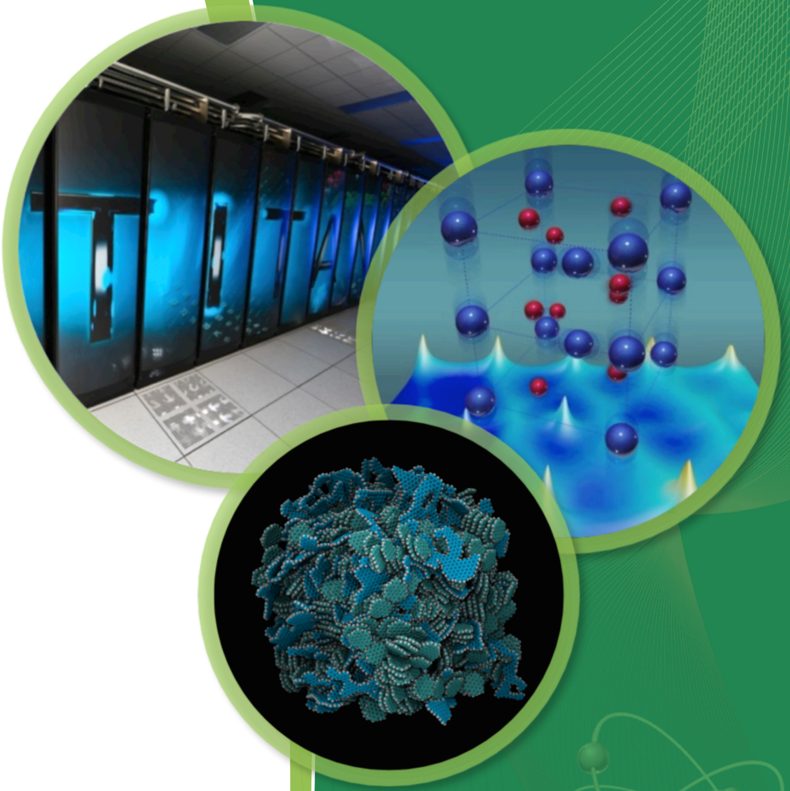
Science Requirements to Engineering Specifications Workshop

DENIM 2016

20 September, 2016



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Oak Ridge National Laboratory

What We Did

- For the first half of the workshop, there were high level presentations discussing the methods for developing Science Requirements into Engineering Specifications are done at ORNL, and LLB
  - David Anderson discussed the Critical Decision path required by the US DOE for large, capital projects, then discussed the development flow for smaller work using eMOD
- Sylvain Desert gave a high level talk about requirements development at LLB
- Patrice Permingeat, LLB gave a talk about selecting the best solution
- Sergei Klimko, LLB gave a talk about specification development optimization software

David Anderson, SNS

- **SNS based on Department of energy model.**
- CD0-CD5 (CD stands for Critical Decision) CD0 Approved mission, CD5 End of project, typically 5 years
- CD2 Conceptual design review
- Small projects goes through eMod up to 100k dollars, engineering process software.
- Scientific productivity process for scientific proposals
- Musts and optionals are shown in the CD1.
- Questions from Group:
  - How do you plan staff?
    - The work is limited to the number of staff not the other way around
    - Priorities are crucial

Sylvain Desert, LLB

- Important to have basic scientific knowledge
- Set scope, validate millstones, give advice
- Lead scientist should not be part of the steering committee
- 1. Define project, here it is important to have a scientific understanding
- Scientists stays scientist
- 2. Bibliography, benchmarking
- . Brainstorming
- 4. Choose best solution
- 5. Prototyping, CAD, McStas etc.

