BUSINESS PLAN

CEN-CLC/JTC 020
Hyperloop Systems

EXECUTIVE SUMMARY

This Business Plan of CEN-CLC JTC20 'Hyperloop Systems' describes the relevant business environment and the standardization priorities for the hyperloop development. Further it describes the scope and planned future goals for the committee. Its aim is the identification of the main objectives, critical aspects for the development of the standards for this new transport mode such as safety, interoperability, and environmental aspects. The strategies for the achievement of the CEN-CLC JTC20 work programme are included together with factors affecting the priorities, the implementation, and its timely completion.

Business Environment
The transport sector is currently facing a major challenge in keeping up with the exponential demand growth for transportation by 2050 while meeting the sustainability goals, emission targets that have been set for 2030 and 2050. Expectations are that the demand for travel will at least double between 2015 and 2050 (see OECD[1]). In order to overcome this challenge, there is a need for improvements in terms of energy consumption, supply chains, capacity and spatial integration. Failing to keep up with the demand and the sustainability will result in degeneration of the accessibility and connectivity of cities, regions and countries. An opportunity therefore exists for hyperloop, an innovative mode of transport that can help meet the transport demand as well as the sustainability goals to reach climate neutrality and reduce transport emissions by 90% by 2050. Some European countries are taking the first steps towards commercial deployment of hyperloop already.

Benefits
Standards have been supporting society and businesses across various markets and have been creating common grounds and language for producers/ manufacturers and consumer for many decades. Hyperloop is one of the transport sectors where the standardization is necessary in support of the industrialization of the sector and the development of the EU regulatory framework. In this context CEN and CENELEC established in February 2020 a joint technical committee CEN-CLC JTC20 for Hyperloop Systems (JTC20).

Priorities
Initially JTC20 will produce foundational standards and deliverables to address the needs of the hyperloop sector at this stage of development and innovation. These standards will focus on identifying existing relevant standards, stakeholder needs and generic functionality of the hyperloop systems. These JTC20 deliverables are an important market tool for technical alignment as well as industrialization and commercialization of hyperloop as a transport mode. Critical aspects such as safety, interoperability, environmental aspects as well as related testing, verification and validation will be the main objectives for these standards.

[1] Pathways to decarbonise transport by 2050 | ITF Transport Outlook 2021 | OECD iLibrary (oecd-ilibrary.org)

1. BUSINESS ENVIRONMENT OF THE CEN-CLC JTC 020 Hyperloop Systems

1.1 Hyperloop Business Environment

Hyperloop is a mode of land transportation capable of high speed and driverless operations, in which a vehicle is guided through a low-pressure tube or system of tubes, for passengers and/or cargo .

Hyperloop system invokes many engineering disciplines including structures, electronics, aerodynamics, electromagnetics, thermodynamics, controls, manufacturing and civil engineering. As shown in AECOM[2] all these disciplines are interleaved in the system, subsystem design. Hyperloop is designed to combine the best of all transport modes into a unique and disruptive mobility solution. Fully-electric vehicles will travel in a low-pressure environment at up to 1,000 km/h with zero direct emissions, using magnetic levitation and electric propulsion. The energy agnostic system could draw power from any energy source available along the route (wind, solar, etc.), serving as the backbone of a multi-modal, emissions-free mobility ecosystem.

Hyperloop could bring enhanced mobility for people, including connections to communities in urban areas with rural communities. Within the same system, hyperloop could serve as the backbone of 21st century on-demand logistics. Moreover, throughout construction and operations, job creation for the European economy would be significant. This has been shown in various feasibility studies in Europe and globally [see Section 1.2].

The World Economic Forum recognizes hyperloop transport-based services[3] as one of the twenty markets that have the potential to contribute to a broader economic transformation and drive inclusive and sustainable economic growth.

A complete observatory of various aspects to the hyperloop system has been provided by Hypernex deliverables.

The technical progress on electromagnetic traction, levitation systems and low-pressure infrastructure on the hyperloop technology has grown fast over the last 7 years. A variety of technical approaches are currently under development for hyperloop systems:

- Traction (Synchronous, Induction and reluctance linear motors; turbines),
- Levitation (Electro-Dynamic active and Electro-Magnetic passive levitation systems)
- Tube pressure levels (like civil aviation or similar to space)

The focus of the hyperloop developers is proving these state of the art technologies at high speeds in various test facilities across Europe and worldwide.

