MEGAPIE AND QUALITY ASSURANCE

P. Ming

To design, manufacture, assemble, test and operate a liquid metal target for the Spallation Neutron Source SINQ requires that each phase of the project be handled very carefully. An instrument to achieve this goal can be the implementation of a quality assurance standard e.g. ISO 9001. Is such a standard necessary? What is the difference for the product and the involved persons having or not having such a standard? These questions will be discussed and also the first steps to implement a Quality Assurance Program are described, along with some thoughts about quality assurance in future projects at PSI.

QUALITY ASSURANCE, WHAT IS IT?

Each project needs independent of the project's goal, a series of processes that are always of the same nature. These processes are the following:

- **project controlling -**
  to have a time schedule connected to the availability of resources.
- **project documentation -**
  to have a system identifying each document and if necessary the reference to the hardware parts of the project.
- **communication organisation -**
  e.g. electronic information exchange and storage.
- **release and acceptance processes -**
  for specifications, procurement and systems.
- **non conformance handling and correction processes -**
  this is one of the key issues of a project.
- **interface management -**
  a challenging task in a project like MEGAPIE due to being embedded in an international partnership.

All these processes can be broken down to sub-processes of various levels to yield a list of tools and personnel to apply them to fulfil their task.

A picture of the effect of a quality assurance standard being adhered to can be found comparing a group of sailing boats before the regatta and at the start.

Before the regatta each boat has its individual direction and speed, all fully self-consistent with prefect control over a restricted scope. This situation changes dramatically as soon the teams start their project or race: The field of boats is fully streamlined.

Each person knows the goal but keeps his individuality to deal with the challenge of the wind. But there are also invisible things the teams are connected to: The competition rules, the norms and classification standards of the boats, the communication procedures by flags and many more procedures These streamlining, "gluing" effects represent a quality assurance system. Of course, each boat could sail along the required course without such a system. The rules always restrict the freedom of each team. But in knowing that these rules and norms are helping to manage the processes each race needs anyway, they agree on them and therefore are able to concentrate on the real challenge of the race! The essence of quality assurance could thus be addressed by the slogan:

"UNITY in DIVERSITY"

IS QUALITY ASSURANCE NECESSARY?

As everybody knows, such a question cannot be answered just by Yes or No without taking into account the background of the project being discussed. If a project has relatively few interfaces, if the team members know each other for a long time and if the ways of communication are really short, a quality assurance system is not required in general. But, in a project like MEGAPIE having so many "boats" from so many countries embedded in a sensitive environment, a quality assurance system is indispensable. It helps not only to have a functioning product at the end; it also helps to minimize the overall effort, provided that the standardisation is implemented with common sense, as opposed to a formalistic way. This allows, then, re-investing the resources gained on the project organisation into other key issues of the project.

QUALITY ASSURANCE IN MEGAPIE

PSI does not have a standard of quality assurance established for its projects. The consequences are that projects like MEGAPIE cannot build up on a tuned network of accepted procedures. Of course, for virtually all procedures needed to tackle the standard project work some solutions exist at PSI. Given the complexity of the MEGAPIE spallation target, the international network of cooperation and the high risk that an eventual failure of the liquid lead target would affect hundreds of scientists using the neutron beams, the wish to introduce some measures for quality assurance was evident. On the other hand, the project, having started some time ago, had already taken up some momentum. The time schedule and the financial resources were extremely tight. To fully implement a quality assurance system, based e.g. on ISO 9001, therefore seemed not to be feasible anymore. Facing these facts the reasonable intermediate solution was to focus on a few key points and key processes.

In a first step the goal of the project has been written down word by word and communicated. That means each person involved should know it and understand why steps, normally not mentioned, are very important and must be fulfilled and documented in a traceable way. A second step was to implement a holding point a so-called *Readiness for Manufacturing Review*. This review assures that all input needed is present and that all persons involved, from the scientists to the designers, the manufacturers and the operators and of course the project management staff, can agree to start hardware production. Changes after this point are in principle still possible but only with dramatic consequences in terms of time and money. In order to establish this readiness for manufacturing, a huge effort is required. First, the input issues and the results of the review must be defined. Second, these definitions must be consolidated in cooperation with the persons involved. Not an easy job if these persons are distributed over France, Latvia, Italy and Switzerland and if all of them speak a different kind of English. The “language finding” is a real challenge!

Parallel to this work, the implementation of an approval and release process, including a documentation system has been initiated. The procedures to be applied to incoming raw and manufactured goods had to be defined and communicated. Being aware of this need, another issue comes up immediately. Are the control instruments duly calibrated, do they have a valid certification? If not, another backpack of work will have to be added to all the other work packages needed to assure quality. Looking at all these tasks, which had to be sneaked into the MEGAPIE project, the question arises: “How could this situation be improved in future projects?”

QUALITY ASSURANCE IN FUTURE PROJECTS

Some facts about quality assurance that are good to know:

1. Any existing norm tells WHAT should be done rather than telling HOW to do it.
2. Any project goal can be reached with or without a quality assurance system.
3. Nobody is forced to use a standard like ISO 9001. Each organisation can define its own standard. But these private “standards” will cover more or less the same issues as an existing norm.
4. Project Management, Process Management and Quality Assurance are strongly bound together and often relate to the same issues.

The most important gain to be made in the future is to improve the organisation of new projects based on the experience from former ones. The projects are different, but all processes of quality assurance are alike. Therefore, feedback (i.e. porting of experience on quality assurance activities) can greatly improve the process of realizing projects. Establishing such a tradition would also reduce the initial effort needed to go into quality assurance. Too often this initial effort is feared, unjustly. Time to harvest naturally comes after seeding.

BEYOND SYSTEMS AND NORMS

This article has included much about management tasks, procedures, standards and norms. All the tools can at most be helpful, but are not the primary reason for success: To reach the goal and achieve an excellent product is only possible with humans. Their brain, in combination with their skills, flexibility and thinking ahead, supported by using just the right hardware and software tools, including quality assurance, can create extraordinary results. Accepting this fact it is for sure that MEGAPIE will reach the goal:

“Having a safely functioning liquid metal target in the one megawatt region for SINQ”!

MEGAPIE (Megawatt Pilot Target Experiment) is an initiative launched by Commisariat à l'Energie Atomique, Cadarache (France) and Forschungszentrum Karlsruhe (Germany) in collaboration with Paul Scherrer Institut (Switzerland), to demonstrate, in an international collaboration, the feasibility of a liquid lead bismuth target for spallation facilities at a beam power level of 1 MW. Such a target is under consideration for various concepts of accelerator driven systems (ADS) to be used in transmutation of nuclear waste and other applications worldwide.

Links

http://megapie.web.psi.ch/
http://sinq.web.psi.ch/
http://www.iso.ch/