




NAVENTIK

POSITIONING SOLUTIONS FOR
VEHICLE AUTONOMY

Company & Technology Intro

Status: August 2020


Technology

 First entirely software - based **satellite navigation** sensor + fusion algorithms on the market

 Complementary technology to **seamlessly** integrate into the **ADAS & Self Driving** stack

Company

 Founders with **20+ years** of cumulated **R&D** experience in automotive vehicle positioning

 Growth to **20 employees** (**16 highly specialized developers**) within **2 years**

**We have built the first embedded satellite navigation technology, the key to deliver ...
... POSITIONING SOLUTIONS FOR VEHICLE AUTONOMY**

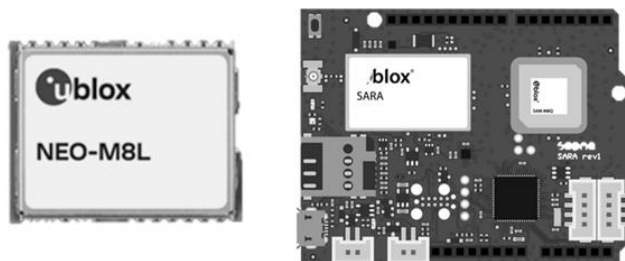


Satellite navigation (GNSS) ... a crucial technology to achieve accuracy, robustness & functional safety for vehicle positioning!



But ... satellite navigation solutions with sufficient performance at mass market suitable cost levels below \$ 100.0 per Unit are not available today!

Chipsets and Receiver Boards



< 200.0 \$ per Unit

Insufficient
Performance



Human
Navigation



ADAS Level 2+
(Highway)



ADAS Level 3 & 4
(Highway + Urban)



Autonomy
(Urban)



