



Advancing Mobility w/PNT

...and Standards!

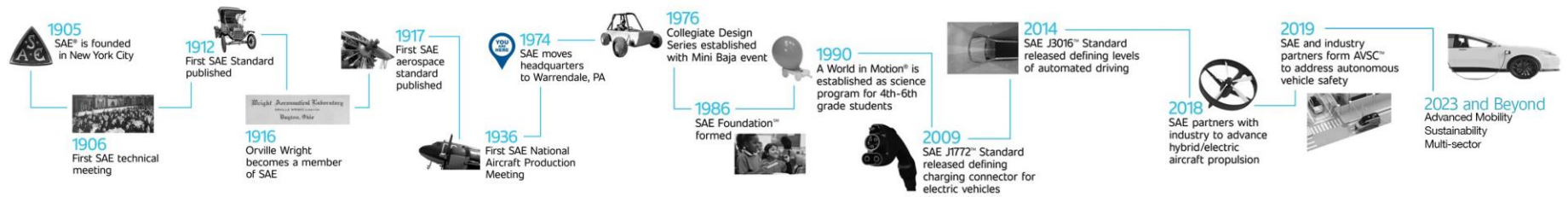
7 November 2023

SAE International provides society and the global mobility engineering community with:

- Neutral forums that convene to address society's mobility needs
- The most reliable and comprehensive collection of engineering resources that advance mobility
- STEM education and professional development programs that inspire and build mobility's current and future workforce
- [Consensus-based standards to advance quality, safety and innovation](#)
- A global community whose collective wisdom makes mobility safe, clean and accessible

