WHAT DO WE EXPECT FROM THE CCC
A VISION FOR TS

N. Bangert, M. Batz, O. Boettcher, G. Burdet, G. Cumer, R. Nunes, P. Pepinster, T. Riesco

Abstract

Control room operation of the Technical Infrastructure under the responsibility of the Technical Support Department (TS) was carried out for decades based on the round-the-clock operation from the Technical Control Room (TCR). The TCR functions and services have been integrated in the AB Department in January 2005 and will finally be assumed by the CERN Control Centre (CCC) in the beginning of 2006. The CCC will be in charge of beam, cryogenic and the Technical Infrastructure Operation for the LHC and its injectors. A well functioning operation and maintenance of the Technical Infrastructure will continue relying on the quality of control room services. The TS expectations of CCC operation are outlined in this paper, which shall result in a well-defined operational framework, for both the equipment groups and the control room team.
1 INTRODUCTION

The monitoring and control room operation of the Technical Infrastructure under the responsibility of the TS department was carried out by the TCR until the end of 2004. Since then all the functions and services so far covered by the TCR have been integrated in principle in the Meyrin Control Room (MCR) and shall be continued in the CCC as of the beginning of 2006. In the context of the CCC from where all CERN accelerators, cryogenic installations and the Technical Infrastructure will be operated, the TS expectations for the CCC have to be clearly established.

On the one hand the integration of all control room teams in a single location will enhance communication and co-ordination of operation and maintenance activities carried out by different teams in different departments. On the other hand the operation of the parts of the Technical Infrastructure, which is not directly related to the accelerator operation must not be neglected. Examples are safety systems in non-accelerator buildings and environmental protection systems. The requirements outlined in this paper give the framework of services that the TS department expects from the CCC all year round and for all systems, irrespective the status of the accelerators and experiments operation.

2 SERVICE COVERAGE

All control room services have to be provided 24 hours a day and 365 days per year with a number of qualified operators appropriate to handle the workload generated at any given point in time. These services concern the entire Technical Infrastructure under the responsibility of the Technical Support (TS) Department. This infrastructure consists of electrical and fluid distribution systems, cooling, ventilation and air-conditioning systems, safety systems for the protection of persons, goods and environment, heavy handling and lifting systems, and finally the corresponding control and monitoring infrastructure.

A contractor covers control room services entirely related to the Technical Facility Management during normal working hours, but those need to be covered by the CCC outside normal working hours.

3 SERVICE RESPONSIBILITIES

The CCC is responsible for the safe and reliable control room operation of the Technical Infrastructure. The CCC is the central location having all the information relative to the operation and maintenance of the Technical Infrastructure that has impact on users. System faults signalled to the control room have to be analysed by the operators to determine their significance, criticality and the degree of urgency for the proper functioning of the processes as required by the users or laws and regulations.

The control room operator is also responsible to decide on the appropriate problem solution and to set priorities respecting general technical state of the art knowledge and the operation instructions provided by the TS equipment specialists. Co-ordination and setting of priorities for repair interventions is particularly important after major faults, which have a large impact all over CERN. Depending on the situation the control room operators are required to carry out first-line on-site interventions and to provide technical assistance to equipment specialists.

Tasks shall be prioritized in the following order:

- Tasks impacting on personal safety or environment protection
- Tasks preventing equipment damage and important financial losses
- Tasks optimizing the operation of accelerators and experiments
- Tasks not covered by one of the above-mentioned categories.

The control room shall reception malfunctions and faults, maintenance and work requests and dispatch them to the appropriate service in the TS department or mandated contractors and any other
concerned or interested service or user. This also implies the co-ordination of concurrent activities based on the centralised information that is not entirely available elsewhere. The control operators are e.g. in direct contact with the control room of the electricity and water suppliers.

The TS department in turn is responsible for the installation, maintenance and operation of the processes as well as for their control and monitoring infrastructure [1]. The TS equipment specialists will provide appropriate training to the control room operators where training internal to the CCC is not sufficient. The TS department with the help and in close collaboration with the control room operators will prepare up to date technical documentation and operation instructions.

