# Digitising and modernising rail network surveillance to intervene on the right time and place, with just the right balance

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# AGENDA

1. Key figures
2. The context
3. The Surveillance & Supervision Program
4. The 4 objectives of the Program
5. Focus on some emblematic projects
6. Usage precautions

# KEY FIGURES ON THE FRENCH RAILWAY NETWORK

SNCF Réseau's mission is to commercialize access to the national rail network, as well as to develop, modernize and secure the infrastructure to optimize train traffic throughout France.

## Resources used

Over **52k** employees

**27 k km of lines**, including 2.1 k km of High-Speed Lines (HSL)

**€ 7.5 bn** Turnover

**2 200** Signal boxes

**Materials consumed**

- **365 k** tons of sleepers
- **155 k** tons of rail
- **1.8 M** tons of ballast

**Energy consumed**

- **1,100 GWh** of electricity


**SNCF Réseau: a special company**

## Values created

**44** Clients (railway companies)

**16 000** Trains running daily

**250k tons** of goods per day

**5 million** daily passengers

**For the planet**

- **21%** reduction in indirect carbon emissions with the circular economy
- **96%** recycled rail and **4%** reused rail
- **24,115 m²** of photovoltaic panels installed

# A COMPLEX GENERAL CONTEXT THAT PRESENTS CHALLENGES AND OPPORTUNITIES FOR SNCF RESEAU

**Technological breakthroughs made possible by digital technology**

### Increasing demand for mobility

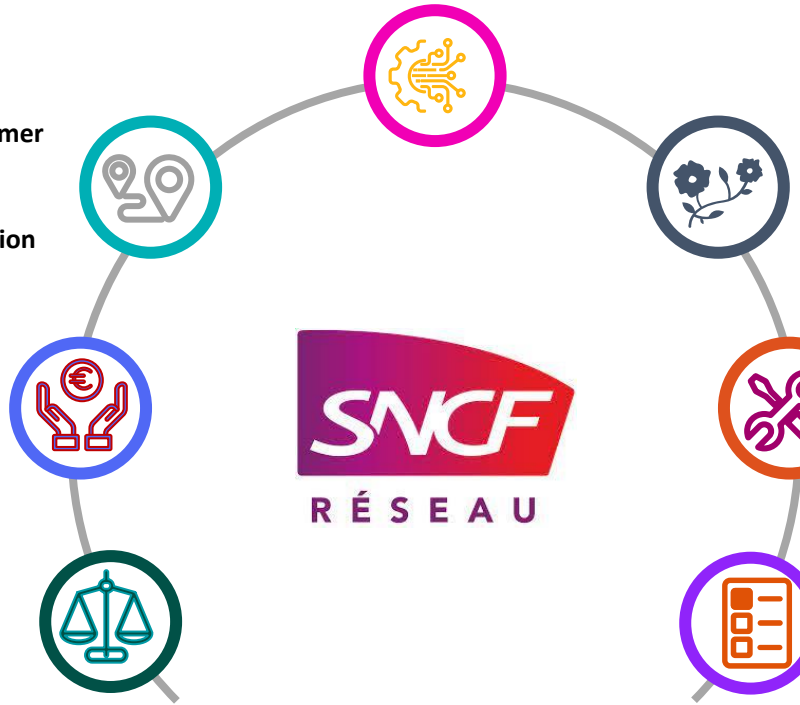
- The company's top priority is **customer satisfaction**
- Progressive market opening of passenger's rail transport **competition**
- Support for **freight**

### SNCF Réseau's business model

Objective : back to **economic equilibrium** in 2024

### Regulatory developments

- Didier Law
- Technical Specifications Interoperability (ITS)




### Environmental requirements

- Reduction in the use of harmful products: glyphosate
- Biodiversity
- Scarcity of materials : PA66
- Adaptation to climate change
  => Asset resilience

