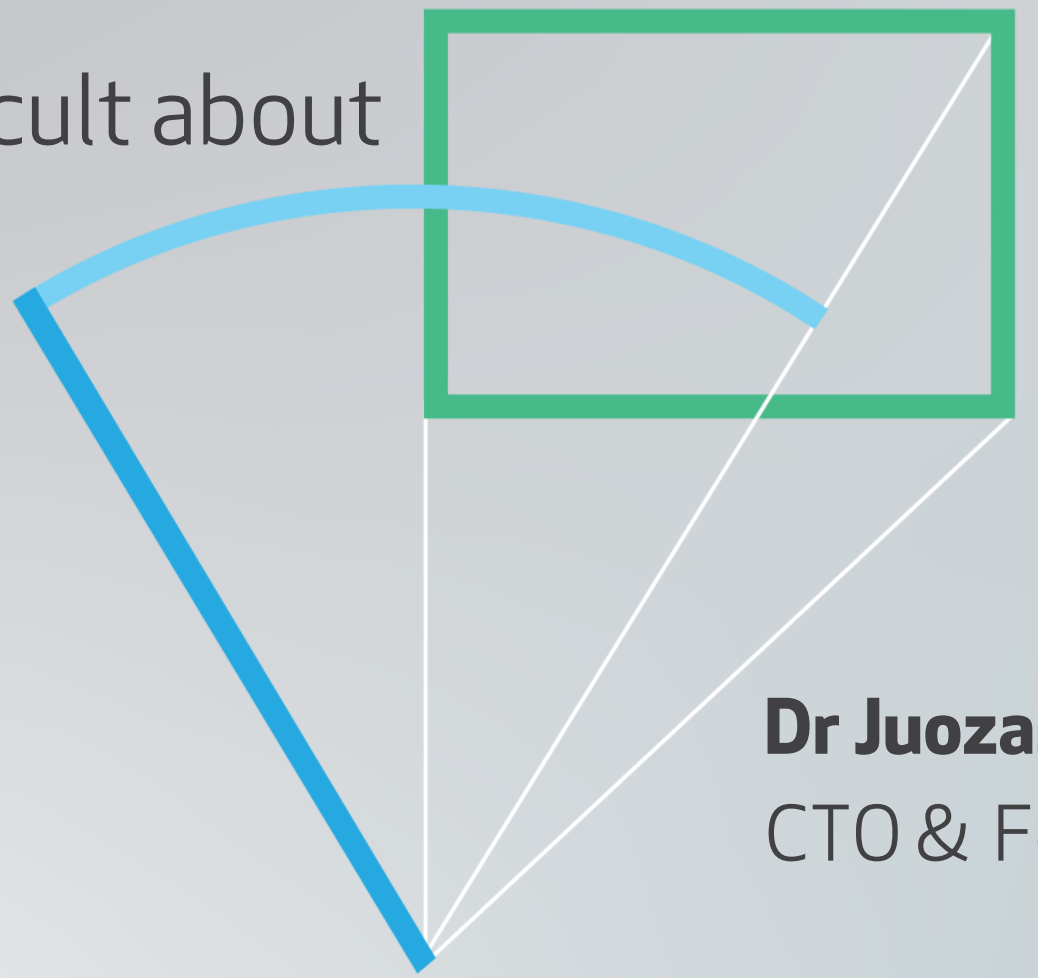
Autonomous Vehicles:

What is difficult about Autonomy?



Dr Juozas Vaicenavicius,
CTO & Founder at Sensmetry, UAB

Annual Economic Forum 2019, 8th October 2019, Vilnius

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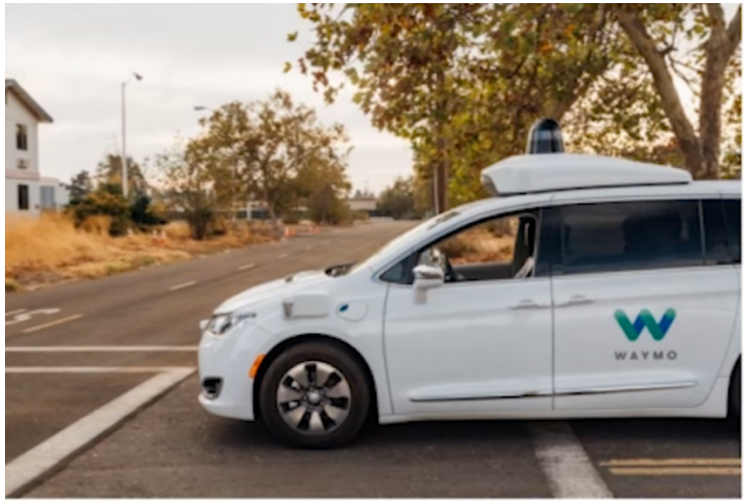
Autonomous vehicles: Where are we?