ADAS
Validation & Testing

(Mass) Market Gap

< 100.0 \$ per Unit

RTK INS

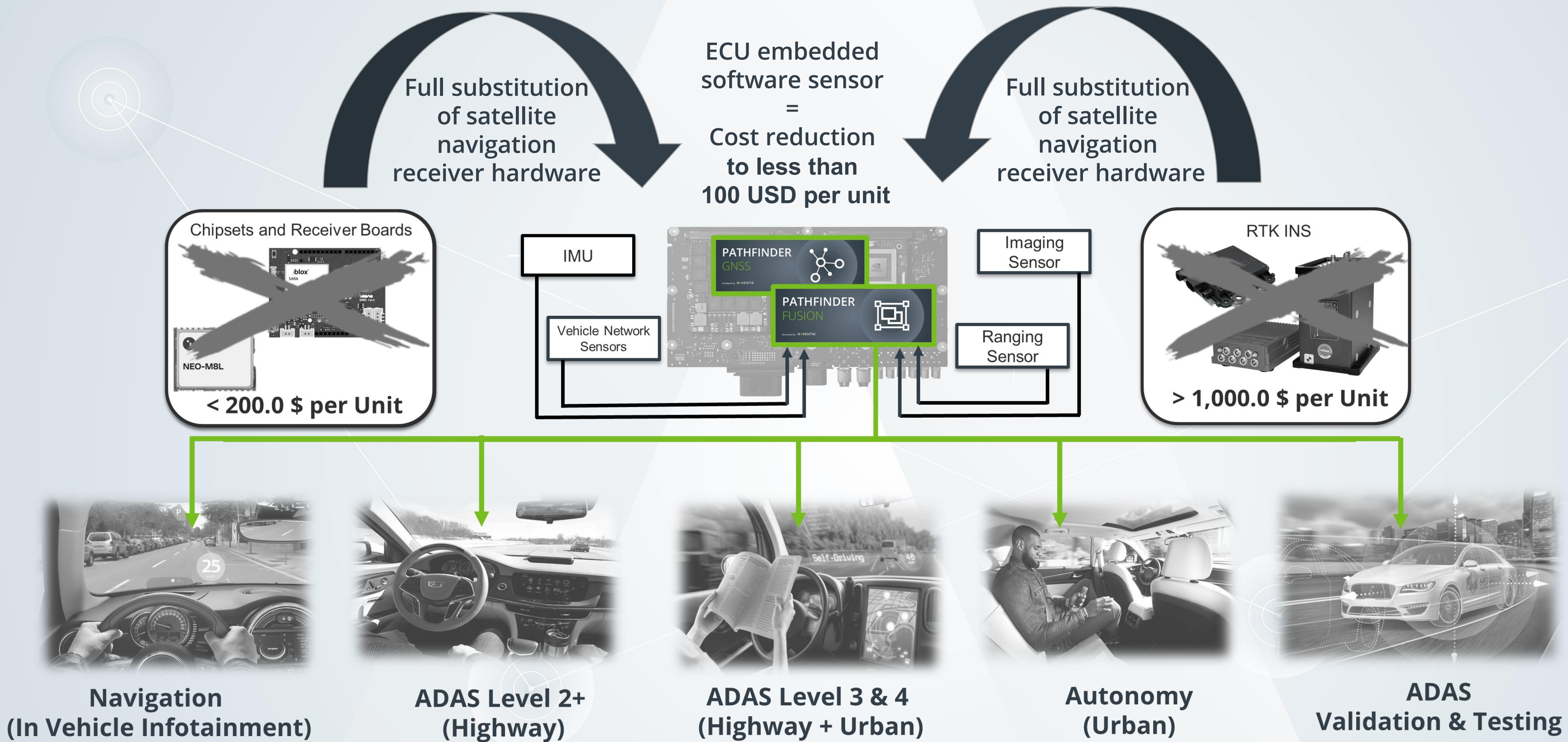


> 1,000.0 \$ per Unit

Too
Expensive

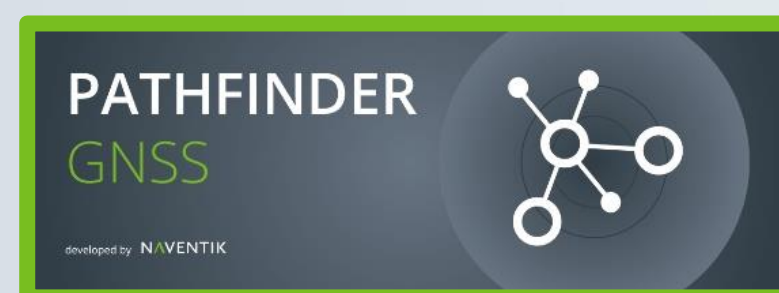
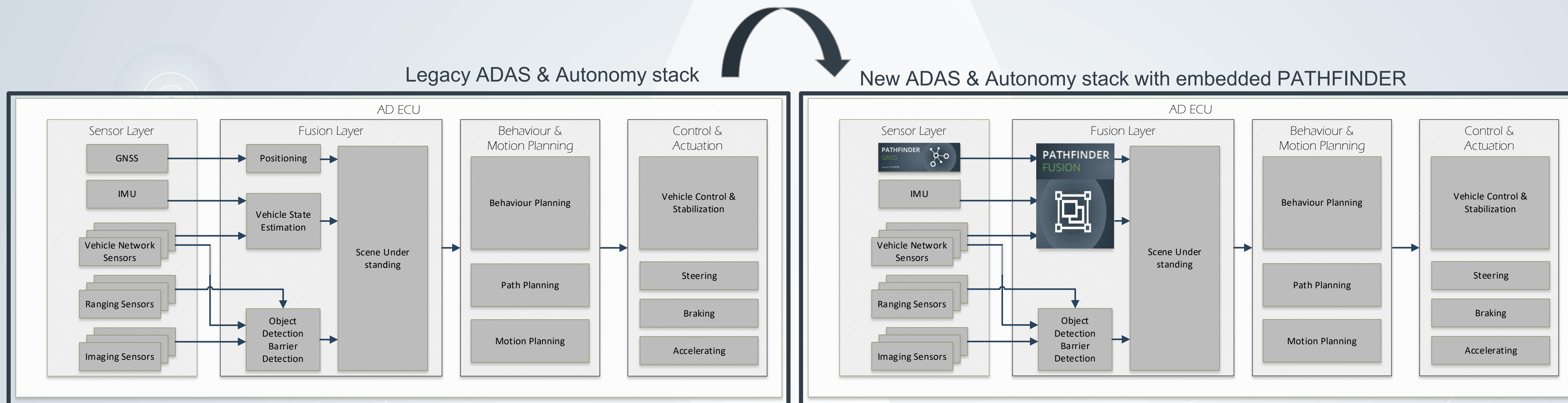
NAVENTIK PATHFINDER - The Embedded Vehicle Positioning Platform

