Installation of a CMMS piece of software aiming to improve the maintenance strategy at Ganil

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After a thorough study led out by a working group during year 2000, the Ganil laboratory decided to adopt a Computerised Maintenance Management Software (CMMS) to improve and federate its maintenance strategy as well as to answer specific regulations emitted by safety authorities. In December 2000, decision was made to use the Carl piece of software and the project started in March 2001. First expected operational applications are expected by the end of the 2001 / 2002 yearly winter machine shutdown.

As we have not got yet any real and practical experience from the use of the CMMS software, the presentation only focuses on the main problems encountered when running the project at the conception and development phases. It explains the approach we have followed, first acquiring the basic vocabulary and concepts attached to this specific domain quite new for us, then trying to integrate and apply them within the wider scope as possible into the laboratory. As far as technical problems are concerned, it mainly shows how the design and architecture proposed by the Carl software have been mapped to the Ganil organisation and structure. At least, some emphasis is also given to environmental and human factors as it is not so easy first to introduce such concepts into a more than 20 years aged laboratory, then to standardise various existing maintenance strategies in use among the different technical groups from Ganil.

Introduction

The heavy ion beam accelerator Ganil is the French host laboratory able to accelerate ions from Helium to Uranium in a wide spread of energy and open to the national and international scientific community. It has been providing beam for the physicists since 1983 so that it's becoming quite an old installation needing a straight maintenance policy.

Yet extensions, upgrades and rejuvenation programs allowed the facility to keep a high level of availability as well as extending the machine performances as time passed. Recently, the Radioactive Ion Beam Spiral project has been set into operation as the first exotic beam consisting of Neon 18 was first delivered in last September bringing so new field of activities in the nuclear physics and astrophysics domains as well as in the condensed matter physics. At the same time, it needed to add new pieces of equipment beside of the existing installation and the result is a quite heterogeneous set of equipment to be maintained in terms in age, complexity and diversity.

Following the recommendations of a study group in 2000, a new project was launched by March 2001 with the objective to introduce a CMMS (Computerised Maintenance Management Software) tool to improve the maintenance strategy over the site and to help people to manage their equipment. This paper summarises the project progress along the conception and development phases and provides its current status as the first operational applications are expected in March, by the end of the yearly Ganil winter shutdown.

1 Maintenance status at Ganil

The first work of the study group has been to give an overview of the maintenance policy inside the Ganil facility [1] and the main points are stressed here.

1.1 The Ganil installation

Ganil is a wide installation and many equipment have to be maintained. It ranges from the 4000 pieces of equipment involved into the beam production to the experimental area which are ever evolving ; it also includes the global site infrastructure offering services such as the electrical distribution network, cooling systems, fire detectors and extinguishers, buildings … An estimation for the equipment to be concerned by the maintenance process is around 7000 pieces ; then according to the level of maintenance and granularity to be reached, this could generate a quite larger number of items to be basically maintained.

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1.2 Maintenance cost

Maintenance cost is very difficult to be estimated as each one does not give the same meaning to this concept. As an example, it is sometimes not easy to consider equipment upgrade as maintenance or not. Improving the functionality may lead to replace some oldest components and so affect maintenance work. A rough figure for this cost is about 1.5 M € a year including the hardware and the sub-contractors cost.

1.3 Organisation

The main issue considering this point is the lack of homogeneity as each technical group manages its own policy. So it's quite difficult to get meaningful and accurate indicators from the maintenance performed ; also there are very few interactions between people from different groups to exchange information and to get a coherent maintenance approach.

1.4 Naming conventions

As a consequence, there are several ways of identifying pieces of equipment, according to different logical concepts, designs and approaches. Furthermore, the existing systems in use are not compatible between them and most of time are not suitable for maintenance naming codification. For instance, the same name is often used to name both the piece of equipment (hardware), its location or the function he has to provide so moving the hardware implies to rename it and in most cases to loose the maintenance history.

