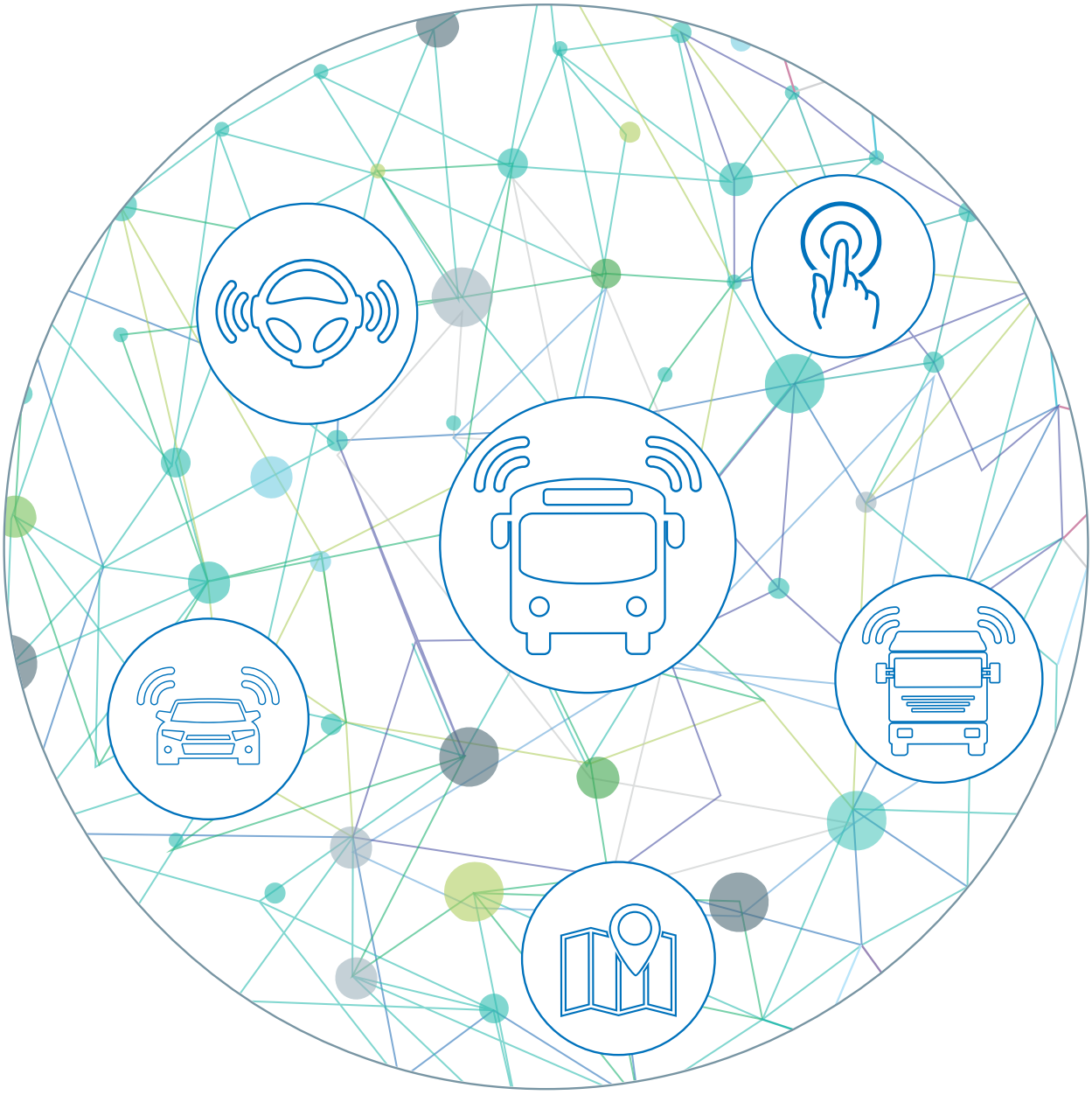
DEVELOPMENT OF AUTONOMOUS VEHICLES

Strategic Orientations for Public Action

Summary Document



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RÉPUBLIQUE FRANÇAISE

May 2018

The development of autonomous vehicles represents a considerable challenge in terms of transport and road safety policies, as well as for our industrial sector.

This document provides a summary of the strategic framework that will structure the French government's policy actions dedicated to the development of automated or driverless vehicles. The publication of this document, which follows a wide-ranging public consultation process, constitutes the conclusion of the first stage of the project I have been entrusted with by the Ministries of the Interior, Economy and Finances, and Transport, as well as the Secretary of State for digital affairs.

