

Overview of the Current and Planned activities in the French Underground Research Laboratory at Bure

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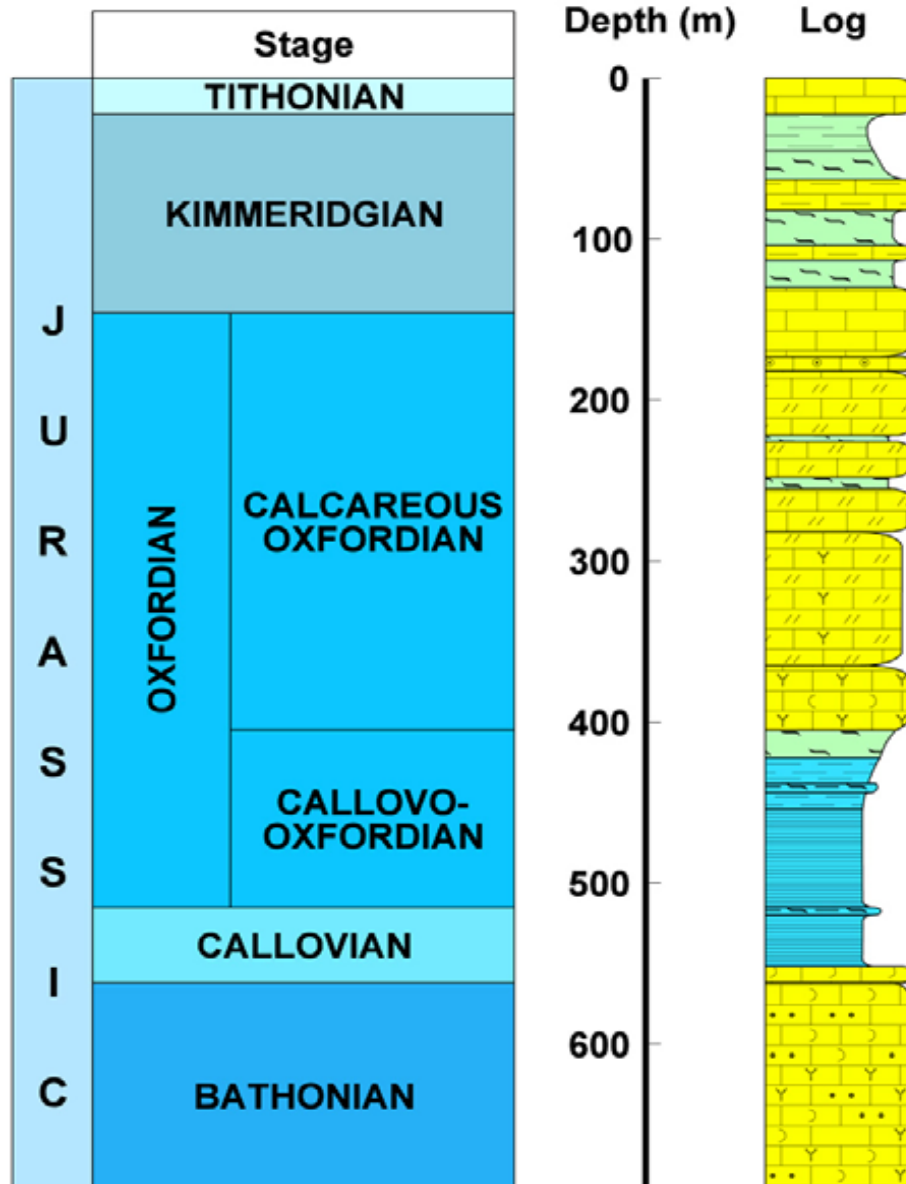


View of the BURE URL



URL Site Location in Paris Basin





Callovo-Oxfordian Clay Main Characteristics

Thickness 130 m
Age 155 MA
(Callovo-Oxfordian)

