EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE

CERN - ST Division

CERN-ST-2001-045
1st February 2001

GAS DETECTION FOR EXPERIMENTS

D. Hay

Abstract

Flammable gases are often used in detectors for physics experiments. The storage, distribution and manipulation of such flammable gases present several safety hazards. As most flammable gases cannot be detected by human senses, specific well-placed gas detection systems must be installed. Following a request from the user group and in collaboration with CERN safety officers, risk analyses are performed. An external contractor, who needs to receive detailed user requirements from CERN, performs the installations. The contract is passed on a guaranteed results basis. Co-ordination between all the CERN groups and verification of the technical installation is done by ST/AA/AS. This paper describes and focuses on the structured methodology applied to implement such installations based on goal directed project management techniques (GDPM). This useful supervision tool suited to small to medium sized projects facilitates the task of co-ordinating numerous activities to achieve a completely functional system.

Presented at the 4th ST Workshop
Chamonix, France, 30 January - 2 February 2001

1 INTRODUCTION

The present trend at CERN is to integrate and deliver proven industrial equipment and apply available specialist expertise to equipment that was in part developed and installed in house. In line with this policy a new contract for the supply and installation of Automatic Gas Detection Systems passed on a guaranteed results basis has been awarded to a manufacturer and installer consortium. The equipment manufacturer is deemed solely responsible and liable for the reliability and performance all equipment supplied and installed by them, including the supervision of system design, installation process and all technical performance tests following final approval from CERN.

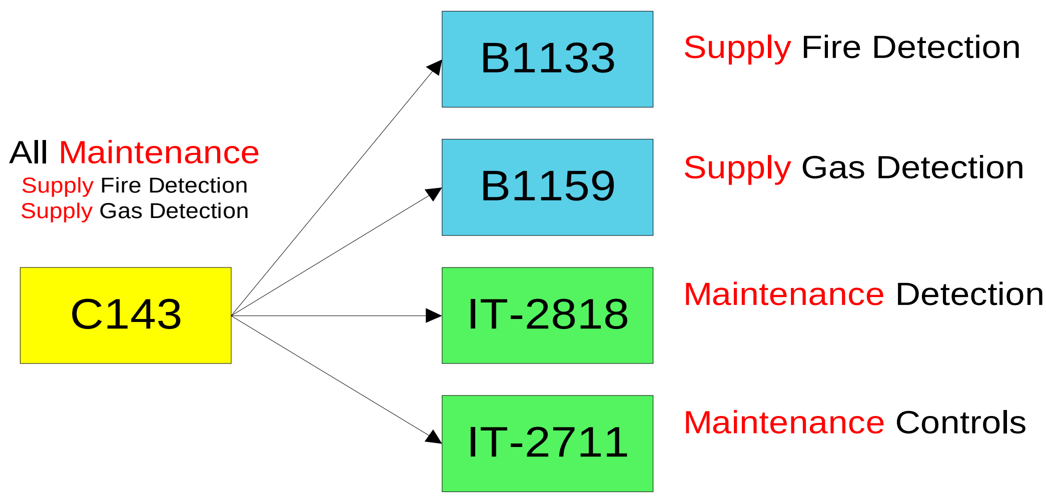

Fig 1 Contract situation ST/AA/AS

2 PROJECT-BASED APPROACH

As shown in Figure 1, in preparation for the LHC era, the existing contract C143 has been subdivided into two supply and two maintenance contracts. This contractual change strategy has led the ST-AA-AS group to organise its supply and installation activities by projects, choosing to apply aspects of goal directed project management techniques to aid the monitoring and control process. The choice of this structured project management tool helps to facilitate the combining of CERN resources and industrial support by creating an environment where internal and external personnel are able to commit to, and appreciate the requirements of a project cycle with one common objective.

To this end, the definition and production of milestone plans, activity schedules and responsibility charts are undertaken at project group level by pre nominated project correspondents. The production of these documents is of paramount importance, as they visually demonstrate the logical sequence or states a project must pass through to achieve final objectives, describing what is to be achieved at each state, who is responsible for each task and how these states are to be achieved.

3 ROLE OF THE PROJECT SUPERVISOR.

The role of the project supervisor is to act as in intermediate between those parties involved, to control and monitor progress taking corrective action on time and in the long term forecast and plan within pre defined time constraints and resources along the entire control and monitoring process. Special emphasis for this co-ordination effort addressing the following:

- Detailed planning of the forthcoming activities, with special attention paid to the tests and acceptance of the new equipment or systems; (safety systems).

- Scheduling of the projects on time, to ensure that all the implied levels can reach the stipulated milestones by the critical dates, and to rationalise the distribution of resources to those milestones and schedules.
- Project supervision (planning, control, reporting, co-ordination), user requirements analysis, production of system specification, feasibility studies, developments based upon CERN specifications, installation and integration, maintenance, support, training, and project documentation.
- Roles must be defined who does what and when.