Autonomous Vehicles (AVs)



Robo-taxies and other special-purpose autonomous vehicles

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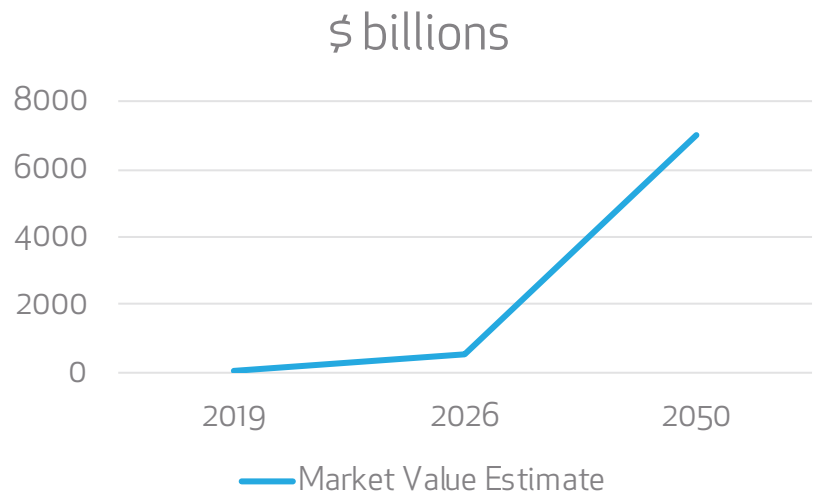
Sources: Waymo, Uber, Navya, Cruise, Scania, Volvo

Autonomous Vehicle Market

Estimated value:

- $55 billion in 2019
- $550 billion by 2026,
- $7 trillion by 2050



At present:

- $80 billion invested
- $0 revenue

- Key use cases :
  - Robo-taxis
  - Autonomous trucks

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Sources: Allied Market Research, Strategy Analytics, McKinsey

AVs: Past the hype

- 2016
  - Elon Musk (Tesla) - New York to LA “hands-free“ within a year.
  - Carlos Ghosn (Renault/Nissan) – self-driving cars by 2020 .
- 2018

Tesla

Source: USA Today

Uber

Source: ABC News

- 2019

  “Small-scale deployments in the next 5 years,
  and then **it’s going to phase in over the next 30 to 50 years.**“

Chris Urmson (CEO at Aurora, industry leader)

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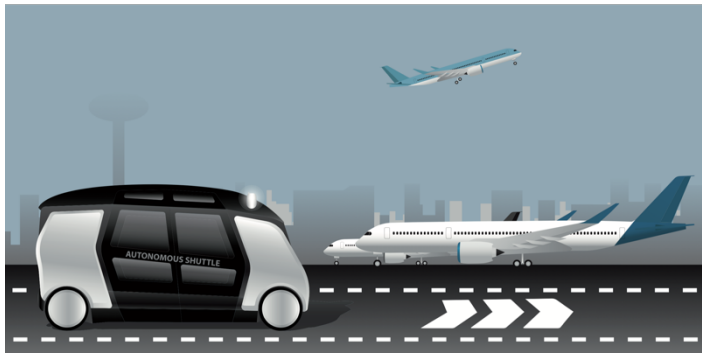
Quote sources: Quartz, The Verge

Autonomous vehicles: What is so difficult?

Key Difficulty: achieving and evaluating safety



How do we evaluate safety of an autonomous system in operation?

Safety is a function of ...

Key difficulty: safety is a function of the complex environment.

Key concept: ***Operational Design Domain (ODD)*** – defines the environment

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What is Operational Design Domain (ODD)?

The ODD is the environment in which the autonomous system must operate

Weather & time of day

Day & Sunny

Night & Rain

Snowfall & Dusk

Terrain / geolocation

Actors

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More practical difficulties

- Difficult to know when and why system fails (black-box models)
- No general-purpose AV, each deployment is custom (different ODD)
- No safe performance guarantees, ODD changes all the time
  - fashion, new vehicles, etc.
- No easy hardware upgrading;
  - sensor change can affect performance in unexpected ways
- Expensive software updating
  - expensive vehicle-cloud-vehicle infrastructure
  - full safety re-evaluation needed
- Very expensive maintenance
  - Do not fix, just replace
- Safety is not enough, robust performance is also needed

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Autonomous vehicles:
What to do to deploy successfully?