The listed responsibilities will evolve as a function of the change in the Technical Infrastructure or its organisation for operation and maintenance. Tasks have to be deducted from these responsibilities and services and have to be defined in more detail in operation instructions, technical documentation and by the CCC management.

3.1 First-Line On-Site Interventions

First-line on-site interventions of qualified control room operators serve several purposes:

- The reduction of intervention times
- The reduction of cost for the stand-by services provided by contractors and TS staff, which are paid by intervention
- The respect of the Two-Person-Rule [2, 3] by having a qualified person easily available

The reduction of intervention times depending on the nature of the problem can be very important. Outside normal working hours the time to arrive on-site for a stand-by service is typically between thirty minutes and one hour. For the control room operators this time is typically between ten to twenty minutes. Therefore a control room operator within certain limits shall carry out first-line interventions on isolated faults, i.e. with limited impact. Interventions on high voltage equipment and the repair of equipment or the change of components are amongst other things excluded [4, 5].

In the case where the control room operator can erase the fault by a simple action (reset, restart, etc) and provided that a proper diagnosis has been done, the intervention of a specialist can be deferred to the next normal working hours. In the case where the operator cannot erase the fault, he must take a decision whether the criticality of the fault requires the intervention of a stand-by service. Therefore each successful control room intervention and good fault assessment can reduce contract costs, because in certain cases the maintenance contractors are paid according to the number of the stand-by service interventions. In addition, the control room operator must be able to give a detailed and technically correct report of the event and his first diagnosis to the stand-by service using the appropriate technical language. Only then a gain in intervention time is possible.

Control room operators should be available to accompany intervening specialist for certain on-site interventions that require two persons for safety reasons.

Between the 1st April 2005 and the 1st April 2007 the service of first-line on-site interventions will be very limited because manpower for the Technical Infrastructure operation from the control room is limited to one person on shift only. During this period the service will be covered either by the TS operation and maintenance teams or TS contractors.

3.2 Quality

The quality of the services provided by the CCC will not have only an impact on the quality of the functioning of the Technical Infrastructure, but also on the image of the operation and maintenance of the TS department. The CCC services are an integral part of the TS operation and maintenance strategy. Malfunctions of the CCC services will have a direct impact on the quality of work provided by the TS department.

All the CCC services therefore need to be carried out with a high standard of quality, which needs to be permanently monitored and adjusted. Persons, who need to get in contact with the control
room, should not need to wait longer than one minute before a phone call gets answered during normal operation conditions in the CCC. During major incidents, where priorities and resource allocation might be different, the waiting time can increase to ten minutes, provided that the persons calling are informed about the situation.

3.3 Reporting

All the CCC activities on the Technical Infrastructure must be reported in writing with a degree of detail that is comprehensible for the TS specialists and contractors to be able to carry out in depth postmortem analyses. With few exceptions the reporting has to be done exclusively with the following tools:

- The CAMMS - D7i
- The Major Event Reports [6]
- The on-site paper logs for on-site interventions

The TS department requires free access to all information that cannot be reported with the above-mentioned tools.

The CCC shall provide yearly statistics concerning the control room operation of the Technical Infrastructure, which enable the TS department to evaluate the level and quality of the described services. At least the following information shall be made available and analysed:

- The waiting time to get a telephone contact,
- The workload the operators are confronted to (phone calls, alarms, reports etc.),
- The number and nature of complaints of users with respect to the services,
- The quality and significance of the monitoring information,
- The quality of the instructions and documentation,
- The down time of accelerators and experiments due to malfunctions in the Technical Infrastructure.

Accelerator downtime data is to be retrieved from the TS Major Event Reports, which are approved jointly by the TS and AB departments.

The control room shall continuously propose quality improvements in close collaboration with the TS department. Therefore, short term reporting shall take place in the weekly TS Operation Committee (TSOC).

