Radio for the Firebrigade: From VHF to TETRA

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01-11-2023

Communication Systems Group 1983 - 2023

Old times…when dinosaurs still existed…

The VHF system offered a good coverage as it used low frequencies which propagated well but:

- Limited number of voice channels: only 2 channels/2 talkgroups on surface and 2 different in tunnels
- No direct communication in tunnel and surface between two different sites
- No monitoring: no way to know when a radio “sticked” in emission
- No geo-localisation of firemen nor vehicles

First idea: improve the VHF network … No GO from top management!

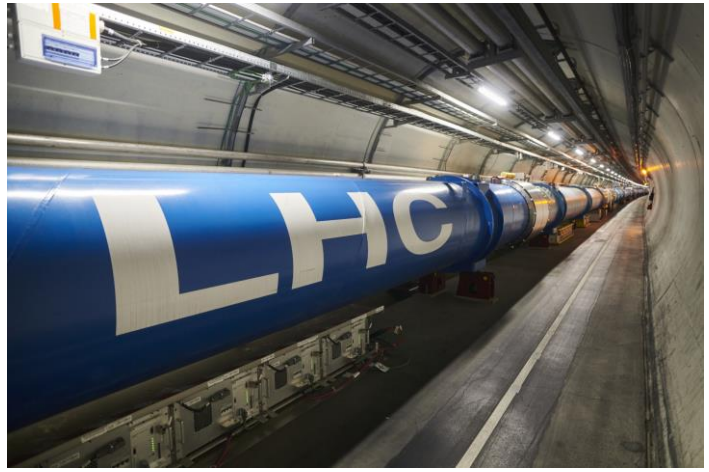
Review of requirements at CERN level

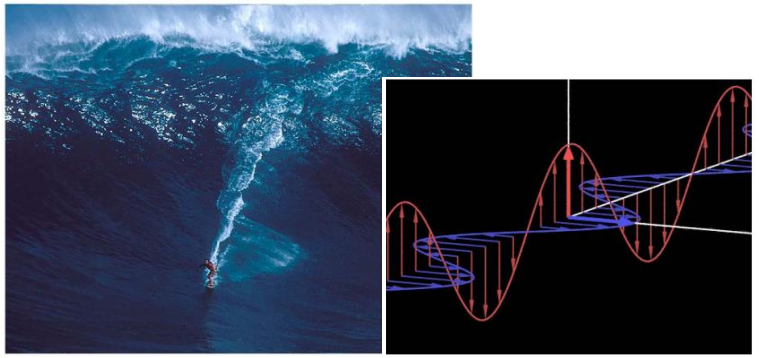
- Establishment of working group with representatives from all departments
  - Drafting of a global technical specification
- Contacts with host state regulators
  - Availability of frequencies on both French and Swiss countries
- Technological survey
  - VHF, DMR, TETRA, TETRAPOL, …
- Initial evaluation of cost

On the way to modernity…(1)

A challenging study phase!

- Covering at least up to 1.5km without repeater as electronic equipment don't survive in the accelerators!
- Coordinating frequencies allocation with both Swiss and French telecom regulators: only 3MHz in common for UL and DL!
- TETRA was a great candidate, but measurements showed interferences carriers at ~400 MHz, the LHC's beam electromagnetic "surfing wave"!





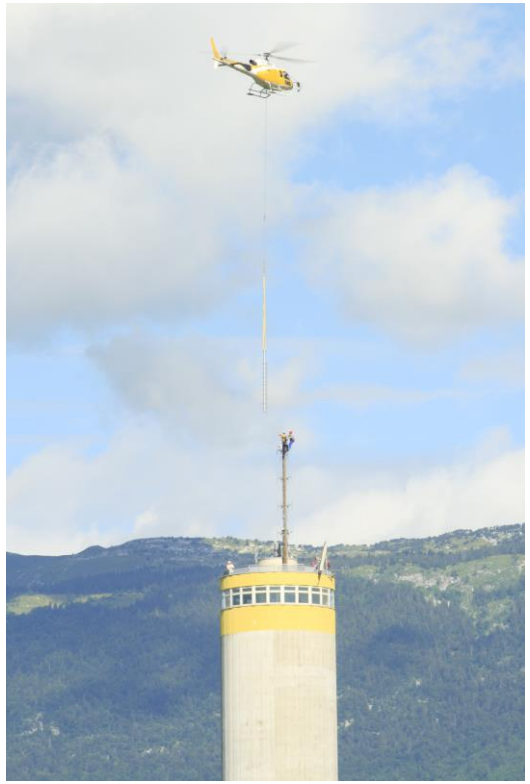
On the way to modernity… (2)

…and a no less challenging deployment!

