THE CCC PROJECT

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Abstract [*]

The building which will host the new CERN Control Centre (CCC) has been designed with public relations in mind as a primary goal, overlooking such important aspects as operators' privacy, security and comfort. A belated effort is underway to incorporate the needs of operators working 24 hours per day, 7 days per week, for many months of the year. However, equipping it with proper operations ergonomics for the target date of January 2006 will be expensive and difficult. The currently projected layouts and schedules of this challenging project are presented.

INTRODUCTION

Soon after the SPS machine started running from the Prévessin Control Room (PCR), ideas of operating all machines from a single control centre were put forward. Recently, during the merging of the Proton Synchrotron (PS) and Super proton synchrotron and Large hadron collider (SL) divisions into what was to become the Accelerators and Beams (AB) department, these ideas were revived. The first project, designed in early 2002 by K.Cornelis and B.Desforges, consisted in a 1090 m^2 extension of the PCR, supposed to house all controls of accelerators, cryogenics and technical services [1]. In late 2002, on the impulse of the Director of Accelerators, the Globino project was launched, proposing to house the control centre inside, then next to the "Globe de l'Innovation" [2], a wooden structure built for the swiss national exhibition Expo'02. This project was then frozen in Autumn 2003. In December 2003, the new CERN management decided that the common control centre should be built as an extension of the PCR.

ORGANIZATIONAL STRUCTURE

No project leader was appointed, but instead the AB and TS department heads are responsible towards the directorate. One working group, chaired by J.L.Baldy/TS-CE, "*Maître d'œuvre*", is in charge of coordinating the building construction. Another working group, the CERN Control Centre Working Group (CCC-WG) [3], chaired by D.Manglunki/AB-OP, "*Maître d'ouvrage*", is in charge of the definition of the layout, the procurement, installation and commissioning of the equipment. Its mandate also includes the definition of the policy for staff management. These two committees work hand in hand and have several overlapping members to ensure a good communication. The CCC-WG had been created by the AB management at the time of the Globino project. In order to save time – a critical resource as one shall see further – most of the aspects of the room studied for the Globino will be retained. Two external companies, CCD [4] and GTD [5] have also been hired to help designing the layouts in an ergonomical way. Both these consultants and the CCC-WG interact with the future users of the control centre to make sure their needs are taken into account. Among those users, the AB operators have now also organized a working group to represent them. This working group should as soon as possible integrate cryogenics and technical services operators.

This organization is summarized in figure 1.

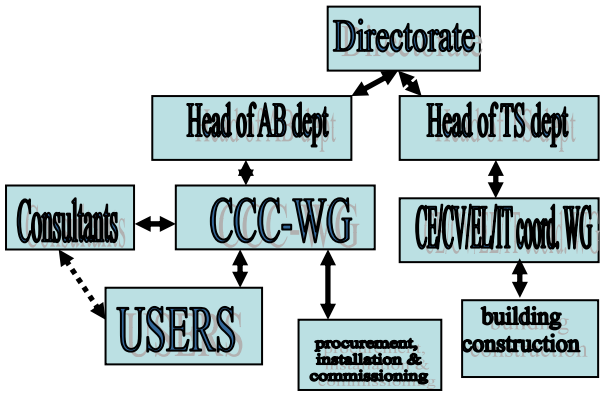

Figure 1: Organigram

SYSTEM IMPLEMENTATION

Required functions

In order to achieve a successful communication between the operators who will be in charge of the LHC, its injectors and their experimental areas, cryogenics and technical services, the new control centre should integrate the beam-related functionalities of the present control rooms: the Meyrin Control Room (MCR), the Prévessin Control Room (PCR), the Cryogenics Control Room (QCR) and the Technical Control Room (TCR).

In particular, one has to keep in mind that in addition to the main programme of operating the LHC, a lot of other facilities will have to be run from the CCC (ISOLDE, AD, East Hall, nTOF, CNGS, …) [6], each machine of the complex operating in any of the following modes:

- Shutdown
- Hardware commissioning
- Cold check-out
- Setting-up
- Physics
- Access
- Machine studies/development

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* This abstract had to be submitted before the project was modified in December 2003. Therefore it no longer reflects the contents of the paper or the opinion of its author.