Technical alignment in the field of “hyperloop systems” is needed for building a solid foundation for further development and implementation. Developing foundational standards helps harmonization of technology developments to avoid future incompatibility.
The interest raised by hyperloop is evidenced by the participation in the Hyperloop CEN-CLC JTC20 plenary meetings of CEN members from 26 European countries, 7 hyperloop developers and observers from European Commission (DG Move), European Railway Research (EURAIL) and the railways CEN TC 256 for Railway Applications.

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[2] AECOM (2020). Preliminary feasibility of Hyperloop Technology. RFP-T8080-180829, July 2020

[3] http://www3.weforum.org/docs/WEF_Markets_of_Tomorrow_2020.pdf

JTC20 Scope

Based on the current technology development, the first step in the CEN-CLC JTC20 standard development is to define foundation standards that describe the user expectations, the functions expected, the generic requirements and the architecture of the hyperloop systems.

Going forward, in mid to longer term the JTC20 standards will provide means for complying with the essential safety, interoperability, environmental requirements. They will be used for industrialization such as compliance by suppliers, contractors and other service providers.
Standards will be required to achieve a coherent method for conformity assessment activities related to passenger and / or cargo safe and interoperable hyperloop systems.

The European Commission is currently preparing for an EU Regulatory Framework for hyperloop as noted in the workplan for 2023[4]. The expectation is that in short to mid-term JTC20 will play a key role in the legislative environment. On one hand the standards developed through consensus will provide the regulator with useful information about the state of the art of the technology, and on the other hand the standards can provide answers to specific requests from the regulator, developing technical requirements for safety, security and interoperability as well as testing and verification methodologies.

The aim of JTC20 standards is to serve as input to EU legislation and in the future as a means of compliance with EU legislation.

JTC20 Stakeholders

Standardization of the hyperloop systems is an open process to anyone including, but not limited to, small and medium-sized enterprises, large corporations, government agencies and interest groups willing to voluntarily participate and contribute to standards development.

The CEN-CLC JTC20 'Hyperloop Systems' aims at:
- developing new standards in the hyperloop field of activity assuring technical alignment, safety and interoperability of different implementations.
- building a common standardized foundation for hyperloop development

The major hyperloop stakeholder types that participate and are relevant to the JTC20 standard setting are depicted below:

JTC20 Stakeholders	Relevance of activities
Hyperloop developers	develop the hyperloop technology in line with the existing or future standards (e.g. Hardt Hyperloop, HyperloopTT, Nevomo,Swisspod, Transpod, Hyperloop One, Zeleros, etc).
Suppliers/Service providers	develop materials/ parts / subsystem / infrastructure / services that enable hyperloop technology in line with the existing or future standards
EU/national legislative authorities	public authorities such as Ministries of Transportation, Economic Development and Innovation that unlock public funding, develop standards-receptive legislation, issue standardization mandates (through EU Committee on Standards Regulation (EU) 1025/2012)

[4] EC work program: https://bit.ly/3FiqCr9

	and public procurement, help induce public acceptance of the hyperloop systems and communicate with the EU bodies;
European Commission (EC)	introduces programs allocating funding to hyperloop and develops a EU regulatory framework for hyperloop systems; mandates the European Standardization Organisations (ESOs) for development of the hyperloop harmonized standards in a standardization request (mandate).
Standardization organizations	Provides the standard setting ecosystem by ensuring stakeholder involvement and managing the standardization process (planning, phasing, voting).
National Standardization Organizations (NSOs) of EU and EFTA countries	responsible for developing European consensus and facilitate the participation of national experts / stakeholders to the JTC20
Independent research bodies	define and validate novel systems unique to the hyperloop, aid in the test planning according to the standards
Certification / inspection bodies	Validate testing results and certify interfaces, parts and processes for commercial use.
Customers / Users	Infrastructure managers, hyperloop operators and users/passengers' associations.

1.2 Quantitative Indicators of the CEN-CLC JTC20 Business Environment

The technological innovation and improvements yield successful market deployment when backed by profitable business models. The business model first input is raw demand volume, followed by customer and public acceptance.

