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Implementing Aerospace Systems Management Tools in Collaborative Learning Environments

by

Dixie Anne Simone Flesher

An Honors Capstone

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4/21/2023

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4/21/2023

Date

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Dedication

This Capstone is dedicated to the people who have supported me throughout my education.
Without their encouragement I would not be where I am or who I am today.

Thank you for being with me though the end of this adventure and onto the next one.

Abstract

In the real world, many engineering firms use methodologies like Agile or Scrum as their project management methodology for time-sensitive projects. They do this by using software like Jira, Trello, or Confluence, where all team members can have real-time updates on where the project is and what needs to be done. UAH's senior design classes mimic real-world engineering projects in many ways such as how they are heavily reliant on collaboration and time management. This allows students to have exposure to what they will experience when they leave school and enter the real world. As of now, many project-based courses do not have a set project management software and they leave it up to the students to use Canvas to stay on top of deadlines and communicate. While this tends to work out, being able to give students exposure to software like Jira in these classes will not only help them have better success rates but also give them the ability to see how big engineering firms like Northrop Grumman, Boeing, and NASA workday to day to get their projects accomplished in a timely and efficient manner. This paper will evaluate several of these platforms, and compare them for efficiency, ease of use, and cost. They will be reviewed by UAH's Integrated Project Team, IPT, the Arise Mission for these metrics, and opinions.

Introduction

The University of Alabama Huntsville's IPT Senior Design Class is a very good representation of a real-world cross collage collaboration project. It gives students a chance to work with different majors to accomplish a yearlong mission. Because of its student lead philosophy there has been no consistent management software used from year to year. This gave a unique opportunity to study how implementing the management software would work and if the students would desire such a system.

It is important in this class that the objective is as realistic as it can be, providing the students with an accurate simulation of a real-world scenario all the way down to the management planning. By providing the students with exposure to software that is used in many major engineering firms, they can add a skill to their resume that will set them ahead of their peers. Due to already understanding this software they will not need extra training upon joining the workforce allowing them to jump straight into the core of their employment.

This paper dives into how UAH's IPT senior design class is run and how Agile software could be used to improve the management and skill sets of the class.

Chapter 1: UAH's Mission Design and Development Senior Design

UAH's IPT Mission Design and Development Senior Design course is very uniquely structured. As the name suggests, it utilizes the IPT structure which is a project management technique that involves the integration of various team members from different departments and functional areas [9]. The idea is to create a team that works together collaboratively throughout the project lifecycle to achieve a common goal. The IPT structure is based on the principle of cross-functional collaboration and communication, which is essential for the success of any project [10]. There are 3 key advantages to this structure; they include encouraging communication and collaboration, providing a clear and common goal, and promoting team accountability.

The first advantage is how it encourages communication and collaboration. By involving students from different degrees and Universities the team can consist of several subject matter experts which allows them to better understand the requirements and constraints of the project. This can help to identify potential issues early on, which can then be addressed before they become major problems.

Along with that, IPT provides the team with a clear goal that they all can be working toward. By having a clear project objective and a shared understanding of what needs to be achieved, team members can work more effectively and efficiently. This can lead to better quality work, increased productivity, and ultimately, a more successful project outcome.

The last major advantage of the IPT structure is how it promotes accountability between the team members. Since this structure involves members from different degrees, there is a greater sense of shared responsibility for the success of the project. Each team member is accountable for their

individual tasks, but also for the overall success of the project. This can help to ensure that everyone is working together towards the same goal and that no one person is solely responsible for the outcome.

While there are several advantages like any project structure it also has a few challenges. Two main challenges are that it can be difficult to manage, and it can be difficult to maintain momentum. With multiple team members from different schools and degrees, it can be challenging to coordinate everyone's schedules, priorities, and tasks. Along with that, the multiple teams also make it easy for projects to become fragmented or for team members to lose sight of the overall objective. Because of these challenges it is key that there be a project management plan in place to allow for effective communication and check-ins.