This resolute course of action spans three major aspects:

- first, the development of autonomous vehicles refers to both technological and industrial developments; in progressive yet rapid stages, it will become possible to safely confer more and more driving responsibilities to automated systems in terrestrial vehicles. These innovations involve personal vehicles, but also public transport and logistics/freight vehicles;
- next, the arrival of self-driving vehicles must go hand-in-hand with efforts to develop the transport sector, making mobility options greener, more accessible and more connected. The Assises de la Mobilité (a consultative convention on transport issues) held by Minister Élisabeth Borne in late 2017 brought to light the scale of change currently being observed in these sectors, involving both social and territorial requirements and the policies to be undertaken in order to meet these needs. The objective is to take full advantage of driverless technology's potential to deliver a renewed transport and mobility system;
- finally, the entire mobility and transport ecosystem will need to adapt to this technological shift. There are many questions for us to answer in terms of ethics, acceptance, insurance and responsibility, infrastructure and equipment in different regions, data, employment and skills.

The strategic framework presented below aims to address the full range of issues at hand. It will act as the cornerstone of the government's policy vis-a-vis the development of autonomous vehicles. The framework will be designed to evolve along with developing needs, so as to ensure that the development of driverless technology will be made to benefit our citizens and local regions, drawing upon the involvement of stakeholders, industrial operators and their employees, as well as laboratories and district councils.

Anne-Marie Idrac,
former minister
& Senior Head of the National Strategy
for the Development of autonomous vehicles

Priority Issues for the National government

The strategic challenges identified by the French government regarding the development of driverless vehicles cover several areas.

MODES OF USE AND LOCAL EXPECTATIONS: ensuring that services provided via automation are suitably adapted to the needs of local citizens and territories, in particular in terms of improved mobility options. Being linked to new forms of car-sharing and on-demand transport, these services could blur the lines between individual and collective transport. It is also important to encourage the emergence of new economic models, while also ensuring coherence between services and local transport policies, and capacity to deploy infrastructures which are suitably adapted to autonomous vehicles.

SAFETY: ensuring that systems being developed comply with expectations and requirements : for individual and collective safety, in terms of both road safety and cyber-security, as well as the protection of individual data. Without adequate safety levels, users will lack confidence in new mobility services. The establishment of robust safety validation systems is a major priority.

ACCEPTANCE: this is an essential condition in the development of autonomous vehicles. Acceptance of these new technologies should not be taken for granted: aside from issues pertaining to safety and suitability, other effects of automation will also affect its acceptance by the public: impact on transport options and their environmental footprint, employment, regional equality, etc.

COMPETITIVENESS AND EMPLOYMENT: on the technological and industrial front, this means ensuring that the use of autonomous vehicles benefits our innovative sectors. This, in turn, means creating a context that favours to experimentation, encouraging the development and fluent use of various technologies in terms of detection, data processing, geo-localization, algorithms, and ensuring a positive economic outcome for local regions, while also anticipating changes and supporting the transitions expected in employment and job skills.

EUROPEAN AND INTERNATIONAL COOPERATION: the international context is characterized by both stiff competition between industrial operators and regions and the development of active cooperative agreements between national governments, with a view to ensuring technology is developed safely and that markets are operating as they should. In addition, France is subject to international rules regarding road traffic and technical regulations for vehicles. We must take into account this international framework in order to ensure that it does not become constrictive, but instead acts a driving force for the development of safe, interoperable technologies that meet the expectations of our citizens (particularly via European-level cooperation).

EUROPE CONSTITUTES A UNIQUELY-SUITABLE SETTING

for the development of a framework for the deployment of autonomous vehicles, especially given the market involved and requirements in terms of interoperability. The principle of subsidiarity is also important, especially for the integration automation into mobility policies. For these reasons, the following steps will be particularly important: development of a technical regulation to guarantee vehicle safety; financing for a European program for research/innovation/experimentation/ pre-deployment, ensuring public authorities are closely involved in the steering of these activities; development of a European framework for the exchange of data produced by the vehicle in connection with its driving environment.

Orientations for Public Action

The primary objective here is to facilitate the emergence, then the deployment, of innovative automation technology, supporting technological progress via a secure framework for industry and public services, and taking into account the development of both the international framework and local expectations and needs.