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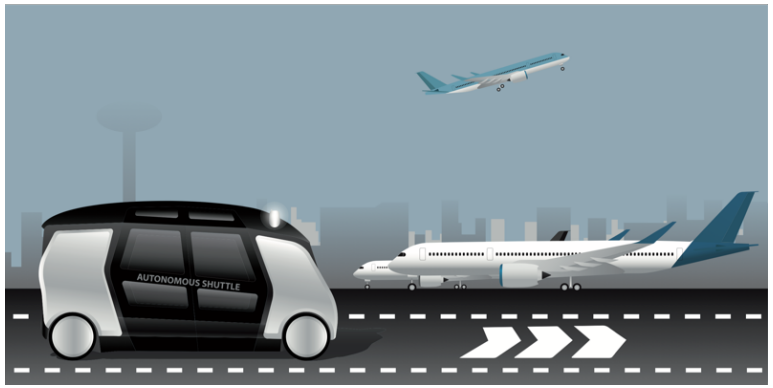
Recipe for deploying an AV for safe operation

- Build a rigorous quantitative model for the ODD
- Formulate requirements for sensing/control/actuation
  - AV companies want to sell expensive things, but most will not work for you
- Validate: check whether the AV satisfies the requirements
  - Real-data combined with virtual testing
- If requirements not met, then improve software/hardware
- Create AV performance and ODD monitoring strategy
- Create software updating strategy



It is a hard Engineering R&D work.
Relax, that is what Sensmetry does for you!

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SENSmetry

- R&D Consulting and Safety Analytics Company for Autonomous Systems

- Founded in 2019 by Autonomous Systems experts Dr Steven Keen & Dr Juozas Vaicenavicius

Mission

Rigorously analyze & quantify the safety and performance of autonomous systems

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Shaping International Safety Standards for AVs

ISO 21448 : Safety of the Intended Functionality - SOTIF

- A standards framework for Safety of Autonomous Vehicles/Systems
- Guidance for design, verification and validation of "driver assist" systems & autonomous vehicles.
- To appear in 2022.

- SENSmetry is an active ISO 21448 contributor (board member)
- The founders are among a few dozen experts developing the standard

SENSmetry develops & offers a safety analysis methodology & services in the SOTIF framework.

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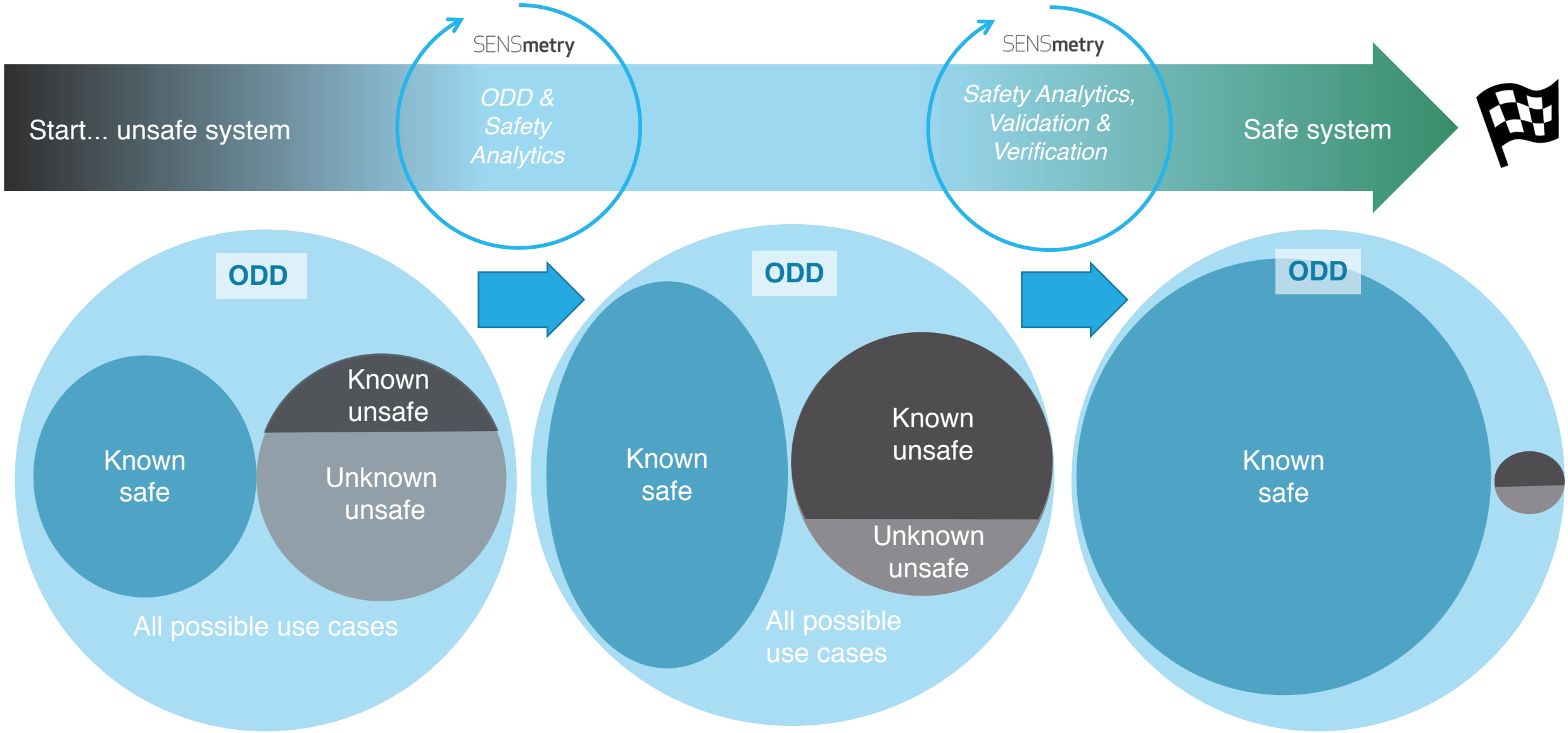
Our value in AVs Development & Deployment