- 6. Test and evaluation, when relevant
- 7. Feedback, “scientist forgot to say”, he wanted something different
- 8. Redesign and iterations
- No questionnaires etc to get the req. from scientists.
- Lead engineer is involved in all instrument projects
- Tool: Equity, Precision, a mathematical and statistical tool to find the right concept

Patrice Permingeat, LLB

- Pairwise Comparison method used at LLB to choose a solution among others
  - Could also be used for athletic tournaments

Sergei Klimko, LLB

- Parameter optimisation of a coil
- ModeFrontier software, can be linked with CAD, McStas, FEA, CAE.
- Comparison of theory and reality.

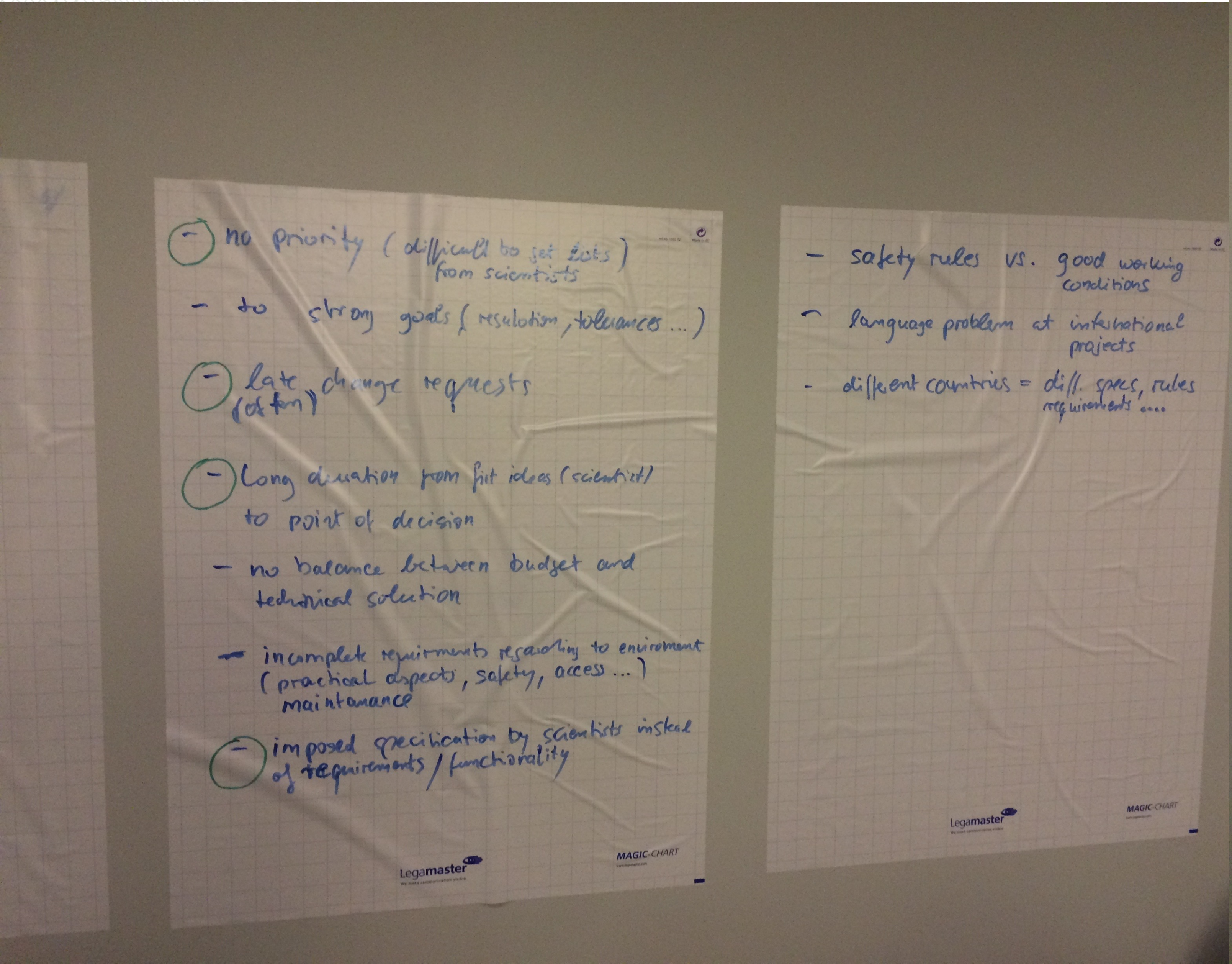
