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## CERN - **ST** Division

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### ST QUALITY WORKING GROUP

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#### Abstract

When CERN engages contractors or outside enterprises for supply and service contracts, a Quality certification is requested. CERN itself has no global certification. Nor are quality assurance systems well understood by the majority of CERN staff. This has not precluded successful activity but it is felt that a structured approach would have some benefits: elimination of occasional accelerator perturbations, improved documentation, efficient use of existing resources, enhanced sharing of experience and knowledge, avoidance of improper handover periods when staff leave CERN. In some cases talented staff spend too much time doing remedial jobs when they are capable of achieving much more. The ST quality working group was formed to address these problems. The goal of this quality working group is to help ST division maintain and continuously improve the quality of its services and operations, and give confidence to ST staff and clients that the requirements for quality are being fulfilled, maintained and improved. Since the working group was formed, the needs of the ST division have changed, thus necessitating a new Quality structure as described in this document.

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## 1 INTRODUCTION

Sometimes we ask ourselves why we need to change. A few years ago it was said “never change the winning team” but, is it nowadays the correct approach? Are we changing as fast and in the same direction as other organizations and enterprises? Have we lost the Quality train? This article identifies the reasons that have pushed ST division to change its traditional way of working. The different constraints are analysed and the consequences are shown. Quality and continuous improvement are seen as a positive solution to overcome the constraints. The implementation of the quality project is explained in different phases. First the identification of the vision, then the options and the reasons for attacking the problem in a certain way are approached. Finally the latest changes in the quality structure are explained.

This article is centred on two words, client and improvement. Client, because only when we are able to identify and understand what their needs are can we begin to fulfil them. Improvement, because the problem is not being able to recognise the errors and furthermore not being able to learn from them.

## 2 EXTERNAL AND INTERNAL CONSTRAINTS

Traditionally the quality drive is exercised in an enterprise mainly for two reasons: an internal request from the organization to improve efficiency, or an external need to adapt to the demands from clients and suppliers. In both cases quality is considered as a means to reduce costs and to improve processes. The main difference between the two cases is that when the request to implement quality comes from the inside, this is seen as a long-term investment. The changes lead to an improvement in the effectiveness, flexibility, and competitiveness of the organization as a whole. This kind of initiative involves every department and each person, and the level of satisfaction of the employees is as important as that of the client. The second kind of initiative is motivated by the need to survive, this is less conceptual and the actions are more centred on obtaining benefits that allow the organization to continue to be competitive. Also if both initiatives arrive at the same stage the second will be more client-oriented from the beginning.

The central policy of a non-profit organization is not usually to be competitive; hence the level of pressure from internal and external clients is somewhat different from the competitive pressures of operating a profitable business. In outside industry the increase in satisfaction of the client can be seen in an increase in sales, but when there is no profit, and the organization is the only provider of the services, then what factors can influence the business to improve its services? CERN is a clear example of a non-profit organization where the non-well-defined client is the high-energy physics community. In parallel ST is an organization with the monopoly of services, without competitors. Until the early 1990s there were no real external constraints to improve services or productivity. But more recently some changes have been introduced and these have had the effect of pushing CERN and ST to improve not only the quality but also productivity. Some of these changes will be explained in this paper.

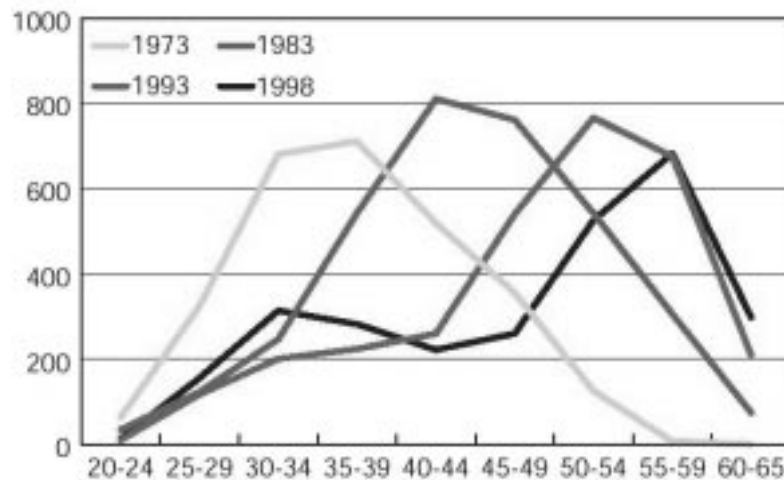
### 2.1 Policy and economic changes

To have a better understanding of how CERN is organized and its management policy, it is crucial to have a clear idea of what the purpose of CERN is. As stated in the 1953 official Convention document for the establishment of a European Organization for Nuclear Research:

“The Organization shall provide for collaboration among European States in nuclear research of a pure scientific and fundamental character and in research essentially related thereto. The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published...” [1].