[5] [6] [7] [8] [9] and other parts of the globe[10] [11] [12]show that improved accessibility through hyperloop would strengthen the spatial-economic business climate in the regions where hyperloop would be deployed. Due to the huge potential of hyperloop, EU countries have **funded the development of hyperloop initiatives** in Europe via EIT Climate-KIC[13], EIT Innoenergy[14] and EIC Accelerator [15] as well as through public-private partnership such as HDP[16] with Dutch government funding.

[5] Cargo Hyperloop Holland

[6] https://zeleros.com/hyperloop-vision-2050-global-network/

[7] Vlaanderen ziet toekomst in transport via hyperloop | Agentschap Innoveren en Ondernemen (vlaio.be)

[8] North Holland study

[9] Y Line Study (Poland, currently available only in Polish)

[10] South America: https://www.hyperlooptt.com/2021/south-americas-first-hyperloop-feasibility-study/

[11] USA: Great Lakes Hyperloop Feasibility Study

[12] Feasibility study results of the TransPod project in Alberta - TransPod

[13] EIT Climate-KIC hyperloop project

[14] EIT Innoenergy hyperloop projects (Hardt, Nevomo, Zeleros)

[15] EIC accelerator: Hardt, Nevomo

[16] Hyperloop Development Program

Some European countries, such as Italy[17], are taking the first steps towards commercial deployment of hyperloop already.

In addition in Europe hyperloop is included in **key plans of the EC**:

1. **Sustainable and Smart Mobility Strategy (SSMS):**

- The new strategy will back the innovative modes of travel as well as setting ambitious targets for zero-emissions vehicles on Europe's roads by 2050. Flagship Seven lays out plans to "validate new technologies". It claims that the EU will put in place favourable conditions for the development of new technology and services. Hyperloop travel is singled out by name, as are hydrogen-powered aircraft and personal electric aircraft. **(Link, page 13 article 64).**

- **Action Plan on SSMS (page 24)**:

    - **Action 47**: Assess the need for regulatory actions to ensure safety and security of new entrants and new technologies, such as hyperloop (2021).

    - **Action 48**: Set up a high-level group ('New Mobility Tech Group') as a first step toward the development of a coherent EU approach and a set of recommendations on facilitating testing and trials of emerging mobility technologies and solutions in the EU ('European Mobility Test Beds')

2. **TEN-T regulation revision proposal:**

- In line with the Action Plan included in the EC's Communication on the European Green Deal, a legislative proposal for a revision of the TEN-T Regulation has been presented to the European Parliament on 14 December 2021. The revised TEN-T Regulation is strongly focused on shifting towards cleaner, greener, and smarter mobility. At the same time, the TEN-T Regulation shows commitment in supporting and promoting hyperloop as one of the innovative technologies enabling the decarbonization of transport **(See Article 44, link)**

3. **EUROPE's RAIL (former Shift2Rail) Masterplan: Link**

- Europe's Rail will promote forward looking activities, tackling disruptive technologies and thinking, performing exploratory research to accelerate the pace towards radical system innovations in the guided transport modes and supporting the evolution of the Innovation Programme in scope and targets **(4.2.2.7, pg 42)**

- Exploratory research and paradigm shift activities may address the following **(pg 42 en 43)**:

    - Research on emerging technologies or their critical subsystems, including maglev/magrail/aerodynamic propulsion and vacuum tube technologies, such as hyperloop solutions.

    - Studies of ultra-high speed (beyond 500 km/h) trains and synergies with nonconventional and/or emerging new modes of transport (e.g., HyperloopTM)

4. Finally, it is important to underline the extremely positive **point of view of ERA** regarding hyperloop as described in the Chapter 9.5.1. "*Product alignment*" of the Observatory [18]:

[17] Venice-Padua project

"The hyperloop is a hard innovation whose technology leap need is offset by its huge benefits, because, from its inception, it includes all mobility criteria that spring from customer demands: clients, users and even non-users that are affected by the presence or operations of the system and accounts for the societal demands given the strong focus on sustainability."

