

Space Situational Awareness

- Development of application for space debris monitoring (detecting, monitoring and imaging of space debris) and mitigation (use of wooden materials for satellite)
- Conduct research on self-healing materials for space application (i.e. space debris impact protection, spacecraft materials, aerospace application)

Access in Space

- Development of green propellant and electric propulsion
- Graphene for space application (i.e. light-powered propulsion system, thermal management for satellite)
- Conduct research on the development of Solar sails for small satellite
- Explore the development of launch systems and facilities (smallsat launch vehicles, propulsion systems, AOCs)

R&D SOLUTIONS

176 M

Localization of bus platform and payload development
SAR and AIS applications: vessel detection, post disaster & operations, flood mapping, off-shore change detection, coastal mapping which can be used for aquaculture and other uses
Development of Maya-2 nanosatellite

145 M

- Continuous development and utilization of S-band SAR and AIS for terrestrial applications and maritime surveillance
- Development of Global Satellite Navigation Systems (GNSS) applications
- Use of satellite altimetry to assess coastal sea level rise
- Bus development
- Optical Payload design and development
- Know-How in Small Satellite Development
- Establishment of ground receiving, archiving and product development and distribution for EO satellite data
- Launch of Maya-2 nanosatellite
- Development and launch of nanosatellite (Maya-3/Maya-4)

563 M

- Develop Earth Observation solutions in public services
  - Land use/land cover change mapping and monitoring system of watershed and ecosystems
  - EO solutions for implementation of precision agriculture (i.e. Site-crop suitability, suitability, crop monitoring and yield, pest detection and disease management, nutrient management, irrigation, soil management)
- Development of MULA (Multi-spectral Unit for Land Assessment) in space
- Continuous development and launch of nanosatellite (Maya-5/Maya-6)
- Development of 3U/6U nanosatellites
- Develop operational application-specific 100-300kg (Infrared and Video Imaging) satellite

957 M

- Continued Develop Earth Observation solutions for public services:
  - Climate monitoring
  - Ocean and climate change
  - Landscape generator and Landuse/land cover scenario modeler for urban development and sustainable land use and transportation policies
- Develop applications using other various available satellite data (i.e. Jason, Sentinel 4, Suomi, MODIS – Aqua and Terra, Hyperspectral EO, Landsat-9)
- Develop EO Data Cubes for Big Data Analytics and Management of EO data
- Develop thematic applications for EO Data Cubes
- Continuous development of MULA in space
- Development of next generation of experimental satellite (i.e. DIWATA-3)
- Develop mission partnerships >300kg satellite:
  - Telecommunications satellite
  - Satellite broadband internet
- Develop operational application-specific 100-300kg satellite: Microwave (SAR)

650 M

- Continued development of Earth Observation solutions for public services:
  - 3D Mapping for Smart Cities
  - EO-based Smart City Decision Support Services
- Develop application for single-photon LIDAR (the next generation of LIDAR technology for 3D mapping)
- Complementation of various remote sensing technologies to be used for indoor and underground applications
- Development Earth Observation Application Products from the Open Data Cube addressing Sustainable Development Goals and contributing to Global Policy Frameworks
- Establishment of web-based or cloud computing services for big data EO analytics
- Know-how of small geostationary communication satellite
- Establishment of testing simulation facility
- Conduct research on Small satellite for IoT applications
- Decentralize and broaden the ground receiving station and small satellite research to regional universities and research institutions

630 M

- Develop GNSS-based indoor location technologies (i.e. High-sensitivity GPS, Assisted GPS, Indoor GPS tracking
- Explore the development of launch systems (i.e. smallsat launch vehicles, propulsion systems, AOCs); and facilities (spaceport/launch sites)
- Graphene for space application (i.e. light-powered propulsion system, thermal management for satellite)
- Development of green propellant and electric propulsion

480 M

- Development of application for space debris monitoring (detecting, monitoring and imaging of space debris) and mitigation (i.e. systems for space surveillance to alert us to natural and man-made hazards)
- Development of High-Altitude pseudosatellite (HAPS) as a new platform for telecommunications networks and remote sensing
- Conduct research on self-healing materials for space application (i.e. space debris impact protection, spacecraft materials, aerospace application)

430 M

- Conduct research on the development of Solar sails for small satellites

450 M

- Develop space-based secure quantum communication (i.e. Quantum computing and communications via nanosatellites)
- Develop applications for space-based quantum sensing and computing

Legend (Text Font): Done | Ongoing | Not yet Available

2020
- Potential S-band SAR and AIS applications
- Development of Maya-2 nanosatellite

2021
- S-band SAR and AIS applications
- Provide research and assessment on coastal sea level rise in the country
- Optical sensor / payload and satellite bus
- Operationalization of Ground receiving station
- Launch of Maya-2 nanosatellite

2022
- New STA applications developed for the enhancement of public services
- Enhanced coordination, decision making, and provision of public services
- Wider applications of satellite remote sensing
- Trained engineers in optical-IR and video imaging satellite development
- Continued development of nanosatellite for education and technology proliferation
- Small Satellite Platforms for Low Earth Orbit Constellation Missions (3U/6U nanosatellites)
- Operational application-specific 100-300kg (Infrared and Video Imaging) satellite