### Maintenance management

Management of assets designed over **centuries**

### Audits of the rail network

- Security organisations
- Regulator
- External audits

# BETTER KNOWLEDGE OF THE STATE OF THE NETWORK AND HOW IT IS EVOLVING THANKS TO THE SURVEILLANCE & SUPERVISION PROGRAM

Modernize and automate ➔

Measurement trains

Remote monitoring

Supervision centers

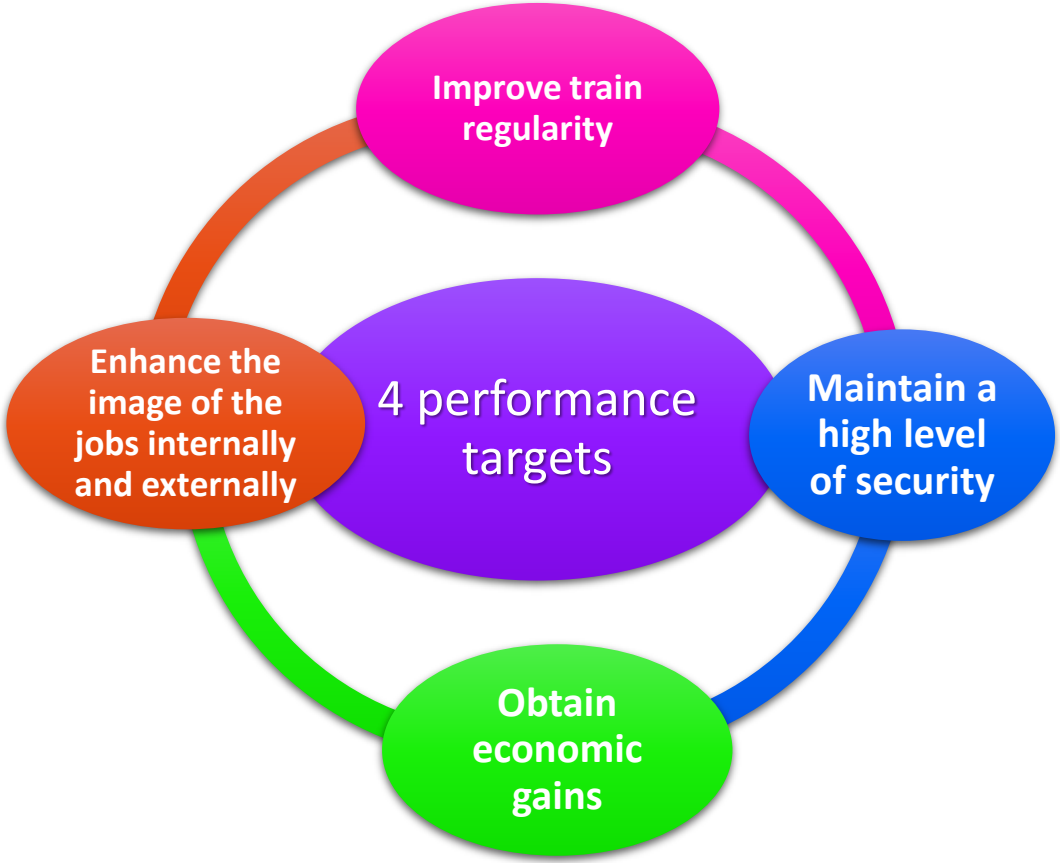
Improve the productivity of monitoring itself

Reduce the number of incidents by anticipating and preventing them

Improve the efficiency of corrective maintenance operations

Optimize systematic and conditional preventive maintenance operations.

# OBJECTIVES OF THE PROGRAM



# EXAMPLE #1: ESV2020, THE PROJECT TO AUTOMATE SURVEILLANCE TOURS

**Running every 8 weeks**

**3 self-propelled trains**

**7/7 since January 1, 2020**

**Replace the walking surveillance tours** of the current track (soon switchings and crossings)

Equipped with SURVEILLE functionalities (AI deep learning detection of anomaly of track components), track geometry and LiDar3D.