Deepest possible integration of the satellite navigation software sensor into the vehicle sensor stack



ADAS & Autonomy Stack

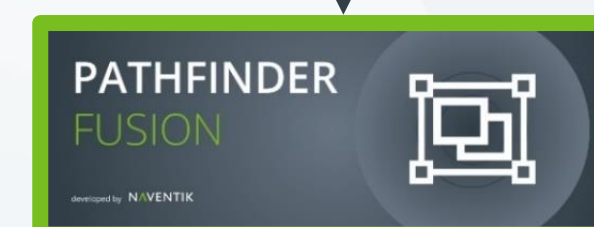
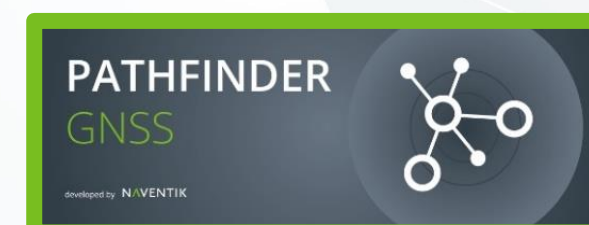
Our technology comprises two separate products, both combined to a unique positioning solution



PATHFINDER GNSS – our proprietary satellite navigation sensor utilizing the “**Software Defined Radio**” (SDR) technology for satellite signal processing - **first on the commercial market**



PATHFINDER FUSION - our **algorithms** for **combination of vehicle sensor data** (LiDAR, IMU, ...) **with measurements of PATHFINDER GNSS or third party GNSS sensors**



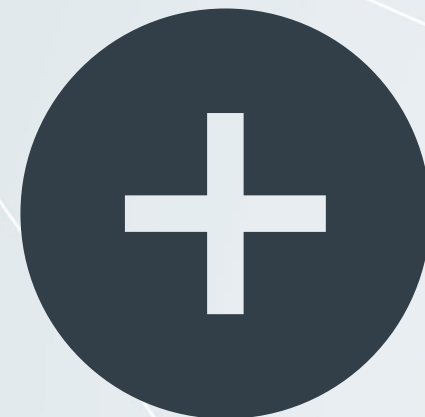
Both combined – we provide the **most comprehensive positioning platform**, combining the GNSS sensor & the fusion for the **deepest possible integration into the vehicle sensor architecture** for maximized accuracy, availability and robustness

Seamlessly embedded on the ADAS compute platform, we push the limits towards ultimate localization performance at **lowest cost, maximized scalability and functional safety**

The SDR Approach - Dedicated For The Future Vehicle ECU

The rising utilization of GPU based ADAS & Autonomy compute platforms enables our solution

Powerful GPU-based compute platforms (e.g. Nvidia Drive) are available at suitable cost levels for mass market & series deployment



With PATHFINDER - NAVENTIK provides the dedicated GNSS based positioning solution, ready to be deployed on the future vehicle ECU & highly integrated into the ADAS & Autonomy stack



Nvidia's Introduction Of ORIN Based Drive Architecture, May 2020

First market available Software Defined Radio GNSS Sensor - The complementary technology for the next generation of vehicle ECU's

ACCURATE AND ROBUST POSITIONING FOR SAFETY-CRITICAL USE CASES



Enhanced Hardware

Reference multiband hardware with high precision clock



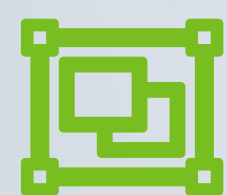
Next generation augmentation services

Precise satellite and atmospheric corrections



Advanced Algorithms

PPP-RTK positioning engine with advanced error modelling and rapid convergence times, interference mitigation and monitoring



