ESS INTEGRATED CONTROL SYSTEM AND THE AGILE METHODOLOGY

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Abstract

The stakeholders of the ESS Integrated Control System (ICS) reside in four parts of the ESS machine: accelerator, target, neutron instruments and conventional facilities. ICS plans to meet the stakeholders' needs early in the Construction phase, to accelerate and facilitate the Commissioning process by providing and delivering required tools earlier. This introduces the risk that stakeholders will not have had the full set of information required available early enough for the development of the interfacing systems (e.g. missing requirements, undecided design etc.) In order for ICS to accomplish its objectives it is needed to establish a development process that allows a quick adaptation to any change in the requirements with a minimum impact in the execution of the projects. Agile Methodology is well known for its ability to adapt quickly to change, as well as for involving users in the development process and producing working and reliable software from a very early stage in the project. The paper will present the plans, the tools, the organization of the team and the preliminary results of the setup work.

THE INTEGRATED CONTROLS SYSTEM DIVISION

The Integrated Control System Division (ICS) is responsible for control of the whole ESS machine and facility: Accelerator, target, neutron scattering, instruments and conventional facilities [1].

ICS Layout

ICS will provide the necessary controls infrastructure based on four components

1. The control system core. Set of systems and tools that make possible for the control system to provide data, information and services to engineers, physicists and operators.
2. Control boxes as the hardware interface to devices.
3. Data management and control system configuration databases.
4. Human-machine interfaces, which are software tools, control-room screens and engineering terminals.

The ESS project is still in a very early stage. This has a clear consequence on the process of gathering requirements from the stakeholders. Users are very often reluctant to provide clear specifications or even to commit to deliver them in a short term. ICS is very much aware of the fact that requirements, technologies and plans might change during the development process as long as the projects evolve. ICS needs a working methodology capable to give enough flexibility to adapt to this changing environment and at the same time to be able to produce simplify versions of the final product that the stakeholders can evaluate and provide feedback from.

ICS discarded from the very beginning the use of methodologies based on Waterfall processes for some of the parts of the project, even the V-Model, going into more Agile methodologies. An Agile process progresses in a series of iterations, where working software is always presented at the end of each iteration as a way to obtain feedback.

ICS started to use Agile methods and practices early in 2013, implementing Scrum in some of its software projects. The main objectives were [2]:

- Improve the communication process between ICS and the stakeholders and also to facilitate a good communication environment for the development team.
- To adapt quickly and efficiently to changes.
- To be able to deliver fast. This is a key objective as deliver fast a working product is the most efficient way to obtain feedback from the stakeholders.
- Transparency. ICS wants the stakeholders to be aware of the progress on the different projects, so they can easily spot on deviations from the requirements.
- Accuracy on the deliver date. ICS must be able to provide all the systems ready for commissioning in 2017.

SCRUM WITHIN ICS

There are different flavors of Agile methodologies: Scrum, Crystal clear, Kanban, Extreme programming, Feature Driven Development, etc. Scrum was the one selected by ICS for evaluation [3] and it is also the most popular of the Agile methodologies. The basics characteristics of Scrum are [4]:

- Self-organizing teams. The team is in charge of selecting the tasks that they will work on, and assign them.
- The product progresses in what is called Sprints. A sprint is a period of 1-4 weeks; at the end of the sprint the team should be able to present working software to the stakeholders.
- Requirements are gathered and collected in what is called Product Backlog. The Product Backlog consists in a collection of requirements. Such requirements are usually redacted in a way that

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the stakeholders describe what they expect from the product. In other words, requirements are written by the stakeholders and they represent something that brings business value to them

- Scrum provides some generic rules, as ceremonies and roles. Although what is really important is the behavior that those rules and roles provide, such as communication and transparency.
- Scrum tries to reinforce communication to all the levels, within the team and between the team and the stakeholders.

Putting It All Together

The normal workflow of a Scrum team is the following:

1. **Product Backlog Planning Meeting** Before any sprint the team and the stakeholders, in Scrum argon they are called Product Owners, meet for a fix period of time. The normal duration of this kind of meetings is 4 hours, although at ICS meetings are kept a little shorter. The objective of this meeting is to elaborate the collection of requirements. Each requirement is usually described in a single sentence, which in Scrum is called *user story*. This user story describes something that the user expects from the product. At the end of the Product Backlog Meeting the requirements are prioritized and organized in the Product Backlog with the highest priority requirements at the top of the list.

2. **Sprint Planning Meeting** The sprint planning is the first meeting of the sprint. During this meeting the team selects the user stories that they think they can be accomplished in a sprint. The team also estimates the user stories and decomposes them into small technical tasks that can be assigned to individuals.

3. **Daily Meetings** Every day the team meets together and discuss on three things:
   - What each member of the team accomplished the previous day.
   - What each member of the team plans to accomplish in this particular day.
   - Identify any obstacle blocking any member of the team.

   The daily meeting is the moment where the team synchronizes and communicates each other. The goal is to let all the members of the team to be aware of the work of their colleagues and to identify conflicts, problems or overlapping. The duration of this meeting is very short, normally between 10 or 15 minutes.

4. **Sprint review** This is probably the most important meeting in Scrum. This meeting is the occasion to show to the product owners all the improvements and progress done in the project. It is at this moment where the team shows working software to the stakeholders and gets feedback from them.