Consoles layout

All console modules will be identical and consist of one PC with three screens. A working position will include several such modules. By the time the CCC starts in 2006, the control systems for the different facilities will probably not be unified yet, but it should nevertheless be possible to start any of them from any console, yielding an extraordinary flexibility to the room layout. In each group of modules will be embedded a telephone and an intercom, whose signals will travel through the IP network. Some fixed displays will be positioned on top of the main interactive screens (see CCD proposition on figure 2), while bigger ones will be positioned on the walls. The technology suggested for the fixed displays is the well-known CATV presently used in the current accelerator control rooms.

In addition to the generic consoles detailed above, some specialised ones will be devoted to the access systems. At the present stage, it is yet unclear whether the hardwired PS, SPS and EA access systems will have to be moved from their present locations or if the new system which is being designed for the LHC will be ready in time to supersede them.

Some 40 console modules will be distributed around the room. According to the international standards defining the design of control centres [7], this leads to a surface of at least 600 m2 for the control room only. This apparently large area is thought to be just sufficient to handle multiple operating scenarios, for instance having to optimise the delicate CNGS beam while commissioning the LHC, without too much interference.

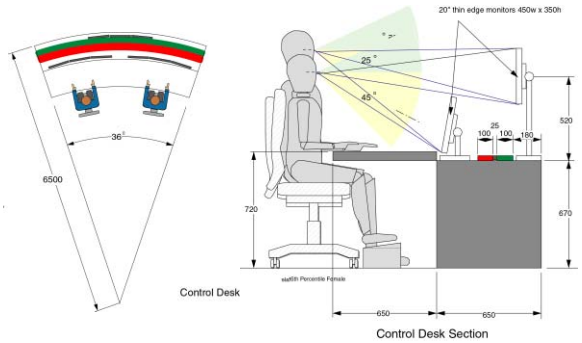

Figure 2: Proposition of CCD for the layout of the generic console in the CCC.

Other systems

As the operating consoles belong to the controls private network, e-mail and web access will have to be performed on separate computers. Dedicated PC's connected to the office network will be provided in the room for that purpose; also the existing PCR wireless network will be extended to grant internet access to laptop users.

Other facilities

The new building has to house not only the control room but also a number of facilities for up to 12 operators on shift and the associated specialists [8,9]:

- Reception/secretariat
- Glassbox-type meeting room
- Kitchen and restroom
- Toilets, showers, lockers

Furthermore, some room has be allocated for the following services:

- Telecom racks
- RF and beam diagnostics racks
- Telecom
- Cooling and ventilation plant
- Control servers
- Repair and maintenance lab for control room equipment

Finally, visitors handling has to be planned carefully in the early design of the control centre to avoid having to squeeze it in at a later stage.

Facilities such as

- a large additional meeting room able to hold large audiences such as the AB Operations Committee
- a videoconference / remote Machine Development room
- operators offices

are strongly desirable in the same building but may not fit in the budget in an early phase.

CURRENT PLAN

Building layout

A 600 m^2 extension with a double height ceiling of about 5.6 m will be built next to the existing building 874 which currently houses the PCR. The control room will be situated in this extension. Special attention will be given to the design of the lights, acoustics and temperature control, in order to provide a maximum level of comfort for the operating crews. As recommended by the ergonomics standards, an outside view will be provided. Figure 3 shows an artist's view of the equipped control room [10]. It was originally generated by CCD for the Globino project but the control room itself does not differ much from that latter project.

The parts of the existing building 874 which have a double ceiling will be vertically split by a slab in order to double the usable surface. This surface will be used for all the other services described earlier. In particular, a visitors' balcony will allow guided tours to look over the control room.

The total area created will then be of the order of 870 m^2.

Schematics of ground and top floors of the extended building are shown in figures 4 and 5.

