

Consolidation of the CERN technical infrastructure and civil engineering.

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BACKGROUND

The function of CERN relies on an important infrastructure.

Until the commissioning of the LEP the main concern was to maintain the infrastructure.

Since a few years parts of the infrastructure have reached an age where **consolidation** – in the form of **renovation** or **replacement** of systems – has become inevitable.

A Few Useful Terms, 1

- **Maintenance:**

- Keep existing equipment in perfect order with the operational parameters within the specified limits.
- The maintenance is made regularly and is a natural part of equipment operation. It requires short outage and is low cost compared to the investment value of the equipment.

A Few Useful Terms, 2

- **Renovation:**

- Thorough overhaul of existing and ageing equipment.

- Requires long outage and is of considerable cost compared with the investment value of the equipment.

A Few Useful Terms, 3

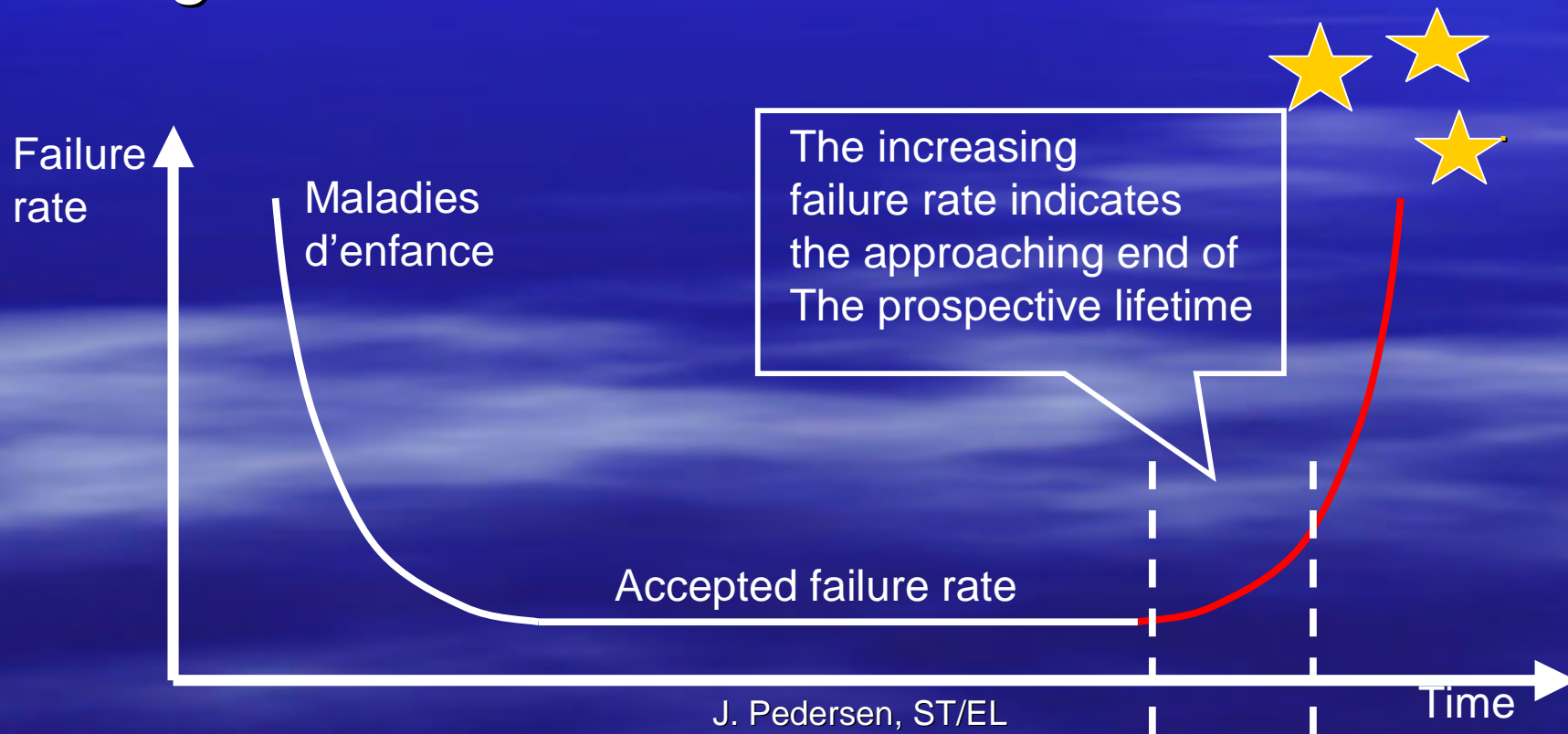
- **Replacement:**
 - Scrap existing equipment and replace it by new.
- **Consolidation:**
 - Major intervention, far beyond maintenance.
 - Either to give an existing system a “New lease on life”. (Renovation)
 - Or purchasing a new system (Replacement.)

