Marine and Coastal Spatial Technology

Maturity Assessment - Data collection types

Commissioner for Environmental Sustainability Victoria

	Earth Observation & Remote Sensing	Smart Sensors & the Internet of Things	Remotely Piloted Vehicle Systems	GPS & Tracking	Citizen Science
CURRENT	• Satellite passive & active sensors • Aerial imagery • Airborne light detection and ranging (LiDAR) • Mobile LiDAR • Ship sonar • Video	• QR codes, barcodes, • Radio frequency identification • Smart phones • Telemetry systems • Sensors / meters / probes • Data loggers • Smart meters • DNA sensors	• Fixed wing, single-rotor, multi-rotor • Blimps, balloons & kites • Boats, submersibles, underwater gliders • Optical camera & video payloads • Thermal camera payloads • Multi/hyper spectral camera payloads	• Data loggers / Passive tracking • Data pushers / Active tracking • Data pullers / Transponders • Free, open centimetre accurate positioning	• Traditional citizen science projects • Citizen science platforms • Crowdsourcing • Real-time data streams for planning/mapping e.g., Google traffic
EMERGING	• SmallSats & CubeSats • High altitude pseudo satellites • Analysis ready data • Configurable payloads • Satellite-as-a-service e.g., Exodus orbitals Ground-station-as-a service e.g., Amazon Ground Station or Azure Orbital	• Real-time 5G mobile internet of things (IoT) • Edge computing • Explosion of IoT devices/things • Intelligent sensor networks • IoT analytics / Digital twins • Smart cities / Mobile phone LiDAR • Low earth communication e.g. starlink	• Hybrid platforms / LiDAR payloads • Specialised payloads • Obstacle detection & collision avoidance • Open real time kinematic (RTK) & satellite-based augmentation system (SBAS) for aviation • Automated reactor pressure vessel (RPV) for sonar seafloor capture	• Integrating IoT connectivity • Geofencing • Device miniaturisation • Precise indoor positioning • Release timers • SBAS/RTK accurate • Global navigation satellite system (GNSS) & inertial measurement unit (IMU) sensor fusion • Dead-reckoning techniques	• New technologies for data collection • Citizen science in policymaking • Gamification • Virtual peers (bots) • Machine learning for citizen science data
FUTURE	• Real-time Earth observation • Persistent Earth observation • HD video from space • Sensor miniaturisation and integration • New sensors e.g. ultraspectral • Space-based edge computing • Satellite on board processing	• Smart cars • Smart houses • Intelligent mobility • The internet of animals	• Solar RPV • Self-driving autonomous RPV • Smart RPV (capture, analyse and act) • Smart sensor payloads • Onboard optimisation of big data processing	• Improved battery life for multi-year lifespan tracking • The internet of animals • Precise smartphone GNSS • Ubiquitous, low-cost, high accuracy devices	• Citizen sensing

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Maturity Assessment - Data technology

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	Artificial Intelligence & Machine Learning	Big Data & Analytics (inc. GIS)	Simulation & Modelling
CURRENT	• Predictive analysis • Decision support systems • Optimisation • Machine learning (ML)	• Local storage & computing • Distributed processing • Data mining • Predictive analysis • Visualisation • Geographic information systems (GIS) analysis for experts • Scripting, visual modelling	• Environmental modelling • Species predictive modelling • Atmospheric modelling
EMERGING	• Artificial intelligence (AI) • Deep learning • Automated feature extraction • Real-time predictions • ML supersampling using combination of optical images and synthetic-aperture radar (SAR) data	• Cloud storage & computing • Hybrid storage (local & cloud) • Multi-cloud environments such as BigQuery • Open data cube • Cloud-based supercomputer capability	• Thematic digital twin • Environmental modelling and simulation & warning • Simulated populations
FUTURE	• Natural language processing • Generative adversarial networks • AI robotics & artificial intelligence of things • Event detection from ML • Space-based ML and AI	• Space-based edge computing • Quantum computing • Fast data • Actionable data • Intelligent modelling (environmental GIS for non-experts) • Self-organising big data optimisation	• Ocean avatar • Real-time monitoring • Understanding blue carbon fluxes