4 FEASIBILITY STUDIES

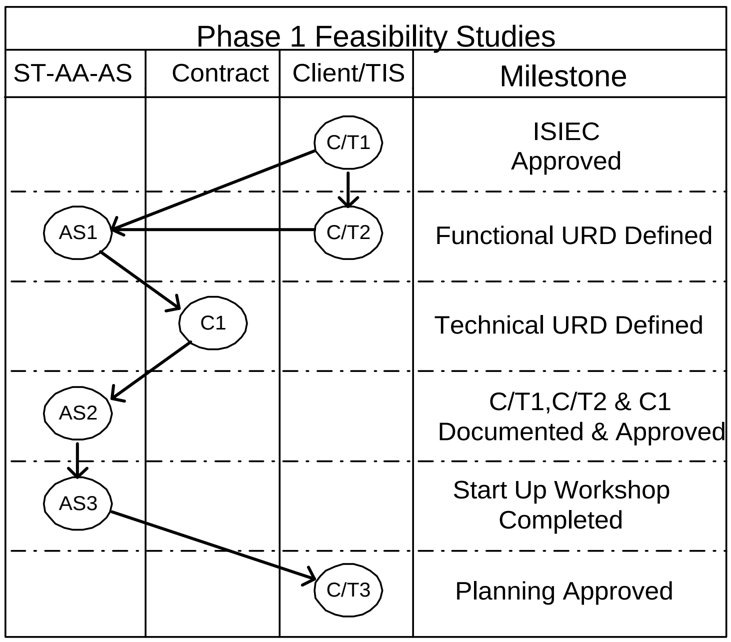

Fig.2 Milestone plan feasibility study.

AS = Responsibility of the ST-AA-AS group.
C = Responsibility of the contractors.
C/T = User and TIS requirements.

4.1 Milestone C/T1 ISIEC Approval (project preparation)

During the conception stage of a new experiment or proposed equipment test in a particle beam zone or laboratory an "Initial Safety Information for Experiments at CERN" (ISIEC) form must be duly completed by the GLIMOS of the experiment and sent to the divisional safety officer of the division concerned. When flammable gas is to be used, the DSO (Divisional Safety Officer) will co-ordinate meetings with TIS safety experts and the divisional FGSO (Flammable Gas Safety Officer), to study in detail the safety requirements of the proposed system. A preliminary risk analysis is carried out at this stage, resulting in the production of a commissioning report whose requirements must be fulfilled before the system can be authorised to operate normally with flammable gas.

4.2 Milestones AS1 & C/T2 Functional and Technical URD

Once the commissioning report is finalised and approved, the project supervisor responsible for flammable gas detection amalgamates the basis of this report to produce a more detailed analysis of the user requirements (URD) from a functional perspective and not a technical perspective which has been delegated to the contractor.

The URD defines each work package and is transmitted to the contractors using a price inquiry form. This form expresses the basic user requirements for the work package concerned. The contractor is under obligation to respond to this price inquiry with a technical and financial proposal using the unit prices of items agreed within the contract by the time constraints specified**.**

Before any installation work can be undertaken. A detailed design of the system, including details of the purposes of any sub-assemblies, descriptions of the physical principles and attributes that regulate and govern the process, stating the constraints inherent to each equipment item to be installed is submitted to CERN for approval.

4.3 Milestones C/T1, C/T2 & C1 Documented & Approved.

On receipt of this proposition, the project supervisor organises a meeting with designated CERN safety coordinators. The purpose of this meeting is to discuss the initial proposition and design layout of the gas detection system. On final approval, the offer is then presented to the user group for technical & financial acceptance.

4.4 Milestones AS3 & C/T3 Start Up Workshop

Once this preparation stage is finalised and the user group has agreed to commit the necessary financial resources, the project supervisor organises a project start up meeting (workshop) involving representatives from the user group, ST correspondents, contract consortium and CERN safety coordinators. The purpose of this meeting, which has multiple roles, is to communicate the overall goals and objectives of the project in hand by stimulation of group discussions and analysis of the project mandate, planning, project organisation, aspects of quality assurance, financial and time constraints. Based on the outcome of this meeting, the project supervisor produces and submits a preliminary planning in the form of a milestone plan, responsibility and activity chart for approval and acceptance. By obtaining an overview of these tasks a foundation for allocating resources and a program of monitoring and control is realised.

