

OUR JOURNEY

CROSS-DOMAIN SAFETY ASSURANCE

for Automated
Transport Systems



Our Ecosystem's Achievements

Since the launch of the cross-domain safety assurance for automated transport systems in March 2023, we have been working together with the entire autonomy ecosystem across land, aviation and marine to build on the report findings, adding details and refinements to the concept.

With contributions from 38 organisations, the report already had significant buy-in from the ecosystem. However, the past 15 months have seen further endorsement and adoption internationally in each of the transport domains.

As mentioned in our March 2023 report, safety of automated transport requires two aspects: 1) engineering safety; 2) communicating safety. In the last 15 months, we have been able to achieve significant progress in each of the transport domains (acting on the report's recommendation) in both aspects of safety.

One of the key achievements has been the widespread adoption of the concept of Operational Design Domain (ODD) across aviation and maritime domains. Land (road) transport had already incorporated ODD as a foundational part of the safety assurance.

Engineering Safety

Aviation

Acknowledging the importance of the ODD concept and the need for a common understanding, the British Standards Institution (BSI) undertook an initial standardisation activity through BSI Flex 1904 v1.0, which provides an ODD taxonomy for Future Flight. This was built on the land (road) autonomy journey from the publication of BSI PAS 1883 (2020) with an ODD taxonomy for automated driving systems. This highlighted the incorporation of learnings between transport domains.

To further drive home the synergies between approaches to safety assurance between transport domains, the Law Commission has been asked by the Civil Aviation Authority (CAA) and the Department for Transport (DfT) to review the law around autonomous flight in order to support the safe development of rapidly advancing technology. This draws on a similar exercise conducted by the Law Commission between 2018 and 2022 on the review for the safe and responsible introduction of automated vehicles on the roads of Great Britain.

Furthermore, embedding a deeper systems thinking approach to safety, the UK's eVTOL Safety Leadership Group (eVSLG) (jointly led by the Civil Aviation Authority and industry) initiated a project to understand and establish the safety requirements for future policy for the safe introduction of eVTOL and drone applications. Led by CAA and supported by WMG, the University of Warwick, and the wider eVTOL industry, the policy recommendations are due to be published by Q2 2025.



Marine

The maritime domain is inherently international, and any discussions on any topic (especially safety) need to be ultimately undertaken at a global level. To this end, the UK ecosystem has been playing a leading role in building the report launch and engaging in strategic discussions with key partners in Singapore, Japan, Canada, Latvia, and Korea.

Two of these engagements are of special mention due to the scale, nature, and future opportunities. In March 2024, Lloyd’s Register and the National Physical Laboratory organised the UK-Japan Maritime Autonomy Assurance workshop in Tokyo, bringing together the stakeholders of Japan’s flagship MEGURI2040 programme and the key UK stakeholders. The need for standardisation and leveraging the concept of ODD were discussed and debated.

In April 2024, led by the National Physical Laboratory, the UK Summit was organised during the Singapore Maritime Week on maritime autonomy assurance in Singapore. The UK delegation was comprised of NPL, Lloyd’s Register, WMG, the University of Warwick, Met Office, UK Hydrographic Office, Plymouth Marine Lab, University of Plymouth, and the Alan Turing Institute.

Both these programmes were funded under the UK Government’s International Science Partnerships Fund (ISPF). As a consequence of these global engagements, there has been widespread adoption of ODD as part of the safety processes, with acknowledgement of additional concepts needed, e.g., Operational Envelope (OE).

Land (road)

One of the major transport achievements of the last year has been the realisation of primary legislation for land autonomy. In May 2024, the UK Parliament passed the Automated Vehicles Act 2024, which lays down the framework for the commercial deployment of automated vehicles on UK roads. It is the culmination of over 6 years of work from policymakers and the wider ecosystem, starting with the three-year project of the Law Commission’s review of the connected and automated vehicle legal framework.

While ODD had been initiated and adopted widely by the land domain, one of the open areas for land autonomy has been a standardised approach to behaviour specification. In our March 2023 report, we emphasised the need for a behaviour taxonomy and its corresponding standardisation. While the importance of it was well understood, there is a standard vacuum. To cater to this, BSI initiated a new standardisation activity on Behaviour Taxonomy (BSI Flex 1891) due for publication in December 2024.

Drawing on learnings from the aviation domain, better and more detailed safety management systems and guidance for simulation qualification are being developed for upcoming regulations for automated driving as part of the UK’s secondary legislation for the Automated Vehicles Act and the Automated Driving System Regulation at the United Nations Economic Commission for Europe.



Communicating Safety

Land (road)

In February 2024, Partners for Automated Vehicle Education (PAVE) United Kingdom was co-founded by the Department for Transport, Department for Business and Trade, Centre for Connected and Autonomous Vehicles, Transport for West Midlands, and WMG, the University of Warwick. PAVE UK is the first national initiative for communicating safety for land autonomy. PAVE UK's vision is to enable public trust and acceptance of self-driving technology through accurate and inclusive awareness and education programmes. Since February 2024, PAVE UK has organised five in-person public-facing events, reaching over 10,000 public audiences.

Marine

Through the UK maritime autonomy ecosystem's engagement with the Japanese stakeholders, there is an increasing emphasis on work on social acceptance of maritime autonomy. Japan's flagship national programme MEGURI2040 now has a dedicated workstream on social acceptance and communicating safety of maritime autonomy.



Our journey



March
2022

WMG introduces the concept for Cross-Domain Safety Assurance across land, aviation and maritime transport domains. Formation of working parties.



June - February
2022 2023

Series of working party workshops on Safety Metrics, Virtual Test Environments and Communicating Safety.