1a

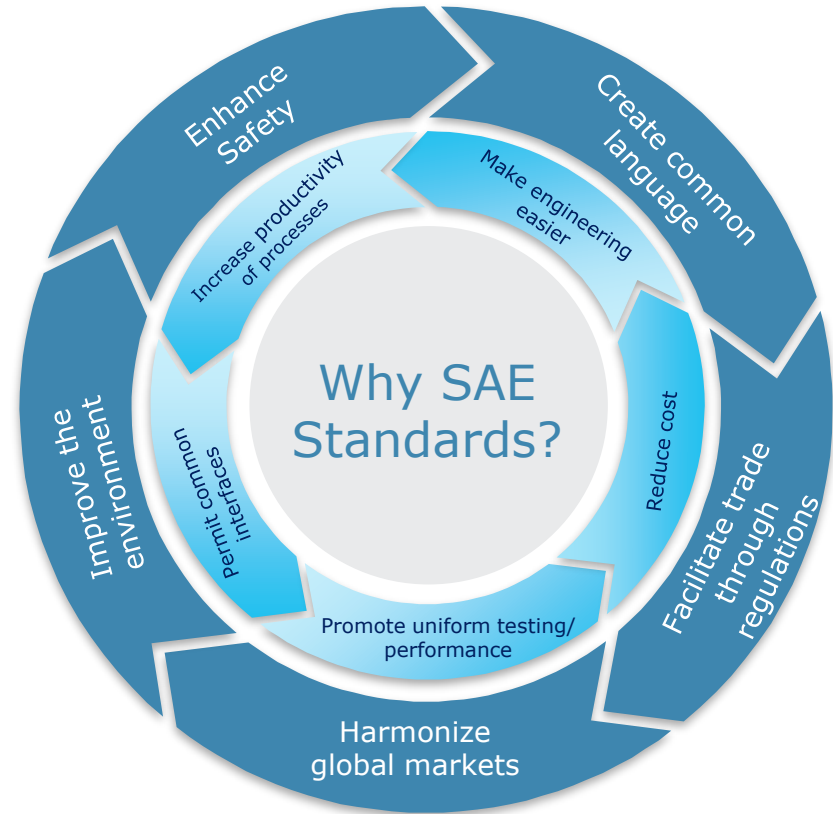
Technical Standards @ SAE International



Standards | Core to mobility engineering

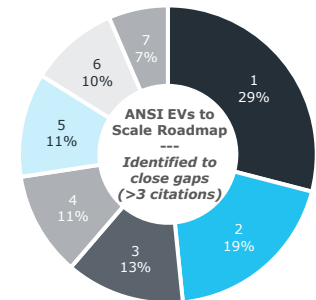
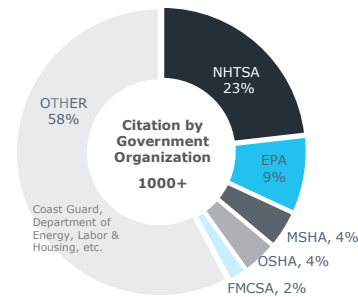
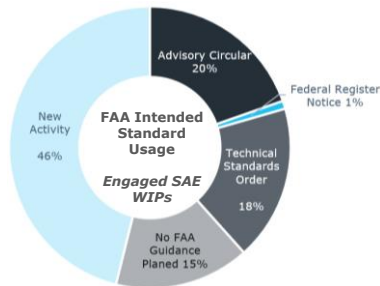
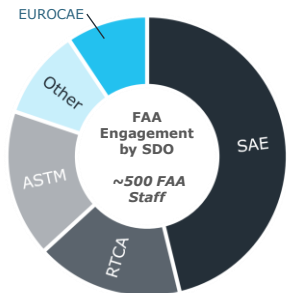
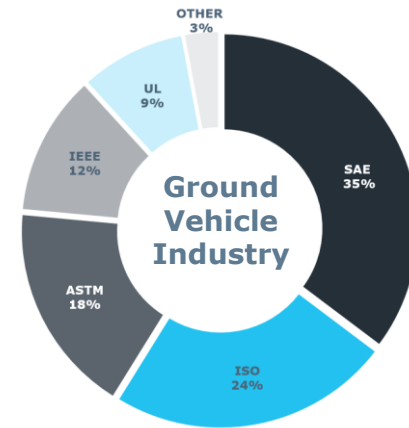
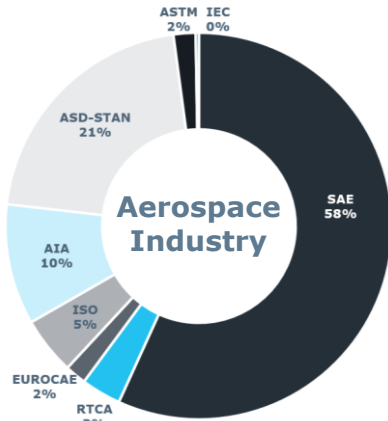
Mobility, Advanced™

- Consistent Product Quality
- Regulatory Compliance Foundation
- Compatibility & Interoperability
- Consistent and Clear Expectations for Product Performance
- Efficient & Cost Saving Procurement



Standards | SAE criticality

Mobility, Advanced™



Standards | In regulations

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1,000+ SAE standards currently cited in international regulations



