TCR AS SUPERVISOR OF TECHNICAL SYSTEMS

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Abstract

Our Technical Control Room (TCR) provides continuous supervision of CERN's technical infrastructure. It also serves the inhabitants of CERN's premises as a contact point in case of problems. Every year, we initiate eleven thousand recorded corrective interventions; about half subsequent to user phone calls, the other half to automatic alarms. TCR tasks are essentially fourfold: collect and distribute information on abnormal operation states; supervise those technical systems for which we have a mandate; initiate corrective interventions; and perform corrective on-site interventions outside normal working hours. A TCR operator normally has an education corresponding to a French BTS and initially little professional experience. He holds short-term contracts, up to a maximum of six years. This paper outlines TCR tasks and presents some statistical data. It also indicates relations between users, equipment groups, contract firms and the TCR as go-between. Finally, it gives an account of our seven years experience with operator contracts of limited duration.

1. INTRODUCTION

In the present paper we describe the context, the activities and some particularities of the Technical Control Room (TCR), and the working conditions of its operators. The description is aimed at staff members of the ST Division, and it was prepared specifically for presentation at a divisional workshop. Some of these people are in frequent contact with the TCR and have their own opinion of the service provided, on its strength and shortcomings. Others know the TCR only vaguely, as a phone number that can be called in case of technical problems. Hopefully, this paper will help for a better understanding and contribute to improve services given by the Division to the Organization.

2. TCR IN THE CONTEXT OF CERN AND THE ST DIVISION

CERN's premises spread over an area of 6 km^2 and house an impressive variety of installations, its technical infrastructure. This infrastructure includes popular things like roads and office buildings, but we also find CERN specific structures such as accelerator tunnels and experimental halls. Many of these civil engineering structures house technical installations, and all need resources and services in one form or another. We use electricity and water, we require cooling or heating, we have to obey safety rules and to respect environmental legislation. All this requires some kind of surveillance. At CERN we have several distinct control rooms, each one in charge of surveillance and operation of specific systems. The Fire Brigade (SCR) takes care of safety, the Meyrin Control Room (MCR) of the Proton Synchrotron Complex (CPS), the Prévessin Control Room (PCR) of SPS and LEP. Several Experimental Control Rooms (XCRs) look after the experiments and the TCR after the infrastructure.

The ST Division is, for most of CERN's technical infrastructure, in charge of its conception, construction, installation, maintenance and operation. Specialized groups within the Division have the responsibility for the equipment in their respective fields. All groups have contracts with outside companies for supplies and services. There are several common denominators, one being our

Technical Control Room. Every group of the Division, but also several groups of other divisions, have entrusted the TCR, to a varying degree, with the surveillance of their equipment.

Around seven thousand users are busy pursuing their exciting tasks at CERN. If any of them encounters a problem with equipment of our technical infrastructure and this requires repair, he calls the TCR. A TCR operator might do himself these repair interventions. In most cases, however, the work is passed on to the specialist, either a CERN group, or an outside company. If a user is dissatisfied with the quality of the service provided, especially the time needed for repair, he tends to blame the TCR, normally the only member in the chain of actions known to him.

3. TASKS AND ACTIVITIES OF THE TCR

The TCR does not get clearly defined mandates from the management or the specialist groups. Instead, we live with numerous detailed instructions that are in constant evolution. This requires attentive listening and great flexibility on our side. In fact, it is essentially up to us to define our mandate. This is an interesting challenge on its own, but carries the risk that we do not really match the specialist's mind.

