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APAC IoT INNOVATION SUMMIT
Kuala Lumpur 24-26 Sept 2019
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Session 5:
IoT Innovation & Ecosystem Collaboration

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Session 5:
Connected Urban Airspace Management for Unmanned Aircraft

Ong Jiin Joo
CTO
Garuda Robotics

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Drones Everywhere on 5G

Beyond Visual Line of Sight and the Connected Urban Airspace Management for Unmanned Vehicles by FutureFlight Consortium

GSMA IoT Innovation Summit
Session 5: IoT Innovation and ecosystem collaboration

Ong Jiin Joo
CTO & Co-founder
Garuda Robotics

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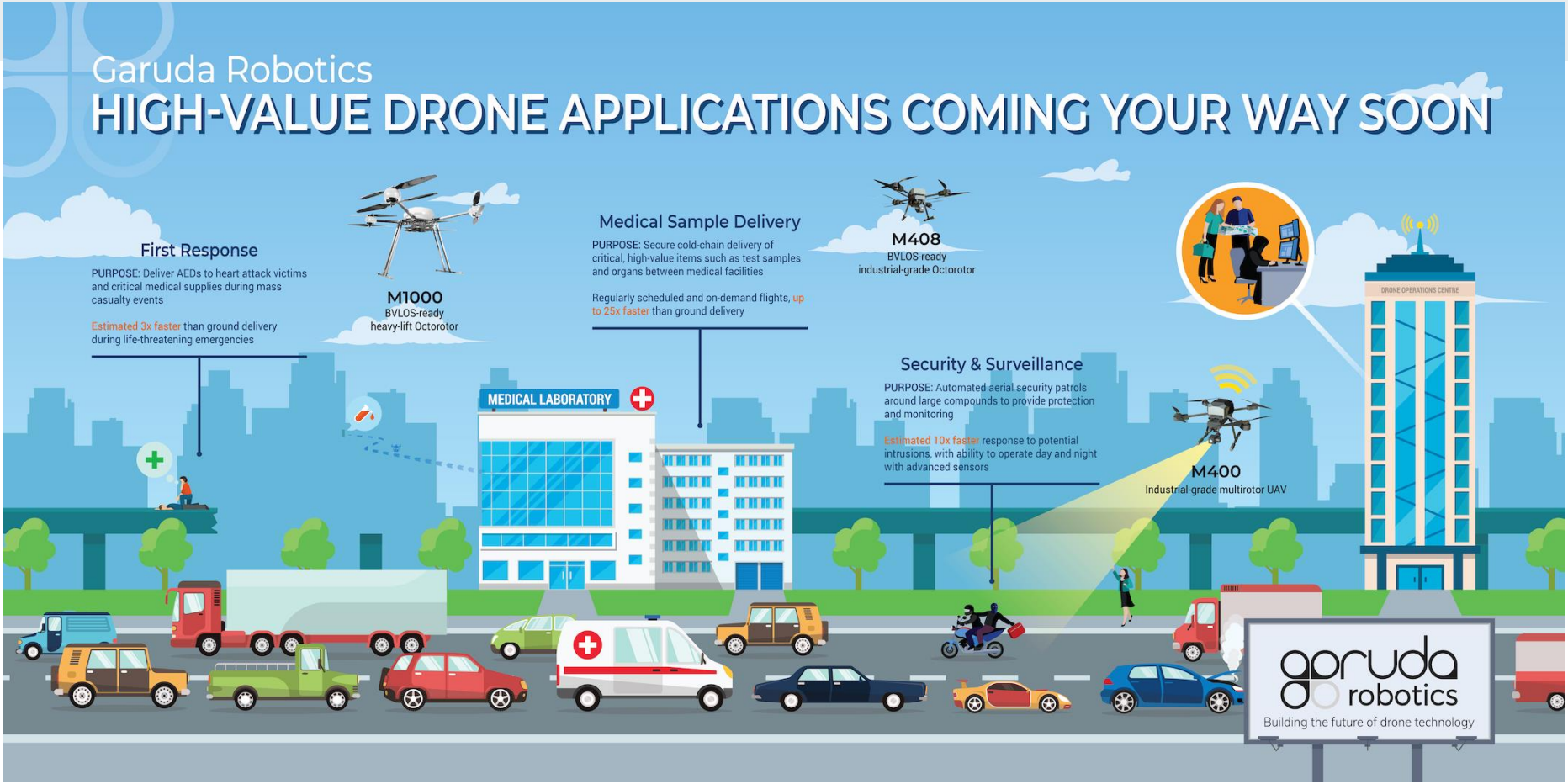
Garuda Robotics

