PARIS
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Taking account of safety issues through the innovation process

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A few words about EPSF

EPSF is the French railway safety authority.

Its missions are :

- To deliver authorisations (RU, IM, TC, EC, APIS)
- To deal with registers (ERATV, vehicles registration, driving licences)
- To supervise authorised entities
- To disseminate best practices
- To develop cooperation with others NSA and European Union Agency for Railways
- To register safety events and analyse them in order to identify tendencies
- To organize return of experience
- To be involved in regulation updates

State of play in France :

- 35 railway undertakings
- 16 infrastructure managers (including harbours)
- 44 training centres
- 11 examination centres
- 6 Debo / 2 AsBo (accreditated by COFRAC)
- 110 000 registered vehicles in the national register
- About 1 000 authorizations delivered since 2006

about
150 stakeholders

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The risks of rail transport are significant

A TGV Duplex of 2 trainsets carries **1000** passengers at **320** km/h and weighs more than **1,000** tons.

Transilien network (SNCF) :

- RER A and B sections
- RER C, D et E
- Lines H, J, K, L, N, P, R, U and T4

About **3 millions** of passengers / day

A freight train can carry **3000** tons of products, potentially flammable, toxic or explosive.

Need for rules and procedures to reduce risks

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New product life cycle

TRL1

Brainstorming ⇨ innovation / idea ⇨ research / development ⇨ prototyping

⇩ TRL5

proof tests

⇩

Homologation :

- ***Applicable standards***
- ***Customer requirements***

industrialization

⇩

Sub-system integration

⇩ TRL8

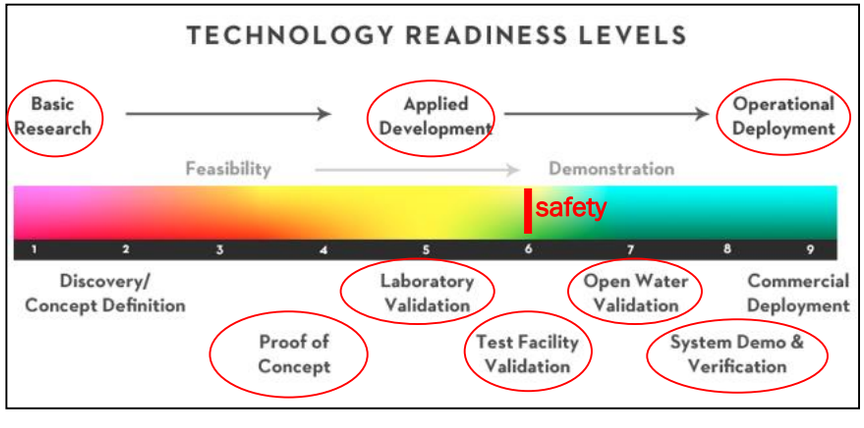
Authorization Process

« What about safety issues ? »

Let's use Common Safety Methods

New risks introduced into the system

≠ Teams
≠ « non standard » thoughts considered at early steps
≠ Risks & conformity non
≠ international context → ≠ rules & standards



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Environment, system, and own limits

An "established" system :

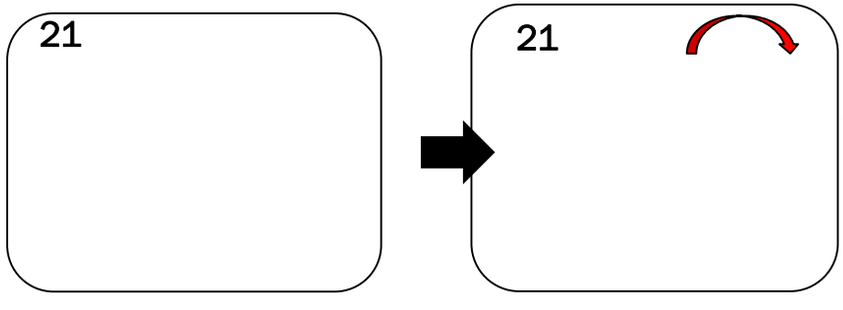
- 30,000 km of tracks to sustain → potential evolutions are "heavy“
- Harmonization / coherence of old and new security systems (crocodile (1872!) / Track circuits (operations of UM71 DC = 45) / ETCS (2000))
- Rules and regulation for operation were set up a long time ago and are based on return of experience

Sometimes, we see “self-limits” on safety principles :

→ At any development of the rail network operated by a change, the level of safe operation of the railway network operated must remain **globally** at least equivalent (GAME) to the reference system → systematic approach

“GAME” tends to become “LAME” : ~~globally~~ / locally

Chauncey Starr, 1968:
“Control of hazard such that the system operates at safety performance rates comparing favorably with the levels of similar, fully viable systems”



7 could become 5…
But 21 must remain 21

→ The innovation must be part of a constrained framework that can be limiting in terms of rupture or “push”

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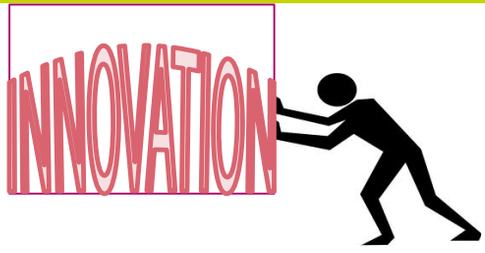
Stereotypes

Regulation and authorization are brakes on innovation !