1.5 Maintenance history

In the same way, many different tools are used to keep maintenance history for pieces of equipment. In the worst cases, the only maintenance history relies on people's mind ; otherwise, it can be achieved using paper sheets or different packaged software including office automation tools such as Word or Excel, database management systems mainly based on Access or sometimes dBaseIII. Even if these dedicated applications proved to be very useful and well adapted for the need they cover, building the maintenance history on them raised with time many problems : either the person who developed the application went away with the knowledge, either the application runs perfectly but turns to be too limited as the problem is becoming more complex.

1.6 Human factors

The last point to be pointed out is perhaps the more sensitive one as it deals with people habits. Most of people have been used for years to work without any organised maintenance policy and consequently were not ready to accept the maintenance concepts and to adopt the organisation inherent with the CMMS installation.

2 The CMMS project

2.1 Project CMMS group constitution

Considering all the points listed above coming from the study group, it was decided to try to federate maintenance policy and at the same time to propose a common software tool and approach for the whole laboratory.

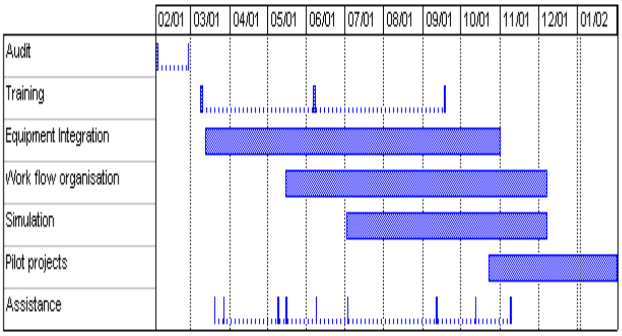
Also as regulations emitted by the safety authorities are enforced, Ganil facility has to set new procedures to keep track of equipment being installed into contaminated areas with the ability to have received the beam. It is foreseen that such an history could be obtained through the use of a CMMS software.

Once the decision has been taken, the study group was transformed into an other structure, the CMMS project group composed with 10 people coming from the technical groups more involved into the maintenance concepts and able to introduce CMMS in their domain within quite a short time. This transversal structure was very well suited to the project but has shown some limits as people worked at very different speed so bringing some problems to synchronise the whole project progress.

Beside of the technical aspects, one major objective for the project has always been to try to convince people rather than to impose them the CMMS and maintenance concepts. So an important guideline was to propose solutions, being not too directive. The challenge was therefore to bring a coherent approach but leaving enough freedom to technical groups for a smooth integration.

2.2 *Global scheduling*

The following diagram summarises the global planning we really followed.



The project started with a site audit performed by the CMMS provider to get an accurate view of the maintenance status in each technical group and to focus on their main attempts considering the use of a CMMS software. The Ganil directors as well as the executive board have also been invited to specify what they expect from the CMMS use in the laboratory. The result of the audit was a synthesis document written by the CMMS

consultant [3] and it allowed us at the same time to start working jointly with the CMMS provider.

Training has been spread over the year to best fit with the project progress.

The project itself consisted of two phases. The first one corresponds to the organisation and conception phase. This phase included three main tasks, the former one was the so-called "**equipment codification**" step in which we had to define how the Ganil installation would be integrated into the CMMS piece of software, how to build the architecture and what naming conventions should be adopted. The second task known as the "**work codification**" consisted in implementing a work organisation relying on the work management associated to the CMMS software. At the end of this phase, we started a simulation of the CMMS use by working on a prototype database.

The second phase aimed to prepare some well delimited applications to be the first maintenance domains set into operation. These so-called "**pilot projects**" were chosen carefully according to several criteria : interest, short-time benefits, size, complexity, people availability and openness for the project, use of different CMMS functionalities … The major objective is here to give us quite a quick experience from the CMMS use.