HIGH-VALUE DRONE APPLICATIONS COMING YOUR WAY SOON

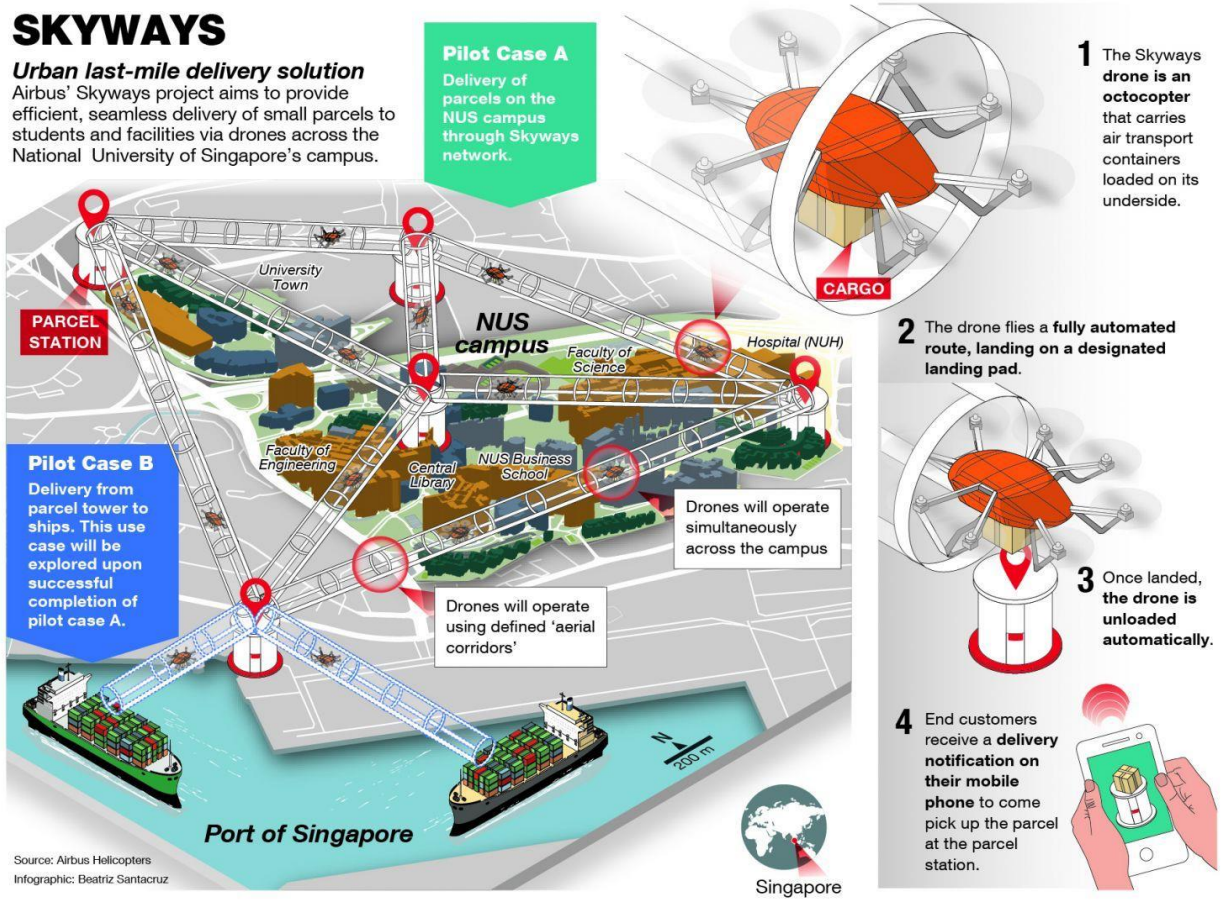


Air Taxis

Urban Air Mobility (UAM) Takes Off in 64 Cities Around the World

Aerial Cargo Delivery

AED / First Responder
Medical (Blood / Organ)