5 INSTALLATION PHASE

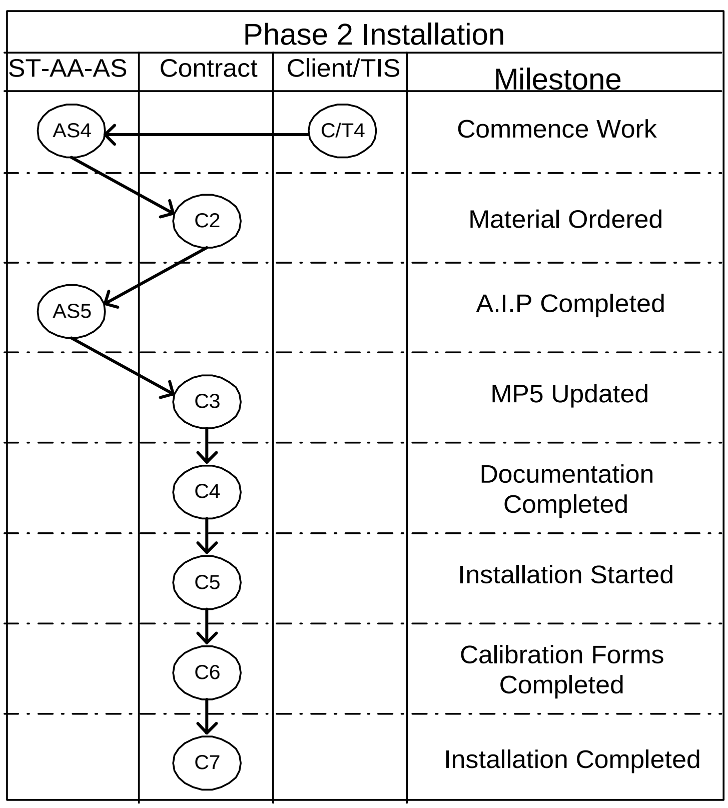

Fig.3 Milestone plan Installation

5.1 Milestones AS4, C/T4, C2, AS5, C3 & C4 Commence work.

On average there can be a delay of six weeks between the ordering and delivery of material from the manufacturers, during this period the parameters of the new system are integrated into the CERN's *CAMM* (Computer Assisted Management) system. The project supervisor prepares (in form of EXCEL sheet) and ensures the transmission of alarms to the TCR and SCR respectively following the ST-MO alarm integration procedure.

5.2 Milestones C5, C6 & C7

Once the material is received, the project supervisor follows the installation process with the contractor. Weekly progress meetings are held with the contractor. The aim of these meetings is to monitor progress and check that the installation process is not deviating from the agreed plan. Corrective measures can be taken quickly for any unforeseen problems.

6 ACCEPTANCE TESTS

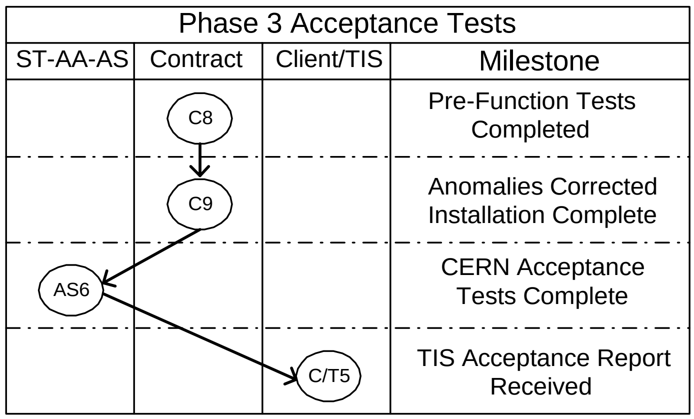

Fig.4 Milestone Plan Acceptance Tests

6.1 Milestones C8, C9, AS6 & C/T5 Acceptance Tests.

Once the contractor considers that an installation is ready for acceptance testing, the contractor under his sole responsibility performs pre functional, installation, and acceptance tests. The project supervisor is consulted prior to the tests and is invited to witness them. Anomalies are recorded and corrected at this stage. The project supervisor checks that the installation is complete and fully compliant with the contract, that all specified tests have been successfully completed and all documentation referred to in the specification have been delivered.

Final acceptance tests are performed in collaboration with CERN's technical and Safety Commission (TIS) and representatives from the Fire Brigade and the concerned technical services. The final acceptance report is drawn up by TIS and distributed to all those concerned.

The contractor guarantees the conformity of the supplies with the contract and their proper performance as set out in particular in the relevant *Price Inquiry* and *Calibration Form* for a period of two years from the date of their acceptance.

7 CONCLUSION

The introduction of structured project management techniques substantially improves the chances of successfully implementing the installation of gas detection systems and delivering a high quality product on time and to cost. From conception to implementation and the final commissioning of the system the activities can be structured, organised and monitored. However, special care should be exercised with the monitoring of the project, given that the contractor could consider itself to be in a monopoly position. Clear specifications will ease the design process, the project follow-up, and optimize the cost of the product by minimizing this potential risk factor applied by the contractor. CERN should also be aware of the possible loss of internal knowledge of its systems. Nevertheless, the knowledge gained by collaborating with industry for the installation of Automatic Gas Detection Systems will improve the quality of our projects and operational tasks. The use of industrial safety standards and the outsourcing of systems development including system installation will help to achieve these goals.

REFERENCES

[1] P. Ninin, M. Vanden, Project Management as a Breakthrough at CERN.

[2] E.S. Andersen, K.V. Grude and T. Haug - Coopers & Lybrand Goal Directed Project Management.

[3] B. Denis, CERN SL, Module 5 -CM Managing By Projects.

[4] IT-2696/ST Technical Specification for the Supply & Installation of Automatic Gas Detection Systems.