The Hypernex project[19] in its published report [20] has identified several competitive factors in favour to the hyperloop:

- significant reduction in end-to-end journey times relative to both air transport and maglev rail;
- very high operating frequencies;
- resilience, to weather conditions which may affect punctuality and cancellations;
- integration to high demand routes due to high costs entailed for the hyperloop infrastructure.

In this report it is observed that if there is an HighSpeedRail (HSR) service with a ticket price in similar range and considering that most HSR city pairs are within distances of 750 kilometers, given the chance to select, the majority of passengers will choose the land transport, and if there is a train, they will take the train. This an area that provides an opportunity for hyperloop.

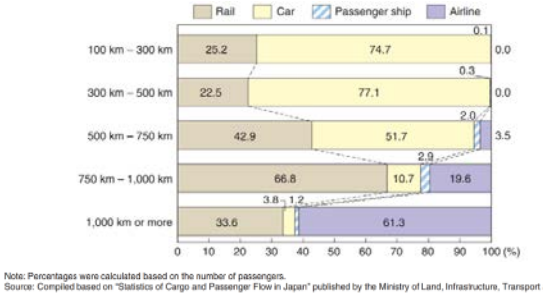

Figure 1- Airline and rail supporting medium and long-distance transport in Japan in 2007

The goal of hyperloop's transport services for passengers is to combine the best of rail and aviation into a new transport mode that is convenient, seamless in experience, safe and reliable. The image below as presented in Hyperconnected[21] report shows the benefits of rail and aviation combined into what hyperloop can offer.

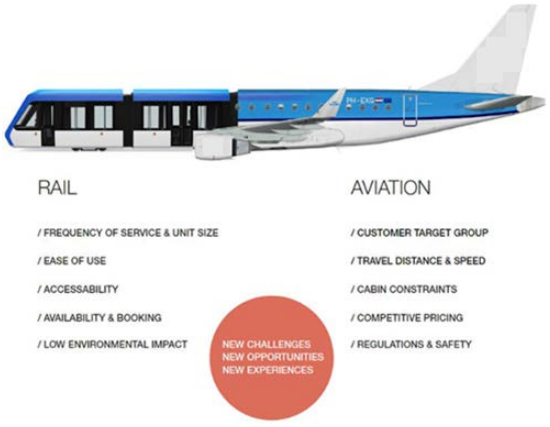

Figure 2. Hyperloop positioning as a modality. Graphic by Schweizer design

[19] Financed by the European Union within the Shift2Rail program (S2R), with a partnership of 24 Research and Public organizations, 8 private companies and 5 public and private initiatives

[20] Hypernex: Deliverable D 2.1- Observatory results

[21] Hyperconnected Europe Phase 1 Report

As the Hypernex report has shown this translates into several advantages in terms of **Comfort and Reliability, Speed, Infrastructure cost and Environmental aspects**. The relevant text is extracted below:

Comfort & Reliability (extracted from Hypernex D2.1)
The features of hyperloop will allow to challenge the aviation monopoly in certain distance segments, allowing for the modal shift to happen. It will be demonstrated that, within these segments, hyperloop can be the potential solution of choice for users because of comfort and reliability, and because of sustainability backed primarily by customers (public and private operators), that will be pushed by regulators and users. Environmental regulation will play a fundamental role.

As a framework to compare, the door-to-door concept helps to understand burdens of different technologies. In this Figure 3 it is possible to observe how aviation suffer limitations as the airport is by nature located out of the city and, the process to access the vehicle is also much more intense and time consuming in general, due to security and logistic reasons.

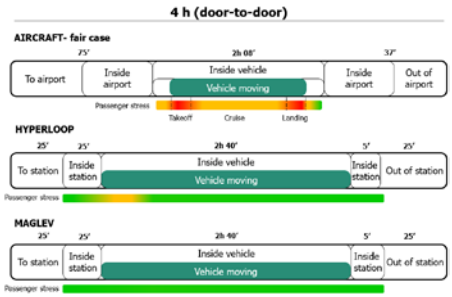

Figure 3 – Journey times breakdown: Aircraft, Hyperloop and Maglev

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Competitiveness regarding Speed (extracted from Hypernex D2.1)
The hyperloop greatly opens the possibility of extending the range of routes where comfort and environmental friendliness can be paramount. Compared to the 4 hours of the HSR, the hyperloop will stay at 100 minutes on a 1,000 km route. This implies the possibility of adding a dramatic improvement in terms of speed see Figure 4.