A unique characteristic of the TCR, common only to the Fire Brigade (SCR), is the permanent presence of its operators, day and night, including public holidays. The other element that guides our approach when taking on specific tasks is the high level of basic technical competence of our operators. Hence our message: *We are permanently present, we have some competence, and we accept any task that makes sense, provided you give appropriate information and training. It's your decision to entrust, or not, TCR with a task for equipment or a service you are responsible for.*

3.1 Distribution of Information through TCR

One essential role of the TCR, a logical consequence of its permanent presence, is to serve as an agent for collecting and distributing information. Just to give two examples:

- In a contract with *"Electricité de France*" (EDF) for the supply of electric energy, CERN accepts to reduce its consumption for 22 days "*Effacement Jour de Pointe*" (EJP) during which time the cost of energy is prohibitive. These days are not predefined; EDF announces them on the eve of an EJP to the TCR. It is the task of the TCR to spread this information all over CERN, in particular to our accelerator control rooms, and to request the shutdown of all big consumers of electric energy.
- The Technical Inspection and Safety Commission (TIS) has edited the Safety Instruction IS37 which defines safety alarms and procedures for temporary disabling of safety equipment. This procedure obliges TCR to help the relevant parties in the transmission of information and to ensure a speedy wind-up in order to minimize safety risks.

3.2 Corrective Interventions Initiated by TCR

Obviously, the main task of the TCR is to get faulty equipment repaired. We encounter technical trivialities like broken windows, jammed doors, and clogged drains. For the annoyed user, it is important that this is repaired immediately. We receive technical alarms from equipment needed to run CERN's accelerators or experiments. Obviously, any time lost for CERN's vocation is crucial and has to get high priority. Even though safety alarms require the immediate intervention of the Fire Brigade, they are also sent to the TCR, together with associated technical alarms, and often require TCR actions as well.

- TCR interventions are numerous, about eleven thousand are recorded every year; see *Figure 1*. A few types of actions are outlined below.
- The largest number of corrective interventions is requested by the CERN users during normal working hours. Most of them are technically trivial and the TCR simply establishes work orders,

in the form of electronic documents, for service companies. In addition, for urgent requests, the work order is accompanied by a phone call.

Also, during normal working hours, automatic alarms appear frequently on the surveillance screens in the TCR. These alarms may be real. It is not uncommon, however, that they are caused by specialists performing maintenance work on their equipment. The operator often has to contact the specialist to find out what treatment he should give to alarms; ignore, or launch an intervention?

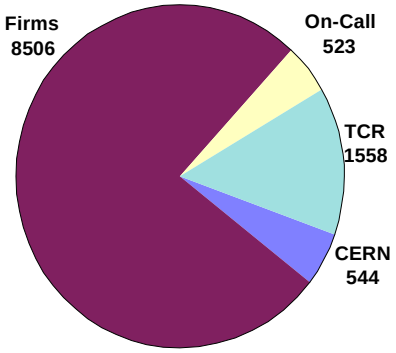

Fig. 1: Recorded interventions during 1996.

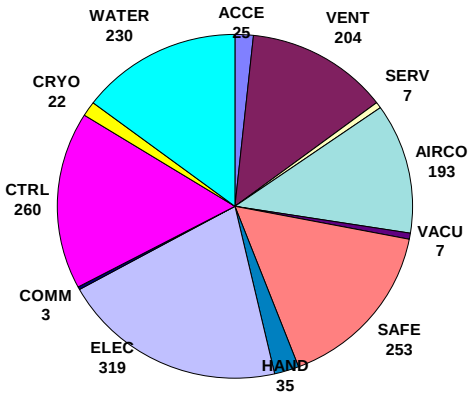

Fig. 2: TCR on-site interventions during 1996.

- For periods outside normal working hours, some groups have organized an on-call service, which involves many people in turn. These may be CERN staff or people from a company having a service contract with CERN. The TCR holds a large folder with the planning of all groups who have established such on-call services. However, it is costly for CERN to call this service. CERN staff gets overtime payment or takes compensation leave, the company gets a contractual payment. Therefore, many groups have asked TCR to minimize the number of these calls and to try corrective actions themselves.
- As can be seen in *Figure 2*, the TCR attempts on-site repairs during nights and weekends on average every four hours. Even if the operator does not succeed, his attempt often brings savings. He may have to call the specialist only for advice, or he can decide to postpone the repair to the next normal working day. It must be noted, however, that the operator's task here is tricky due to the complexity of the site and the large variety of equipment. The specialist tends to criticize the operator for unsuccessful interventions. He does not realize that even simple things are complicated if you are confronted with them rarely and in an unfamiliar technical or geographical environment.