The goal is also to help French companies achieve a favourable position in new markets for technological services linked to autonomous vehicles.

In order to achieve this, France has committed to a system of controlled and responsible development of autonomous vehicles, based on the following principles:

- progressiveness of the approach, based on experience ("learning by doing");
- priority given to issues of road safety and cybersecurity;
- vigilance regarding impact on mobility, the environment and public acceptance;
- importance of experimentation in order to evaluate impact and risks, moving quickly towards large-scale projects;
- consideration of all types of vehicle use;
- close cooperation between public authorities and industrial groups in order to develop a regulatory framework bolstered by thorough analysis of impacts and risks, while also integrating employment issues;
- Importance of European cooperation, particularly with regard to vehicle approval and interoperability of systems, as well as financing for research and innovation.

At the legislative and regulatory level, this involves first defining **a solid framework for experimentation,** particularly in terms of responsibilities, in order to cover the full range of modes of use to be tested. Thereafter, the process will involve preparing for the full-scale arrival of highly-automated vehicles on our roads, expected to occur between 2020-2025, **particularly in terms of traffic rules, driver responsibility, and driver training.**

The framework used to assess, demonstrate and validate the safety levels of these systems will need to be drawn up immediately, notably including methods and tools to be used for validation. This validation framework will combine, depending on use-cases, elements drawn from the UN, EU or national level. France considers this to be a priority issue, which must be managed via co-construction between government and industrial groups, with an emphasis on experimentation.

Public support for innovation and experimentation must encourage the development of systems and use cases, contributing to a shared base of knowledge, evaluation methods and validation processes (from the point of view of their economic, social relevance and acceptability).

The development of digital infrastructures and connectivity may act as an acceleration factor for the development of autonomous vehicles. The evolution of technologies involved, particularly the arrival of 5G, will lead to adopt an incremental approach based on the most mature technology (ITS-G5) and the most suitable networks available, in order to justify connectivity investments.

The exchange of data from autonomous and connected vehicles constitutes a key area for value creation through the development of transport-related services. The contractual (and, if necessary) regulatory framework should contribute to facilitating the exchange of data, while also respecting the framework for the protection of personal data and cybersecurity. The development of a national framework will also need to take into account the evolving European framework.

The orchestration of the transport ecosystem will need to combine, aside from various technical skill sets, visions and contributions from a wide range of stakeholders, including from outside the automobile industry (such as transport services, infrastructure management, digital, insurance, and national and local authorities), while also ensuring transverse connections between various modes of transport.

Priority Actions

Based on these principles, the following actions have been identified as priority actions to be undertaken by the public sector:

1. **Constructing a framework** for 2020 - 2022 to allow the use of personally-owned self-driving cars, as well as public transport vehicles and highly-automated freight delivery vehicles. Where necessary, the traffic and responsibility rules, as well as driver training, may also need to be adapted.

2. **Establishing a national framework for the validation** of automated public transport systems. Creating technical regulations and approval framework specific to autonomous vehicles at the European and international level (UN/ECE).

3. **Updating technical regulations** to integrate issues such as cybersecurity, and developing methods for threat analysis via a working group involving both the Government and industry.

4. **At the Government's initiative,** defining rules for the sharing of experiments data, as well as tools and methods for evaluations and validation of systems.

5. **Structuring a national experimentation program** that covers all types of cases use (personal vehicles, public transport, freight and logistics), involving industrial sectors and local government, thereby enabling the development of system validation tools. The "Future Investment Program" will be mobilized in order to support this approach and maintain the financial support of the national government.

6. **Constructing a framework by 2019** that will facilitate the exchange of data produced by these vehicles, thereby contributing to improving road safety, traffic management, and infrastructure maintenance, as well as the wider development of transport services.

7. **Preparing one or several plans for the deployment** of connected infrastructures, in particular via the analysis of the suitability of various technologies based on the different use-cases and road networks.

8. **Encouraging and supporting the development** of high-precision digital mapping, particularly by identifying actions that could eventually be better handled via mutualization.

9. **Implementing a system to monitor** individual and social perceptions and acceptance of self-driving vehicles, in order to identify critical issues (including ethical concerns).

10. **Carry out a detailed analysis** of the impact of driverless technology on employment and job-skills requirements.