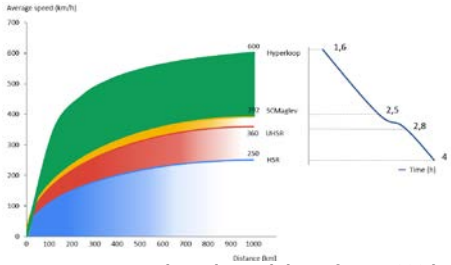

Figure 4. Average speeds and travel times for a 1,000 km route

Competitiveness regarding infrastructure cost (extracted from Hypernex D2.1)
The average cost of HSR is 36 M€/km (Armitt & Houghton, 2016) and has been maintained for the UHSR (Ultra-High Speed: over 300 Km/H) despite the added requirements (Figure 5). The chart also showcases how all different maglev solutions have higher infrastructure costs than HSR, a key factor for their lack of market penetration, together with their marginal speed advantage compared to a potential HSR evolution. On the other hand, the hyperloop shows different cost depending on the pressure of operation and propulsion system. Thus, for a aviation pressure levels mimics HSR costs, thus making it more suitable for long distances. This is why this solution might be especially suitable for long distance hyperloop routes, where the business case would be negatively impacted by growing Capital expenditures.

similar speed benefit, the proposal of one developer of the consortium shows most active key technologies on-board (propulsion, energy storage, levitation) and a much simpler infrastructure that works with

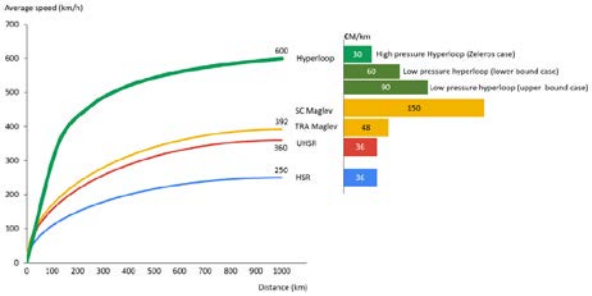

Figure 5. Infrastructure cost of land transport

Environmental care (extracted from [Hypernex D2.1])

Finally, being a 100% electric transport with zero direct emissions, hyperloop can enable the decarbonization of operations in those aviation routes where emissions per passenger/kilometer are more penalized: short to medium distance routes, where aviation efficiency levels are at its lowest (ICCT, 2020). These facts, added to the fact that hyperloop can be brought to city centers given its reduced needed space and low acoustic impact, adds key elements for users to promote a modal shift from the regional aircraft on those routes of less than 1,500 Km

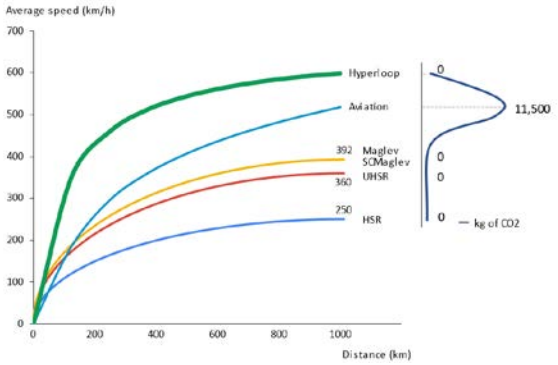

Figure 6 - Emissions of current transport solutions for a 1,000 km route

2. Benefits expected from the work of the CEN-CLC JTC20 Hyperloop Systems

The development of European standards benefits hyperloop development and its deployment in the following generic aspects:

- building a common standardized foundation for hyperloop development
- fostering the technical alignment
- fostering the agreements on common safety targets
- fostering the agreements on interoperability

- strengthening the spatial-economic business climate
- fostering the development of the industrial environment
- fostering the cost's optimization
- accelerating the development of the hyperloop system through more synergies
- removing technical trade barriers
- building up trust for public acceptance necessary for hyperloop market scaling up.

3. Participation in the CEN-CLC JTC20 Hyperloop systems

All the CEN / CENELEC national members are entitled to nominate delegates to CEN / CENELEC Technical Committees and experts to Working Groups, ensuring a balance of all interested parties. Participation as observers of recognized European or international organizations is also possible under certain conditions. To participate in the activities of this CEN-CLC JTC20, please contact the national standards organization in your country.