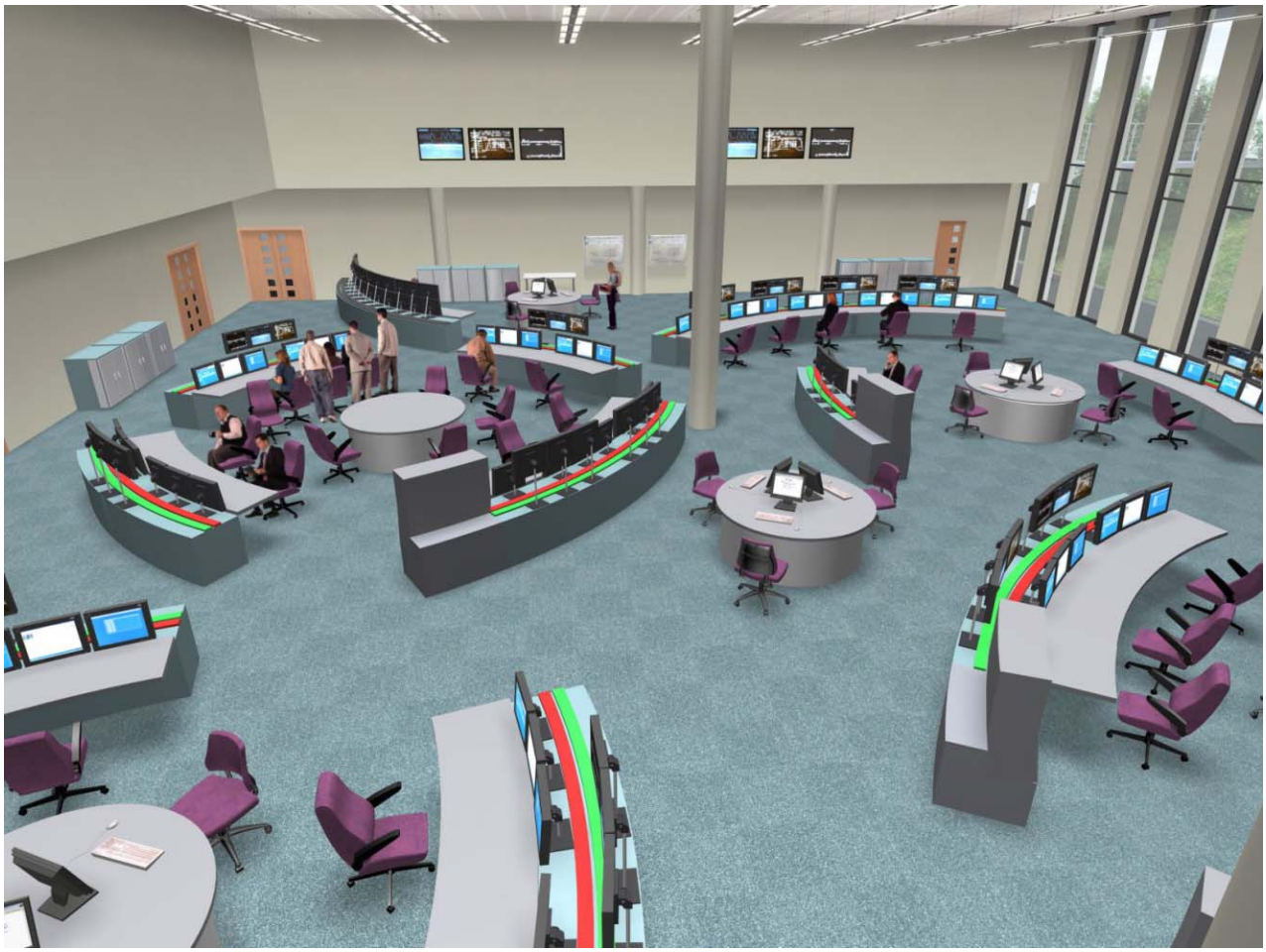

Figure 3: Artist's view of the control room seen from the visitors' balcony, in the framework of the Globino project. In the current state of the project, the ceiling height should be lower (5.6 m instead of 7.0 m) and the visitors' balcony will be facing the main window