Sensor Fusion

Adding inertial or vision aided navigation increases availability

→
Several Meter to One Meter

→
One Meter to Decimeter

→
Decimeters to Centimeters

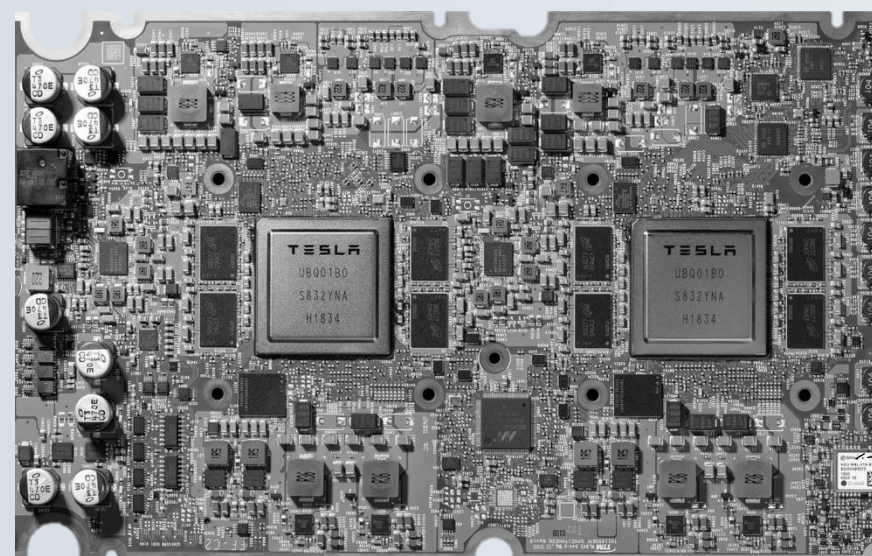
→
Continuous and Robust



WHATS ON THE HORIZON – ADAS

For SAE L2+ in serial production vehicles, the current solutions are “OK”.

- Price Range between 8 € for IVI – 40 € for ADAS L2+ is the current level of industry acceptance
- Growing demand for Integrity & FuSa will increase the requirements beyond technology capacity



Certified corrections will “**Maybe**” add Integrity & Protection Levels

- Increased “solution” price to the system cost for amortization will hit a price sensitive market
- For current GNSS sensor solutions (M8, F9), further application specific integration & fusion support will be needed to achieve the requirements for L3 & L4



For ADAS – NAVENTIK provides application specific integration support & fusion technology

WHATS ON THE HORIZON – AUTONOMY

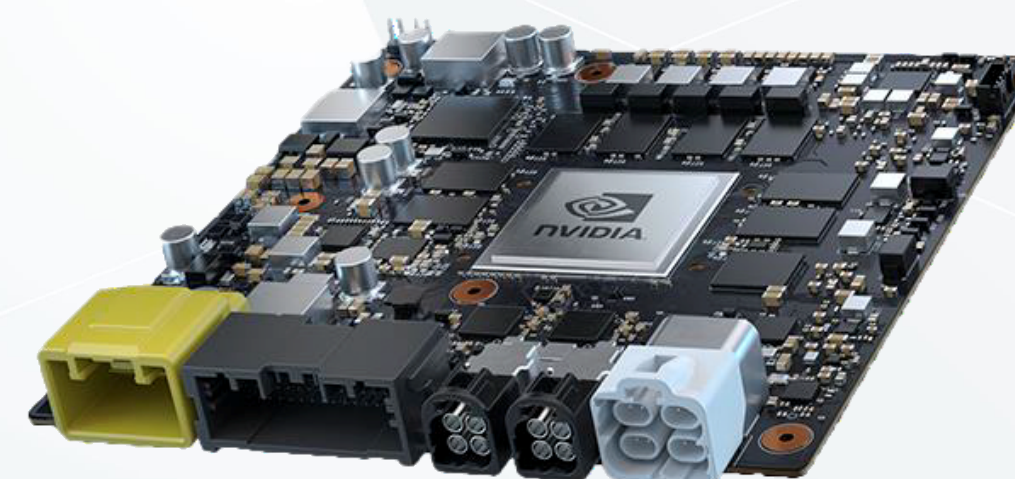
Bosch's VMPS **“Could”** be the complementary “off the shelf” sensor solution

- The current price around EUR 1.000 per unit is much too high for a deployment below the Mercedes S Class and the Audi A8 – OEM's always consider the cheapest solution
- Even willing to pay up to 8.000 USD per GNSS solution in future - Autonomy Stack System Integrators (Waymo, Cruise) will not consider “one stop shop solutions” for GNSS positioning, demanding different vendors GNSS sensors the IMU and the correction service