Ship to Shore
Food / E-Commerce



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Incident Response

COVERAGE

Drone & Docking Station

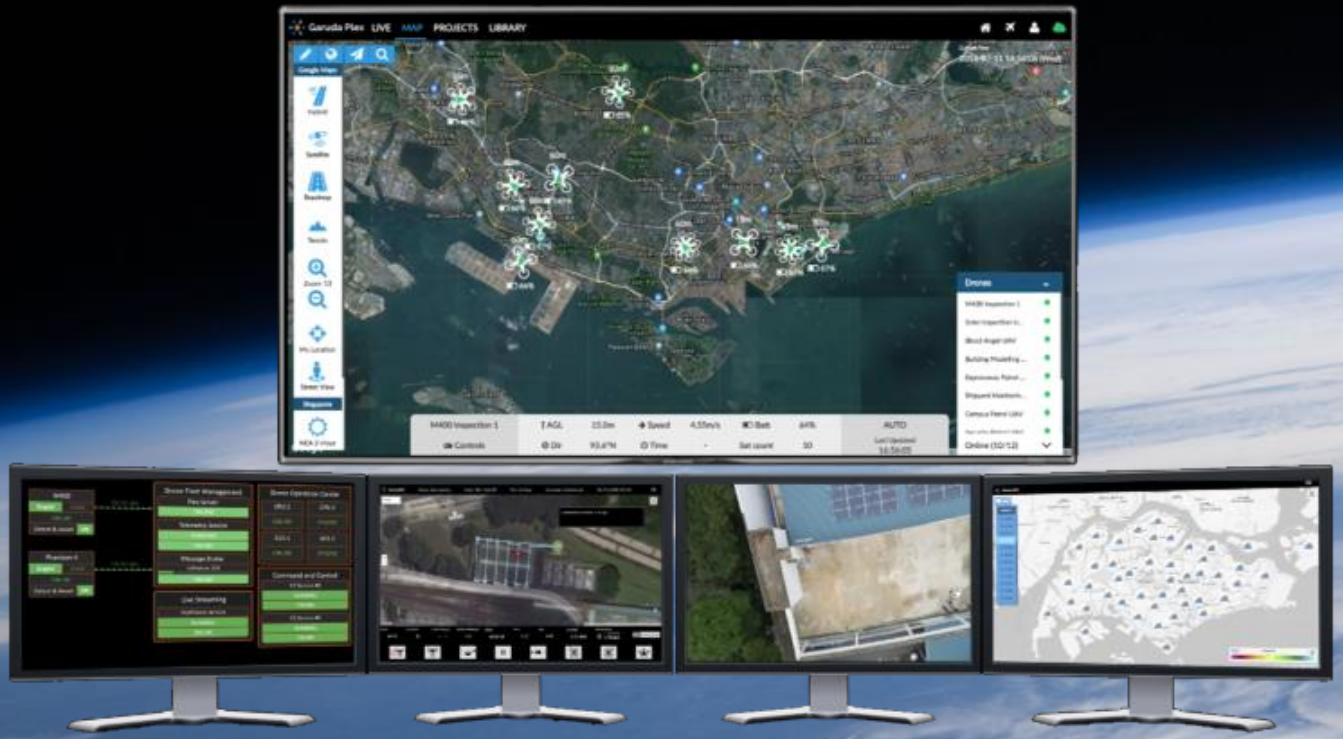
RAPIDER.4 drone
Surveillance drone (EO/IR), weatherproof