4. TOOLS USED BY TCR

Obviously, the most important tools the TCR must have at its disposal are those for communication. Telephones are heavily solicited. We also rely a lot on e-mail, a little on fax, and interphones can be used between most control rooms.

The entire distributed control network and all associated informatics applications for remote control of equipment are also of vital importance. The TCR being essentially an alarm-driven control centre, the Central Alarm Server (CAS) is one of the most useful tools we have at our disposal.

For the dispatching of work orders to the specialists and the companies, we use some functions of a powerful Computer Assisted Maintenance System (CAMS, RAPIER). Many specialist groups use far more functions of this system for maintenance and other similar purposes.

Other informatics tools are in regular use. We have a data logging and retrieval system, an electronic logbook, a program to publish electrical energy consumption on the WEB, several administration programs for shift planning, payment of shift allowances and soon also for the on-call services.

We acknowledge the important contributions of several groups from the ST Division, but also from SL, IT and EST, in providing us with these tools. This is a continually evolving field of activity where the desired reliability is, however, not always up to the expectations of the operators. A statement picked up is: *In old times, we had to survey some technical installations, now, we have to nurse in addition the informatics system.*

We are also using with great efficiency some old-fashioned tools, which involve paper and pencil, checklists, and a huge bulk of written instructions all carefully hidden in numerous folders.

5. TCR ORGANIZATION

TCR has 14 operators which are organized around two groups of seven. One of them holds the more experienced members, the other the new recruits. A shift team is then formed of two operators, one from each group.

We follow sequences of seven consecutive shifts applying a *M-A-N* pattern (Morning-Afternoon-Night), interleaved with rest days and normal working days. The basic cycle is repeated every seven weeks, during which the operator works between 24 and 54 hours a week, with an average of 40. Every shift lasts eight hours plus an overlap time, 15 to 45 minutes, and shift changes take place at 6 a.m., 2 p.m. and 10 p.m. Without training or other absences, an operator would be 80% of his working time on shift, and 20% would be available for a second job. In reality, an operator spends more like 90% on shift. During holiday periods, this figure goes even above 100%, requiring overtime work.

For our shift planning, we use a spreadsheet program, which can be consulted by everybody at CERN through a NICE server. Due to its regular and periodic pattern, the planning is, in theory, defined many months in advance. In practice, however, as two operators must always be present, any absence for whatever reason implies replacements to be organized. The operators look after their replacement themselves and no administrative work by others, e.g. the supervisor, is required for that. This works perfectly and is one proof, amongst many others, of the devotion of the operators to their duty. The only problem is that CERN's Staff Rules and Regulations fix limitations on consecutive working days and maximum working hours, which we are often unable to respect.

6. THE OPERATORS

6.1 Contracts of Limited Duration

Since 1990, all contracts for TCR operators are of limited duration of three years with a possibility of renewal once only. The total period of employment on these contracts of limited duration is of six years at the most. The reason for this limitation is that shift working has detrimental effects on one's health and social life. Therefore, it must be limited, in terms of time, and not degenerate to a professional career. Since 1997, these contracts are established for first employment, which corresponds well with the objective to entrust these operator posts to young technicians without much previous professional experience.

Naturally, our operators would like to see a permanent contract at the end of this period. Even though we can never give any guarantee, we did manage in the recent past to transfer the best

operators to other posts, normally during their second three-year contract. We are also fairly selective and terminate contracts at the term of the initial three years if performance and potential are judged unsatisfactory. Several operators are now reaching the term of the maximum of the six years. They approach this in various ways. Some are quite worried and this reflects in their performance, others prepare in an excellent way for their professional conversion.

6.2 Requested Formal Education

It is not easy to define the most appropriate level of education required for a TCR operator. We tried those corresponding to career paths ranging from IV to VI. Though the formal education is not the only aspect, personality and motivation are often more relevant, we came to the conclusion that career path V, which corresponds to a French BTS or a British HND, is best suited for the job.