3 The Carl Master packaged software

3.1 The Carl Master choice

After evaluating four different packaged software, we decided to use the Carl Master software provided by the Carl-International company located in Lyon, France. The main reasons for this choice were mainly the product ergonomy and the ability from the provider to give us assistance along the project progress. Also it seemed to us that the product was a good compromise and balance between the capabilities we were expecting and the complexity it presents (so the manpower and time to be invested into its deployment).

3.2 Main characteristics

As far as technical aspects are concerned, the software runs within a Windows client / server environment. The CMMS software relies on an Oracle database running on a Windows NT server.

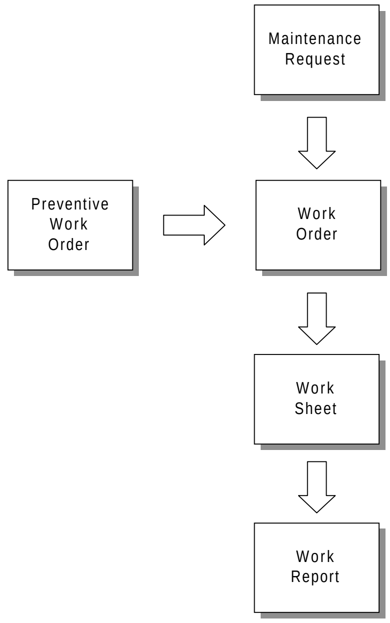
The software consists of different modules corresponding to the classical CMMS functionalities to manage equipment, work, inventory, budget, human resources and purchasing. As the first scope of the project only deals with the equipment management and work management modules, only these functionalities are briefly presented in this document.

3.3 Equipment management

The equipment management module allows to organise, structure equipment along three managed trees : a functional tree, an auxiliary one and a familiar one (to define models). Specific links can be established between these trees to get transversal views of the equipment to be maintained. Additional trees can be defined along the main tree to provide more possibilities to access data.

3.4 Work management

Work and activities can be organised, scheduled and archived with the work management module, according to the intervention cycle :



- The first step corresponds to the work initialisation and intervention demand emitted by any user in case of failure, abnormal behaviour … This step can be done using the Carl **Maintenance Request** or by phone call, e-mail, paper sheet …
- Then the **Work Order** step is only required in case of work having to be prepared and previously scheduled. From the work oder are generated **Work Sheet(s)** to be given to the field workers.
- The **Work Report** corresponds to the intervention itself and integrates all the information needed to keep a full maintenance history : equipment, location, function, name of workers, spare parts, sub-contracts, working time, description of the diagnostic and work, comments …
- Preventive maintenance can also be performed from **Preventive Work Order** allowing to trigger Work Orders according to calendar dates, counters or specific conditions.

4 Integrating Ganil maintenance into Carl

The conception and development phase of the project consisted of defining how the Ganil installation and organisational structure could be modelled through the Carl software. At the end of this phase were produced two reference 50 pages documents [4], [5] explaining how to organise, name pieces of equipment, giving syntax and codification rules and proposing a maintenance organisation.

4.1 Modelling the Ganil facility

Named as the "Equipment codification" task, mapping the Ganil installation into the hierarchical trees proposed by Carl took quite a long time since many solutions could be foreseen. It had to integrate and mix different approaches, concepts, ways of doing maintenance, granularity level of items to be maintained, respect of rules issued from safety requirements ; technical and physical characteristics, physical or logical networks organisation …

An other difficulty factor has been the fact that in order to preserve the whole maintenance history we wanted the tree structure to be independent from the existing hierarchical structure and Ganil organisation ; so the equipment representation will remain unchanged even if in the case of a structure reorganisation. This willingness often struggled with the people's reflex to build their own proprietary tree structure.

The first decision led us to consider the main tree as a functional organisation, the auxiliary one to display the geographical location of equipment and the familiar tree for the equipment model representation. Then were decided the allocation of the main branches, the way to integrate controlled areas into the geographical tree etc ...