1



150



87



21



402



1



42



232



3



60



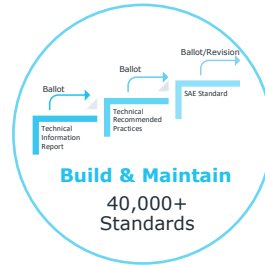
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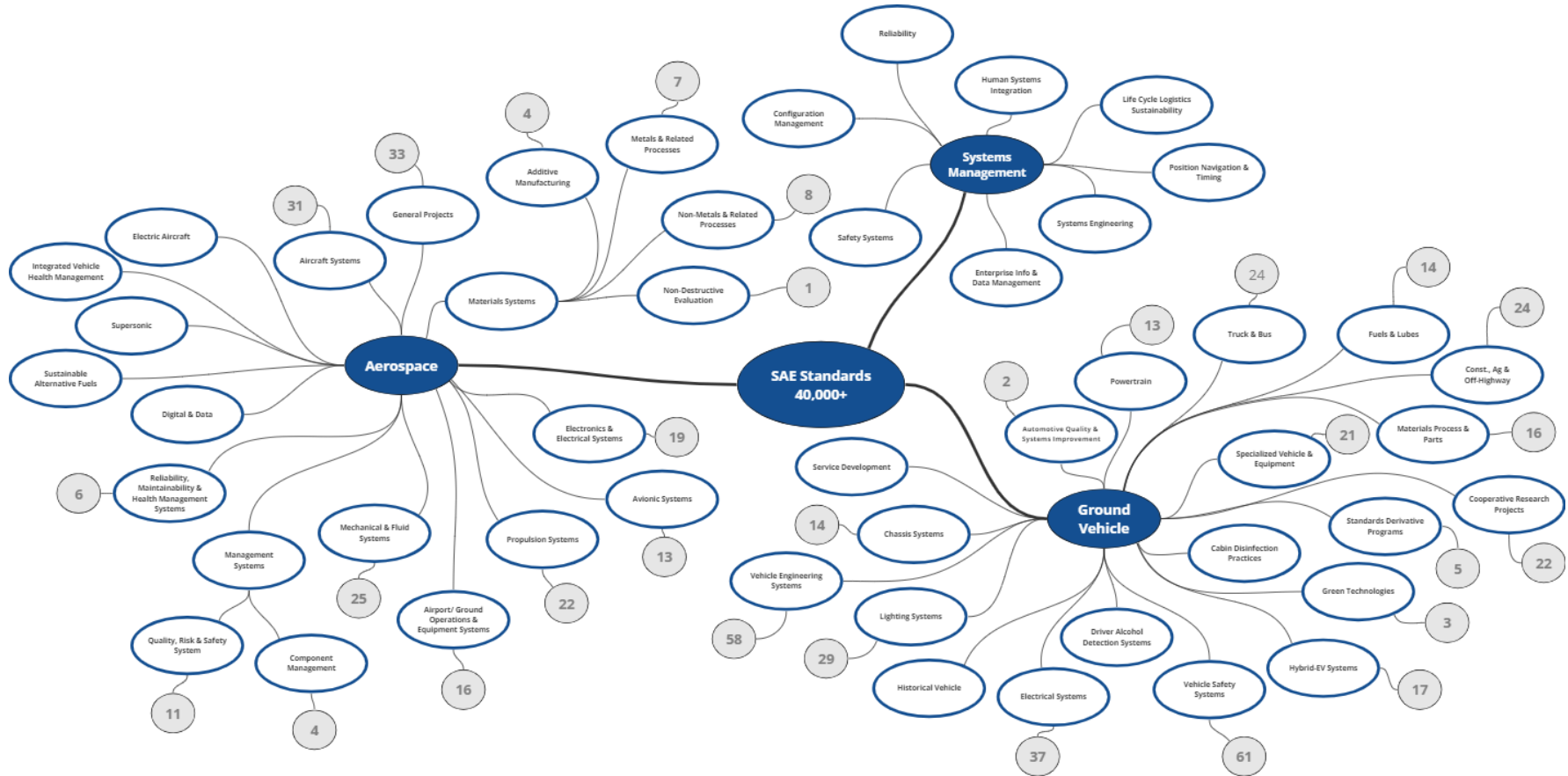
Standards | Robust infrastructure

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Standards | Technical breadth (domains)

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Achieving Precision

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~cm-precision for HAV

Camera

- Atmospheric conditions
- Obstacles, vegetation
- Changing route conditions
- Night conditions
- Glare/lighting

Lidar

- Atmospheric conditions
- Obstacles, vegetation
- Surface topography
- Surface reflectivity
- Resolution
- Cost

Why precision (and accuracy) are important

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Improve traffic flow

- Automated driving alone will make things *worse*
- Need to *increase* congestion
- *Requires* cooperative driving

Improve safety

- Accidents will happen
- Mistakes -> unexpected behaviors
- Unexpected behaviors -> accidents

Achieving Precision

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Requires combination approach

- GNSS
- Terrestrial Based Positioning & Timing Systems
- On-board sensors
- Controlled groundspace
- V2X Communication networks
- AI mapping

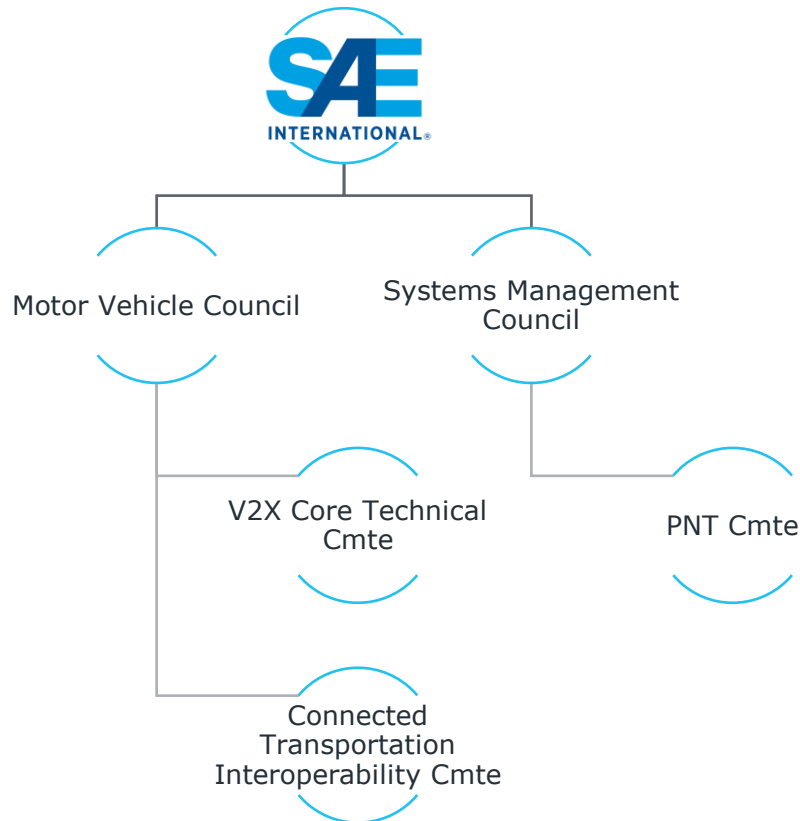
Requires cooperation across many stakeholders