5. **Sprint retrospective** This meeting marks the end of the sprint. The team and stakeholders meet together to discuss about the past sprint. The goal is to identify:
   - What it was working, so the team can continue doing it
   - What is not working, so the team can stop doing it
   - What the team can start doing to improve the process

The Long Term Planning

At ICS we also add a long term planning based on Agile. This is based on the Agile planning onion [5] (Fig. 1).
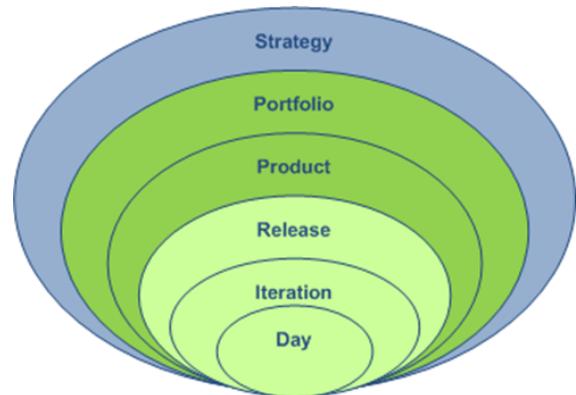

Figure 1: The Agile planning onion.

Several levels of planning compose the Agile Planning Onion:

1. Day by day planning, this is done during the daily scrum meetings
2. Iteration planning, this is part of the sprint-planning meeting
3. Release planning. The goal of this planning is look ahead on the future and to elaborate a list of official releases of the product.
4. Product planning. Plan the roadmap of the product for the coming years, the different versions of it for example.
5. Portfolio. This is a high level planning where the management and stakeholders can plan the collection of different products that they want to produce in the coming years
6. Strategy. That defines the strategy in a very high level, such as possible collaborations, different new lines of market or technologies, etc.

ICS elaborated plans at all the levels of the Agile planning onion. For some of the ICS projects all the planning levels are available to everybody on a webpage. This increases the transparency with the stakeholders, and they can give feedback on the proposed planning,

The Tools

At the beginning of the implementation of Scrum at

ICS is still researching new formulas to attract stakeholders and to involve them into the development process. It is foreseen to setup seminars, workshops and courses where ICS can explain and publicize Scrum methods and techniques. It is also foreseen the use of gamification techniques [7][8] in order to make more attractive the transition from traditional methodologies as well as to keep stakeholders engaged with the projects.
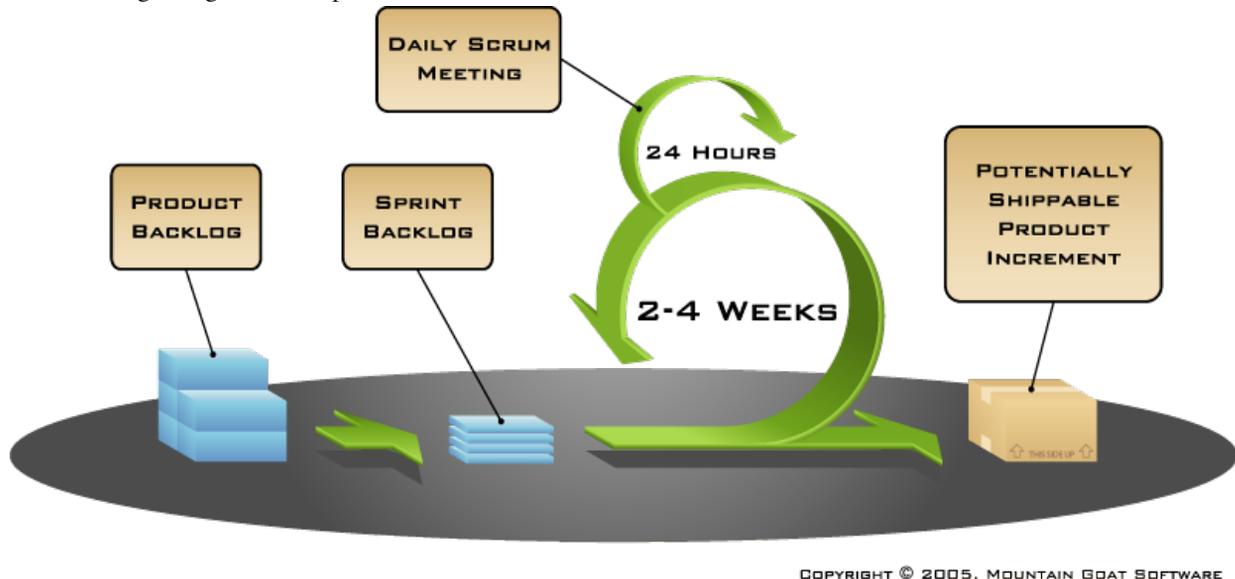
After six months, ICS is becoming a reference on the

Figure 2: The Agile workflow

ICS, the main tool was just a simple Scrum whiteboard on the wall. The product backlog was composed by a collection of index cards, and for the technical tasks some sticky notes were used. Then, when the teams were getting bigger and some members of the team were located offsite, ICS moved to the use of on-line tools, e.g. Trello. These tools allow sharing the Scrum board with the different teams, to add comments on the tasks and to assign the issues to the member of the teams, as well as to receive email notifications. Soon ICS realized the need for even more sophisticated tools that let the team to create subtasks, to do estimations on the tasks and the user stories, to produce metrics, etc. After a study of the current available tools, free and commercial, ICS took the decision of using Jira[6]. Jira is a highly recommended tool for task tracking and the Greenhopper plugin adds the necessary features to be able to set up an Agile environment (see Fig. 2).

RESULTS

The implementation and use of Scrum at ESS has not been easy. ICS had to deal at the beginning with a very strong resistance to this new kind of methodology. The fast and continuous success of the first sprints for some of the software projects changed quickly the appreciation of Scrum from the stakeholders and within the ICS Division.

use of Agile in general and Scrum in particular at ESS. At the time of writing this paper, all the software projects at ICS are developed in a Scrum way and many other non-software projects are expected to use it. ICS has become an Agile evangelist within the ESS community and many other teams and groups have shown their interest in applying Agile and Scrum processes and techniques on their own developments.

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