

# Driving into the Future with ST Engineering Autonomous Buses

2 Dec 2020

**Sebastian Yee**

Head of Autonomous Vehicle Testing & Simulation,  
Urban Solutions Division



# ST Engineering Group

Vision: to be a Global Technology, Defence & Engineering Powerhouse



## Aerospace

- Aircraft MRO
- Passenger-to-freight conversions
- Aviation asset management



## Electronics

- Smart Security
- Smart rail and road solutions
- Smart Connectivity including IoT solutions



## Land Systems

- Customised mobility and security systems for defence, homeland security and commercial applications



## Marine

- Shipbuilding
- Ship and rig related repairs, upgrades and conversions
- Environmental engineering

AAA  
rated by Moody's S&P

About S\$13b  
\*market capitalization; STI, MSCI  
Singapore Index Stock

>S\$320m  
annual R&D spending  
(~5% revenue)

22,000  
employees worldwide

# End-to-End Transportation Solution: Competitive Edge

Leverage Singapore's Smart Nation ecosystem to accelerate speed of operationalization



## Participate in full value chain



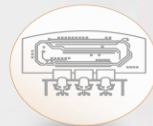
Mobility As A Service (MAAS)



Fleet Management



Safety Monitoring



Command & Control



Testing & Inspection



Maintenance Repair and Overhaul

# Shaping the Future of Public Transport

Working with regulators and members of the ecosystem

## Operational Deployment

Singapore as a Lead User of Smart Mobility solutions



## Research Institutes & Agencies

Focused co-invention and co-creation of technologies



## Strategic Partnerships

with Authorities & key players to deploy and operationalise Autonomous Transports



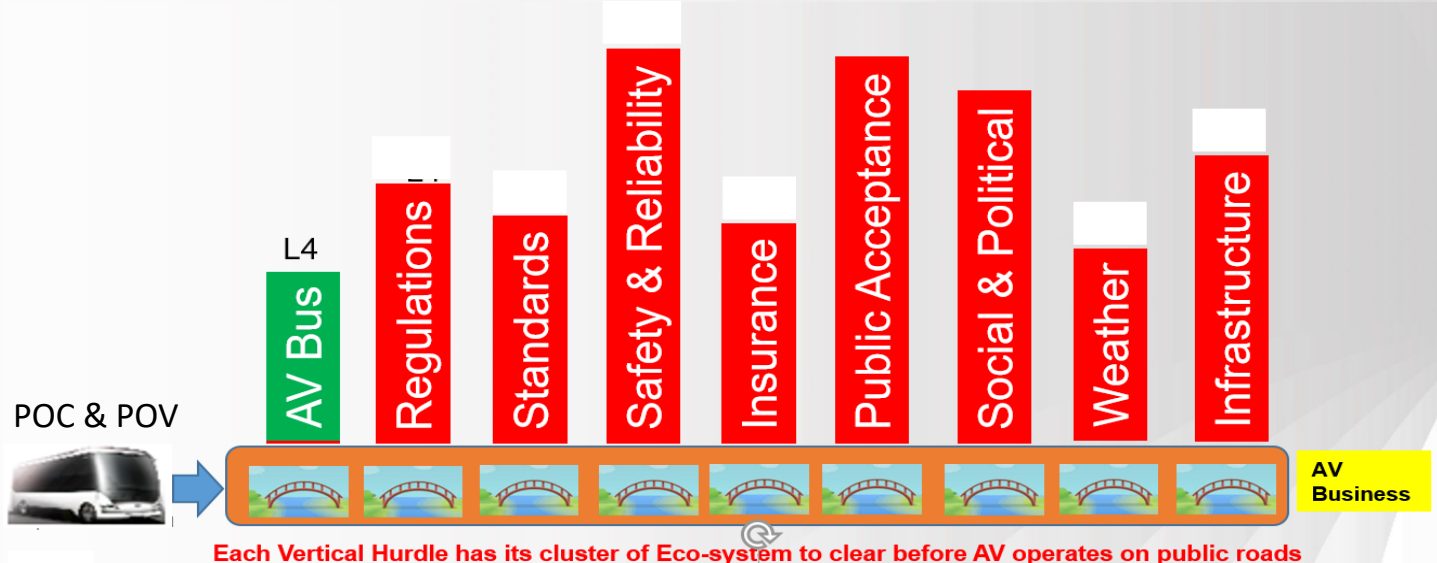
## Institutes of Higher Learning

To develop the next generation of talents in Autonomous Systems, Sensors, Modeling and Simulation



## Gaps in AV operationalization

- By having a trove of adverse weather data in an urban environment and to use it to validate the algorithms and position AV position **as truly all-weather**.
- **Safety is paramount** in any AV deployment. The ability to rigorously validate pedestrian/cyclist intention prediction algorithms for cluttered urban environment is key.
- Human-like driving characteristics **to enhance ride comfort** for AV Bus