2023
- Enhanced monitoring system for GHG, sea surface temperature and other climate conditions
- Provide persistent monitoring of climate condition using available EO satellites to improved hazard management and disaster risk planning
- New HEIs/SUCs conducted R&D on applications using available satellite data
- EO Data Cubes
- Establishment and operationalization of Philippine Data Cube for country-level development of policy and planning
- Launch of MULA satellite
- Testing simulation facility
- Continued lean satellite development
- Potential of telecommunication and broadband internet services are explored
- Operational application-specific 100-300kg (Microwave satellite)

2024
- EO-based Smart City Decision Support Services
- EO solutions in support to SDG Goals and Global Policy Framework
- Science-based, data-driven, geospatial monitoring of SDG indicators
- Web-based and cloud computing services for big data EO analytics
- Trained engineers in communication satellite development
- Potential of satellite-based IoT networks for emerging applications
- Widen the capability of universities and research institutions on the research and development of small satellite

2025
- Potential of GNSS-based Indoor location technologies
- Feasibility study for launch systems and facilities In the country
- Potentials of graphene for space application
- Provide safer and efficient propulsion system for spacecraft and satellite

2026
- Provide monitoring and mitigation measures for space debris
- Provide research on the development of HAPS for telecommunication networks and remote sensing
- Provide innovative materials for space application

2027
- Potentials of solar sails to satellite development

2028
- Secured, reliable and fast communication
- Enable new measurements and solutions to broaden the applications of EO

VISION

Philippines as a globally recognized spacefaring nation in the long run, having capitalized on local talent development and public & private sector involvement

OVERALL OUTCOME

A space capable nation providing services for wide-range of applications: climate change, disaster mitigation, natural resource management, human security and communication

MILESTONES

OVERALL STRATEGIES

S&T Policies

Earth Observation
- Develop open data policy for Earth Observations data
- Develop regulations for the collection, distribution and use of EO data
- Develop a plan with the private sector for co-investment on EO resources that will result to inward capital investment in the Philippines and industry revenue of Php 10 billion/annually in 5 years

Satellite Development
- Develop partnerships with space companies linked to existing MOUs with foreign countries to encourage technology transfer and attract investment
- Incorporate private sector needs and input in development of small satellites
- Involve private sector in development of satellite roadmap to incorporate industry interests in projected satellite development proposals.
- Develop regulatory policies on satellite manufacturing (e.g. national security, risk management, international compliance)
- Expand the coverage of satellite communications nationwide by developing and executing a public private partnership (PPP) model wherein broadband services will be accessible to the most remote areas in the country. Access include technical access and price access.

Facilities and Services

Environment and Climate Change
- Decision support system for resource management using space-based information
- Provide persistent monitoring of climate condition using developed satellites for improved hazard management and disaster risk planning. This is also to expand the conduct of climate studies and disaster risk assessment in the country.
- Improve environmental assessment and monitoring, precision agriculture, maritime domain awareness and disaster management through EO solutions

EO solutions for Government and Industries
- Embed end-to-end EO solutions to government institutions to deliver complete solutions
- Expand utilization of satellite data to improve public service through partnerships with government institutions and private industries
- Enhance efforts toward safeguarding the national security and territory through EO solutions
- Launch National Open Data Platform
- Establishment of web-based or cloud computing services and platforms for big data EO analytics

Satellite Development
- Establishment of ground receiving, archiving and product development and distribution for EO satellite data
- Establishment of testing simulation facility
- Establish Philippine Space Tech Center into premiere PPP center and as strategic partnerships to attract foreign manufacturing and R&D.

Human Resources

Earth Observation Applications
- Broaden the research and application of EO to regional universities and research institutions
- Partner with universities/colleges to embed EO applications to engineering, science and business courses

Satellite Development
- Invest on the Know-How in Small Satellite Development
- Begin R&D and upskilling for satellite builds (5 MS/PhD for satellite ECE; 5 MS/PhD for space assets and security - physical and cybersecurity; 1,000 engineers with satellite build training)
- Develop optical-infrared satellite with the aim of building capability for support operations for satellite manufacturing (P 1.75B) including 10 talents for satellite optics and satellite engineering and 5 partnerships to upskill local manufacturers for satellite supplies
- Broaden and decentralize the ground receiving station and small satellite research to regional universities and research institutions
- Collaborate with international space companies specializing in small satellite technology to enhance capabilities of universities and research institutions

Satellite Communication
- Invest on the Know-how of satellite communication
- Develop and launch secure small geostationary communications satellite with the following as outputs; 20 talents for satellite communications ECE, 5 partnerships to upskill local manufacturers for satellite supplies and upgraded ground station capabilities

Access in Space
- Develop initial pool of launching technology specialists through international scholarships and research programs

Disclaimer: This roadmap is not yet final as this is still for consultation and validation with PhilSA and stakeholders