Phase 2

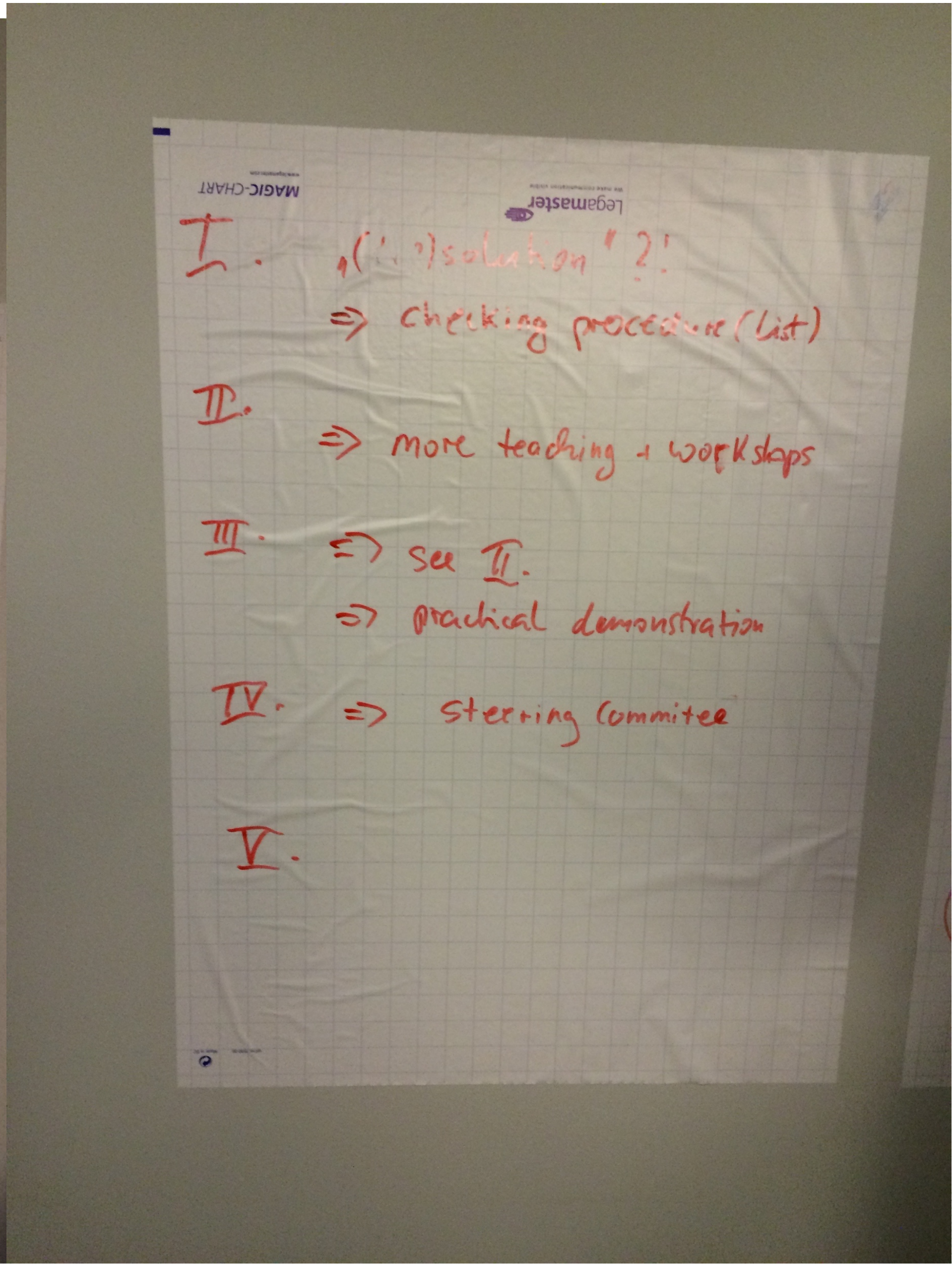
- We broke up into 4 subgroups, and each identified 5 or 6 problems we all experience developing Science Requirements into Engineering Specifications
- We returned to the large group, and compared the results from the 4 subgroups, and produced 1 single list of the top 5 problems associated with developing Science Requirements into Engineering Specifications
- We went back to the subgroups, and independently proposed solutions to the 5 problems
- Back as the large group again, we discovered that all 4 subgroups had the same answer for the top 3 problems, 4 different solutions for problem #4, and ran out of time before discussing problem 5