Currently 24 Standardization bodies are participating and following the CEN-CLC JTC20 work: Austria (ASI), Belgium (NBN), Bulgaria (BDS), Cyprus (CYS), Czech Republic (UNMZ), Denmark (DS),

Finland (SFS), France (AFNOR), Germany (DIN), Hungary (MSZT), Iceland (IST), Italy (UNI), Lithuania (LST), Luxembourg (ILNAS), Netherland (NEN), Norway (SN), Poland (PKN), Portugal (IQP), Serbia (ISS), Spain (UNE), Sweden (SIS), Switzerland (SNV), Türkiye (TSE), United Kingdom (BSI).

4 OBJECTIVES OF THE CEN-CLC JTC20 AND STRATEGIES FOR THEIR ACHIEVEMENT

One of the biggest hyperloop development milestones reached so far at the European level is the creation of a Joint Technical Commitee CEN-CENELEC/JTC 20 (JTC20), which was promoted by the Spanish Association for Standardization (UNE) and the standardization body of the Netherlands (NEN) in October 2020.

4.1 Defined objectives of the CEN-CLC JTC20

The objective of the JTC20 is the standard setting in support of the development of the EU regulatory framework. European Standards (ENs) will be needed not only for complying with the technical requirements of an EU hyperloop related legislation, but also in drafting these requirements by assisting the policy makers at the national and European level. Closer coordination between EU/government driven regulation and industry driven standardization will allow for maximizing synergies in supporting innovation [Ref]. This will enable shorter time to market and return of investments for hyperloop developers and all other stakeholders.

The objective of CEN-CLC JTC20 is to in:

- Short term: develop foundational standards to enable technical alignment necessary for the hyperloop development
- Mid-term to long term: development of the technical standards in support of technical development of systems, sub-systems, safety, interoperability, environmental essential requirements and testing, verification and validation.

The CEN-CENELEC organizations will be ultimately in charge of generating and promoting the new standards that will allow the introduction into the market of safe hyperloop systems and to achieve the maximum possible interoperability of services throughout Europe, mainly seeking the functionality of the service and its operability at continental level.

The JTC20 will elaborate a set of European Standards in the hyperloop sector that are a result of stakeholder proposals. The first set of proposals have been proposed by stakeholders in France, the Netherlands, Poland and Spain.

These are proposals for the foundational standards and deliverables to address the stakeholder needs, definitions and generic functionality of the hyperloop systems. They are an important market tool for industrialization and commercialization of hyperloop as a new transport mode.

4.2 Identified strategies to achieve the CEN-CLC JTC20 defined objectives

Establishment of the Leadership and Working structure

The Chairmanship of CEN-CENELEC/JTC20 is hold by Spanish maglev and ERTMS expert Dr. Jaime Tamarit (UNE, Spain) and the proposal for the creation of the CEN/CENELEC JTC was put forward by Spanish UNE and Dutch NEN normalization agencies in 2019. In the first plenary

meeting the chairman's nomination was submitted to the CEN Technical Board who later approved it. The creation of 2 working groups was proposed and the initial working structure was settled.

The working structure, the working groups, and the Advisory Group were defined in detail along further plenary meetings held in February, July, and October 2021 and in February and June 2022. All decisions adopted by the JTC20 were approved by the CEN Technical Board.