February
2023

Led by National Physical Lab and Lloyds Register, UK - Singapore Maritime Autonomy workshops in Singapore.

July
2023

BSI initiates standardisation work on ODD Taxonomy for aviation autonomy.



March
2023

Transport Select Committee inquiry on Self-Driving Vehicles.
WMG together with 38 organisations launch Cross-Domain Safety Assurance policy paper.

 DriveSafe AI

September
2023

Wayve and WMG £1.9 million DriveSafeAI research project launched to develop AI safety in self-driving vehicles funded by Centre for Connected & Autonomous Vehicles (CCAV).

UK's eVTOL Safety Working group (including WMG) undertakes safety analysis of future eVTOL operations in the UK.

December
2023

Led by National Physical Lab, maritime autonomy programme under ISPF programme.



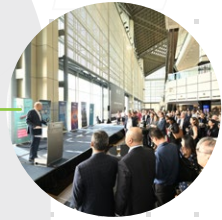
February
2024

PAVE UK launched: UK's national initiative for communicating safety for land autonomy.
BSI initiates standardisation work on Behaviour Taxonomy for land.
Law Commission launches consultation on Aviation Autonomy.



March
2024

Led by National Physical Lab and Lloyd's Register, established maritime collaboration workshop with Japanese Marine ecosystem in Tokyo. Introducing ODD-based approach.



April
2024

Led by National Physical Lab, UK Summit on Maritime Autonomy at Singapore Maritime Week.



May
2024

UK passes the Automated Vehicles Act 2024.

August
2024

WMG, NPL and Met Office contribute to the POSTbrief for MPs on automated vehicles.
BSI publishes first version of Aviation ODD Taxonomy standard.

July
2024

Civil Aviation Authority (CAA) launches project of safety assurance for eVTOLs.



September 2024

PAVE UK roundtable discussion with Minister Lilian Greenwood on Automated Vehicles Act's secondary legislation and communicating safety at CENEX 2024.

Our next steps

While the last 15 months have yielded significant achievement and progress owing to the collective effort of the UK's stakeholders, we are still in the initial stages of the long journey to realising safe autonomy across land, aviation, and maritime transport modes.

Over the next year, we will focus our efforts to strengthen existing concepts in Engineering Safety and Communicating Safety. To concretise our focus on each of the themes, more specifically, we will focus on:

Aviation

- + Enhance ODD concept for aviation autonomy through updates to BSI Flex 1904 and companion documents
- + Introduce the concept of behaviour specification for aviation autonomy
- + Liaise closely with the Law Commission's consultation on aviation autonomy to drive home the concepts of engineering safety (underpinned by ODD) and communicating safety
- + Initiate workstream on communicating safety for drones

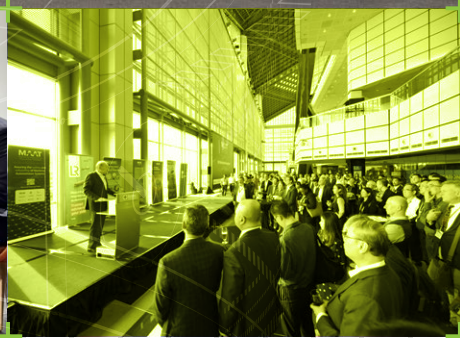
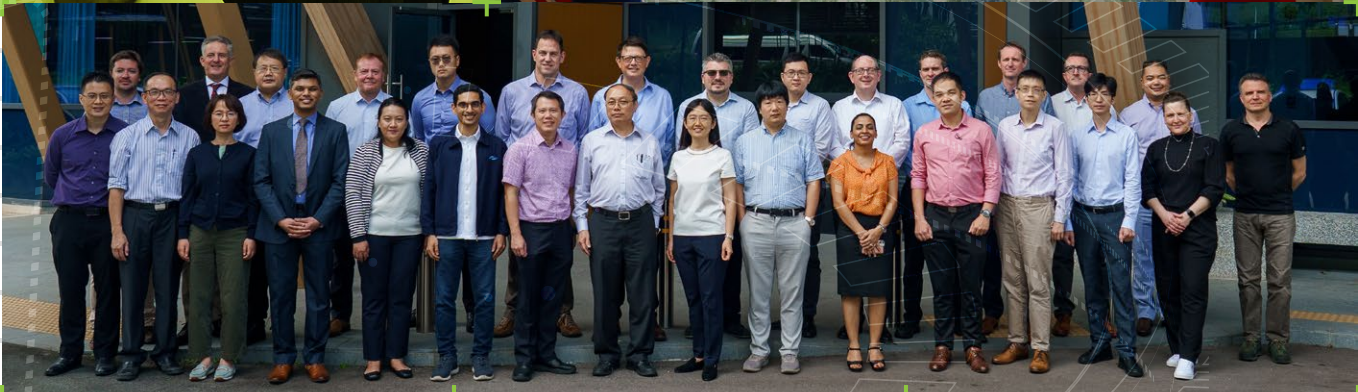
Marine

- + Concretise and drive consensus on ODD concept and its alignment with the Operational Envelope (OE) concept
- + Initiate standardisation activity for ODD taxonomy for maritime autonomy
- + Initiate standardisation activity for behaviour specification for maritime autonomy
- + Initiate workstream on communicating safety for maritime autonomy

Land

- + Develop detailed engineering requirements as part of the secondary legislation of the Automated Vehicles Act
- + Develop a media library for accurate and inclusive communication of automated vehicle concepts
- + Engage (two-way conversation) with the public on understanding and managing expectations from automated vehicle technology through PAVE UK

An overarching focus across all transport domains is to develop detailed guidance for the use of Artificial Intelligence and/or machine or Machine Learning in safety critical applications.







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