NVIDIA **“Is”** paving the path towards a series production ADAS & AUTONOMY GPU

- The decreasing price for processing capacity/ GPU's enables further deep integration of GNSS sensor technology and the direct embedding of signal SDR algorithms like PATHFINDER GNSS
- With PATHFINDER - NAVENTIK will provide an independent GNSS solution for Autonomy



For Vehicle AUTONOMY – NAVENTIK provides a dedicated GNSS sensor technology

PATHFINDER Deployment Examples

Our first product integration projects



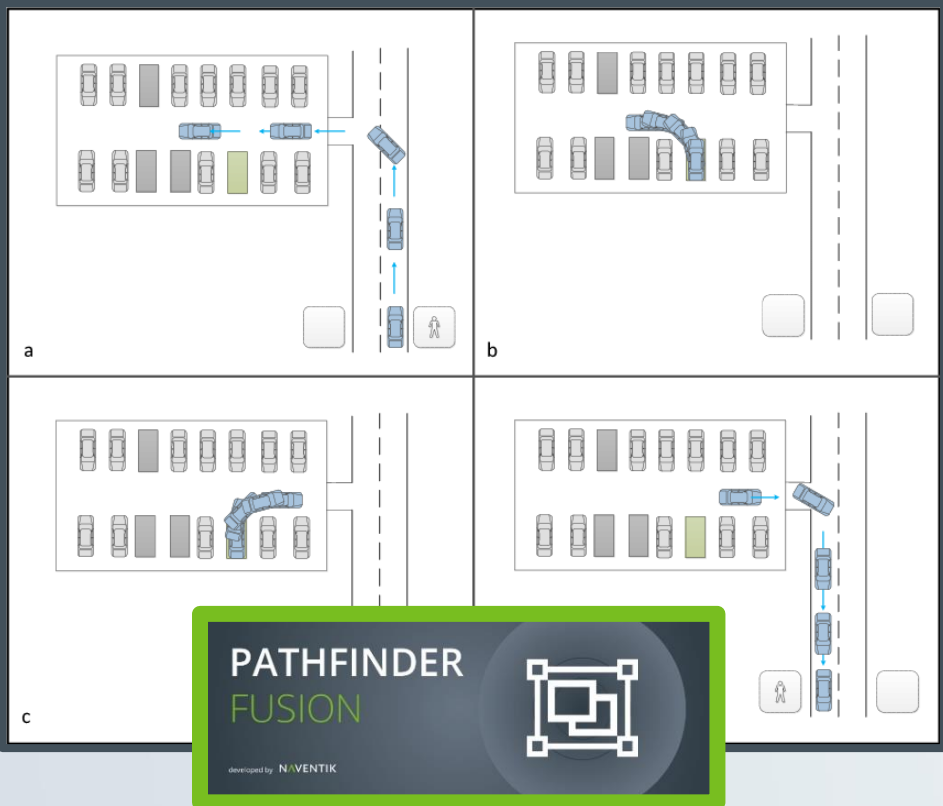
Application

ADAS Integration

Customer

Automotive
OEM + Tier 1/ China

Use Case



Automated Valet Parking (AVP)

NAVENTIK is engaged to develop the vehicle positioning engine based on GNSS & IMU sensor data, deployment of PF Fusion on automotive grade ADAS controller, development along customers functional safety requirements.

From 2021 to 2022 - Product integration & requirements development, 2023 - Start of series production (SOP)