Requires changes to technical documents (prescriptions)

Disadvantage:

- ESV dependence (a high need of reliability),
- a lot of data including track geometry (too much?)

# EXAMPLE #2: TOUTATIS: PREVENTING THE DEGRADATION OF EARTHWORKS


**TOUTATIS = T**ournées **OU**vrage en **T**erre sur **A**lerTes **I**ntempérie**S** (Earthworks Structures Tours on Storm AlerTs)

- Project objective: **monitoring Earthworks Structure (ES) during bad weather conditions**, as **climate change** may lead to an **increase in bad weather conditions** that degrade ES
- Case of use: heavy weather can cause damage: **specific surveillance** must be carried out by the agents on the track
- Problem encountered: no **appropriate** tool to **master the ongoing bad weather**, information to be linked with the **level of risk of each ES** in order to determine the **level of priority**
- Solution provided: **triggering bad weather tours** on ES **at the right place, at the right time** and with precise visit objectives thanks to the **TOUTATIS** tool

**Record** the triggering thresholds (vigilance and alert) for each ES

**Use** satellite data from MétéoFrance radars to predict bad weather

**Trigger** an alert if the thresholds set on the Supervision NG application are exceeded

**Contact** the maintainer and **follow up** the incident

Landslide due to bad weather

# EXAMPLE #3: ANTICIPATING TRACK UNIT FAULTS THROUGH REMOTE MONITORING

**Context**

- Infrapôle Paris Nord: **20% of the track units are remotely monitored** (SKAg and SCAg sensors) in order to inform the maintenance company in **real time** of the appearance of precursor signs of a breakdown.
- The SKAg and SCAg sensors measure the **electric power supply in the control circuit of the needle** and help to **identify faults**.

**Issues**

**50% of the defects can be anticipated** (visible on several curves) with a more or less a long horizon:

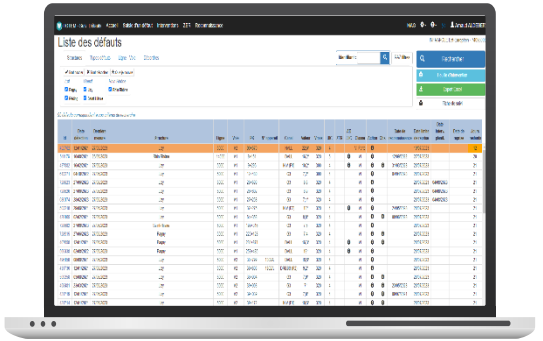
- **> 24 hours:** allows the intervention to be scheduled at night without any impact on the availability of the infrastructure and therefore on traffic.
- **< 24 hours:** leads to pre-incident corrective maintenance, which is still preferable to reactive post-incident management.

**Results**

- **From a 'visual' defect detection...**
  - Faults are visualized and must be identified
- **... to automated anomaly detection**
  - Use a **neural network** for learning discriminating features
  - Detection of unusual behaviour in the latent space
  - Alert generated when the density of abnormal curves is too high

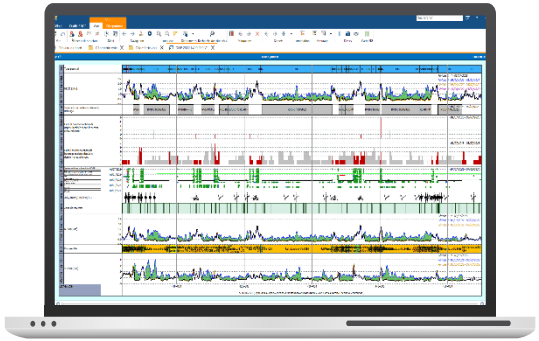
# EXAMPLE #4: THE TOTEM PROJECT, A FIRST-LEVEL DIGITAL TWIN

**TOTEM = T**raitement **O**pérationnel des **T**ournées des **E**ngins de **M**esure (Operational Processing of Measurement Equipment Rounds)