However, it is to be noted that for the majority of TCR interventions a lower level would be quite appropriate. Still, even if not frequent, operators have to master complex situations where they need an excellent technical background and a great maturity of judgement. It must also be stressed that the team of two operators has to take decisions that have a strong impact on the functioning of CERN, including on the availability of its major tools, the accelerators and experiments.

6.3 Required Additional Qualifications

The role of the TCR as information dispatching centre requires that every operator masters both official languages, French and English, spoken and written. Our experience is that the knowledge of foreign languages is not very widespread amongst technicians. Further personal qualities are required in communication, management of stress situations, and a lot of psychology. Operators have to represent the TCR in meetings organized by other groups or divisions, hence competence for efficient participation in meetings is also desirable.

Usually, a newly recruited operator brings some professional competence for a limited number of technical domains. He has to learn, if only superficially, many technical domains previously unfamiliar to him. A particular field where the initial competence is normally lacking is with modern controls and computing.

6.4 The Second Job

As could be seen in Section 5, a TCR operator does not have to spend all his time on shift. Though not much, there is some time available for working normal hours, and every operator spends this on a second job. TCR itself can only offer a second job in relation with its main activities: technical systems and in particular remote control and computing. We do not easily succeed in finding a second job fully in line with the operator's main professional competence. Occasionally, we manage to get a placement with other groups or even with other divisions, e.g. recently LHC/VAC kindly accepted to offer a second job activity in electronics to one of our operators.

6.5 Training as Operator and for the Second Job

Much time is spent on training for all our operators. Initially, one full month is entirely devoted to systematic training for the job as operator. Two of the experienced operators organize this and follow it up. We rely on training provided by experienced operators, specialists, and through formal courses. This initial training includes explanation of systems, visits of sites and equipment, and playback of video recorded seminars. The initial period often also includes intensive language training, between 4 and 15 weeks, 20 hours per week, with *Cours Commerciaux de Genève*.

An operator often receives solid training in software engineering methods and techniques, a domain with a bright outlook for the transition at the end of his contract. Some of our operators did embark with great success in specialized training involving examinations and diploma awards. This puts them at a recognized level of competence, useful at CERN, and essential elsewhere.

6.6 Termination of Contracts

The operators have Periodic Interviews, as all other CERN staff, and we consider this *MOAS* exercize a very useful personnel management tool. Already at the very first interview and then through all the following ones, the contract termination is considered and the best ways for preparing that event are discussed. All operators are encouraged and actively helped by the management, after their third year as operator, to find a conversion to a normal job. This effort has so far been mainly limited to the directly concerned Section and Group Leader. An active implication by other groups of the Division, and by other divisions, is highly desirable to increase the possibilities for the placement at CERN of the really good operators; we do have them.

Looking at our seven-year's experience with this type of contract for TCR operators, we get a somewhat contrasted picture. In total, we recruited 20 operators during this period. For three of them, CERN decided not to award a second three-year contract; another four found a normal job (three at CERN, one outside), between their fourth and sixth year. So far, only one has continued to the full six years and immediately found an excellent job outside CERN. Also to be mentioned: five operators who had been engaged as TCR operators before 1990 with fixed-term contracts could be moved to other jobs at CERN during this period.

7. CONCLUSIONS

It is not at all easy to find the best scheme for running a technical service like the TCR.

The responsibility for the equipment is with others, but operational problems are channelled via the TCR. How can the operator stand to be often blamed and rarely acknowledged? What is the achievement of an operator during his shift? What satisfaction can he draw from the job? How can we avoid frustration?

Shift work has negative implications on health and on social life. Shift work must be limited and six years are a good compromise. Compromise between the time required for learning the job and the time left for doing it efficiently. This limitation is also very important to keep the operator competitive for other jobs on the market. But, how can we avoid anxiety and keep people motivated as they approach the end of their contract?

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