Summary Group exercise

- **Problem 1**: Scope creep
  - **Solution**: Change management process
- **Problem 2**: Cultural differences
  - **Solution**: Classes, meetings, informal chats
- **Problem 3**: Unnecessary / unreasonable specifications
  - **Solution**: Explanation of consequences, peer review
- **Problem 4**: Prescribed solution from scientist
  - Solution: No agreement
- **Problem 5: Lack of decision making**
  - Solution:

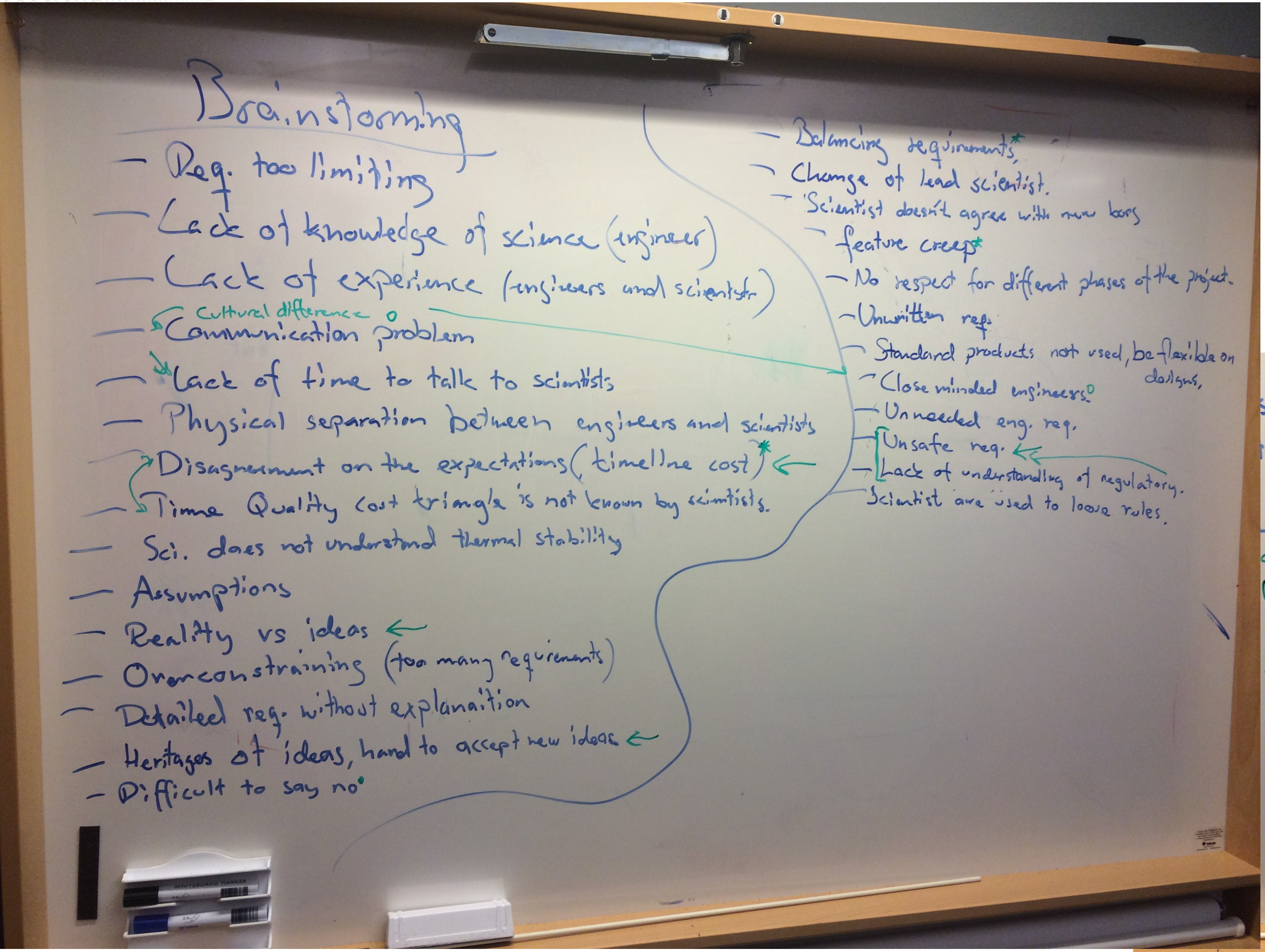
Subgroup 1 Discussion and Solutions

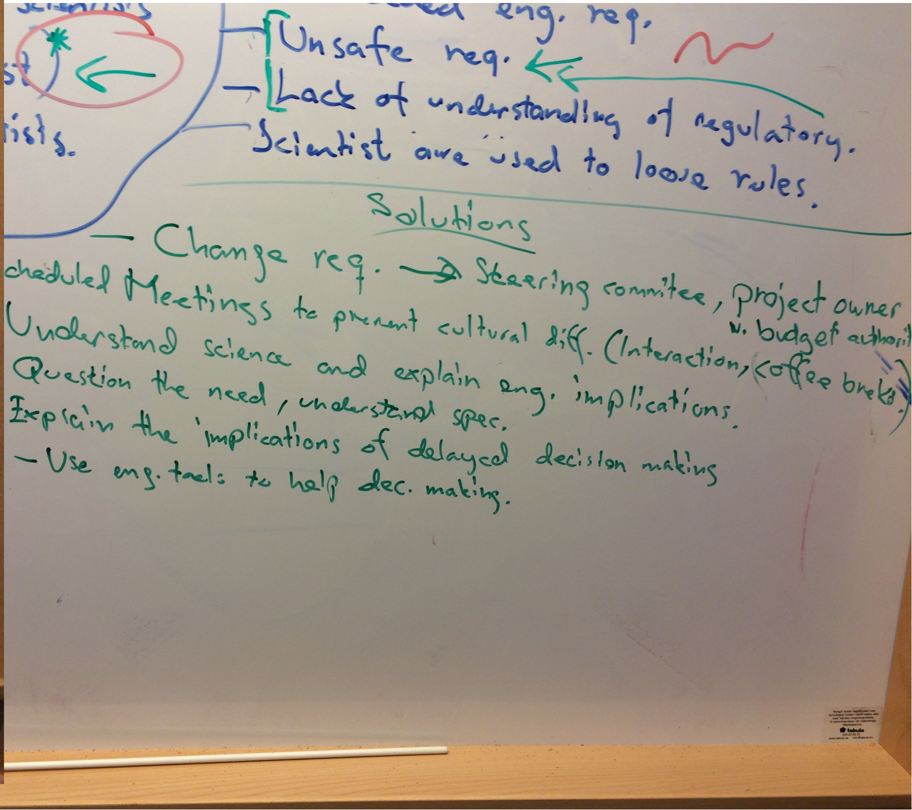




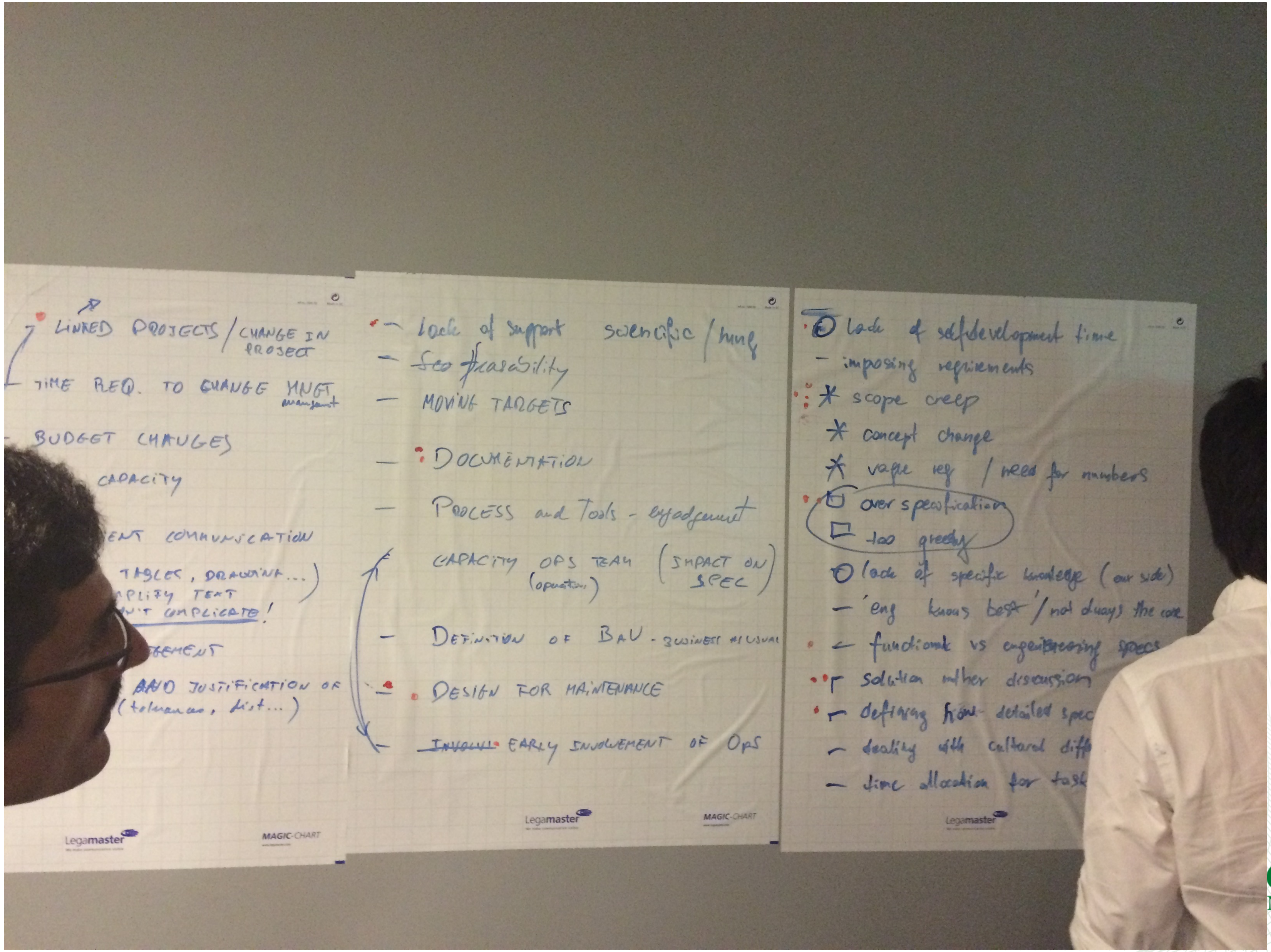
Subgroup 2 Problems and Solutions

Subgroup 3 Discussion and Solutions





