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SUMMARY OF ST/MA DELIVERABLES FOR LHC

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Abstract

The ST/MA group is responsible for the monitoring of the CERN Technical Infrastructure as well as the design, installation and maintenance of personnel protection system such as access control system, fire and gas leak detection, safety alarm monitoring systems and radiation monitoring systems (in collaboration with TIS). This paper provides an overview of the main projects and services managed in the group and outlines the scope, the organisation and the planning of the main deliverables for LHC.

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1 INTRODUCTION

The ST/MA group is responsible for the monitoring of the CERN Technical Infrastructure as well as the design, installation and maintenance of personnel protection and safety systems. For the LHC, the ST/MA group deliverables are:

- Access control systems (§ 2.1).
- Access safety systems (§ 2.2).
- Fire, gas and oxygen detection systems (§ 2.3).
- Evacuation systems (§ 2.4).
- Safety alarm transmission system (CSAM project) (§ 2.5).
- Radiation monitoring systems (RAMSES project) (in collaboration with TIS) (§ 2.6).
- Technical infrastructure monitoring systems (TIM project) (§ 2.7).

2 DELIVERABLES: DESCRIPTIONS

The facts and figures of the deliverables of the ST/MA group is given in the following Table 1.

Table 1
ST/MA deliverables: Facts and Figures

Systems/sub-systems	~ 420
Engineering effort	~ 10 Manyears per year
Contracts	4 + 4 in preparation
Computers/ Workstations :	~ 130/40
PLC:	~ 200
Access gates/doors:	~ 100
Access Points:	~ 50
Video cameras:	~ 50
Fire&Gas stations/sensors:	~ 140/1220
Radiation stations/sensors:	~ 80/360
Generic sensors:	~ 370
Generic Inputs/Outputs:	~ 6200
Total estimated value (EVM):	~ 31.000.000 CHF

In the rest of the chapter, a summary description of the deliverables is given.

2.1 Access Control systems

The Access control systems [1] included in the ST/MA deliverables are:

- the LHC sites access systems whose main function is the local and remote control of the vehicle traffic and the pedestrian access to the LHC sites,
- the LHC buildings access systems whose main function is the local and remote control of the access to the LHC industrial buildings where the personnel access pits are located,
- the LHC experimental services areas access systems whose main function is the local and remote control of the access to the LHC experimental services areas (LHC underground areas accessible during beam operation),

- the LHC accelerator and experiment access systems (access control systems) whose main function is the local/remote control of the access to the LHC interlocked areas. This system works in conjunction with the access safety system described in the next section.

Figure 1 shows a illustrative example of the access control system installation.