CERN was created as a research centre funded by European countries, where the outputs and spin-offs from the Organization could not be sold. The aim was not profit but pure research. In this kind of environment it is the scientific community who set the objectives and thus they themselves are the client and the supplier. But to produce this pure science, the scientists need an infrastructure.

While for pure research it is difficult to set ‘tangible’ objectives, for the team in charge of the general services it is possible. Until now the people working on the infrastructure were also considered scientists, in reality most came from research teams, so they try to do their tasks by following the same philosophy, more artisan than industrial.



**Figure 1:** Evolution of the staff age and decrease of personnel.

The different economic crises in Europe led to a continuous budgetary decrease for the Organization. The personnel also decreased taking along with them the know-how. An organization based on experience more than on documentation began to suffer from this situation. Figure 1 shows the evolution of the age of CERN’s personnel, and how during the last 10 years the most experienced staff have left.

This is probably the first external constraint pushing forward the quality: Quality in order to survive with a smaller budget and fewer personnel.

## 2.2 Contracts

The decrease of personnel lead CERN to make an important change in its human resources policy. The lack of personnel was compensated for with service contracts. This pushed CERN into two new challenges. First, train people to change from ‘faire’ to ‘faire faire’. Second, learn how to co-ordinate the input given by different enterprises into a final product or service. All this dealing with highly structured enterprises, consortia, and as always with a client who is not well defined and is accustomed to changing his needs during the realisation phase.

We have to add a third challenge to the first two, the quality. CERN continues to require the bidders to be quality certified. The advantage of a certified enterprise is that a third party ensures its quality system. This can be understood as its ability to produce the same product or service more than once, with the same characteristics and if not, then it is able to trace the product, identify the problem, find the reason, and solve the non-conformity. But as ST division is not the final client in most cases, ST must realise that if does not have a quality system or it is incompatible with our supplier’s then it will not create the quality working environment that it seeks. We must also have a way to trace the product, solve the non-conformities, update the contract to the new needs of our clients, maintain and update our quality records, etc.

The major danger of asking for a certification is interpreting quality assurance requirements as a way to eliminate minor enterprises, solely regulatory, as if they had no beneficial effect on work performance or, as a way to ensure that the product or service you are purchasing is adequate to your needs. Certification is not the solution to all problems. To find a product or service adequate to our needs, the first and most important thing is *to write clearly our needs (the needs of our partners)*. The clearer our user requirements, the fewer problems we will have [2].

This brings us three new external constraints, how to transmit quality from our contractors to our partners, how to pass from 'faire' to 'faire faire', and finally how to co-ordinate different enterprises with different methodologies to give a homogeneous and coherent final product.

### **2.3 LHC**

Right from the onset, the LHC division realized that the traditional methods used at CERN to build previous accelerators would not suffice for logistics and economic reasons. The size and duration of the project, the geographical distribution of the institutes, contractors and suppliers involved in the design and construction, and the extensive use of advanced technologies all called for a Quality Assurance Plan (QAP) to be put in place. Moreover, the intrinsic complexity of the machine and the difficulty, not to say the impossibility, of correcting defects and/or consolidating the cold parts of the machine, required particular attention to be paid to the quality of products and of workmanship. Detailed documentation of all accelerator components, from the early design stage, continuing through all fabrication and testing processes, until the final installation and operation are also essential as very few accelerator builders will remain at CERN after the initial start-up of the LHC.

The objectives of the LHC QAP are to ensure that the LHC machine is built according to its design goals, on time and within budget, and that it can be operated, maintained, and improved to the entire satisfaction of the user community, in a cost-effective manner [3].