- National/Supra-national regulators/legislators
- Vehicle manufacturers
- Local governments
- CONSUMERS

Requires €€€€ and prioritization

Relevant PNT Standards

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SAE 1002
U.S. National Grid Standard



SAE 6857
Req's for Terrestrial-Based PNT



SAE J2945/7
High-Precision Positioning for V2X



SAE J3258
V2X Infrastructure Support for
GNSS Corrections

Toughening a PNT System with COTS Inline GPS/GNSS Jamming Protection

- Issuing Committee: [Pnt Position, Navigation, And Timing](#)
- Rationale: There is a need to strengthen the resilience of all PNT systems without having to replace the receiver or install an expensive blocking or controlled reception pattern antenna array. COTS inline antijam antenna electronics work in conjunction with two or more low-cost fixed reception patterns antennas to toughen any PNT system by minimizing or eliminating the impacts of intentional or unintentional jamming from one or more directions.

Interesting case study by Safran:

[Using a Passive Anti-Jam Antenna to Combat GNSS Interference - Safran - Navigation & Timing \(safran-navigation-timing.com\)](#)



Figure 2 - UAS with two FRPAs and inline anti-jam antenna electronics

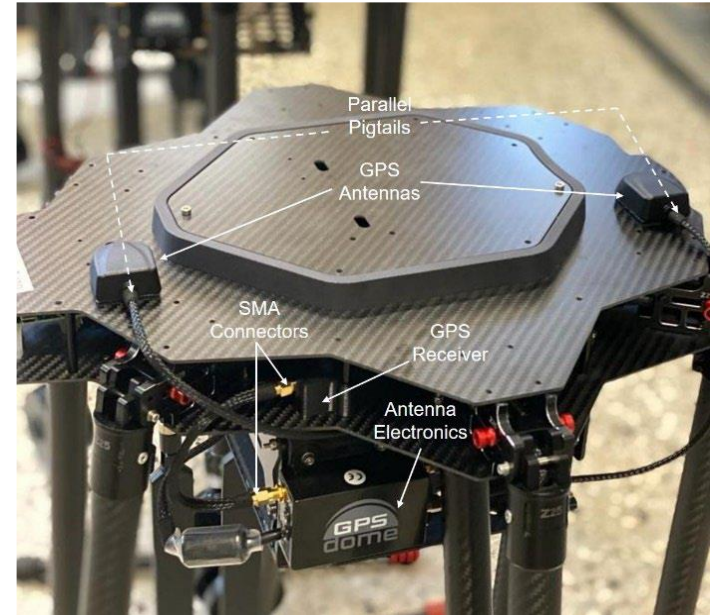


Figure 9 - Recommended parallel pigtails orientation

SAE PNT Committee

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“SAE1026 is a high visibility standard.

The DOT PNT director is aware of it and has a draft; members of The National Space Based PNT Advisory Board are aware and have a draft.

If the White House is not aware, they will be soon.”

-SAE PNT Committee

- We are introducing an approach for an **all-traffic management system**
- Concept with a single UAS use case, implementing a MIL-STD-1553 type network within a cellular network where the cellular server is the bus controller and each UAS is a remote terminal. We will emulate the way inertial and GPS data is distributed over 1553 with each UAS providing data to the server that will allow control and tracking with an accuracy up to a million times better than ADS-B.



For interest in joining the SAE PNT committee or further information on current and planned activities:

William Woodward, PNT Committee Chair
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James Farrell, PNT Committee Vice-Chair
20TH Century Navigation Hall of Fame



Thank you!



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