Re.COVER dock
Portable charging station, weather shield

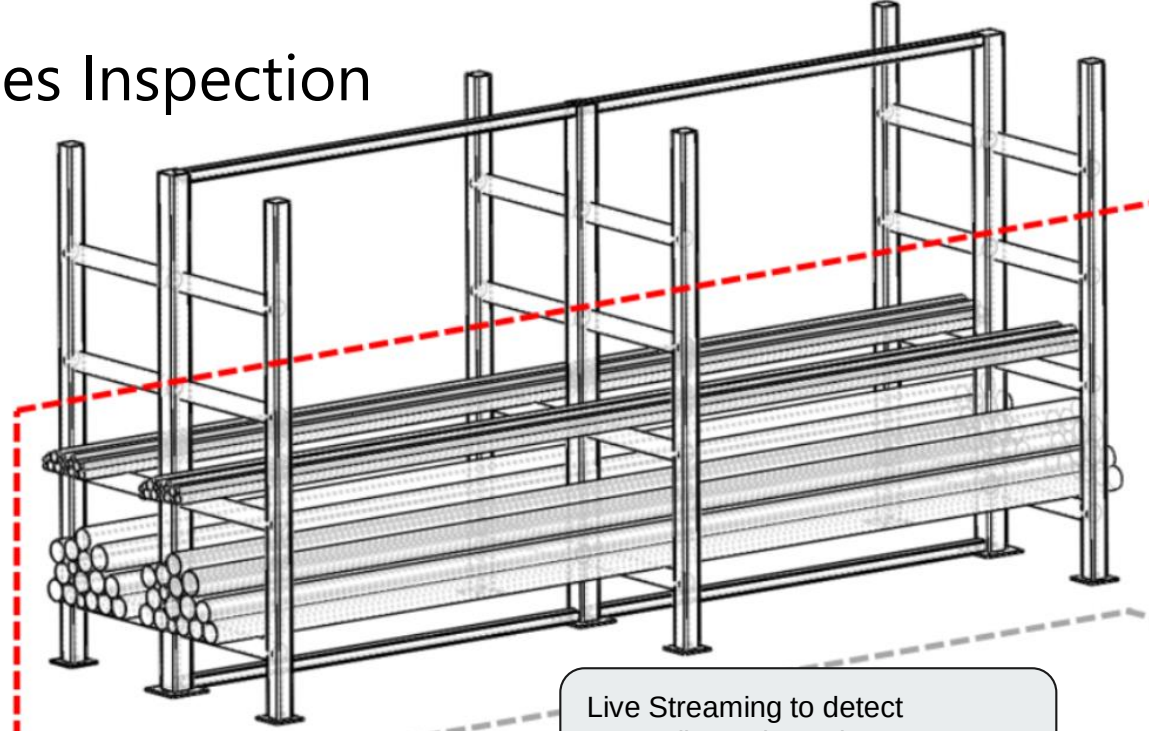
Natively commanded through 4G Networks

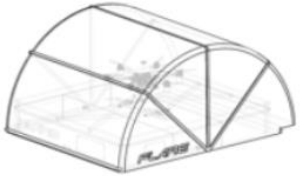
Plex Horizon

Drone Operations Center



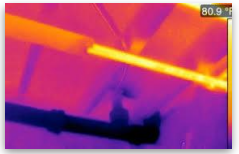
Facilities Inspection





Live Streaming to detect anomalies, raises alarm immediately in Command Center

High Quality photos uploaded at each rest stop



Routine Infrastructure Inspection payload premounted (vision, thermal, gas)

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Facilities Inspections

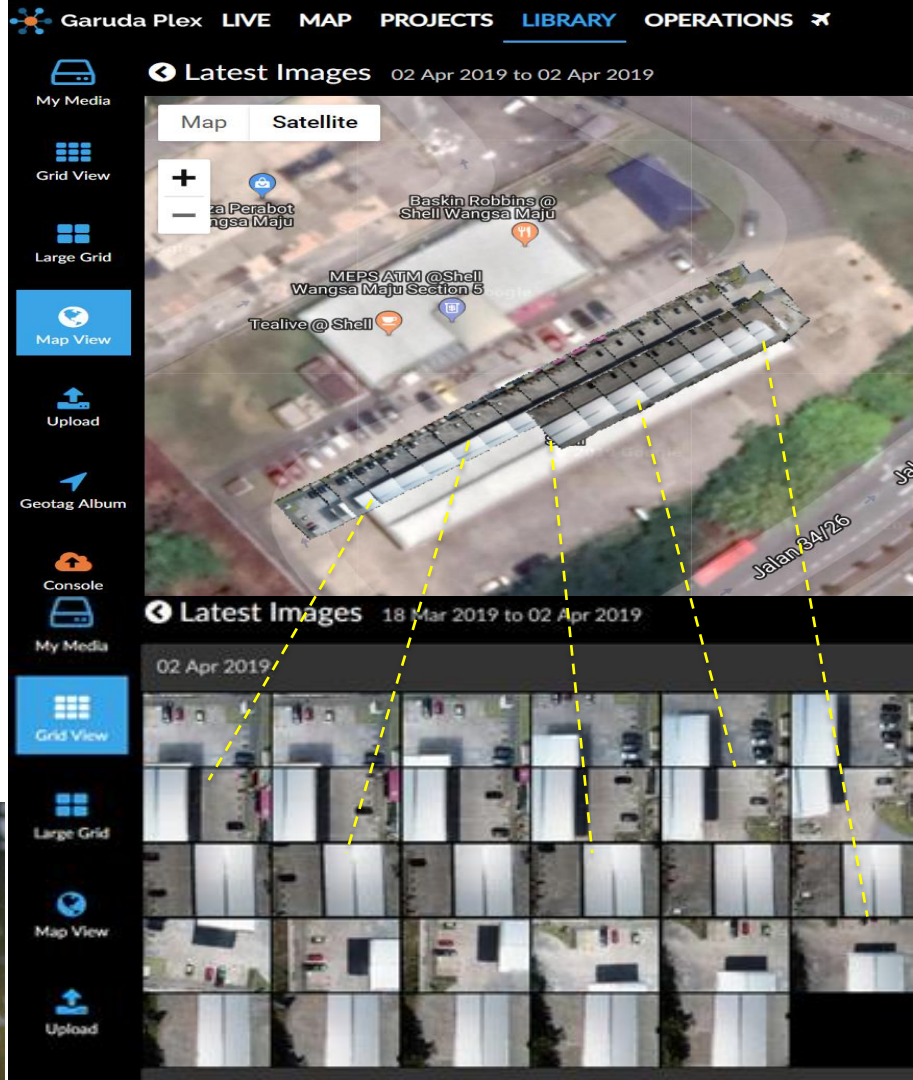
UAVs flying with automated mission plans will regularly inspect infrastructures for defects without requiring people to work at height

Remote Monitoring with UAVs

- **Remove risk of working at height**
- **Faster and cheaper** than conventional methods
- **Inspect routinely whenever** – rapid deployment

GR Facilities 4.0 Solution

- Geotagged photos and video
- Anti-aedes capsule deployment
- Facilities 4.0 cloud-based data storage
- Safely inspect to HSSE Standards
- Permits management