Regulation and authorization stretch the « time to market »

System safety and risk assessment MUST be data entries, especially in early steps.

BASIC QUESTIONS (but not so…) :

- Does the innovation fit within the existing legal framework?
- Does the normative framework provide a specific framework for innovation?
- Does the innovation impact a subsystem?
- Does the innovation degrade the level of safety?
- What are the impacts on the system and its interfaces?
- Is this innovation substantial?

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High - density areas

- 54% of the world's population lives in urban areas
- 66% of the world's population will live in urban areas by 2050 (2.5 billion people)

Such density of population has specific impacts :

- Already strained infrastructures that will have to absorb the growth
- Availability is the key, but need to find the right balance with safety
- Maintenance has to be efficient AND fast
- Safety Management System has to include robust processes as each safety event is a potential crisis
- Expected reactivity transcends human factor mastering

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Safety cases

Date : 20/09/2003

Cause : KVB defect (disconnection of an electrical terminal)

Consequences :

Inadvertent activation of the KVB

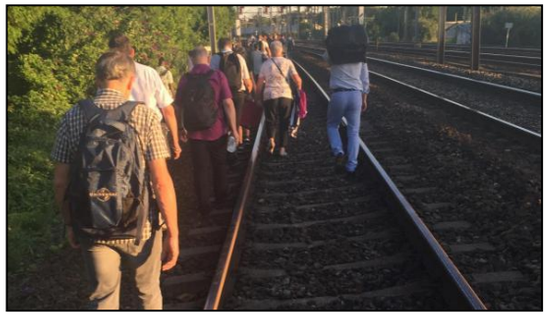
Passengers on the tracks while trains were operating on the adjacent track

Date : 19/07/2016 :

Cause : Fire in a transformer in Saint-Denis (malevolent act)

Consequences :

- No more catenary power near “Gare du Nord”
- Opening of crisis unit
- Passengers on the tracks



Time lost : 9 hours to go back to normal, 516 circulations impacted, 24 trains cancelled

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Main links with SMS :

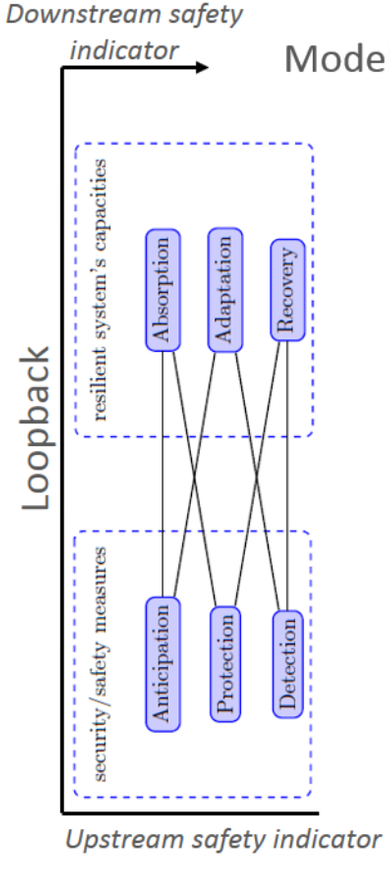
- Risk assessment for technological items
- Risk associated with the presence of people in the railway right-of-way
- Management of circulations
- Emergency cases
- Maintenance

Regulatory safety research

It is mandatory for safety authorities to keep pace with the latest status of science and technology.

By identifying safety issues (up to 30 000 safety events per year) and analyzing them, we are able to identify where the efforts should be placed.

The goal is to contribute towards the preservation and improvement of the high degree of safety of the railway network.



Modelize the SMS with all its components (processes / procedures)

Weighting using experience and risk analysis (formal method)

Inject safety events to perform a stress - test

Assess how the SMS reacts

« Grade » the robustness

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For consideration

- New command/control systems (ERTMS, GNSS)
- Human factor assessment
- New generation of vehicles resilient to attacks Interaction rolling stock /infrastructure
- Interaction vehicle / infrastructure
- Securing maintenance working areas
- Electromagnetic compatibility
- Monitoring of critical points (PN, bridges…)
- Protection against intrusions and suicide
- Reduced safety-certification costs using virtualization tests
- Development of new materials
- New organizational approaches
- Analysis of technical data and / or security (big data) / precursors

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Conclusion

Safety has to be taken into account in every project at every steps.

Safety must be put into perspective of other criteria.

Safety must be put into perspective in order to be addressed systemically.

In all cases, anticipation is indispensable.

There are many tracks of direct or indirect safety innovations, particularly in terms of safety management systems and human factors

The greatest potential lies in the good correlation between the level of safety to be achieved and the fair assessment of the risks.

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“Concern for man himself and his safety must always for the chief interest of all technical endeavours.”
(Albert Einstein)

Thank you

“It's not that we need new ideas, but we need to stop having old ideas.”
(Edwin Herbert Land)

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