The iterative development process framework according to the emerging safety standard ISO 21448 'SOTIF' for AV/ADAS.

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R&D Team

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SOTIF contributor

Ignas Vysniauskas
R&D Technical Lead

Tilo Wiklund
Data Scientist

Dr Rimantas Vaicenavicius
Chief Statistician

Partnering with a network of experts in Machine Learning, Data Science & Engineering across the world.

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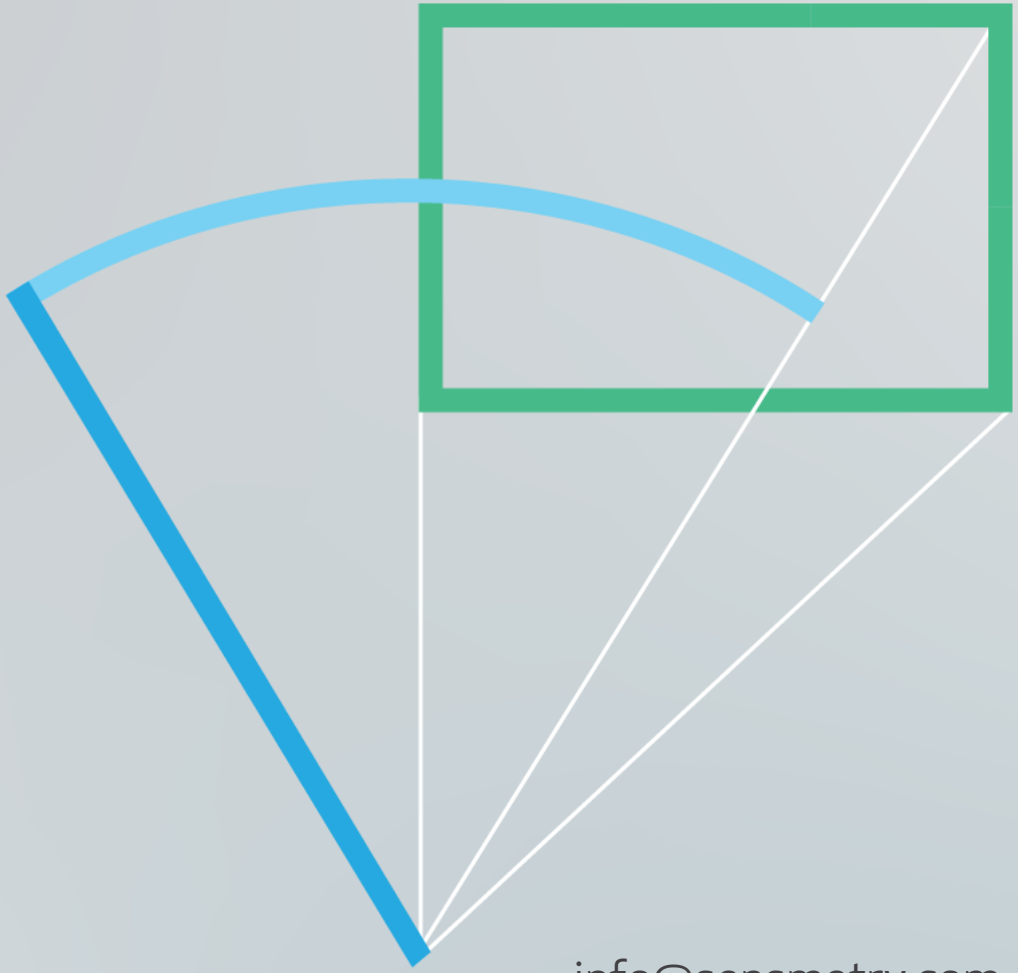
Thank You



Safe Autonomy –
Quantitatively.

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