4.2 Naming conventions

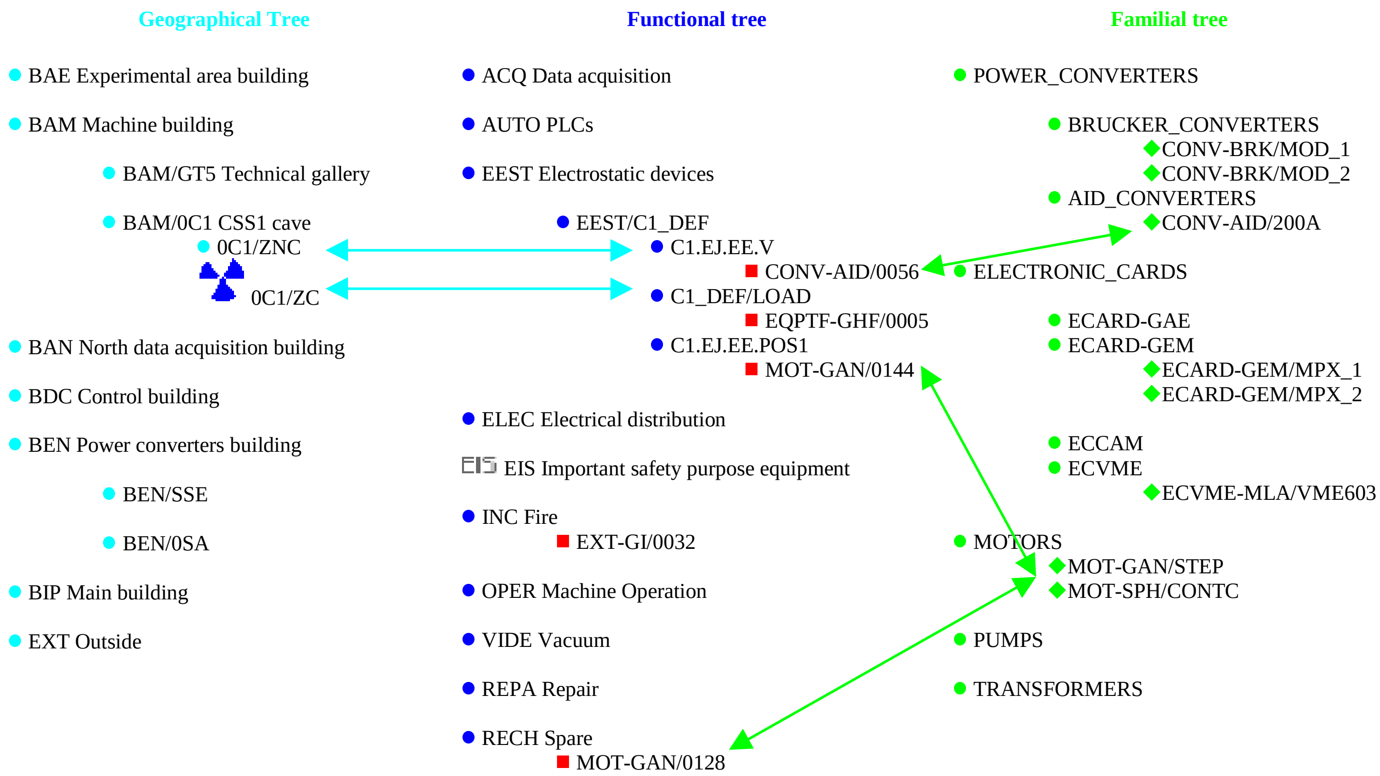
Also some time was spent to propose naming conventions according to the CMMS principles and recommendations, the software constraints and as far as possible to be compatible with the existing systems.