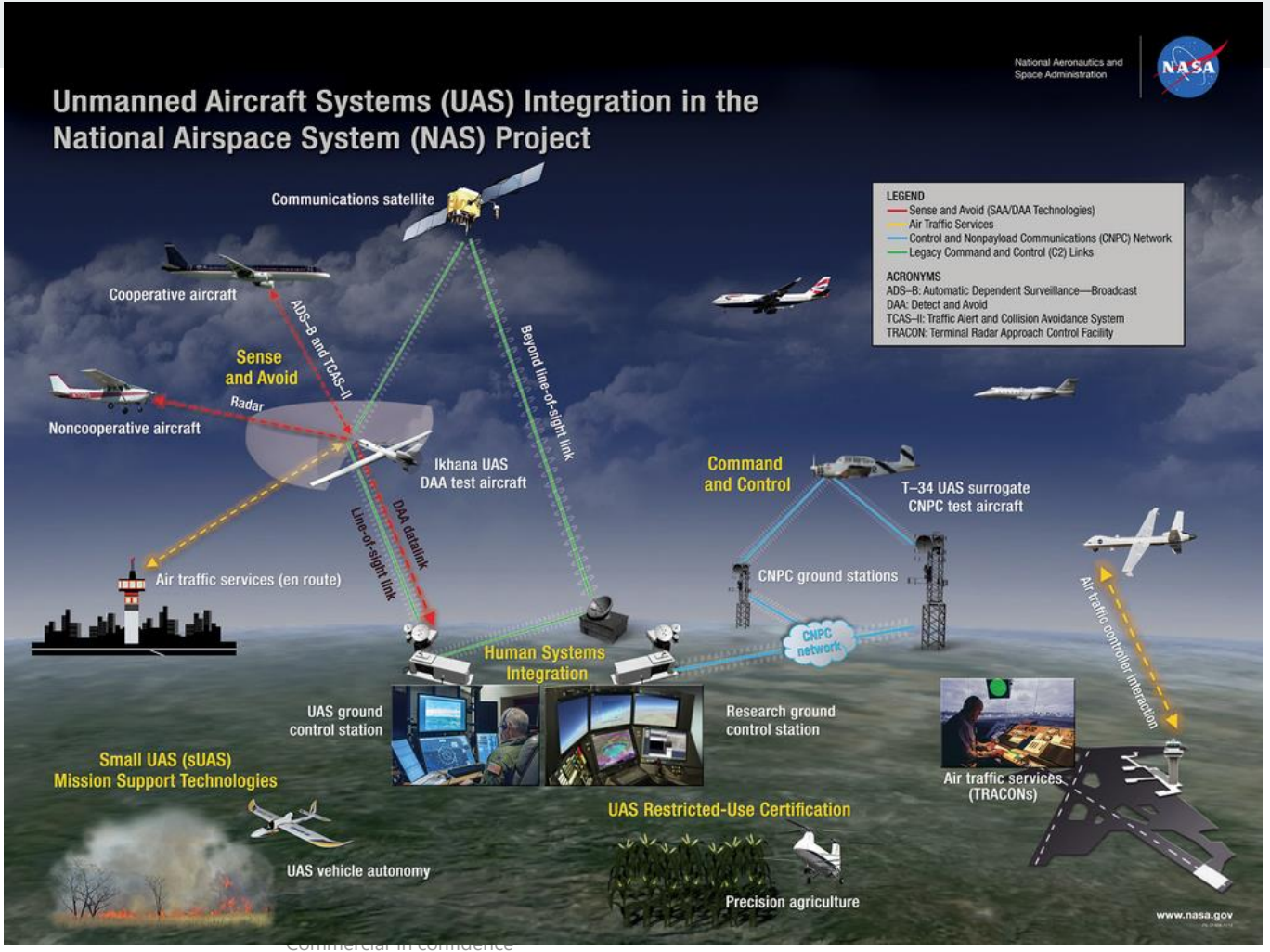
Network Coverage

State of the World

1) Lack Infrastructure
2) Military Oriented
3) Competing Standards
4) Cautious Regulators

BVLOS operations has immense commercial benefits.