As the class stands the project management structure is very vague and up to the class to decide. The general layout is a program level team and 3 sub teams at the UAH side and 1 team from the College of Charleston. Each UAH sub team consists of a Program Manager, Chief Engineer, a Lead Systems Engineer, and several subsystem experts. The teams each decide their management plan, and the program team gives an overarching plan. While this has worked out every semester it has several flaws. Since each team has its own style, it makes it hard for the teams to stay up to date on where each team is at. It also makes it hard for the other university to be involved. Since there is no unified platform for all the teams to communicate there tend to be problems with information getting relayed and implemented. Agile is a way to fix these issues.

Chapter 2: Agile Background

Agile project management is an iterative approach to managing software development projects that focuses on continuous releases and constant feedback [3]. The point of Agile is having constant, incremental deliverables, instead of one massive deliverable at the end of the timeline [4]. Agile teams deliver work in small, but substantial, increments. Agile is one of the most flexible project management methods and is used widely in the engineering world.

Agile allows teams to use specific software that allows them to collaborate more effectively. By providing features such as task management, team communication, and progress tracking, teams can stay updated while working remotely from each other. Some examples of Agile software include Jira Software, Trello, Asana, and Monday.com. There are 3 main benefits of Agile that they keep teams organized, provide real-time project breakdowns and tracking, as well as provide an efficient way to collaborate.

The first benefit is organization. While this might seem like a simple thing, with a large-scale project that takes many teams to complete comes along it can be difficult to find a way to keep a common system. This is where Agile is helpful. Many Agile software tools provide a dashboard that is neatly laid out and open for all members of the team to access.

The next benefit is the real-time tracking and project breakdown. Since many projects require multiple teams, having one place for all project management keeps the team on track. Agile not only does this, but it also breaks down the project into smaller deadlines and provides the team with ways to update other members as progress is made. This allows members not only the

ability to see the intermediate deadlines and final deadlines are posted, but the members can leave updates and update their status as they work, and if they come to a problem, they need advice on they can flag it so the issue can get resolved quickly.

The last main benefit is that it provides an efficient way to collaborate. Since many teams are not all located together it can be hard to keep everyone updated and on track. Normally this is solved by several weekly update meetings, but these meetings can be very time-consuming and take away from more important work. Agile provides a means around this. By being able to have real-time updates, teams can stay constantly updated and leave comments and questions in the software, leaving only meetings needing to be had when big problems need to be tackled or when final reviews are needed.

While there are many benefits to Agile there is one potential drawback to the software. This is that it can be complex and difficult to learn when first implemented. This is because with any new software there is a learning curve. To accommodate for this, teams need to compare the many options for Agile software tools to see what best fits their needs.

Overall, the Agile project management software is a powerful tool that can help teams manage their projects more effectively. By breaking down work into smaller tasks and tracking progress in real-time, these tools help teams stay organized and focused on their goals. However, it's important to keep in mind that these tools can have a steep learning curve, so teams should carefully evaluate their needs before selecting the Agile project management software that is best for them.

Chapter 3: Trade Studies of Agile Software

The Agile software tools being compared in this study are Jira, Trello, Asana, and Monday.com. These were chosen because they are widely used and easily accessible [5]. Table 1 below shows a breakdown of each software's cost, key features, and real-world users. This table is a summary of the 5 main software's for ease of comparison [6],[7],[8],[9],[10].

Table 1: Software Breakdown

Software	Cost (yearly) 50 people	Scheduling	Ease of Use	Real World Application
Jira	\$3900	Kanban Board Road maps Joint Documentation	Very	Twitter, NASA, Northrop
Trello	\$6000	Kanban Boards Activity Tracking Issue Reports	Very	Visa, Zoom, John Deer
Confluence	\$5500	Kanban Board Activity Tracking	Very	Facebook, Netflix, Linked in, Robinhood
Monday	\$6000	Kanban Board Gantt Chart	Very	NHL, Adobe, JotForm, PayPal
Asana	\$6600	Kanban Board Project Tracking	Very	Google Amazon Intel Autodesk

Table 2 shows a trade study comparing the information from Table 1. There were 4 figures of merit, or FOM, that were looked at in this study. They were real-world applications including ease of use, simplistic layout, and cost. Ease of use refers to how easy it is for users to learn and use the software. Simplistic layout refers to how easy it is for users to navigate through the software, and cost refers to how much it costs to purchase and maintain the software. The FOM's were weighed either a 1, 3, or 9 with 9 being the most desirable and 1 the least. Table 2 shows the breakdown of each software for these FOM's.