The lack of human resources and the policy of technology transfer affects the LHC division in the same way as ST division. 40% of the ST personnel is now working directly or indirectly for the LHC. So the third type of external constraint that pushes ST towards a quality approach is to know and to use the procedures, definitions, and standards written by the LHC division.

### **3 THE FEAR OF CHANGE**

Also if ST division has different external constraints, then that will help ST division to improve its services; all the previous quality campaigns failed. The main reason was the word 'quality' itself. Quality is understood or perceived differently by each member of the Organization. Like 'beauty', everyone may have his or her idea of what 'quality' is. In plain language, the standardized definition of 'quality' in ISO 9000 refers to all those features of a product (or service) which are required by the customer. So, quality is not quantitative, is not a concept to say that something is good and the best you can produce, but it is exactly the product or service your client requests. The term quality is not used as a single term to express the degree of excellence in a comparative sense nor is it used in a quantitative sense. Quality refers to the level of agreement between the supplier's capability and the client's needs.

In the same vein another problem is that the more current quality concepts are not well understood. People used to confuse quality assurance with quality control. The two represent different aspects of quality. So, perhaps at this juncture it is worth clarifying the two concepts. Quality assurance means all the planned and systematic activities implemented within the quality system, and demonstrated as needed to provide adequate confidence that an item will fulfil requirements for quality. While quality control means the operational techniques and activities that are used to fulfil requirements for quality. This involves operational techniques aimed at monitoring a process and at eliminating the causes of unsatisfactory performance.

The same thing happens with quality manual and quality plan. A quality manual is a document stating the quality policy and describing the quality system of the organization. A quality plan is a document setting out the specific practices, resources and sequence of activities relevant to a particular product, project, or contract.

This misunderstanding and mix-up of concepts makes the majority of people reject quality. The common idea is that they produce 'quality' products and give 'quality' services, and it is admitted that the client is not always clear, and the product definition changes several times during the life of the project. If ST division has not precluded successful activity, it is nearly impossible to optimize our work without a change in the way of life. In the past the three main types of constraints were less strong, but in a few years the lack of resources will make the situation worse.

We have seen that a structured approach would have some benefits: elimination of occasional accelerator perturbations, improved documentation, efficient use of existing resources, enhanced sharing of experience and knowledge, avoidance of improper handover periods when staff leave CERN. In some cases talented staff spend too much time doing remedial jobs when they are capable of achieving much more. This double feeling has definitively pushed the division to undertake the quality approach.

ST division was afraid of change but finally decided that it was better to dare to change. It is easier to solve the problems as they arise, but to really solve them you have to attack the cause.

#### 4 LOOKING FOR A VISION

In service organizations the first step is to identify the mission. Every one must know the reason for his work. For the ST division the mission is to provide services and support for CERN's infrastructure in the following areas: civil engineering, cooling and ventilation, air-conditioning, some low-temperature support work, transport of material and personnel, heavy handling of equipment, remote monitoring of technical installations CERN-wide, telecommunications, site and buildings maintenance and renovation, maintenance and installation of electrical systems and power distribution.

Once the objectives are clear then comes the vision or what we want to reach. Our vision was set by the Division Leader [4], and is to:

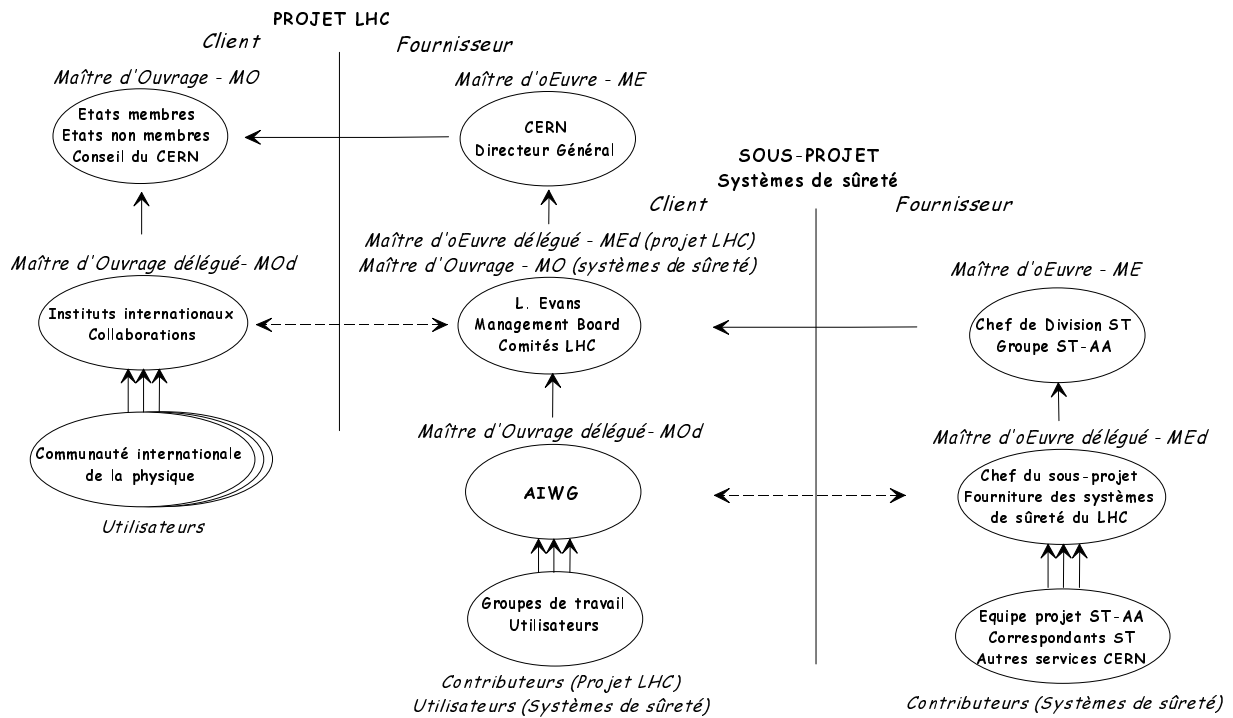
- Maintain and continuously improve the quality of our services: this implies better communication, better documentation, and the establishment of work procedures.
- Improve the quality of our operations, to continually meet all the stated or implied needs of our partners.
- Provide confidence to ST staff that the requirements for quality are being fulfilled, maintained, and improved continuously.

In the previous sentences there are two main words that we need to identify and clarify to reach the vision. The first one is partner (or client), the second one is service. Identifying services, and identifying clients is vital to be able to improve something, because we must always remember that quality is not quantitative, is not a concept to say that something is good and the best you can produce, but that it is exactly *the product or service your client requests*.

In a research environment the idea of client, partner, supplier is not so clear. Basic economic rules such as supply and demand do not apply. Revenue does not come always from the people receiving services, and funds can be cut off regardless of the need for or the quality of the service. When you don't know to whom you may respond or where are the limits of your supply your objectives can change too often. An example of how difficult it is to identify the real client is shown in Fig. 2. This also shows the different relationships between customers and suppliers for the control access system at CERN.

Understanding work processes, identifying customers and defining our services would have been the first key points for the quality endeavour for any of the two types of approach explained in Section 2. But as the external constraints are not yet strong enough, and the internal request was not felt as a first priority, the project began with a pre-phase.

ST division looked for a milestone, an objective to reach in the race for quality, and discovered that it first had to identify what ST's mission was, what services to give and to whom.



**Figure 2:** It is not always easy to identify who is your real client and to whom you may respond. Example of client identification for the new LHC access system. Courtesy of E. Cennini ST/AA/AC.

## 5 WHAT DO I NEED TO IMPROVE?

The study of the internal and external constraints has given us the reasons to improve. Now we need to know what to improve, how to improve it, and to begin. As mentioned before, the normal approach is to first identify the services and the clients, afterwards to study the services with their processes, and finally to identify the weak points that need to be improved. This approach was not the best suited for CERN. ST division does not have enough pressure from inside or from outside nor the resources to begin with a systematic and methodical analysis. Also, several initiatives had begun in different places and it was necessary to co-ordinate them and to ensure the coherence between them. Spontaneous initiatives can be very dangerous because in the desire to obtain a quick result, the local optimization can destabilize another service. For that reason, it was decided to begin with a compromise approach that will set the base of a feedback and training structure, but that instead of a systematic identification of the services will attack the present services directly by looking for an immediate spin-off, so as to be able to fight against the undisciplined initiatives.