Clay 40-45%

Carbonates and
quartz 40-55%

Pyrite 1-2%

OM 1%

Porosity 15-18%

Pore size 20-30 nm

Project Time Table

- 30 December 1991 Law on the management of High Level-Long Lived radioactive waste
- January 1994-June 1996 Pre-investigation surveys, preliminary to the installation of laboratories on three sites
- 3 August 1999 Delivery of the authorization for the implementation and operation of the Meuse/Haute-Marne Underground Laboratory (BURE)
- 30 December 2005 Presentation by Andra of a summary report on the feasibility of an Underground Repository for HLW-LL
- 28 June 2006 Law for the long term management of HLW-LL radioactive waste

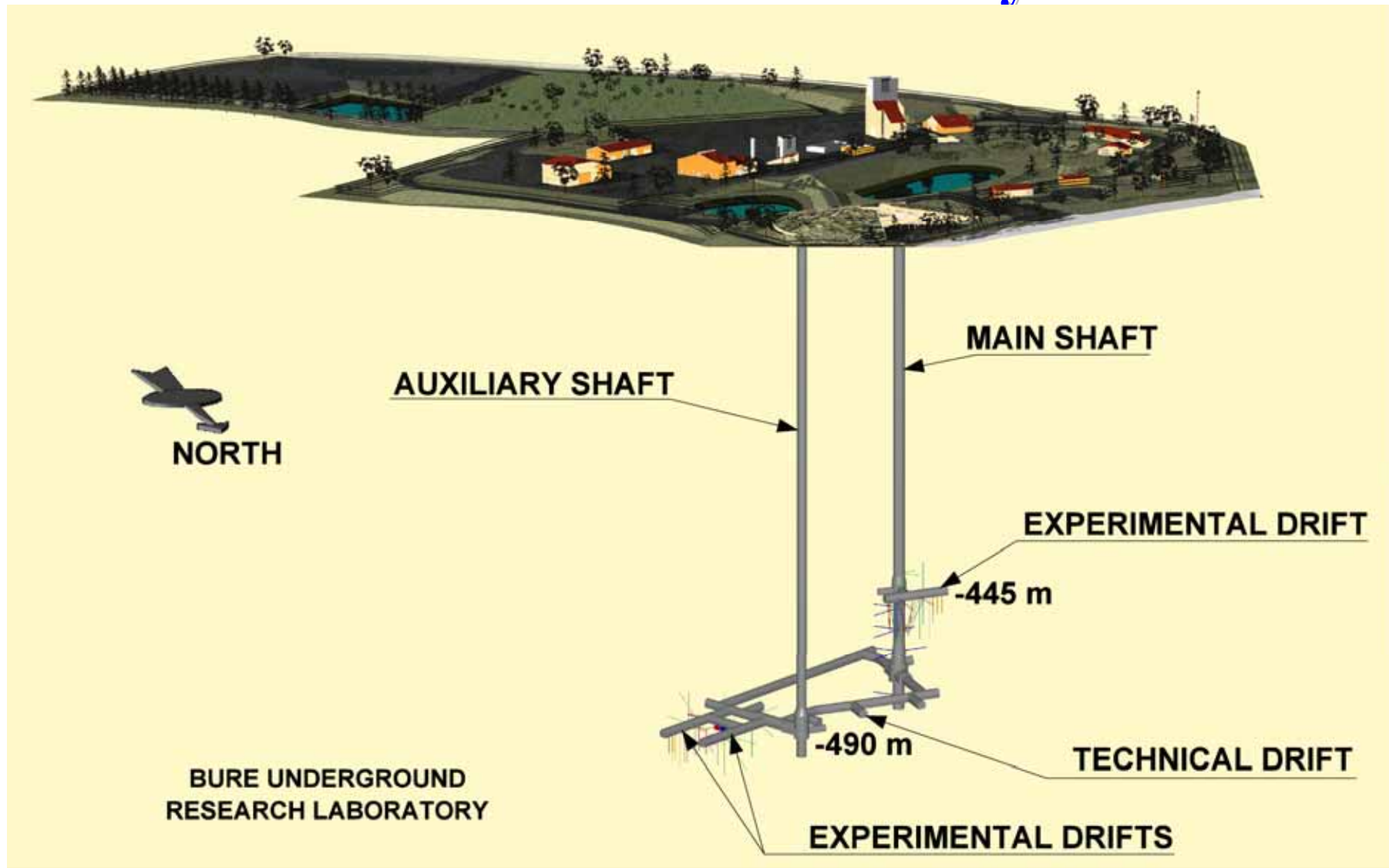
URL Research activities

- **A Fundamental understanding** of the geoscientific properties and processes that govern geologic isolation in clay rich rocks. This include :
 - ❖ Permeability and head measurements
 - ❖ Pore water characterization
 - ❖ Diffusion and retention experiments