Table 2: Trade Study

	Jira	Trello	Confluence	Monday	Asana
Real world application	9	9	9	6	6
Ease of use	9	6	6	9	6
Simplistic Layout	6	9	6	9	6
Cost	9	1	3	1	1
Total	33	25	24	25	19

From the study it is shown that Jira would be the best software for this class. This is because it is one of the most used software for engineering as well as having the lowest yearly cost. Because Jira is a software that many major engineering companies already use, giving students access to it early will put them ahead for when they graduate and start working. The other benefit is the low yearly cost. Since it is the lowest cost for the same capabilities it is the easiest software to justify UAH spending money on.

Chapter 4: Agile Surveys

A survey was conducted of the IPT Mission Design and Development Senior Design. The main goal of the survey was to see how many students had used Agile before and if they would be interested in it being implemented in the class setting. Of the students that replied, 81.8% of the students have not been exposed to some type of Agile program, and 95.5% were interested in implementing the Agile software. Figures 1 and 2 show graphical results of these.

Figure 1: Survey about exposure to Agile

Have you worked with Agile before?

22 responses

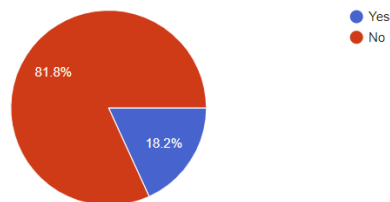
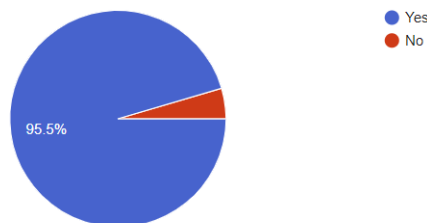


Figure 2: Survey about desires for management software implementation

Would you like to see a class wide management software?

22 responses



This survey shows two main points. The first is that many students are not exposed to Agile, this is to be expected, but it does put these students at a disadvantage. Since many major engineering firms are based around Agile project management software not having exposure to the software causes the students to be less favorable than those who have seen the software before. The second point it shows is that the students in the class have recognized that there is a need for a common platform for project management.

Chapter 5: Implementation of Agile in Senior Design

Based on the trade study it has been decided that Jira is the best software to implement. This section lays out the basic process for implementing Jira. The main process consists of defining the workflow, setting up the Jira instance, configuring the project, and training the team.

The first step has to do with defining the workflow and each member's role. This takes place before the software is even opened. The entire project team should sit down and break down the overarching goal into smaller stages with milestones at each stage and member responsibilities to obtain these milestones.

Once the team has a defined work breakdown, they then turn to Jira to set up the project there. Jira has two main boards; the road map, which maps out the project goals and deadlines, and the Board which breaks down the goals into to do lists, progress lists, and done lists. Both map the deadlines, the roadmap does it on a timeline, while the Board keeps it in a list view. The team can utilize both options as they input their dates and work breakdown for the project. Figures 3 and 4 shows Jira's two options for project tracking.

After the project is set up in Jira the team will need to be trained and briefed on all of Jira's features. Jira offers a free training course that ranges from 20 minutes to 2 hours on several of its features. This training is very useful because it allows the students to learn as much or as little as they want about the software.

Once the students are trained on the software, they are fully ready to start the project. In the case of this class the above steps would be followed, and then also shared with the professors of the

class so they can also stay up to date. Each team would be able to stay updated on the other status, and they will be able to share common documents that are needed to complete the project.