A Few Useful Terms, 4

- **Prospective lifetime:**
 - Period where spares and support are available and where failure rate and maintenance cost are acceptable.

Prospective lifetime

- The end of the prospective lifetime is reached when the failure rate starts to climb on the right side of the “bathtub” curve



Maintenance:

- Most technical equipment must undergo maintenance during its lifetime, in order to make optimum use of it.
- The maintenance should be planned from the beginning. Both technically and financially.
- This way the equipment will function a long time before....

Renovation

- Requires long outage and is of considerable cost...
 - Is the equipment worth it?
 - Can “active” parts be changed and “passive” parts be kept?
 - Is there a good economy in this solution?
 - Is there time for the long outage?
 - Is there a risk of encountering surprises in the process?

Replacement:

This solution holds the following advantages over the renovation:

- Costs can be estimated with comparable precision.
- The replacement costs may look higher, but the renovation does hold some quagmire-potential.
- The old installation may run while the replacement is constructed.

Candidates for consolidation

- Single equipment or systems, that will stop accelerator operation in case of fault.
- Single equipment or systems, that will stop an experiment in case of fault.
- Single equipment or systems, that will impede CERN's activities heavily.
 - No heating during winter
 - Rain through the roofs, down into costly electronics

Characteristics

- The consolidation interventions should be characterised by the following:
- The cost should be beyond what can be covered by the maintenance budget.
- The work should be planned and executed over a few years. It should be handled as a project with a schedule and a dedicated budget.

Examples

- The following examples show both active and passive systems in need of urgent replacement or renovation. In most of these cases we are on the right side of the “bathtub”.

Meyrin site heating

- The central heating system at Meyrin.
- Existing since the very early days of CERN.
The system is in a state that leads the people responsible for it to consider it a candidate for renovation or replacement.

SPS roofs

- A number of the SPS buildings have roofs that are leaking.
- Following heavy rain, the equipment in the buildings is subjected to showers, not always compatible with the function: High voltage switchgear, RF systems etc.

SPS reactive power compensation

A second, new reactive power compensator is needed to arrive at a system no longer depending on the obsolete Saturated Reactors.

SPS 18 kV network

- Buried 18 kV cables.
 - The cable system has caused a number of power cuts with accelerator and physics outage as consequence.
- 18 kV switchgear in the BA substations.
 - The 18 kV switchgear is obsolete, no longer supported by the manufacturer, neither with respect to maintenance nor with respect to spares.
 - The technology (minimal oil breakers) combined with the age renders the equipment potentially dangerous.

PS Power distribution.

- Rotating Machine*)
 - The rotating machine was installed in 1968. It has seen 34 years of service, feeding the PS pulsed network.
 - Starting a new project **today (2003)** would allow a replacement to be commissioned in 2006, with the rotating machine arriving at the end of its prospective lifetime.
 - *) Generating the PS pulse from energy storage.

Conclusions.

- Certain systems of the CERN infrastructure is obsolete and should be renovated or replaced.
- Such activities are by nature important. In terms of money, time and complexity; but also to the users.
- They should be dealt with as projects, and inserted in a strategy, at least divisional.

Estimated Cost of Consolidation.

- **Reactive power compensator:**
 - Around 5 Million Swiss francs
(Based on an existing purchase option and recuperation of existing filter equipment and civil engineering)
- **Buried 18 kV cables:**
 - Between 5 and 6 Million Swiss francs.
- **18 kV switchgear in the BA substations:**
 - Between 12 and 13 Million Swiss francs.
- **PS rotating machine**
 - Around 6.5 million Swiss francs
(An educated guess)