For pieces of equipment, the naming convention is the following :

HARD	-	MAN	/	DEVICE_ID

where :

- "HARD" (5 characters max.) is the hardware category belonging to a predefined list.
- "MAN" (3 characters) is the manufacturer designation also belonging to a predefined list (including the Ganil technical groups names considered as providers).
- "DEVICE_ID" (so that the name of equipment is less or equal to 20 characters) is either the manufacturer serial number or a Ganil incremental number.



A similar convention has been adopted for equipment models featuring a model identifier being the manufacturer or a Ganil designation.

4.3 Implementing a work flow organisation

This part of the work corresponded to the "Work codification" task aiming to propose a work organisation to be introduced in parallel to the CMMS deployment. This is truly the main key issue of the project as introducing a CMMS piece of software is much more that only proposing a new software to help and to ease maintenance : it's mainly a new work organisation to build and to propose for the laboratory by changing and federating people' habits in a common and coherent way.

The objective was to establish a work organisation according to the maintenance concepts brought by the CMMS piece of software. So, we finally defined a Ganil work flow diagram relying on the model proposed by Carl. It covers all the cycle from the source (Carl Maintenance Request, e-mail, phone call, procedural formulary …) to the intervention and the way to achieve it. Specifities resulting from the Ganil laboratory had to been inserted into this cycle : structure organisation, management methods, safety constraints … Also specific flow diagrams were designed to show how to introduce, suppress and switch equipment within a safe and coherent way.

Beside of the CMMS administrator having access to all the functions, we defined three profiles for actors belonging to the technical groups involved into the maintenance process ; these profiles have specific rights on the CMMS software to only perform tasks they are qualified for.

- Each technical group names one **CMMS contact person** having the charge of a first level administration, giving help and assistance to the group he belongs to. So CMMS contacts are the link between the CMMS administrator and the technical groups. They have the same rights as the CMMS administrator expect for the global and system management.
- **Maintenance responsible** are people from the technical groups allowed to take place in the whole work management cycle as proposed by Carl : they may create and validate work orders to prepare interventions, allocate work sheets to people, transfer a work from one person (or one group) to an other one, do anything on work reports. They are not allowed to modify the tree structure but own the right of introducing, deleting equipment into the CMMS. Preventive work orders may also be defined and scheduled by them.
- **Field workers** are mainly concerned by the daily maintenance**.** They access to information related to equipment and, in the work flow, are allowed to create and fill work reports or to create work orders to be validated by their maintenance responsible.

5 Project status

5.1 The "pilot projects"

The following table is the summary of the pilot projects (chosen according to the criteria listed in 2.2) with their expected delivery date, the numbers of equipment and items to be maintained and an estimation of the job achieved.

Project	**Delivery date**	**Nb eqpt**	**Nb items**	**Done (%)**
Ariane power supplies	01/03/02	25	150	20
Beam slits	01/03/02	100	400	20
Alcatel vacuum pumps	01/03/02	60	120	20
Electrical distribution	01/02/02	50	50	70
Fire detectors / extinguishers (preventive maintenance)	01/02/02	500	500	90
Radiological detectors	01/03/02	120	360	10
Beam profilers	01/03/02	250	700	20
Rotating wire beam profilers	01/03/02	20	120	20

5.2 Concluding remarks and future plans

A huge work has been already performed during 2001, estimated at ≈ 3600 hours with many disparities within the 10 people constituting the project group. Now our first objective is clearly to switch to operation the first pilot projects.

Then an important issue will be to get a first feedback of the CMMS use by discussing with users, setting and controlling indicators to appreciate the CMMS use and evolution.

In parallel, we will start thinking to extend the CMMS scope by adding new functionalities or Carl modules and inserting new maintenance projects from other technical domains.

References

[1] P. Martel et al. "Compte-rendu des réunions du groupe de réflexion" GAN/SST/0031 Mai 2000

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[4] E.Lécorché, G.Sénécal "Codification Equipements" GANIL/P/GMAO/014/DT Octobre 2001

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