All eyes on Telcos - shared spectrum / towers



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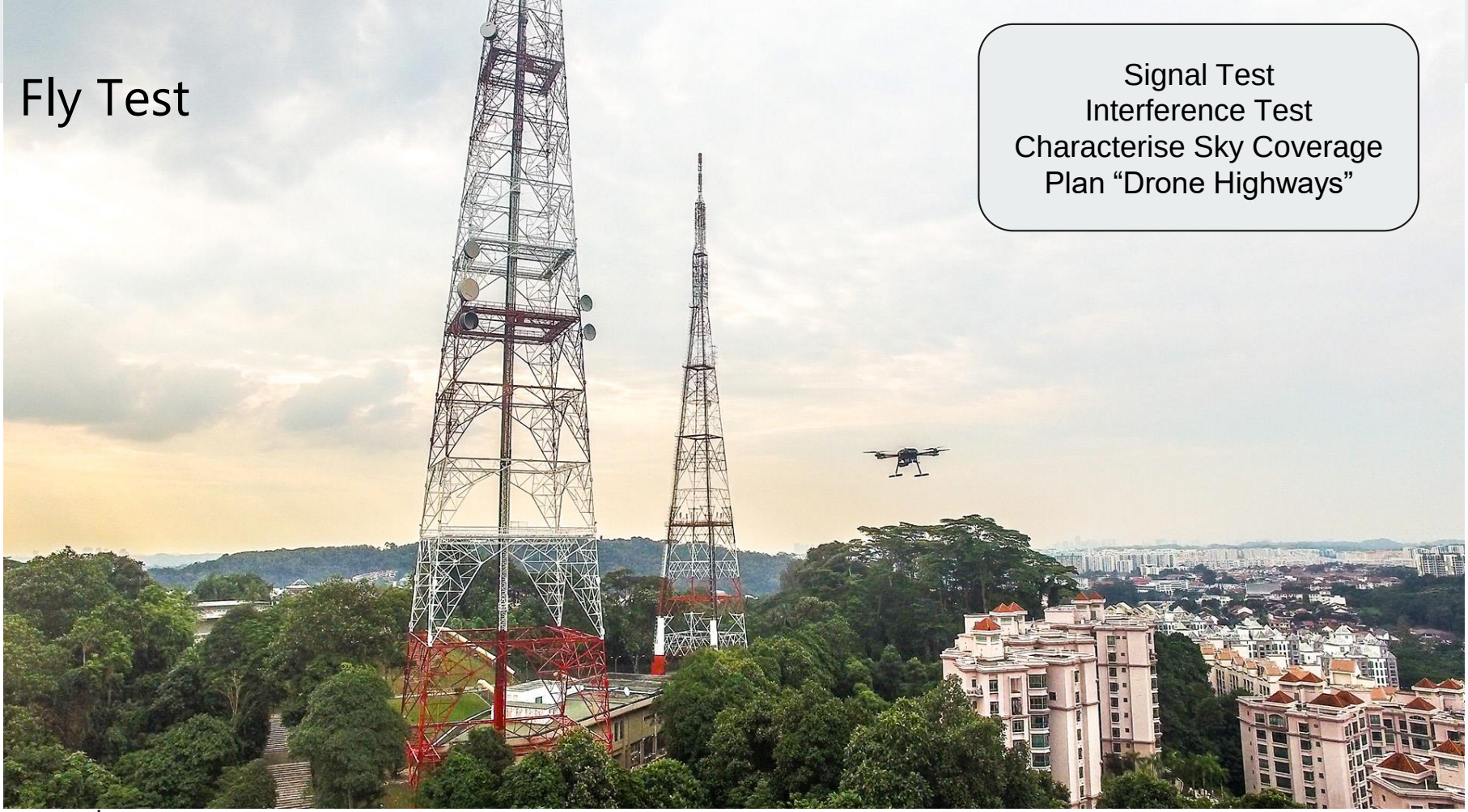
Future Flight

CONSORTIUM

END-USERS	ENABLERS	
Parkway Pantai	Drone Manufacturers / Operators	Technology Providers / Enablers
SCDF The Life Saving Force	garuda robotics	Singtel
Security Industry Institute	FLARE Dynamics	ARETE M
	VOLANS-i	gemalto a Thales company
	skyfront	acorn
		AIRMAP

PIONEERING URBAN BVLOS OPERATIONS

Fly Test



Signal Test
Interference Test
Characterise Sky Coverage
Plan “Drone Highways”