The first milestones were then set as follows:

- Setting up a feedback, information structure. A quality working group (QWG) was set up with a representative from each group (quality linkman) so that the interests of each service could be heard and considered. The structure would not only give the first input but also distribute the information and collect the comments.
- Identification of constraints. Only a good understanding of the internal and external constraints allows us to tackle the problems and the needs in the right dimension.
- Establishing a common vocabulary. Each linkman gives a clear quality vocabulary to avoid misunderstandings and to involve everybody in the quality endeavour.

In order to obtain a fast result with major involvement of the staff, it was decided by the QWG to send out a questionnaire. It questioned in plain language the relationships between ST and our different clients. The main objectives were to identify:

- the services that are provided by the division and the clients,
- services that are not provided or where the provider is not clearly defined,

- procedures used for internal and external services,
- existing structures for the interaction/feedback for services and procedures,
- quality background,
- difficulties in dealing with the quality and the contracts,
- problems coming from lack of co-ordination between services.

The questionnaire was also a means to receive comments, ideas, requirements, solutions from all the staff so as to increase their involvement in the process. It is important to remember that in quality the co-ordination process comes from the top down, but what makes it alive is the input from the bottom up (ideas, needs, feedback).

The methodology and results can be seen in Ref. [5]. After the presentation of the report, it became apparent that a bigger input was necessary from the division leader and the group leaders to move forward positively with the quality drive. Indeed they arranged and participated in a quality workshop at the end of 1999 where the decisions taken were mainly based on the feedback from the questionnaires.

During this workshop it was decided to form six new Working Groups to fulfil the quality needs of the ST division and to maintain/re-orient four old WGs [6]. The new mandate of the QWG is to emphasize the role of the Quality linkmen as mediators and initiators. The main tasks will be to help in the understanding and implementation of the new procedures and strategies, and to make sure the new procedures and strategies are being used, collect the non-conformities and help the working groups to adapt them. The Working Groups are:

- LHC Quality Plan: In charge of the verification of the compatibility and follow-up of the LHC QP inside the division.
- Purchasing: In charge of the new purchasing procedures and templates for the MS and TS.
- Templates: Will prepare the templates for the memos, technical notes, procedures and meeting minutes.
- The WG for the 'Gestion de Projet'. The participants of the former WG will facilitate the application of the documents and guidelines elaborated by them.
- The Documentation working group will continue with the standards on the storage and format of the drawings done by outside companies. This document will be in agreement with the LHC drawing standards and will be sent with the technical specifications of the division. This group also will continue with the prototype of the EDMS system with the structure and the documents for one ST project.
- Contracts policy: To define and implement a common policy for the contracts. This working group will be supported by the maintenance managers and administrative follow-up working groups.
- Maintenance Managers: For the follow-up of the maintenance and optimization of the outsourcing and quality of the technical service. With two subgroups, CAMMS and operation.
- Finally a WG to write guidelines for the contracts administrative follow-up.

Figures 3 and 4 show these Working Groups.



Figure 3: Working groups to fulfil the quality needs of ST division.



Figure 4: Structure of the contracts policy working group.

## 6 A RACE WITHOUT A FINISH

The new structure emphasizes the role of the QWG as mediator and re-injector. The feedback is concentrated and treated before being re-injected into the working groups. The procedures are followed and explained to the staff, and improvement is made dynamically.

The priority areas set by top management were not exactly the same as those defined by the majority of the staff, but show a clear willingness to establish a permanent structure to make progress with the initiatives and to train and involve the staff in the quality approach. It is foreseen that in the future new Working Groups will be created to tackle the requirements that were identified in the questionnaire.



## 7 CONCLUSIONS

ST division has been reticent to begin a quality process mainly because the external and internal constraints did not push it. But now, those constraints are stronger and some systematic and structured approach is necessary to deal with these constraints. Several initiatives had started in the division but to avoid overlap and confusion it was necessary to co-ordinate them all. A working group was set up for that purpose and as first task identified the status of the services and evaluated the more urgent requirements of the staff in order to improve their work. As a result the top management has created an even stronger structure that will help in the implementation of the procedures created to fulfil the requirements.

To have satisfied partners, ST division has to believe that quality is living and not process driven. Satisfying the customer is a race without a finish. We must continuously improve ourselves and not become stagnant and we must learn from our mistakes and also learn from our successes. True and long-lasting quality is to do with attitudes, behaviour, beliefs and commitment.

*"It means smarter staff and management."*

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