AITC Final Presentation

INTRODUCTION (Jordan)

Hi, looking at us you may be seeing some familiar faces from around the office! As part of our ANU engineering degrees we are to complete a multifaceted engineering group project to ensure that the different disciplines of engineering can unselfishly work together. This has all recently been rebranded under the name TechLauncher which strains interfiled relations even further by combining students of both the Engineering and IT colleges!

Introduce team members and fields of study. Mention Samson Missing

Summarise project with context to RP1

Celine’s Laser

Unlike many other project teams, we were afforded the opportunity to share a work space with our client for business hours on Fridays which we were exceptionally grateful for, particularly Celine’s guidance and everyone that we had to pester for project specifics. Staff who I should thank: Celine, Mark, Bradey, Elliott,usefull James - whoever is taking that mantle this week, Chris, and Jack

Brief summary of our work and conclusions

On a daily basis we each contributed to tasks of requirement development and investigation.

Explain non-chronological order of discussion, asked to each explain our roles.

ALEX’S SECTION:

I am a final year Engineering and Science Student with majors in Mechatronic systems and Physics with a specialisation in Astrophysics and astronomy. I have done research projects working around AO, The AITC internship and have worked with EOS as a summer intern.

I was responsible for calling Celine to organise this project for the team, ‘perhaps’ at the last minute. Fortunately, this was the one and only case of ‘just in time management’ in the whole project. Using my prior experience here I was able to get straight to work. I have known James Webb for a while and have also performed vibration tests in the EOS optics lab many years ago so I was the first person to get in the lab with James and pester him about all the different details we needed to know to start writing requirements.

Similarly, already being familiar with the 1.8m telescope and having done the safety induction session with Chris Moore already I was also able to get into the telescope dome and start making measurements for the requirements early on. Once we got the Models of the telescope from EOS we noticed that the Solidworks import of the older models did not include the correct hole sizes and taps for the side of the telescope where the lasers were to be mounted. To remedy this these measurements were taken in the dome and I made a technical drawing with the correct hole specifications.

Once the team got rolling my prior involvement with the EOS and AITC teams was less important. It was at this point that I transitioned to doing a lot of solidworks work. My time spent with EOS gave me over 200 hours of experience using the software. I was able to add components to the telescope model and create images to best express our working conceptual designs. Here are the images produced which were used on our poster to communicate our final conceptual design. We focused on a combination of the ANU and EOS lasers mounted together on the EOS breadboards to minimise the amount of rework required. Here you can see a side shot of how the observation floor would look with the system installed. The EOS breadboards are seen there on the right and the electronics cabinets for the lasers are located over on the benches on the left. This design obviously does not consider all of the interfaces beyond the mechanical for which requirements have been compiled, but it is just a conceptual design to be used as a starting point.

One of the other tasks for the group which I was heavily involved in was presenting the three progress report pitches on campus which formed part of the group’s assessment. I am a confident speaker so I suited the role well. My prior experience in AO also allowed me to answer some of the more wide-field questions asked by the audience that were perhaps outside of this project's scope.

Now, I‘ve saved the best for last to talk about so bear with me as I spend a minute on documentation. Following up my time with James and in the Telescope was the responsibility of writing up these requirements in this formal documentation. I won’t go into what that documentation was as you are going to hear all about it in a minute. There were many times where I was required to document requirements and I can assure you it is exactly as much fun as it sounds, but it is an important part of the systems engineering process. As you can imagine, in this well documented project a lot of editing had to be performed on the documents. I spent many hours doing this and I can safely say that the rest of the group is quite sick of me regaling them with the virtues of the oxford comma! Thank you very much and I am now going to hand over to NAME to talk.

JORDAN:

I’m Jordan, I’m in my penultimate year of the ANU materials and mechanical systems engineering degree and I have recently returned to studying after a year long internship during 2016 where I worked at Thales in IT hardware development and selection.I will continuing work in the RP1 space for my final year thesis from mid July this year to May 2018 where Celine will be my supervisor.  
  
Beyond the all of group activities, my area of leadership was developing the systems engineering structure to the project from project initiation to closure and satisfying the ANU’s needs through the project pitches which Alex and I co-presented. As i was responsible for the project structure I was able to directly respond to questions of the course conveners. I assisted Markus in the development of and content writing for the Project Poster which is currently hung in the corridor adjacent to Celines office. Markus will go into more detail on the poster as that was truly his brainchild.

Systems engineering can be very top heavy especially within the context of a semester long course limited project. To ensure that we maximised value we could add to the project while working in a structured format I took the traditional sys-eng process and put it on a diet. I should clarify, while I developed the structure for the project documents, the content was populated by the entire team.  
  
For this I developed an initial Project Proforma outlining the scope, goals deliverables and schedule. This was an extremely useful exercise as it provided a medium to clarify an initial misunderstanding in the scope.and tasking.  
  
The review process outlined was to ensure initial redirection or verification, a more formal review approaching project closure to ensure that delivered sufficiently covered the required content and a final hand over. This process was particularly effective as, as it was not too heavy in nature and the second review revealed a few areas for further investigation which strengthening the project for final delivery. These additional areas in particular was the realisation that there is currently no water plumbed to the dome which is required for the laser head cooler heat exchangers and nor is there fresh filtered air access. Due to time constraints we were unfortunately unable to investigate further into accessibility and hatch access of the dome. While this was out of the initial scope to our project it would have provided another layer of vital information.  
  