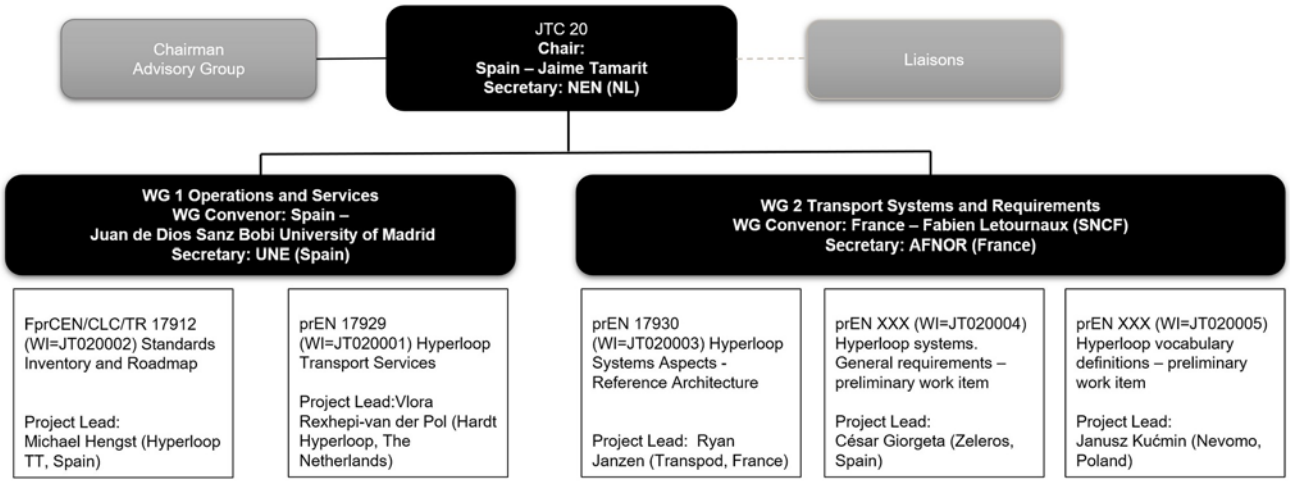

Figure 7 – JTC20 structure approved by the plenary meeting of 06/30/2022

The Chairman Advisory Group

The Chairman Advisory Group (CAG) aims at advising the JTC20 chairman on the preparation of the plenary meetings. The plenary meetings are held two times every year.

After approved by the plenary meetings held on 11th June 2021 & 30th July 2022, members of the CAG are (with the right to vote):

- **Chair**: Chair of the JTC20;
- **Secretary**: Secretary of the JTC20;
- **Convenors** of Working Groups;
- **The Work Item leaders**;
- **Nominated experts** (7 experts appointed by the national delegations and approved by the plenary meeting of 30th July 2022)

The Working Groups

The aim of a Working Group can be summarized in the following points:

- Ensure WG experts have appropriate briefing on relevant rules and procedures.
- Promote WG consensus, take attention to quality of technical content, interim draft and standard draft to JTC-20 secretariat.
- Specific WI: guiding and supporting WI leaders, monitoring deadlines
- Build a team:
  - Getting trust between experts
  - Promoting consensus
  - Work progress communication

- Coordination WG1-WG2
- o Reporting to JTC20 secretariat,
- o Contribute to the Chairman Advisory Group

Two working groups are settled to deal with Operations & Services (WG1) and with Transport Systems & Requirements (WG2)

Working Group 1: Operations and Services with a total of 48 experts from 9 countries, is managed by Juan de Dios Sanz Bobi (UNE, Spain), with the assistance of the secretary Javier López (UNE, Spain).
Working Group 2: Transport Systems & Requirements with a total of 45 experts from 8 countries is managed by Fabien Letourneaux (AFNOR, France) with the assistance of the secretary Eric Balcaen (AFNOR; France). This Working Group holds management meetings with a frequency of three meetings by year.

Work program of the CEN-CLC JTC20 Hyperloop systems

The initial set of JTC20 deliverables are created utilizing the system engineering principles. Through these principles the strategy is to focus on the technical alignment of the functionality of the hyperloop systems instead of diving directly into the various state of the art technical solutions currently being developed by the hyperloop developers.
Utilization of systems engineering principles in drafting of the foundational standards in JTC20 shall provide a solid base for hyperloop development as well as future hyperloop standards.