EXPERIMENTS WITH SELF-DRIVING VEHICLES IN FRANCE

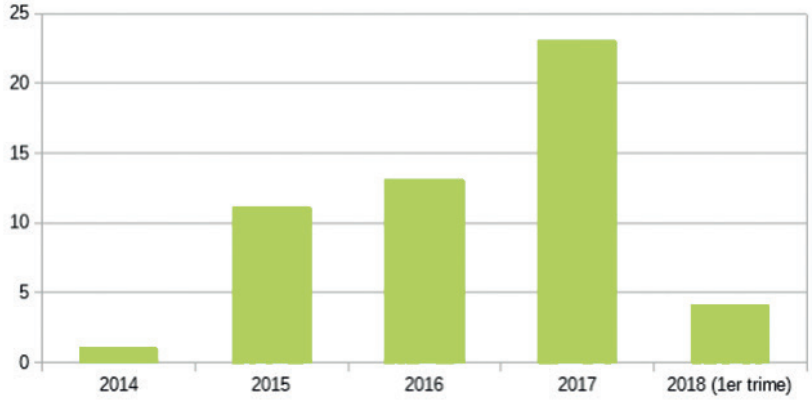
Overview

From the end of 2014 till early April 2018, 54 exceptional authorizations were given to provide "W Garage" licenses in France for the purposes of experimentation with automated or autonomous vehicles (23 of these were issued in 2017).

Among these licences, 26 involved personal vehicles (of which 11 in complex urban areas), 15 involved urban shuttles and 13 were modified certifications in order to extend the duration of validity, the geographic area or the number of vehicles covered by a processing authorization.

Since mid-2016 there has been a major increase in the number of requests to trial self-driving shuttles, mainly for demonstration purposes. In 2017, several transport operators were working with vehicle manufacturers in order to carry out experiments on a wider scale, in order to test the potential for integrating these types of vehicles into public transport services.

Annual number of test authorizations



TYPES OF EXPERIMENTS

Motorways and carriageways

This area pertains exclusively to experimentation for personal vehicles. Vehicle and equipment manufacturers have been testing vehicle functionalities with automation levels of 2 and 3 (and more recently, level 4) using the SAE classification.

Over 10,000km of road networks (motorways and dual carriageways) have been authorised for experimentation (including the entire motorway and dual carriageway network).

Experimentation vehicles have travelled a cumulative total of over 200,000km between 2015 and 2018.

Low-speed urban areas/ mid-speed peri-urban areas

This type of road traffic involves experimentation for personal vehicles designed for both public and private use. Vehicle and equipment manufacturers have been testing vehicle functionalities with automation levels of 2 and 3 (and more recently, level 4) using the SAE classification, on routes which are more demanding in terms of interactions with other users, but also more in terms of

vehicle positioning (as satellite positioning systems tend to experience more difficulties in urban centres).

Very low-speed urban areas, public transport

This traffic type involves experimentation with public transport shuttles, serving stops not currently accessible via existing public transport.
Vehicle and equipment manufacturers have been testing vehicle functionalities with automation levels of 4 and 5 using the SAE classification, along pre-defined routes (most often isolated from other road users or having low rates of encounters, over moderate distances).

Experiments and demonstrations in sparsely-populated or rural areas are currently being planned by several stakeholders.