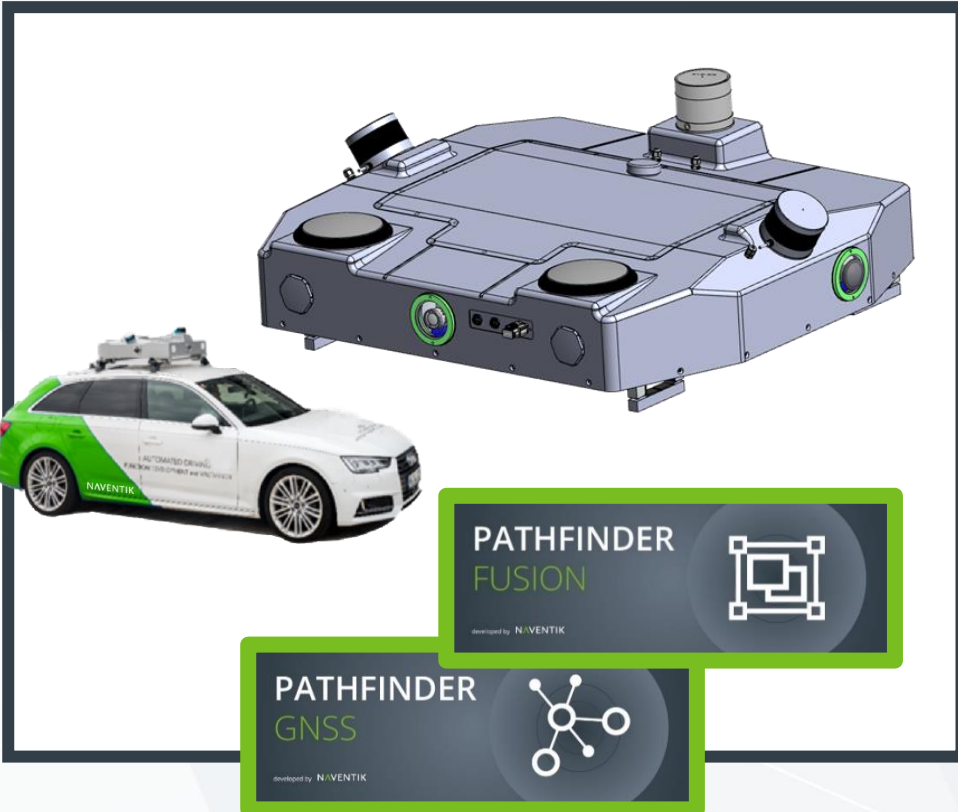
Application

ADAS Validation

Customer

Automotive Tier 1
/ Austria

Use Case



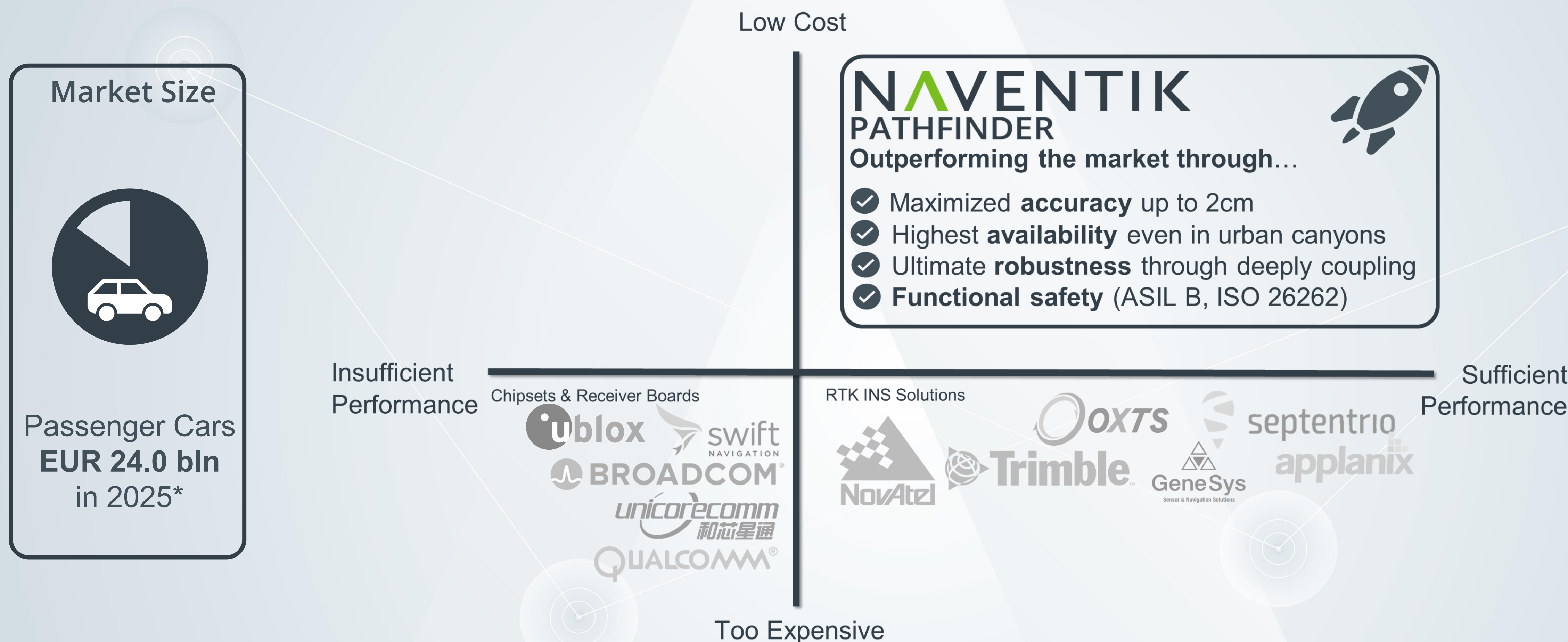
Dynamic Ground Truth (DGT)