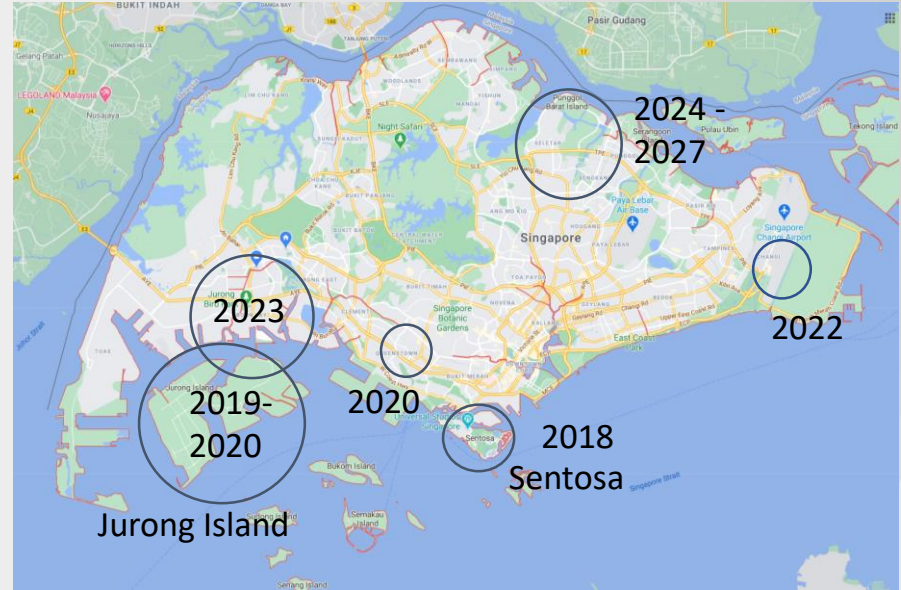
# Our Autonomous Transportation System Trial & Deployment

## Public Trial & Service

|                               |      |
|-------------------------------|------|
| Sentosa Resort Island         | 2018 |
| Keihanna Science City (Japan) | 2019 |
| Science Park 2                | 2020 |
| Jurong Island Industrial Park | 2020 |
| Jurong Town                   | 2023 |
| Punggol Digital District      | 2024 |

## Closed Service

To be announced Feb 2021



12m

7m

4m

# Current AV Development and Trials

Land Transport Authority  
We Keep Your World *Moving*



12m Autonomous Buses for Fixed & Scheduled Services

National Environment Agency  
Safeguard • Nurture • Cherish



Development of autonomous road sweeper

Gardens by the Bay

First fully operational driverless shuttle trial




ST Kinetics

sentosa THE STATE OF FUN




Legend:

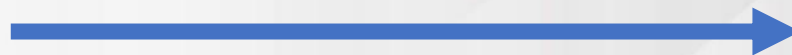
- : Pick-up/Drop-off Stop
- ⊙ : Roundabout
- : Loop

# Challenges

- AV Bus Braking Profile can be very challenging. (Suburb to Train Station)



Peak Period



Non Peak Period

No seat belt for Public Transport

Emergency or Hash Braking is undesirable



# Unexpected Environment Condition



Random Tree Pruning along the roadside



Flooding : No more road marking

# Unique Traffic Situation (VRU)



Very “Brave” Elderly Jaywalker



Zebra crossing Accident caused by Blind Spot

# Scenario Based Testing related to actual traffic requirements



# Unique Traffic Situation



Nestia

Automated buses dodge peacocks, tourists and plants in Singapore ...

[Visit](#)

Creator: STAFF | Credit: REUTERS





# Public Trial of Autonomous Shuttles at Sentosa

More than  
**6,000**  
passengers

Average commuter  
rating  
**4.55**  
on a scale of 1-5

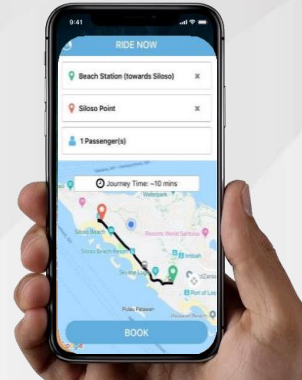


## Background

- To provide important insights into **the** commuter experience, infrastructural features, mind-sets acceptance and how Autonomous Buses interact with other vehicles and road users

## Public Road Trial

- 6-month Public Trial
- 4 units of autonomous buses  
5.7km route
- Day and night operations in light to moderate rain



Members of public visiting Sentosa were able to hail our autonomous shuttle via the Ride Now Sentosa mobile app

## Key Takeaways/Lessons

- Validated the system performances (2019)
  - Service availability at 90%
  - 100% of confirmed booking completed
- Useful data collected on:
  - System reliability
  - Commuter travel pattern and behavior
  - Changes in environment on the system performances
  - Execution of contingency plans
  - Public feedback / acceptances
- Next stage (2021)
  - Explore the use of V2I/roadside sensors at challenging road junctions





**Thank You...**

**See U in  
Uniquely Singapore**

