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Future Drones (UAM/BVLOS) & End-to-End Freight Logistics Architecture

AMSL Aero Vertiia, Dronamics, Elroy Air, Swoop/Wing, 15s Highway Drone Docks, Moorebank ARMG, Aurora/Waabi, Cargo sous terrain & Physical Internet

07. Future Drones (UAM/BVLOS) & End-to-End Freight Logistics Architecture

Prepared for the Architect of Tech — Transport for NSW (TfNSW)



Future Freight, Drone Logistics & Physical Internet Continuum

1. Aerial Mobility & Drone Logistics: From Suburban BVLOS to Heavy-Lift Cargo

1.1 Sovereign NSW & Global eVTOL / Heavy-Lift Cargo Aircraft

Low-altitude aviation ($0–3,000 ext{ ft}$) is bifurcating into **Suburban Last-Mile Delivery**, **Emergency/Medical BVLOS Corridors**, **Highway/Rail Drone-in-a-Box**, and **Middle-Mile Regional Heavy Cargo / Passenger eVTOL**:

Aircraft / Platform	Payload & Range	Propulsion & Autonomy	Strategic Application for NSW	Reference URL
AMSL Aero `Vertiia` *(Bankstown Airport, Sydney, NSW)*	**4–5 pax or 500 kg** cargo **1,000 km** (H2) / 250 km (Battery) 300 km/h cruise	Tilting-wing 8-rotor **Hydrogen-Electric eVTOL**; autonomous & piloted modes.	**Sovereign Sydney flagship!** Connects Western Sydney Aerotropolis, Westmead Hospital (CareFlight partner), and regional NSW hubs (Bathurst, Dubbo, Newcastle) point-to-point without runways.	https://www.amslaero.com/
Dronamics `Black Swan` *(Europe / Global)*	**350 kg (770 lbs) 2,500 km range** 200 km/h cruise	Fixed-wing composite BVLOS cargo drone airline (first with IATA/ICAO designator `0Y` / `DXE`).	Middle-mile regional air freight across outback NSW from 400m unpaved strips at **-50% cost and -60% CO2** vs. turboprops.	https://www.dronamics.com/
Elroy Air `Chaparral` *(USA / Global)*	**136–225 kg (300–500 lbs) 480 km (300 mi) range**	Hybrid-electric **VTOL** with autonomous ground-straddling carbon cargo pod pickup.	Lands vertically at regional hospital/rail depots, drops a pre-packed pod, straddles a new pod, and takes off in <2 minutes with zero human ground crew.	https://elroyair.com/
MightyFly `Cento` *(USA)*	**45–225 kg 965 km (600 mi) range**	Hybrid eVTOL with internal **Automated Load Mastering System (ALMS)** conveyor.	Automatically ingests parcels, weighs and shifts cargo internally to balance Center of Gravity (CoG), and ejects deliveries.	https://www.mightyfly.com/
Swoop Aero `Kite™` *(Melbourne, Australia)*	**3–5 kg medical payload 130–175 km range**	Bi-directional autonomous VTOL integrated with **Airservices FIMS (UTM)**.	High-priority pathology blood samples, anti-venom, and bushfire emergency medical logistics across regional NSW Local Health Districts.	https://swoopaero.com/
Wing (Alphabet) *(Canberra, Logan QLD, Melbourne)*	**1.5–2.5 kg parcels 20 km round-trip** 105 km/h cruise	Lightweight ($5 ext{ kg}$) tethered-winch VTOL + rooftop **Autoloader** network.	World's most proven suburban BVLOS drone network (**400,000+ commercial Australian deliveries** from Coles/shopping mall rooftops).	https://wing.com/australia/



Regional NSW Medical & Emergency Drone Network

1.2 Drone-in-a-Box (DiaB) for 15-Second Motorway & Rail Incident Response

- **Platforms: Skydio Dock for X10** (with *NightSense* zero-light obstacle avoidance), **DJI Dock 2**, and **Percepto AirMax**.
- **TfNSW Operational Architecture:**
- Weatherproof, air-conditioned robotic charging docks installed every $10–15 ext{ km}$ along the M1, M4, M5, M7, Sydney Harbour Bridge, and Blue Mountains/South Coast rail corridors.
- When SCATS/radar detects a motorway crash or Wayside/DAS fibre detects a rockfall or overhead wire fault, the nearest DiaB opens its roof in **15–30 seconds**, launches BVLOS along the transport corridor right-of-way (pre-approved under **CASA Broad-Area BVLOS**), streams live 4K thermal/optical video into the **Transport Management Centre (TMC)**, and auto-generates a 3D photogrammetric crash scene so police can authorize lane reopening **40–60% faster**.