3.4 Control and Monitoring Infrastructure

With the exception of phone calls all the information necessary to provide the control room services depend on control and monitoring systems. Different parts of the Technical Infrastructure are controlled by different systems and are interconnected to transmit system faults, status information and process views to the control room. The information is presented to the operators either using the Technical Infrastructure Monitoring (TIM) or the specialist monitoring systems of TS-CSE, TS-CV and TS-EL.

Monitoring and operation from the control room is only possible when the entire chain of computing infrastructure is operational, including the computing network. Therefore the control room operators have to monitor, diagnose and carry out corrective first-line intervention on the TS controls and monitoring infrastructure. The systems concerned are PLC’s, local and remote monitoring systems, SCADA systems and servers. Only after a proper control room diagnosis the responsible service can be informed (AB-CO, IT, TS-CSE, TS-CV, TS-EL), who in most cases ensure interventions based on voluntary stand-by services only.
3.5 Specific Services

3.5.1 Safety Alarm Systems

In addition to the already described services the CCC is required to carry out the following tasks with respect to Safety Alarm Systems:

- Site Access Systems failure diagnosis and basic on-site intervention
- Accelerator and experimental areas systems fault diagnosis
- Accelerator and experimental areas access systems operation

The operation of the accelerator and experimental areas access systems consists of the change between access modes and managing the persons entering and leaving the protected areas.

3.5.2 Energy Monitoring

The monitoring and day-to-day management and co-ordination of users of electricity is a CCC service that has an important impact on the smooth functioning of CERN and can have considerable financial consequences. The CCC must assure a continuous monitoring of electrical power and energy, so that limits established by the electrical service are not exceeded.

4 QUALIFICATIONS

The control room operators must have a general technical background and a basic knowledge of the systems that are part of the Technical Infrastructure, and their control and monitoring systems:

- Electrical networks, power distribution and low voltage equipment
- Electro mechanics
- Fluid distribution, cooling and ventilation systems
- Safety systems such as fire and gas detection systems
- Industrial control systems and monitoring systems
- Advanced user knowledge of WINDOWS and UNIX operating systems

The operators shall be informed about the evolutions of the installations and its operational state and configuration. In particular, the operators shall have an understanding of the functioning of the maintenance and operation contracts and the corresponding constraints and rules. This concerns e.g. intervention times, contractor obligations, contractual limits, obligations for information exchange, key persons and their functions and also the CERN obligations and limits of responsibility.

To achieve this, the operator must be able to understand and analyse system functions and faults of a multitude of interconnected systems. System correlations must be well understood as well as the impact of faults on process equipment and behaviour. System malfunctions are often signalled via telephone or require technical discussions with specialist over the telephone. Therefore a good geographical and hardware knowledge is required. In particular, it is important that the operators can have fluent technical conversations in French and English over the phone and are able to write reports and work orders in French. This is due to the fact the TS contractors are in general only familiar with one of the official CERN languages and most of the TS specialists have a preference for French.

The TS equipment groups will provide appropriate training where control room internal training is not sufficient. The participation in the maintenance and operation during the shutdown as a member of the equipment groups would allow to temporarily increase manpower and to train the operators on the equipment they monitor from the control room.

5 CONCLUSION

The service requirements for the control room operation from the CCC have hardly changed with respect to the mandate of the former Technical Control Room (TCR). The responsibilities, the
quality of service, the domains to be covered and the required qualifications have been summarised. Some details on each of the subjects are already formalised in the form of technical documentation, operation instructions and rules established internally by the AB Department. The AB operation teams shall establish the missing parts in collaboration with the TS before the start of CCC operation in the beginning of 2006. Services will evolve as a function of the changing environment for operation and maintenance of the Technical Infrastructure. The TS department will provide all necessary technical support that the operators need to fulfil their mission. It is up to the AB department to put in place the appropriate organisation that is in phase with the expressed needs and other organisational and technical constraints for CCC operation.

REFERENCES

[1] Roberto Saban, Organization of the process control activities in the TS Department, interfaces to the AB Controls and Operations Group, EDMS Nr. 529964, CERN TS-204-181(HDO)