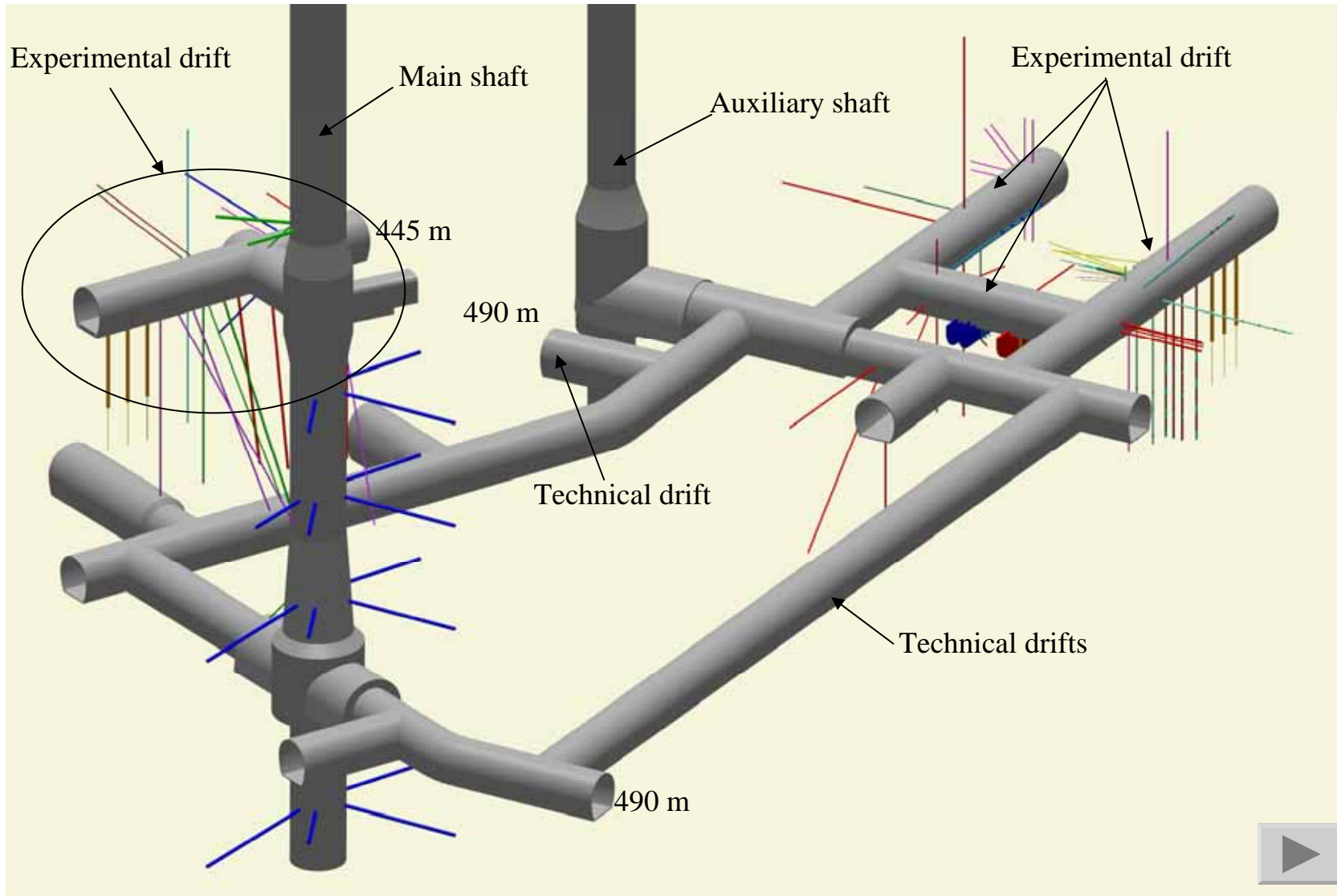
- **An understanding of excavation and operational effects** : the construction of the laboratory itself serves a research purpose through the monitoring of the excavation in order to study :
 - ❖ Rock mass reaction to shaft and drifts excavation i.e. EDZ formation and evolution
 - ❖ Chemical perturbations created by the ventilation of drifts and constructions materials (shotcrete)