NAVENTIK is engaged to integrate PF GNSS & PF FUSION to fully substitute the currently used RTK INS system (unit cost kUSD 85) into roof mounted ADAS validation & HD mapping product. Development of an LiDAR IMU fusion integration .

2021 - Product integration & requirements development, Mid 2021 - Start of series production (SOP)

Market Overview

Satellite navigation solutions for vehicle positioning – How we tackle u-blox F9 & Bosch's VMPS



*) GSA – Market Report 2019, segment road vehicles segment, annual volume of GNSS sensor sales to equip new produced vehicles

PATHFINDER Software Defined Radio Approach (SDR)

The first SDR solution on the market - developed considering automotive standards. The key to...

Hardware
Reduction
To **Lowest
Cost**

Data Integrity
By Real Time
Confidence Data
Generation

**Flexible
Integration**
For Different
Use Cases

Scalability
to
Series
Production

Functional Safety
Compliance
(ISO 26262,
ASIL B)

And ... Its Not Just Automotive !

Complying to Automotive Standards means Potential for Technology Deployment in further Markets & Applications that utilize next Gen ECU's and Autonomy Sensor Stacks



Trucking
PoC Successful



Construction Vehicles
PoC Successful



ADAS Validation
PoC Successful



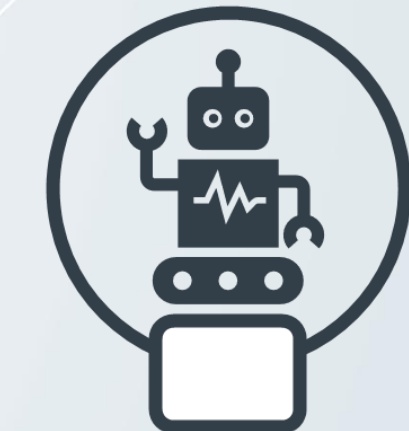
ADAS Integration
3 PoC's Successful



Railway
PoC Successful



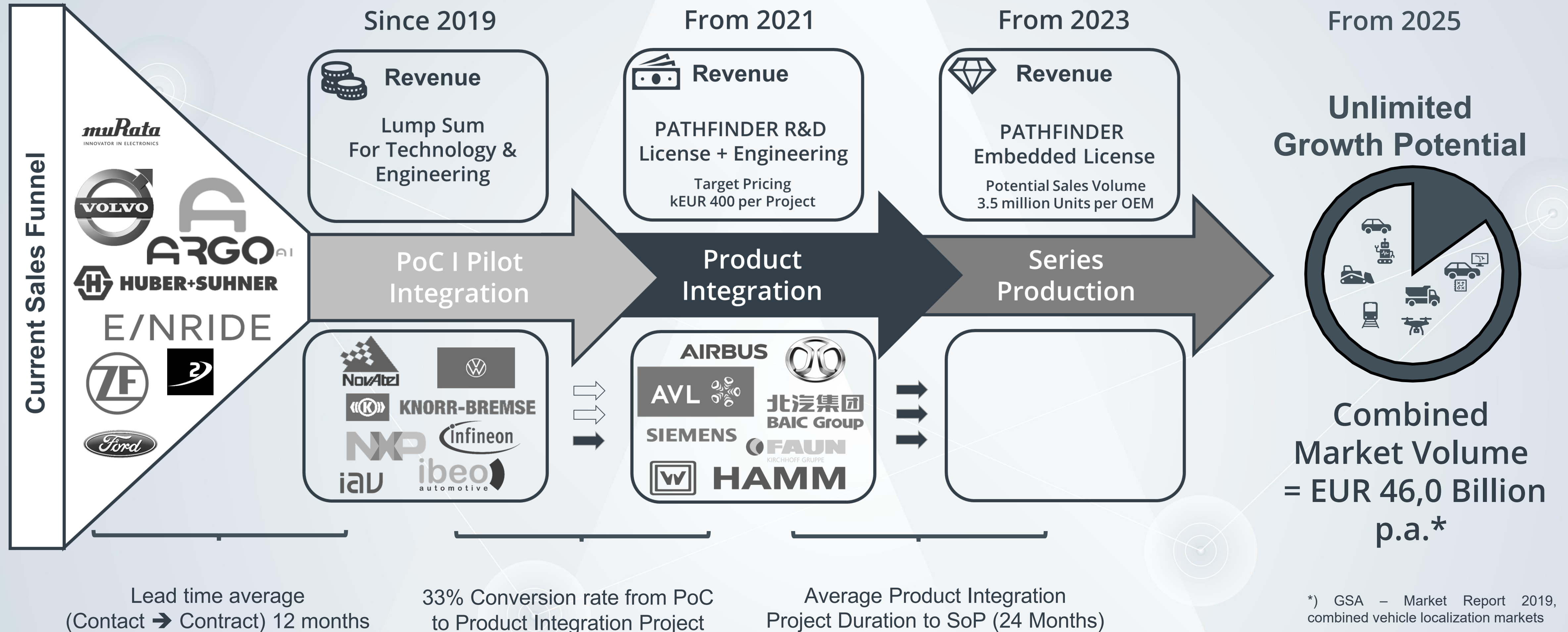
UAV's
PoC Open



Robotics
PoC Open

NAVENTIK – A Tier 1.5 Solution Provider

Technology + Know-How along the development cycle towards series production



Founders & Management Team

A strong combination of automotive R&D and management experience – collaborating since 2014