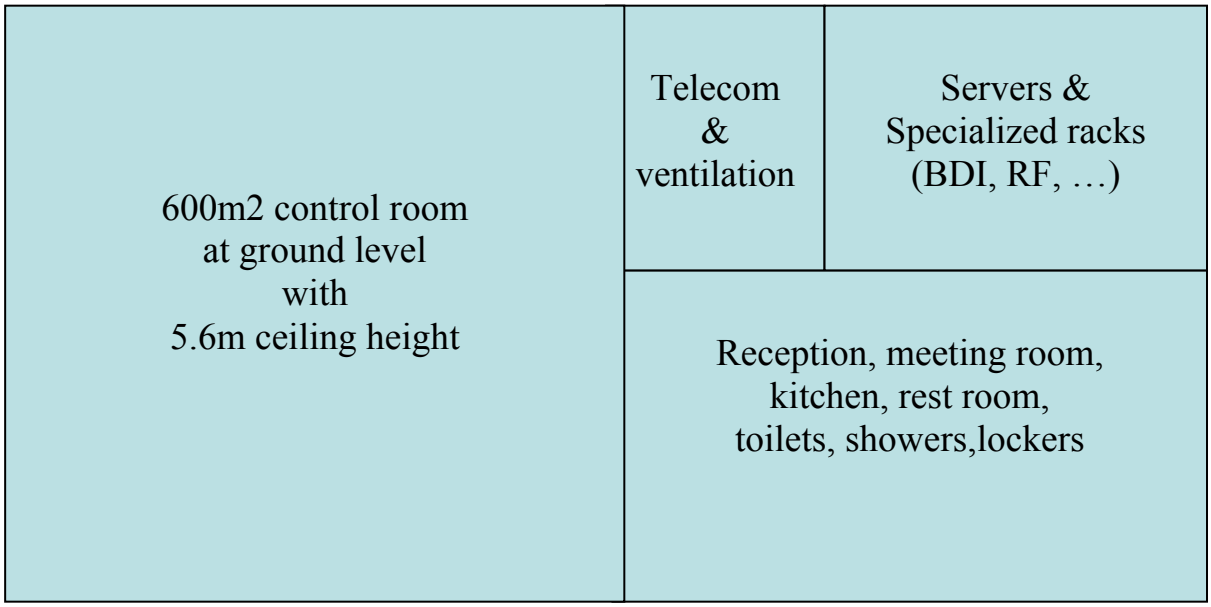

Figure 4: schematic layouts of the ground floor of the extended building

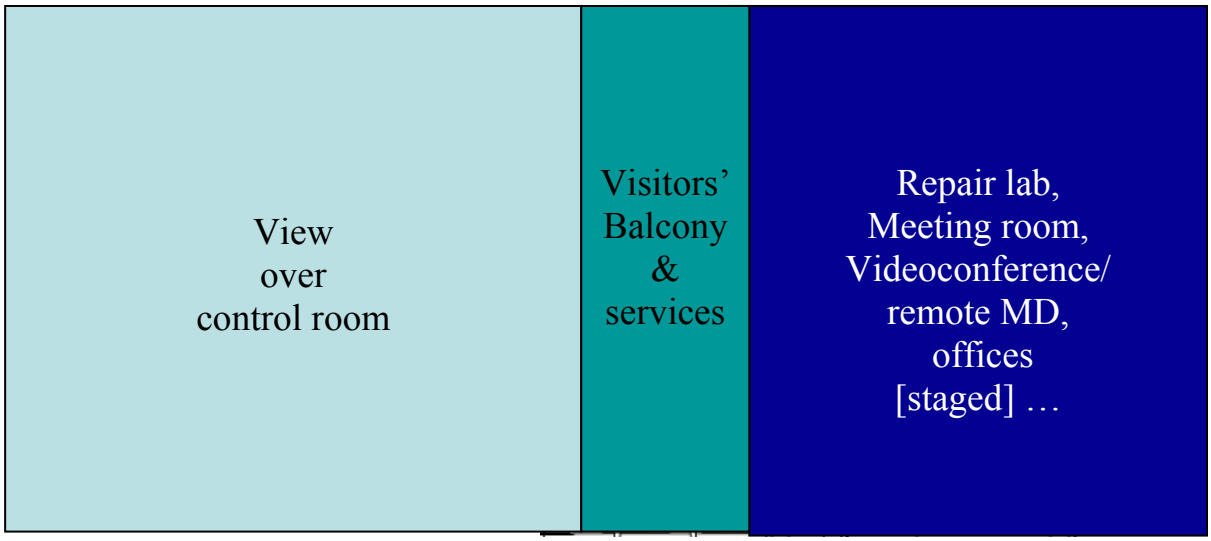

Figure 5: schematic layout of the top floor of the extended building

Budget

A figure of 8.1 MCHF, including 10% contingency, has been allocated for the whole project, divided into

- 4.9 MCHF for the civil engineering, ventilation, sanitary water and electricity,
- 3.2 MCHF for the users' budget, including furniture, computers systems, displacement of PS complex access controls, communications, users services, and ergonomics.

These numbers however need to be refined as they are based on rough estimations and interpolations of previous projects. Depending on the refined estimation, features which are presently planned for a later stage, such as an ABOC meeting room, might be implemented right from the start.

Schedule

In order to deliver the beam to the SPS in April 2006, the following deadlines have to be met:

- 29/2/2004: the CCC-WG issues the engineering specification of the building to the civil engineering committee.
- 30/4/2004: the civil engineering committee issues a detailed planning for the work to be performed and confirms the building costs.
- 30/6/2004: the CCC-WG issues the specifications for the equipment and starts the call for tenders.
- 15/11/2004: end of SPS run and magnets tests. The PCR can be partly dismantled.
- 1/1/2005: start of civil engineering work.
- 1/11/2005: start of installation and commissioning of equipment in the CCC.
- 1/2/2006: Startup of the accelerator complex from the commissioned CCC.

Although feasible, this schedule does not allow for delay. In particular, an extension of the SPS physics run in 2004 would be detrimental to the timing of the project.

Staff integration and migration issues

It is strongly felt that all staff working in the operation crews should be dealt with using similar rules. In particular, experience has shown that one should not mix CERN staff members with industrial services.