Figure 3: Jira Road Map

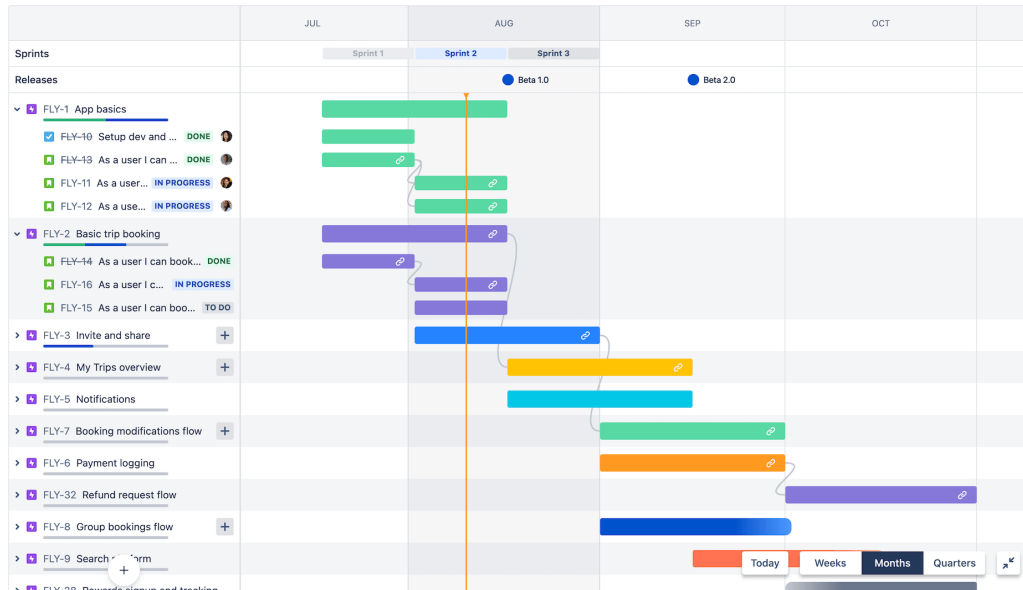
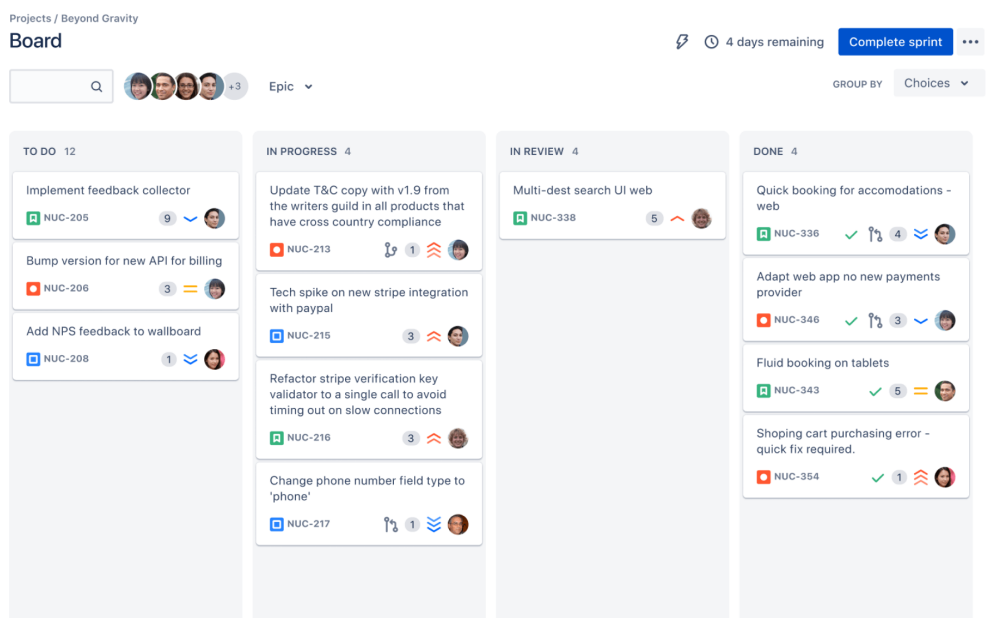


Figure 4: Jira Board



Conclusion

In conclusion, this paper discusses the benefits of using Agile project management methodologies, such as Jira, Trello, or Confluence, for engineering senior design courses, specifically the University of Alabama in Huntsville (UAH)'s Integrated Project Team (IPT) Mission Design and Development Senior Design course. This course involves collaboration and communication among team members from different degrees and universities. While there are strong advantages to this style of class, keeping teams organized and providing real-time project breakdowns and tracking has been proven to be hard. Agile provides a solution to this problem. By using the Agile methodologies and software the senior design class will be provided with a common platform to share real-time updates and project tracking. This will provide a better way to collaborate and stay on track to complete the project more efficiently. Agile will also provide students with hands-on experience with management software that is highly desirable in the real world. By giving students this opportunity, they will be able to add a skill set to their resume that will set them ahead as they enter the work force.

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