The current work programme of the JTC20 consists of five projects divided among the current two working groups
In December 2020 the European countries agreed to start the work on:

1. **WG1: FprCEN/CLC/TR 17912** (WI=JT020002) Standards Inventory and Roadmap – expected publication in 2023

Led by Michael Hengst (Hyperloop TT, Spain) this Work Item was activated in February 2021
Final prTR for Standard Inventory and Roadmap was adopted during the 4th WG1 meeting (Madrid, June 29, 2022). Fully coherence to adjusted Project Plan (deadline July 7, 2022)

2. **WG1: prEN 17929** (WI=JT020001) Hyperloop Transport Services – expected publication in 2024
   Led by Vlora Rexhepi-van der Pol (Hardt Hyperloop, the Netherlands) this Work Item was activated in February 2001. Final WD for Transport Services was adopted during the 4th WG1 meeting (Madrid, June 29, 2022). Fully in coherence to adjusted Project Plan (deadline September 1, 2022)

3. **WG2: prEN 17930** (WI=JT020003) Hyperloop Systems Aspects - Reference Architecture – expected publication in 2024

Leaded by Ryan Janzen (TransPod, France) this Work Item was activated in February 2021 with the aim of providing an enquiry draft by beginning of September. Final WD was submitted according to adjusted Project Plan (deadline September 1, 2022).

In January 2021 the European countries agreed to start the work on:

1. **WG2: prEN XXX** (WI=JT020004) Hyperloop systems. General requirements – preliminary work item

Led by César Giorgeta (Zeleros, Spain), this preliminary Work Item was activated in February 2021 for a maximum of three years.

2. **WG2: prEN XXX** (WI=JT020005) Hyperloop vocabulary definitions – preliminary work item
   Leaded by Janusz Kucmin (Nevomo, Poland), this preliminary Work Item was activated in February 2021 for a maximum of three years

The work on all projects is executed in parallel in close coordination between the projects. The next step is activation of the preliminary work items in 2023.

Safety, Interoperability and standardization
The possible existing combinations between vehicle, control systems, supervision systems, traffic management systems, etc. are, by all accounts, many. It should therefore be considered that the hyperloop in order to achieve its full potential must be a safe and interoperable system. As a first step technical alignment is necessary. CEN-CLC JTC20 will define, establish, and standardize the methodology and framework to align hyperloop systems and ensure interoperability and high safety standards throughout Europe.

Liaisons

Addressing safety and interoperability in an appropriate way requires close cooperation between legislative and technical standardization efforts. Without appropriate standards or legislation, the European industry will lack its unified approach. Involved European holders.
Stakeholders are the EC Departments of DG Growth, DG Move, Joint Research Centers, DG RTD and a delegation of the European hyperloop industries. Initial meetings with hyperloop developers underline the positive attitude of the EC towards this principle of transportation.
At European level, the experience from CEN/TC 256 and CENELEC/TC 9X is of great value. In addition, the experience from international committees ISO/TC 269, ISO/TC 20, IEC/TC 9 will be an important input, among others. To which a liaison is established.
The incorporation of other interested bodies like UIC (International Union of Railways), European Infrastructure Managers (EIM) and European Rail Freight Association (ERFA) also underline the positive attitude of these institutions towards hyperloop.
In general terms, all interested bodies are invited to participate actively in the standardization work performed by the JTC20 Hyperloop Systems

4.3 ENVIRONMENT

Hyperloop is designed as a highly energy efficient system with zero direct emissions. As such it is inherently by design a sustainable mode of transport.

The target for hyperloop is to use less energy and resources per passenger than any other transportation modes by terms of less waste and lower costs. Additionally, it has the possibility to be completely powered by renewable electricity.

Standards shall consider environmental impacts in all stages of the life cycle as laid down in the available CEN/CENELEC guidelines, such as CEN/CENELEC guide 4 available in BOSS, and beyond. Thereby ensuring that the standards play a key role in enabling more efficient use of energy

and natural resources, as well as preventing unfavorable environmental impacts. Possibly resulting to higher levels of public trust and customer satisfaction.

5. FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE CEN/JTC 020 WORK PROGRAMME

CEN/CENELEC JTC20 operates in a complex environment with many players from fields such as developers, researchers, politics, legislation, rail operations, aviation and industry. The contribution to its work is predominantly voluntary. There is a variation of expertise in different areas as well as in standardization procedures.

The key factors that affect the completion of the agreed timelines are:

1. Availability of the work force;
2. Technology convergence and interoperability is dependent upon funding being available to undertake the joint necessary pre/co-normative research;
3. Availability of expertise (Certification, Cyber Security, IT…)
4. Execution of the CEN/CENELEC rules of procedure and processes by the CEN/CENELEC management centre, JTC20 secretariat and the JTC20 members.
5. Finalization of the hyperloop regulations by DG MOVE