A **unique aggregate tool to visualize and better use measurement data**, composed of 2 modules:

- **MSD:** module for monitoring defects in compliance with our standards
- **MAG:** visualization and graphic analysis module of the measurement



**Improve** the functionality of existing tools of track jobs, catenary and signalization

**Report the exceeding of defect thresholds,** as defined in the maintenance specifications

**Give access to the maintenance units the records** of geometry monitoring equipment

With Eurailscout France and based on the IRISSYS™ software developed by ERDMANN

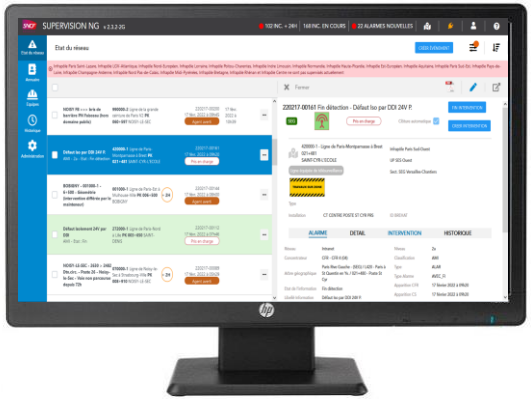
# EXAMPLE #5: SUPERVISION NG

A **real-time incident management tool** developed by Capgemini for SNCF Réseau, that allows us to have

- **A centralized, enriched and shared information**
- A better **synergy between supervision, maintenance teams and traffic managers**

## SUPERVISION NG

- Viewing and accessing incident files
- Identifying and calling maintainers
- Centralization of disturbances from all sources
- Sharing information in real time

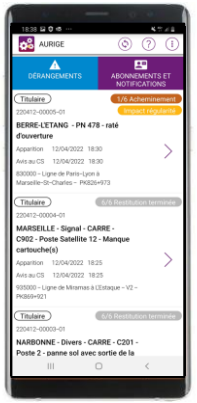


## CARTOGRAPHY

- Interactive mapping
- Knowledge of network constituents
- Visualization of incidents on hover
- Visualization of the environment

## AURIGE

- Summary sheets
- Statement Status
- Route guidance
- Photos/material
- Unavailability



# EXAMPLE #6: THE 3D FACTORY

## Gauge (OMEGA2):

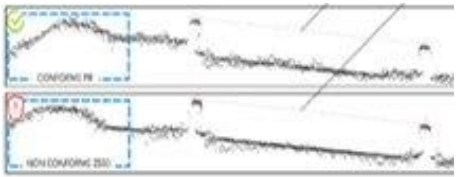
The start of production in an industrial mode of obstacle sheets in the FOVEA tool has been active since May 2024 with ramp-up. Since then, 15,000km must be  treated in 2024.

## Catenary geometry (GEOLIDAR):

Production started on June 2024. This need is essential to ensure the continuity of catenary geometry measurement following the imminent delisting of our last VZC car.
11,000km must be treated in 2024.

## Ballast profiles:

**35,000 km of treatment are planned this year.**
**The start of industrial production is planned for the end of the year**



## Other use cases experienced:

- Vegetation
- Fencing / access / object detection

With our 2 subsidiaries: Eurailscout France and Altametris

# USAGE PRECAUTIONS

## Leave the human at the center

Risk of loss of professional gesture, critical thinking of the maintainer and any taking of initiative and responsibility
Importance of maintaining a mix of “human eye” and “machine”

## Importance of the quality of the data produced

Location of data from surveillance trains
Attachment to a known asset in our databases
Need to implement quality control

## Too much data kills data

We must help the maintainer to understand the data and especially to sort out all these dates at the risk of missing essential data: decision support tools
“Blast” effect: being able to manage it

# THANK YOU

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