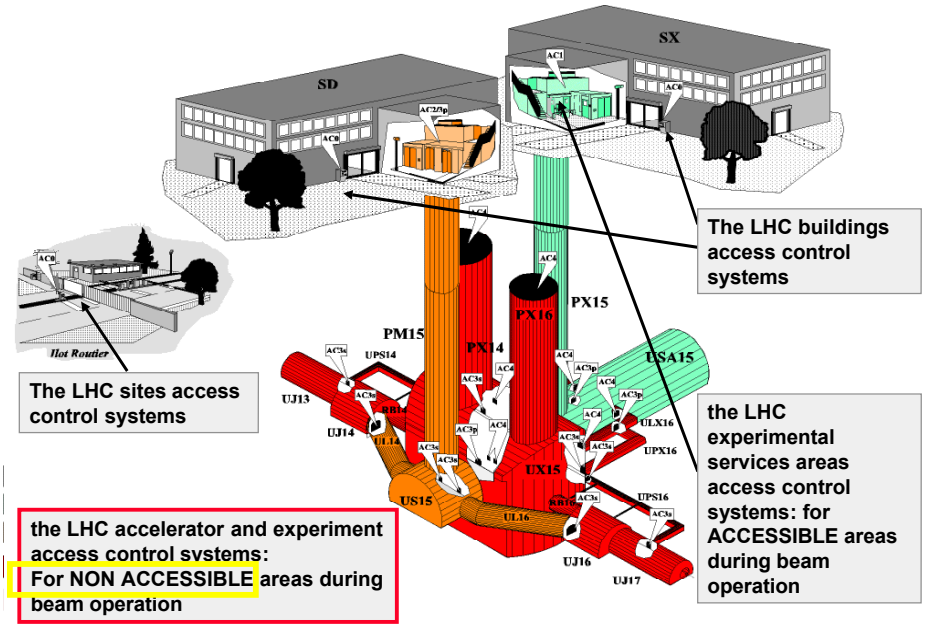

Figure 1: Access Control System

2.2 Access Safety system

The Access safety system [1] included in the ST/MA deliverable is the LHC accelerator and experiment access systems (access safety systems) whose main function is the beam and machine interlock for personnel protection.

2.3 Gas, fire and Oxygen deficiency detection systems

The LHC Gas, fire and Oxygen deficiency detection systems represent half of the LHC *alarm-of-level-3*. The detection systems will be homogenized throughout CERN and connected to the CSAM system (see Section 2.5) for the alarm transmission to the fire brigade.

The Gas, fire and oxygen deficiency detection systems included in the ST/MA deliverables are:

- The LHC Surface Detection of Fire, Gas and ODH systems
- The LHC Underground Machine Fire Detection systems
- The LHC Underground Machine ODH systems
- The LHC Experimental Areas Fire & Gas detection systems
- The SNIFFER Experiment detection systems

2.4 Evacuation system

The LHC Evacuation system has two main functions: to sound the LHC emergency evacuation and to sound a Beam Imminent Warning (BIW) before injecting the beam in the LHC. Sirens shall create the two signals with different time modulations to distinguish the two types of evacuation. Pushbuttons shall trigger and emergency evacuation, creating an *alarm-of-level-3*.

The evacuation systems included in the ST/MA deliverables covers the evacuation of the main LHC caverns.

2.5 CERN Safety Alarm Monitoring system (CSAM project)

The CSAM project [2] will provide CERN with an integrated safety alarm system covering "Alarm-of-level 3" plus other safety related data; acquisition, transmission, logging and display. For the LHC, it concerns the LHC machine, the LHC experiments and the experimental areas. This safety information will be made available in the safety, technical, experiments and accelerator control rooms as well as in the 10 safety zones covering the LHC.

The safety alarm monitoring systems included in the ST/MA deliverables are:

- The SCR and TCR central monitoring systems
- All LHC safety zones (10) alarm acquisition and display systems.

2.6 Radiation Monitoring System for the Environment and Safety system (RAMSES project)

The RAMSES project [3] has been launched as a collaboration between TIS and ST. It will provide LHC with a state of the art radiation monitoring and alarm system. RAMSES will survey the LHC accelerator, the LHC experimental areas and the environment of the LHC. TIS will exploit this system to assess radiation risks and to control the release of radioactivity. In addition, it will be integrated into the control rooms of the LHC accelerator and the LHC experiments.

The radiation monitoring systems included in the ST/MA deliverables are:

- The LHC environmental monitoring systems for the ventilation gas for all sites
- The LHC environmental monitoring systems for the release water for all sites (radiation and non-radiation) for all sites
- The LHC meteorological monitoring systems for the environmental impact evaluation
- The LHC radiation personnel protection systems for mixed radiation fields, X rays and photons for the surface and underground machine and experimental areas.
- The LHC radiation personnel contamination monitor systems for β and γ radioactivity for all sites.

Figure 2 shows a illustrative example of the RAMSES installation.