Subgroup 3 Solutions



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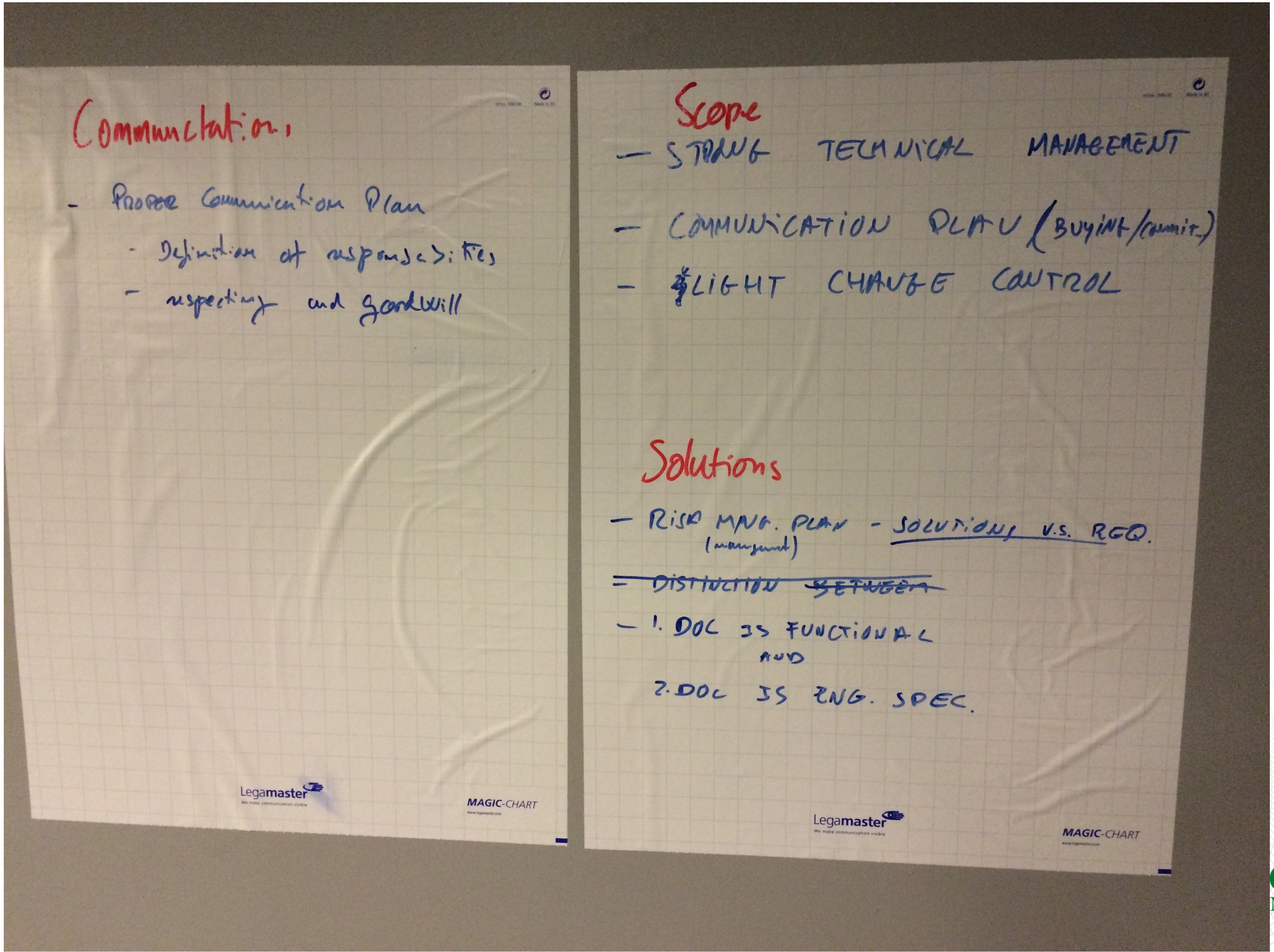
Group 4 Discussion and Solutions



Large Group Problem Statements, plus 3 Solutions