- **Regional knowledge of geological and hydrogeological properties of the host rocks and the surrounding aquifers**

Bure URL – General Layout



Overview of the experimental programme



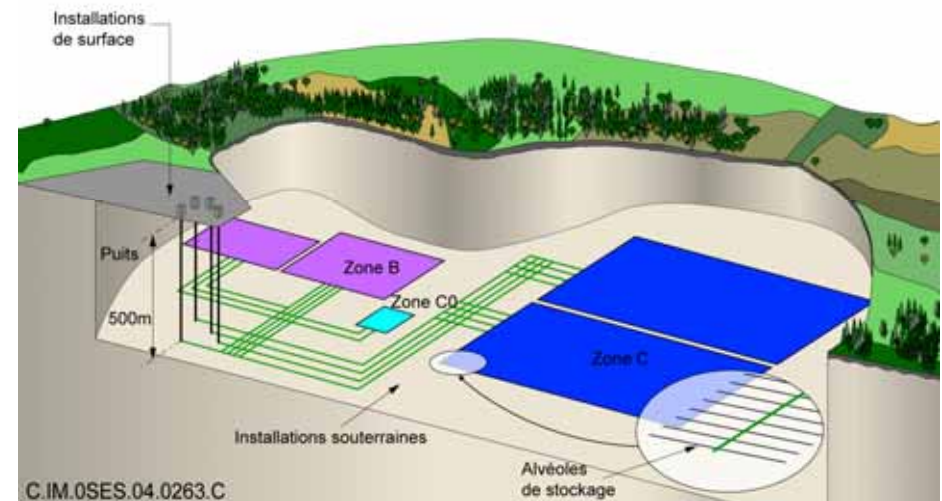
Conclusions at the end of the 1991 law

- Favorable characteristics of the Meuse / Haute-Marne site
- Robust and realistic disposal concept taking advantage of favorable geological conditions
- Safety evaluations supporting the feasibility approach

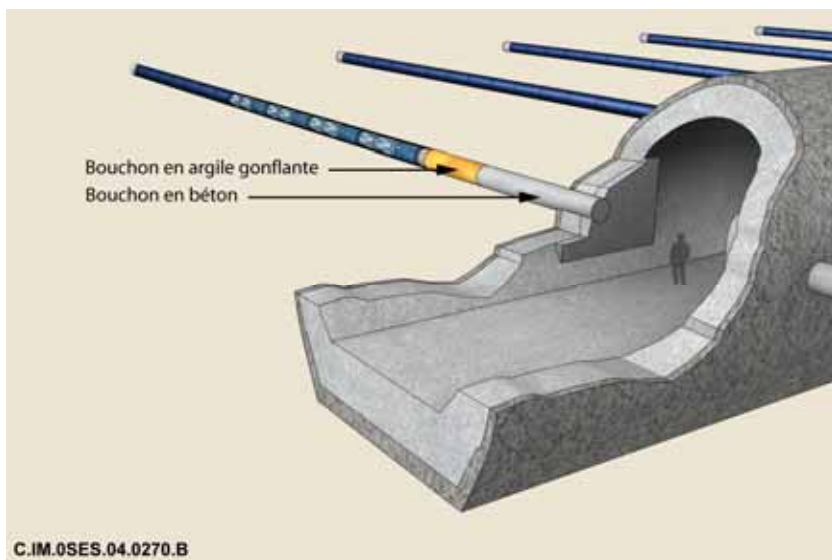
A feasibility in principle is ensured in the light of the knowledge acquired and analyses performed

Principles of Disposal Architectures

- Implantation at a single level in the middle of the layer
→ optimum use of the confinement properties
- Separation of the packages in the different zones (B, C, possibly used fuels)
→ limited interactions, management flexibility
- Modularity of the disposal zones
→ progressive construction and dividing up relative to safety