On the other hand, the TCR presently deals with Facilities Management matters which are unrelated with beam, accelerator or physics operations; as already agreed, these activities should be outsourced rapidly.

As the PSB will be running from the MCR in 2005, their operation crews should stay on the Meyrin site over that period. All the other operating crew should start moving to Prévessin at the end of the 2004 run.

Once the control room is operational in February 2006, and although a staged move is technically possible, all teams (accelerators, technical services and cryogenics) should start operating from the CCC at the same time to ensure the best possible integration.

OPEN ISSUES

- The current plan does not allow for any delay. If the building is late for any reason, there will be no place to operate the SPS from in 2006. An alternate solution in case of a delay needs to be prepared.
- During its displacement in winter 2005-2006, the PS complex access system will not be operational. However, the LEIR machine might have to be commissioned during this period [11].
- A solution is being studied to allow the observation and processing (FFT, BTF, …) of some fast analogue signals in the PS Complex which cannot be transported over long distances.

CONCLUSION

The CCC project will define what the CERN Control Centre will be for the next 25 years or more. Its careful design will be a key element to the success of the operation of the LHC and the other CERN facilities.

- The project is now well defined, with a realistic budget and a very tight schedule. Reutilisation of the studies done for the former versions of the project should help one to complete it in time.
- As it is now decoupled from the public relations, the design is driven by the control room ergonomics, while taking the visits needs into account, and not the other way around.
- The optimisation of the layouts is under way, and will be finished by the end of February 2004.
- Some issues still need to be addressed, but solutions are on their way.

ACKNOWLEDGEMENTS

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