Large Hadron Collider: a Status Report
ACCU, Sept. 10, 2003
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ATLAS main cavern: cranes
Cracks have appeared in the shaft of the CMS service caverns, with water leaks. This is considered to be “normal”, but must be repaired. The delay for CMS is under evaluation.
How about the Schedule?

In a perfect world, the project would take eight months.

But based on past projects in this company, I applied a 1.5 incompetence multiplier.

1.5 \times 8 = 12 months

And then I applied an L.W.F. of 6.3.

L.W.F.?

Lying Weasel Factor.

...Vendors lye
The LHC Dashboard

• To monitor the progress of LHC components production
• Can be accessed from the LHC project home page:
  • http://lhc-new-homepage.web.cern.ch/lhc-new-homepage/
• Shows progress of:
  – SC Cables
  – Dipole assembly
  – Progress of installation
  – …..
• Note the Disclaimer:
  – Not a contractual document
  – Does not engage CERN
• … but we hope it will increase transparency of the process
Dipoles

Cryodipole overview

23 dipole collared coils received and approved in July, i.e. one per working day
Cruising rate : 35 cc/month

Cold test benches bottleneck is being solved
4 in place
2 just commissioned
2 just arrived
12 in total by the end of the year

Updated 31 Aug 2003
Data provided by D. Tommasini AT-MAS
Cold mass assembly @ ANSALDO
LHC: Winding Learning Curve

New recruits

Senior staff
The longitudinal welding

- Pre-developed at CERN
- Installed directly CMAs
- Two weldings synchronized
- Root welding STT: high quality very sophisticated control, a world PRIMA for this conditions and austenitic steel
- *Problem on the press, now almost over* (task force working since November 2002)
- Some time is still needed to improve welding quality and avoid repair
- Each CM leak tested 26 bar !!!

Final target: 50 h
Cold masses stored at CERN
Histogram of the number of quenches to reach the nominal LHC field (8.33 Tesla) for the first 50 LHC dipoles
Quadrupoles and SSS

- Corrector supply is still a problem.
- The contract for SSS assembly will be extended for up to one more year (with no effect on the overall planning but some extra cost) to compensate.
Sector 7-8
The LHC Tunnel ready for INSTALLATION - July 2003
1. The installation of the general services of the first sector was terminated on time. The sector was ready to receive the cryogenic distribution line on July 21.

2. Some delay in isolated areas - 6 week delay in cryo-line installation – can be recuperated.

3. Click on General Coordination Schedule in the LHC Dashord (http://lhc-new-homepage.web.cern.ch/lhc-new-homepage/)
   - yellow line: where we should be (updated every month)
   - Black line: where we are
   - Red line: position of last month
Conclusions: LHC Machine & Areas

• In brief
  – Insolvency cases occurred in 2002 have been dealt with without impacting on the overall project schedule (but some increase in CtC).
  – Superconducting cable production has about reached its nominal rate.
  – Cryo-dipole production is ramping up in all 3 firms
  – The LHC master schedule can be found at the project home page: http://lhc-new-homepage.web.cern.ch/lhc-new-homepage

• Concerns:
  – Cracks at CMS shafts
  – Production of correctors for the SSS quadrupoles
  – Late production of cold feed boxes is delaying dipole cold testing at CERN
Earned Value Management

- Work packages divided in small units
- Reported:
  - Planned Cost (PC)
  - Actual Cost (AC)
  - Earned Value (EV)
- Cost variance: EV-AC (negative for extra cost)
- Schedule Variance: EV-PC (negative for delay)

- Data inserted, first EVM based report presented to FC next week
- Data can be accessed from HomePage (password required)
  - [http://user.web.cern.ch/user/cern.html](http://user.web.cern.ch/user/cern.html)
6. Conclusions: where are we?

• **Sept. 2001:**
  – extra cost-to-completion of the LHC programme was declared, of about 800 MCHF (machine, detectors, computing, missing extra contributions w.r.t. 1996 plan);

• **Dec. 2001:**
  – main remaining contracts adjudicated (cold mass assembly, cryoline…);

• **March 2002:**
  – LHC commissioning rescheduled to April 2007, to comply with the industrial production rate of the main components (e.g. cables);
Conclusions (cont’d)

• June 2002:
  – Following internal reviews and recommendations by the External Review Committee, Management proposed a “balanced package” of measures, to absorb the extra cost in a constant CERN budget (approximate figures!):
    – 400 MCHF programme reduction, focusing of personnel on LHC, savings, extra external resources (e.g. for computing);
    – 100 MCHF rescheduling LHC to 2007;
    – 300 MCHF full repayment of the LHC reported to 2010 from 2008

• Dec. 2002:
  – Management’s plan, 2003-2010, approved by Council;
  – A long term loan (300 MEUROs) was obtained by the European Investment Bank, to cover cash-flow peak.

LHC back on track!
Today:

- **LHC Progress** is gauged by *new specific control tools* in addition to the classical peer committee reviews:
  - **Machine:**
    - Data collection for Earned Value Management concerning the material budget is completed and reporting has started;
    - Cost & Schedule Annual Review;
    - *LHC Dashboard* allows monthly update on production and installation
  - **Detectors:**
    - Regular Integration reviews
    - Periodic machine-detector meetings
- **LHC cost remains stable;**
- **Production of machine and detector components, installation and integration are approaching the cruising speed;**
- **Several old concerns have been overcome, new concerns appear, no show stopper.**
• CERN has profited from Cost-to-Completion crisis in 2001 to enforce real changes;
• A leaner programme, a well-focused Laboratory;

• With less reservation than last year, we can confirm the LHC schedule:
  – completion of the LHC machine in the last quarter of 2006,
  – first beams injected during the spring of 2007

• Thinking about LHC upgrading has started