Space Technology Applications Roadmap

Updated as of February 2024

R&D SOLUTIONS

Downstream Segment

space operations for terrestrial use, and products and services which rely on satellite technology, signal, data to function (e.g. satellite broadcasting, selected GIS, GNSS-enabled devices).

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 timeline

176 M
- 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

107 M
- Continuous development and utilization of S-band SAR and AIS for terrestrial applications and maritime surveillance
- Use of satellite altimetry to assess coastal sea level rise
- Development of Global Satellite Navigation Systems (GNSS) applications

181 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)

157 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

100 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

30 M
- Develop GNSS-based indoor location technologies (i.e. High-sensitivity GPS, Assisted GPS, Indoor GPS tracking)

70 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)

50 M
- Develop applications for space-based quantum sensing and computing

Year markers

2020
Potential of S-band SAR and AIS applications

2021
- S-band SAR and AIS applications
- Provide research and assessment on coastal sea level rise in the country

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

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

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

2025
- Potential of GNSS-based Indoor location technologies

2026
- Provide monitoring and mitigation measures for space debris

2027
- Enable new measurements and solutions to broaden the applications of EO

2028

MILESTONES

OVERALL STRATEGIES

R&D technologies

- 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
- Develop thematic applications for EO Data Cubes
- 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

Human Resources

- 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

S&T Policies

- Develop open data policy for Earth Observations data
- Develop supporting policy for the establishment of Philippine Data Cube as an open data platform for Earth Observation data
- Develop regulations for the collection, distribution and use of EO data
- Forge partnerships with international institutions for EO data sharing and utilization and adoption of global policies and standards
- 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

Facilities and Services

Environment and Climate Change

- Decision support system for resource management using space-based information
- Update agricultural/land classification, assessment and other EO government use cases monitoring through satellite data
- Enhance the monitoring system for GHG, sea surface temperature and other climate conditions through EO data
- Provide persistent monitoring of climate condition using developed satellites for improved hazard management and disaster risk assessment in the country. 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
- Establish Climate change resilient communities through EO solutions
- Launch National Open Data Platform for mainstreaming EO data
- Establishment of web-based or cloud computing services and platforms for big data EO analytics

NAST Foresight

Environment and Climate Change
- Geospatial technology (i.e. remote sensing, GIS and spatial statistics)
- 3D Mapping and modeling tools
- Computerization and Big Data Analytics
- Precision agriculture
- Comprehensive long-term watershed ecosystem observation systems

Shelter, Transportation and Other Infrastructure
- Real-time continuous disaster-monitoring technology using remote sensing information of multiple satellites

ICT
- Cognitive Technologies
- Big Data and Analytics
- Quantum computing

Governance
- Geographic Information System
- National defense technologies – Secure and reliable communication systems

Space Exploration
- Data Science
- Machine Learning and Artificial Intelligence
- Precision agriculture systems that make use of satellite data

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Space Technology Applications Roadmap

Updated as of February 2024

NAST Foresight

Upstream Segment

It includes research, space manufacturing and ground systems (fundamental and applied research activities, scientific and engineering support activities, material and components supply, manufacturing of space systems, subsystems and equipment, telemetry, tracking and command stations).

R&D SOLUTIONS

Space Exploration
- Design, assembly, integration and testing of satellites, other spacecraft and their payloads, systems, subsystems and components
- Use of space systems to develop and deliver products and services for scientific, experimental and commercial applications (e.g. telecommunications, navigation, surveillance, Earth observation, etc.)

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

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176 M
- Localization of bus platform and payload development
- Development of Maya-2 nanosatellite

2020
Development of Maya-2 nanosatellite

38 M
- 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 and Maya-4)

2021
- Optical sensor / payload and satellite bus
- Operationalization of Ground receiving station
- Launch of Maya-2 nanosatellite
- Continuous development and launch of nanosatellite (1U size)

382 M
- 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

2022
- 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

800 M
- 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)

2023
- 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)

550 M
- 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

2024
- 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

600 M
- 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

2025
- 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

450 M
- 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)

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

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

2027
- Potentials of solar sails to satellite development

400 M
- Develop space-based secure quantum communication (i.e. Quantum computing and communications via nanosatellites)

2028
- Secured, reliable and fast communication

MILESTONES

OVERALL STRATEGIES

Facilities and Services

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. The construction of the Philippine Space Tech Center will serve as production facilities for small satellites and establishment of other facilities such as clean rooms, vacuum chambers, spacecraft and instrument level testing area for small satellites.

Satellite Communication
- Pilot broadband access project to 2-10 municipalities for rural development and disaster risk reduction (primary applications - education, government internal communication and defense)
- Purchase from and partner with satellite broadband companies to provide broadband services to expand reach for remote areas (Php 2B)

Access in Space
- Conduct feasibility study on the potential of the country to serve as ground station for satellite communications and space surveillance including debris monitoring
- Evaluate expansion of production for commercial export purposes and economic viability of a launch facility in Mindanao in collaboration with the government and the academe

Human Resources

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

S&T Policies

Satellite Development
- Develop partnerships with space companies linked to existing MOUs with foreign countries to encourage technology transfer and attract investment
- Identify commercial aspects of satellite data for distribution to private sector
- Explore commercial production of satellites with guidance of industries and government
- 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.

Space Situational Awareness
- Harmonization with international with international standards and policies for space
- Continuous effort in developing proactive mechanisms to help observe and impose existing treaties and agreements concerning space

R&D Technologies

Satellite Development
- Localization of bus platform and payload development
- 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):
- Develop 3U/6U nanosatellites missions
- Development and launch of 100-150 kg satellite (Multi-spectral Unit for Land Assessment) in space
- Development of next generation of experimental satellite (DIWATA-3)
- 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 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)

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