Management Team

Technology



Sven Bauer
Co - Founder
Co - CEO | CTO

- MSc. Computer Science, 8+ Years R&D Group Leader for Automotive Projects
- Co-CEO, Technology Development Lead

Business



Peter Kalinowski
Co - Founder
Co - CEO | CFO

- MSc. Business Administration, 12+ Years at EY & NSH Group
- Business Administration, Finance & Sales

Operations



Michael Jüttner
Co - Founder
COO

- MSc. Electronic Engineering, 7+ Years in Automotive Project Management
- Customer Project & Software Integration Lead

Safety



Dr. Robin Streiter
Co - Founder
Head of Functional Safety

- MSc. Communications Engineering, 8+ Years in R&D
- Functional Safety Lead

Advisor



Stefan Gottschlag
Business & Sales Advisor

- 20+ Years in Automotive
- Former CTO Preh Car Connect, Project Manager Navigation VW/ Luxoft

Team of 16 (13 FTEs): 4 senior developers, 10 developers, 1 commercial, 1 administration with unique automotive background



NAVENTIK

Our Vision

Developing
**Autonomy Means
Equip & Enable
Vehicles To Answer
Four Basic Questions:**

- 1. Where Am I?**
- 2. What's Around Me?**
- 3. What Will Happen Next?**
- 4. What Should I Do?**

We deliver

THE POSITIONING PLATFORM

To Answer The **First Question –**

The Question of **Where!** For Vehicles **On the Ground or in the Air**
Accurate, Robust, Scalable To Lowest Cost and Functional Safety Compliant!

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GRÜNDER
WETTBEWERB
DIGITALE INNOVATIONEN

 **TechFounders**

Volkswagen
**FUTURE
MOBILITY
INCUBATOR**
Dresden

 **nvidia**
INCEPTION PROGRAM

INNOVATIONSPREIS MITTELDEUTSCHLAND
GEWINNER 2017

ICG
ISO 9001
zertifiziert