Shenzhen & Highway Drone Operations

2. Surface, Intermodal & Underground Freight Innovation

2.1 Automated Port-Rail Intermodal Precincts — Moorebank (Sydney) & Global Peers

- **Moorebank Intermodal Precinct (South-Western Sydney — 243 Hectares):**
- Operated by **LOGOS / Qube**, connected directly to **Port Botany** via the dedicated $36 ext{ km}$ Southern Sydney Freight Line (SSFL).
- **Automation Stack:** Fully **Automated Rail-Mounted Gantry (ARMG) cranes** and **Automated Stacking Cranes (ASCs)** handling up to $1.55 ext{ million TEU/year}$ at the IMEX terminal, paired with optical character recognition (OCR) portals, automated straddle carriers, and co-located robotic high-bay distribution centers (**Woolworths Primary Connect NDC** using Vanderlande/Dematic ASRS).

- **Quantified NSW Impact:** Removes **3,000+ heavy diesel truck trips per day** from Sydney's M5/M7 motorway corridors and cuts $>110,000 ext{ tonnes of CO}_2 ext{/year}$.
- **Global Benchmarks: Yangshan Phase IV Automated Port (Shanghai)** and **Port of Rotterdam (ECT / Maasvlakte II)**—where autonomous guided vehicles (AGVs) swap their own batteries robotically and interface seamlessly with automated rail cranes.



Rotterdam & Yangshan Automated Intermodal Terminals

2.2 Autonomous Heavy Freight Trucks (Middle-Mile Hub-to-Hub)

- **Aurora Innovation (`Aurora Driver`):** Operating driverless Class 8 heavy trucks on the I-45 Dallas–Houston corridor using proprietary **FirstLight FMCW (Frequency Modulated Continuous Wave) LiDAR**, which measures both range ($>400 ext{ m}$) and instantaneous radial Doppler velocity of every pixel—essential when a $40 ext{-tonne}$ truck needs $300 ext{ m}$ to stop (`https://aurora.tech/`).

- **Waabi (Founded by Prof. Raquel Urtasun):** Combines an interpretable end-to-end generative AI driver (**Waabi Driver**) with **Waabi World**, a closed-loop neural simulator that synthesizes reactive traffic and sensor corruption to validate safety without needing billions of physical road miles (`https://waabi.ai/`).
- **Einride & Kodiak Robotics: Einride** deploys cabless electric freight pods supervised by a remote human-in-the-loop mesh operator; **Kodiak** packs its entire LiDAR/radar/compute stack into swappable side-mirror **SensorPods**.
- **Applied EV (Australia):** Builds the **ISO 26262 ASIL-D** safety-certified **Digital Backbone™** and cabless **Blanc Robot™** chassis for precinct and industrial freight (`https://www.appliedev.com/`).

2.3 Underground Automated Freight Pipelines (Cargo sous terrain & Magway)

- **Cargo sous terrain (CST — Switzerland, `https://www.cst.ch/en/`):**
- Backed by a dedicated Swiss Federal Act (2022), CST is building a $500 ext{ km}$ network of $6 ext{-meter-diameter}$, three-lane tunnels $20–50 ext{ m}$ beneath Zurich, Basel, Bern, and Geneva (first $70 ext{ km}$ Härkingen–Zurich link underway).
- Induction-powered autonomous carts carry Euro-pallets continuously at **$30 ext{ km/h}$ ($24/7$)** while an overhead ceiling monorail moves express parcels at **$60 ext{ km/h}$**, lifting goods directly into city consolidation hubs via vertical elevators to cut urban heavy truck traffic by **up to 30%**.
- **Magway (United Kingdom, `https://www.magway.com/`):**
- Uses **Linear Synchronous Motors (LSM)** to propel compact freight carriages through **$0.9 ext{-meter}$ diameter utility pipes** buried alongside motorways or railways at $50 ext{ km/h}$ with sub-second headways—moving railway-scale parcel volumes without taking up surface road lanes.

2.4 Autonomous Curb/Sidewalk Robots & The Physical Internet (π)

- **Starship Technologies, Serve Robotics & Cartken:** 6-wheeled electric sidewalk robots traveling at $6 ext{ km/h}$; Starship has completed **>6 million commercial deliveries** consuming just **$0.04 ext{ kWh}$ per delivery** (the energy required to boil a single kettle of water!).



Starship Autonomous Sidewalk Delivery Robot

- **The Physical Internet (π / PI — Prof. Benoit Montreuil & EU ALICE Roadmap):**
- Replaces proprietary, half-empty shipping boxes with standardized, modular, interlocking composite **π-containers** ($0.12 ext{ m}$ to $12 ext{ m}$ that snap together like LEGO bricks), open automated cross-docking **π-nodes**, and **TCP/IP-inspired Open Logistics Protocols**—eliminating the **40–50% empty air** inside trucks and slashing **25% empty "dead-head" truck running** by over half.