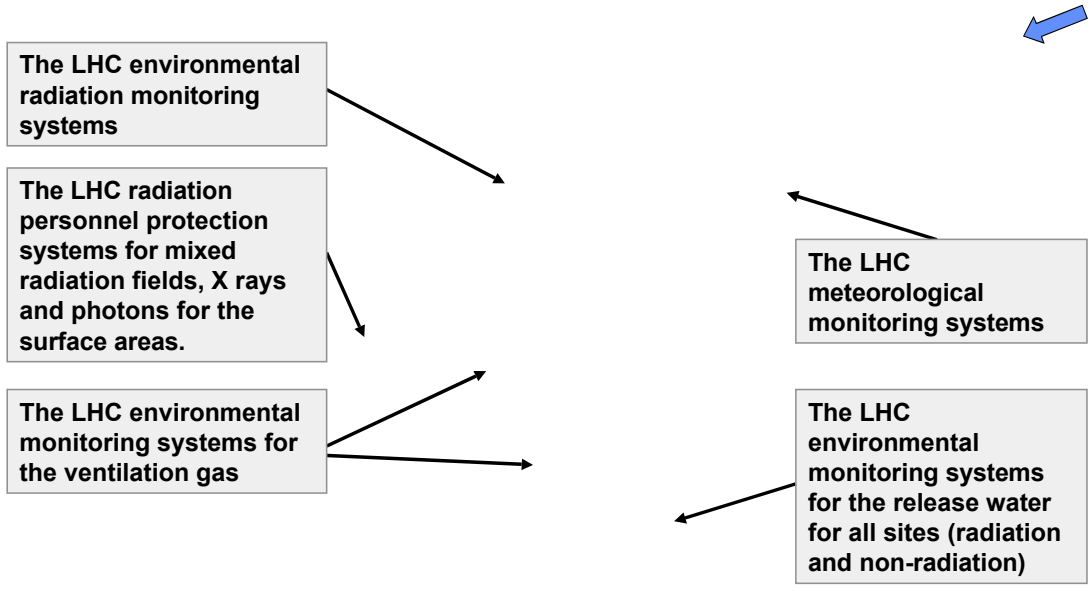

Figure 2: RAMSES installation at point 5 (surface)

2.7 LHC Technical Infrastructure Monitoring system (TIM project)

The TIM project [4] will provide a monitoring system for the supervision of LHC and LHC experiments technical infrastructure. It covers technical data acquisition, transmission, logging and display. This information will be made available in the technical, experiments and accelerator control rooms as well as for the technical equipment groups.

3 DELIVERABLES: STRATEGY

The group strategy is based on three axis: contractual, technological and methodological.

The group's contractual strategy is mainly based on placing industrial contracts for the systems' realization. In some cases, like the CSAM, the detailed design is also included in the contract, This overall strategy, however, is complemented with an in-house development and realization team (insourcing) for the Technical Infrastructure Monitoring (TIM) project and, recently, for the Safety Access project. Indeed, the right balance between insourcing and outsourcing is always reviewed to optimise between cost-resource-knowhow is also described in details in [5].

The group's technological strategy is based on the use of the proven-on-the-field technology (i.e. where similar applications/realizations exist). These include the use of CERN standard industrial automation components (PLC), software operating systems, databases, SCADA systems, fieldbuses and communication networks. Notwithstanding these basic principles, the group is actively involved in the evaluation of new products and technologies to be able to evaluate the potential use within the group and the division (for example in the field of automation, SoftPLC, and in the field of human machine interfaces).

The group's methodological strategy is based on internationally recognized standards like the ESA PS005 [7] for the software development and the IEC 61508 [6] for the overall lifecycle of safety related projects. For the management of the single projects, the group is mainly organized following the Goal Directed Project Management technique [8]. The use of this technique encompasses the type of project and actually provides a solid support for the integration of the group projects with the LHC tools (like the EVM) and the CERN purchasing procedures.

4 CONCLUSIONS

The ST/MA group faces many challenges for its LHC deliverables. Being among the last services to be installed, the specifications of same systems are still pending validation. The increase of workload also imposes a careful organisation of the work that requires a special care for the teams evolution.

5 ACKNOWLEDGEMENTS

We would like to thank all the members of the ST/MA group for their dedication in the LHC project activities.

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