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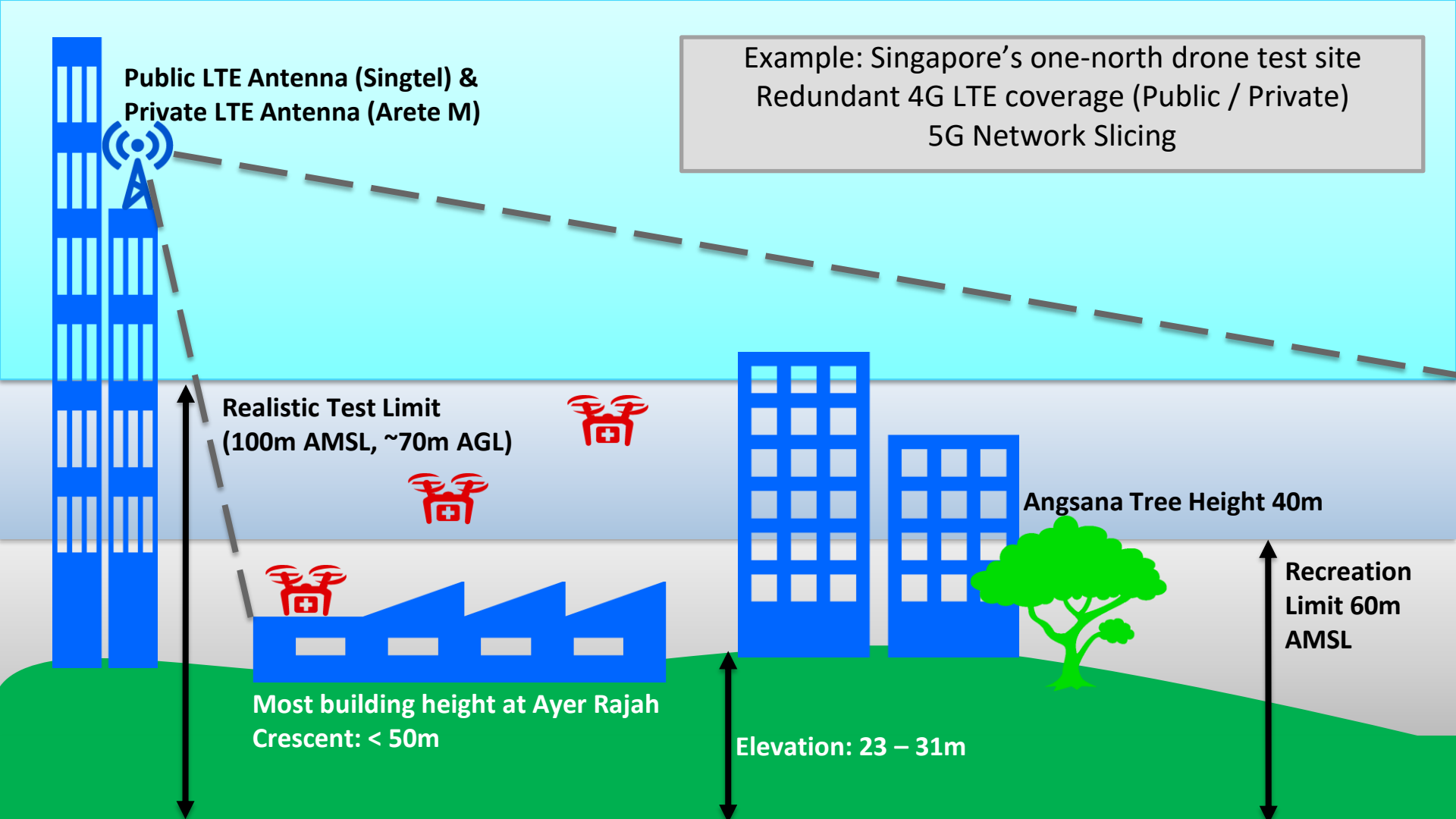

Example: Singapore's one-north drone test site
Redundant 4G LTE coverage (Public / Private)
5G Network Slicing
Public LTE Antenna (Singtel) &
Private LTE Antenna (Arete M)
Realistic Test Limit
(100m AMSL, ~70m AGL)
Angsana Tree Height 40m
Recreation
Limit 60m
AMSL
Most building height at Ayer Rajah
Crescent: < 50m
Elevation: 23 – 31m

Garuda CoPilot

We Built an On-board Companion Computer to Flight Controller that provides

1) Redundant Connectivity
2) Navigation within Dense Urban Environment
3) Additional Failsafes / Emergency Landing Procedures
4) Detect and Avoid sensors and systems

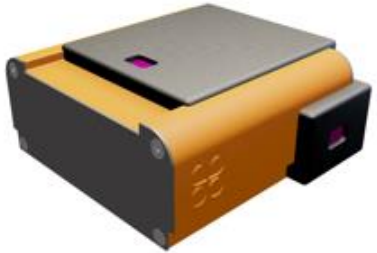
Redundant Connectivity (2019 situation)
Dual Link Module (DLM) by Arete M

Band 1, 3, 7, 8	3G, 4G LTE (FDD)
Band 62	Private LTE (TDD 1.8Ghz)