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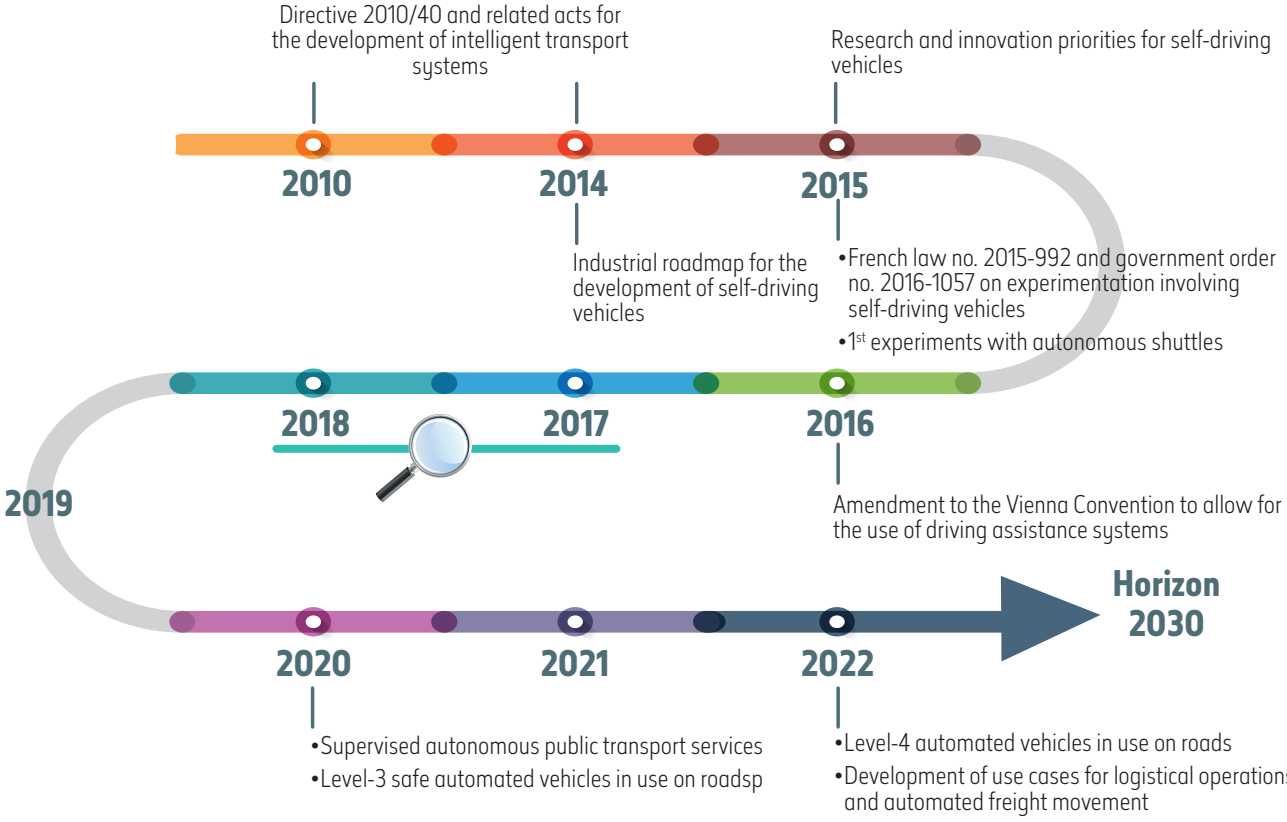
30 reports were received by the administration, and seven meetings to discuss feedback have been organised since the end of 2014.

In terms of safety, no accident causing material or bodily harm has occurred during these test runs (totally over 200,000km of journeys). However, several types of incidents have occurred, notably linked to the vehicle's surrounding environment (areas where construction is taking place, presence of toll booths, shift from a 3-lane to a 2-lane road, thick fog, objects on the road, etc.), as well as the behaviour of other road users (failure to maintain a safe distance, cutting in, cars idling on the hard shoulder when traffic has slowed down at a motorway exit, etc.)

The experiments in question have allowed vehicle manufacturers to acquire a base of driving data and to improve algorithms used by self-driving cars.

Moreover, demonstrations involving self-driving shuttles have allowed operators to present the concept to the general public, and to improve their assessment of public perception of these vehicles (and, in certain cases, of the services being offered).

Calendar



Focus on 2017-2018

Europe & International

French proposal to the EEC-UN regarding technical regulation of self-driving vehicles, using a systemic approach

European strategy for use of automated, connected and cooperative transport

2017-T1 | 2017-T2 | 2017-T3 | 2017-T4 | 2018-T1 | 2018-T2 | 2018-T3 | 2018-T4

France

Sector-based road map for the development of automated public transport

- Assises de la mobilité (consultation convention for Transport issues)
- Consultations on the development of automated vehicles
- Nomination of a national director of autonomous vehicle development

- Law on transport orientation strategy
- Industrial roadmap for autonomous vehicles updated (to reflect innovation, experimentation, employment, standardization, etc.)
- Strategic framework for public action for the development of self-driving vehicles

- Framework for road use of highly-automated vehicles (highway code, driver responsibility, driver training)
- Framework for ratification or validation at European and international level (EEC-UN); national framework for automated public transport
- Cybersecurity: technical regulations and threat analysis
- Rules for data sharing, establishing tools and evaluation methods used to validate vehicle systems
- National experimentation program regarding validation process
- Framework for vehicle data exchange
- Plans to roll out connectivity systems between networks
- Development of high-precision digital mapping
- Monitoring of individual and collective perceptions and acceptance
- Detailed analysis of impact on employment requirements and skill sets

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