- Blind vault
→ Limit circulation in the disposal
- Compatibility of materials
→ Limit interactions, maintain properties in the long-term
- Dimensioning
→ Limit the thermal load ($T < 90^{\circ}\text{C}$)



Four major objectives for the works beyond 2006

- Consolidate data acquired over the period 2002-2005 and conduct long term experiments
- Carry out integrated tests of a technological scope
- Quantify more precisely the safety margins
- Carry out a survey of the transposition zone in the surroundings of the underground Laboratory in order to determine more precisely implantation sites

A close link between scientific and technological activities

Engineering studies

Outside URL activities



Detailed studies of individual components :

- ILW and HLW disposal packages
- Handling equipment of packages (ESDRED)
- Sealing of drifts
- Interfaces packages/handling equipment/vault
- Construction and closing of the vaults



Detailed studies of bodies of architecture

- Liaison works (Shafts)
- Infrastructures of the shafts zone
- Optimization of thermal dimensioning
- Determination of nuclear surface installations

Major Scientific Themes (2006-2010)

- Enhanced control of elementary phenomena
- Couplings between phenomena and disposal components at the interfaces
- Changes of scale (verify data validity)
- Transients in the period 0-500 years (mechan., hydro., chem.) for a better definition of the processes under operation and reversibility phase.

Scientific Experiments in the underground laboratory

Data acquisition over the long-term

- Hydromechanical evolution of the shafts and drifts
- Continuation of installed experiments beyond 2006
- Setting up experiments on rock/materials
- Diffusion experiment in the long-term (2007)

Survey work:

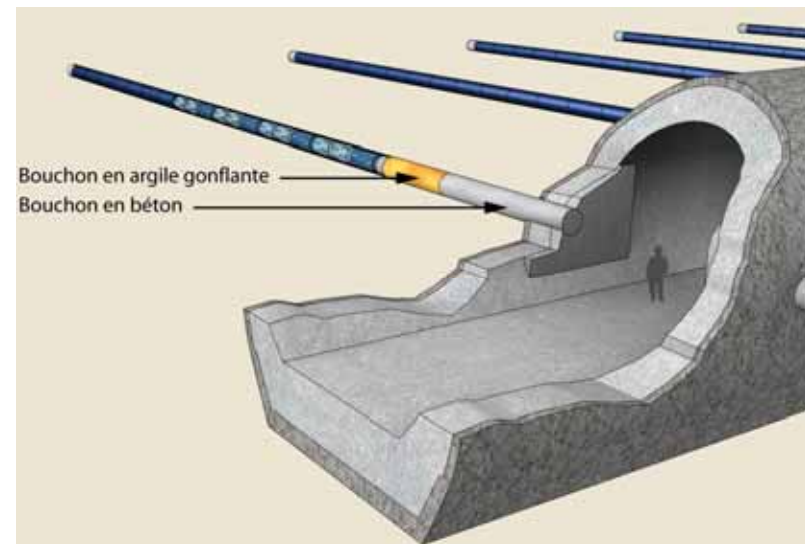
Apprehend variability at different scales

- Sinking of survey drifts
- Creation and evolution of EDZ in various excavation conditions (sliding and rigid support-orientation vs natural stress field)

Demonstrator and technological tests

Inside URL activities

- Trial drift and demonstrator of current drift
- Construction of a lasting concrete cladding
- Demonstrator integrating clay core, concrete plug and buffer material
- Prototype of a disposal vault for ILW wastes (e.g. : l=80m)
- HLW horizontal demonstrator vaults (e.g. : l=40m)



Conclusion: Next steps

- 2009: Choice of the repository site
 - Results coming from the regional investigation program (borehole and seismic data)
 - New results from the URL experimental program
- 2012: Preliminary file
 - Preliminary results from the demonstrators
 - Experiment reports, geological survey, modeling
 - Preliminary safety analysis
- 2015: File for permission request
 - Final results from experimentation and demonstration operations
 - Social sciences
 - Means for the observation, monitoring and transfer of data (sensors, fibers, etc.)

Thank You !