<u>Other (ISM) frequencies</u>

VLOS Telemetry	920 MHz
VLOS Command	2.4 GHz

CoPilot



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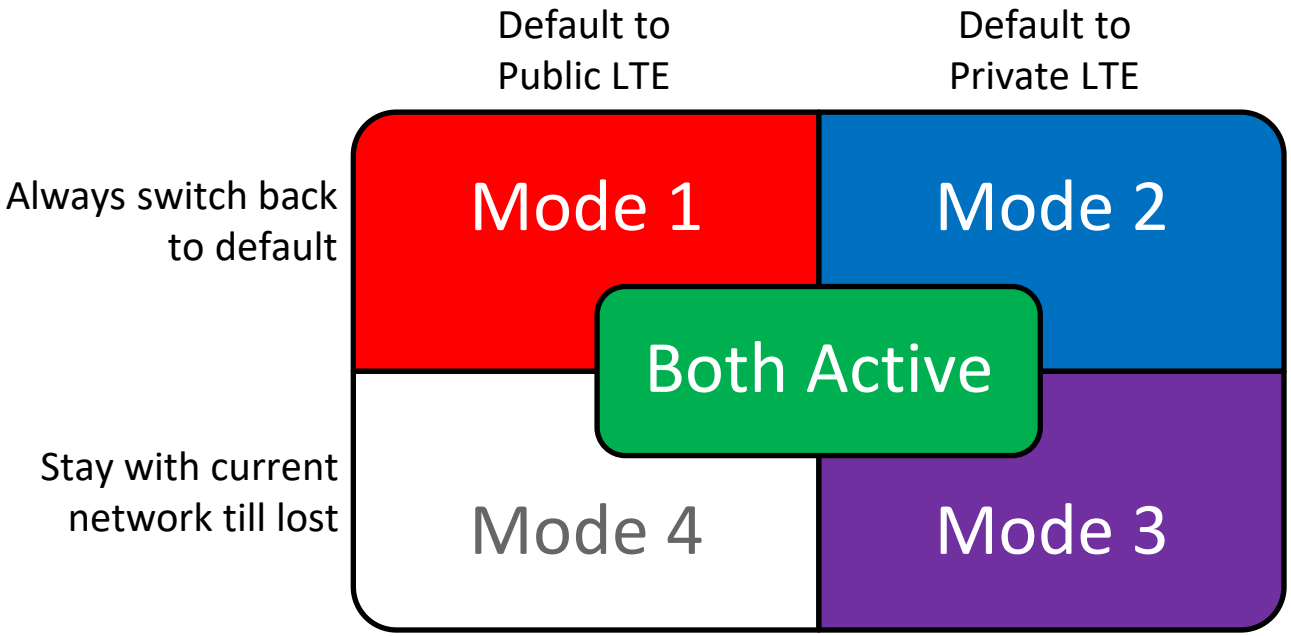
Public / Private Network Configuration



Example Scenarios

<u>Mode 1</u>
Commercial edition of CoPilot with Singtel IoT SIM embedded

<u>Mode 2</u>
Law Enforcement Agencies (Police etc.) who uses Public LTE as backup

<u>Mode 3</u>
R&D, explore stability of connection

Mode 4: Currently unused (no use case)
Both Active: Challenging implementation (effective de-dup packets)

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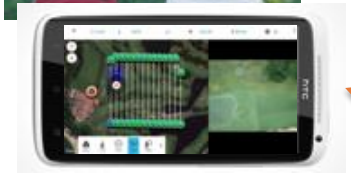
Drone Operations

Plex Pilot (VLOS)



Plex Horizon (BVLOS)

UAS Services (UTM)

State

Public Safety

Manned Aviation

Weather Terrain

Garuda Plex

ENTERPRISE

Business End Users

Prosumer

Commercial

Industrial

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Connectivity Architecture

Command Center
(Plex Horizon)

Wired

aws

Gov Flight Management System

Commercial UTM (eg. AirMap)

Wired

Garuda Plex

Services / MQ

API Gateway

Wired

Government Servers

Private LTE
(Arete M)

Public LTE
(Singtel)

Public LTE

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SRD / ISM

(433, 920, 2.4, 5.8)

VLOS Comms

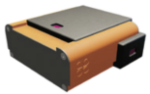
LTE Comms Module

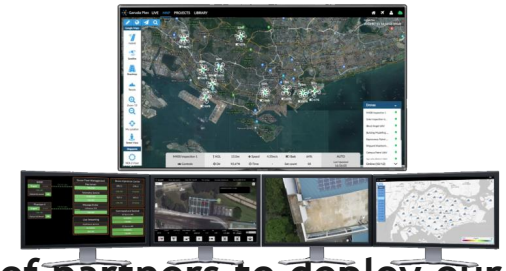
CoPilot

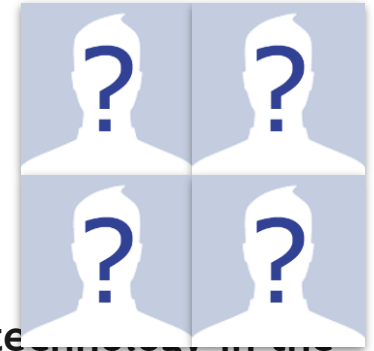
Flight Controller

Government Trackers

FutureFlight Consortium partners are conducting intensive flight trials with CoPilot and a variety of drones.







We're assembling the next wave of partners to deploy our technology in the field and kickstart their involvement in the commercial rollout of BVLOS drones.

Gain early access to cutting-edge drone technology developed and tested for the future of urban BVLOS operations

https://futureflight.sg

The FutureFlight Consortium (FFC) is a group of technology partners developing and demonstrating technology for urban Beyond Visual Line of Sight drone operations.

Launching in 2020, the Technology Access Program grants early access to FFC technology, allowing service providers and infrastructure operators to jumpstart market entry.

TAP members get access to FFC white papers, technical reports, regulatory compliance frameworks, partner technology and solutions for testing and deployment.

<u>Application Focus Areas</u>

1. Medical deliveries
2. Security patrols and incident response

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Thank You!

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