Extension of the existing mast at the top of the Water Tower to host the 2x new omnidirectional antennas to increase Rx diversity

- Declaration to the OFAC revealed that:
  - ✓ Water Tower was not declared, only the crane used for construction was!
  - ✓ And the new extension was an obstacle to air navigation

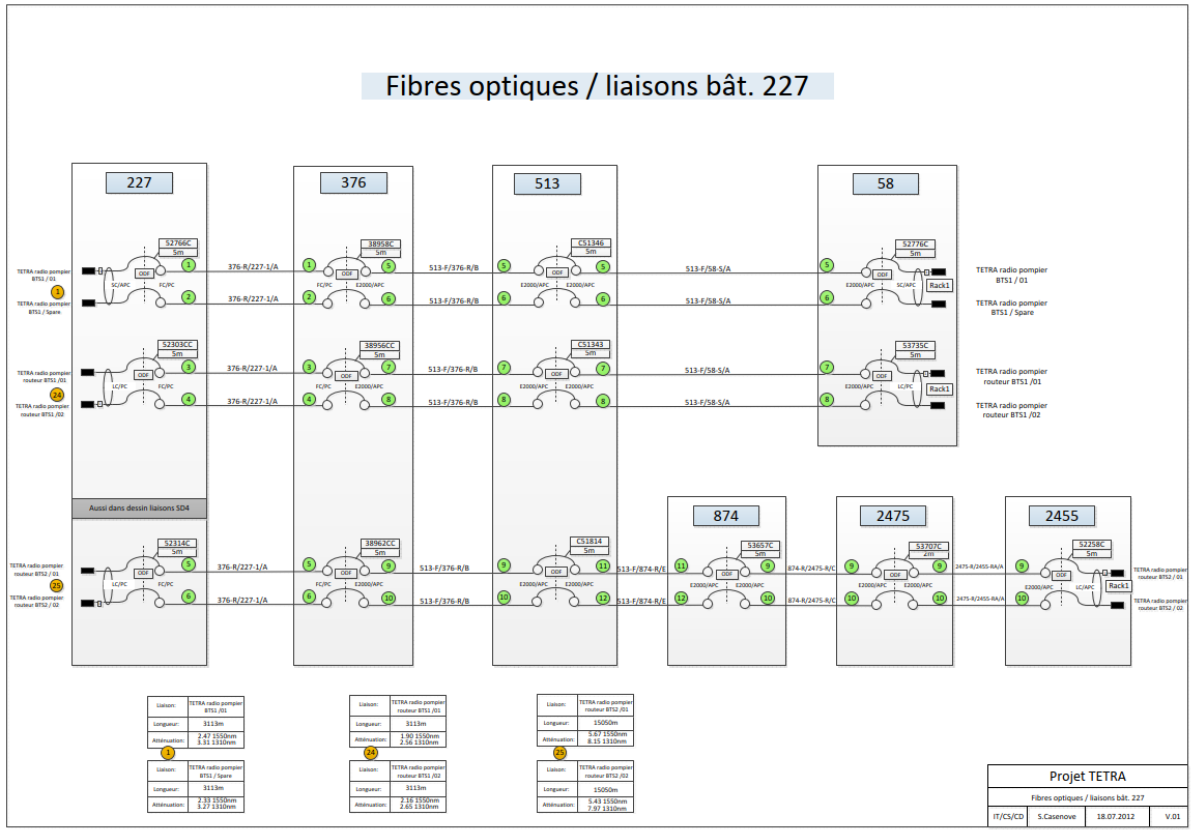
- The installation of the antennas required a big crane which weight was not supported by Meyrin technical galleries, therefore a helicopter had to be used instead!



On the way to modernity… (3)

Optical fibre deployment for all BTSs and repeaters covering the surface and the accelerators

- In less than 6 months during LS1 period ~50 fibre links pulled and tested
- With many technical constraints:
  - ➢ Only E2000/APC single mode fibres
    - ✓ Not always possible on old trunks
    - ✓ Required optical coils of several meters to protect the transceivers from reflected signals
  - ➢ Less than 15km of links length to avoid inter-symbol interferences
  - ➢ Low attenuation tolerated by the optical repeater system



TETRA, what was new?

Before After

TETRA system remained as robust and safety oriented as VHF when offering many more features:

- “Unlimited” number of talkgroups thanks to a digital technology
- Direct communication between any radio located on any CERN site
- Monitoring of the whole system
- GPS geo-localisation of handsets and vehicles interconnected to the GIS portal for dynamic update of plans
- And more:
  - ✓ Lone Worker protection system
  - ✓ Dispatchers with advanced features
  - ✓ Interconnection with TETRAPOL systems from French and Swiss Public Safety Services
  - ✓ Etc…

TETRA extended to…

Open days

, but also…

Hackathon

CSA / Guards

TI CR and Piquets

CMS

EN-EL

Lifts

ALICE

AWAKE

ATLAS

And finally, TETRA industry recognition

Two prizes at the International TETRA Awards

- Best use of TETRA for Public Safety
- Outstanding single-site TETRA installation

Alberto Garcia Molero, Yann Lechevin, Aurélie Pascal, Sascha Schmeling, Frédéric Chapron
International TETRA Awards, London, 2014

Thank you for your attention

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