The major deliverable was the Systems, Subsystems specification, the SSS, containing all of our requirements, identified conflicts, project context and the high level interface diagram which Gerard will discuss. Each requirement has a link to the to source data should further investigation be required at a later stage. All identified conflicts between requirements were listed, justified and a possible solution identified. While complete verification process of the requirements was out of scope however a high level consideration was, verification process of the type

Finally the Project Handover document outlining our project progress against the scope, further considerations and issues highlighted.

GERARD:

Hi everyone, my name’s Gerard and like everyone else I’ve been involved in a variety of roles throughout this project. Aside from the major stuff that everyone has been working on, like brainstorming potential designs and collating requirements, there are a few areas where I have been working in particularly. These include: The confidential Toptica Requirements, The High Level Interface Diagram, and the Key Requirements Table. So I’m going to talk briefly about these areas, mainly focusing on what I did and how it fitted into the rest of the project.

So, I’ll begin with the confidential Toptica Requirements. Initially we had very little work with for the Toptica laser, we had a sales brochure and a couple of papers that discussed it, but we were going to need a lot more if we were going to collect a meaningful number of requirements. Luckily, Celine was able to help us out by taking us through an Non-Disclosure Agreement process and then providing us with an Interface Control Document. In total we collated 76 requirements for the Toptica, a vast majority of which came from this document. I don’t know how I ended up being the one to get stuck with the task of extracting those requirements from the document, but I suppose someone had to do it!

The 76 Toptica requirements made up pretty close to half the requirements that we collected throughout our project. It became apparent as we moved through the milestone of 100 requirements that the SSS document that contained these requirements was becoming fairly daunting. In an effort to improve it’s readability I created a High Level Interface Diagram (slide). The diagram acts as a summary of the various interfaces that the final laser interface will need to satisfy before it is mounted. The interfaces on here are Control, Power, Water and Air.

As an example, if you consider the Control Interface, you can see that all the relevant interfaces are marked in green and connect the various components to the EOS control room. If we take a particular one of these connections, say number 3 that connects the Toptica to the Control Room, we can then go to the High Level Interface Description Table (on next slide), and find the relevant description: ‘Ethernet Interface’, and the corresponding requirement. I hope that this diagram is able to convey the high level aspects of the system easily and quickly, certainly a lot quicker than the time it would take to read 150+ requirements in search of the relevant ones!

The Key Requirements table (slide) was created for the same reason: to convey the important aspects of the SSS quickly and clearly. I chose the requirements of size, weight, power draw and number of power sockets to be the key requirements, although it could certainly be argued that other requirements might end up being more important, if it turns out that these particular requirements are very easy to satisfy. However, I thought that some of the first things that someone looking to design this System would want to consider would be where the various components would physically fit and where they could be plugged in. This was information that was certainly very helpful to have handy when we made our own conceptual designs.

SAMSON:

* Collecting information about dome, control system etc; interviews, measuring etc
  + Interviewing EOS staff to find info with Markus and Gerard
    - Chris: Detail about the dome, gave us pointers on where to go for some of our other questions.
    - Alex Pollard: Information about the observatory control system, how to interface with it etc. Info on the weather station at the dome. Worth noting that I already had a basic idea of how the OCS work from my internship.
    - Jack: More details about interfacing with the OCS and how Can bus works.
  + Gathering other info about the dome:
    - No. of power points
    - Measured the available space on each level for equipment, head room, etc.
* · Making pretty cad models
  + Fancy toptica model (didn’t end up using)
  + Decals for models made by Alex
* · Conflict analysis
  + Analyzed all the conflicts identified Alex and Jordan, to determine if they were going to be an issue, and if so how to mitigate them.
  + Some conflicts basic physics calculations, for example the power conflicts and the
  + Others I needed to go up the dome and measure/count stuff. E.g. The available space for the auxiliary equipment and the number of power points.
  + Others were just looking up spec sheets etc.
* EOS laser
  + Emailed James Webb to get the first set of requirements
* Requirement editing
* Project reviews

MARKUS:

My name is Markus, and just like everyone else, I’m a fifth year engineering student. But unlike all the mechatronics guys, I’m specialising in Electronics and Telecommunications! I’m also in the double degree program with Science, specialising in Astronomy and Astrophysics.

My colleagues have already covered most of the technical aspects – and I certainly played my part with those – but I think it’s important to mention how our effective teamwork enabled us to successfully achieve our goals. While we did work individually toward each of our strengths, we certainly did not work in isolation. To that extent, a lot of my work involved setting up a solid framework to allow the team to get on with their work, without having to worry about how to manage our data and documents.

Even though not all of our team members were familiar with LaTeX, we - and by that I mean mostly I - decided very early on that we would use LaTeX as the framework for our documents.

Out of curiosity – can I get a show of hands – how many people predominantly use LaTeX for their scientific work? (Ok, so about \_\_\_ of the room. That’s an interesting division between science and engineering [or something])

Any of you who have worked collaboratively will know just how difficult it can be to work together on documents. That’s especially true for LaTeX documents, that require back-end packages to be up-to-date and compatible on everyone’s computers. Plus you can’t work work on a document at the same time, even using Dropbox, without risking conflicts and overwriting work. To get around these issues, I got the team working on a ShareLaTeX repository for all of our main documents. A nice side effect of ShareLaTeX is that it allowed us all to work on the same documents together, in real time. I can really recommend ShareLaTeX to any of you who need to work collaboratively with LaTeX!

As you have seen and heard, our main goal was to develop a big long list of systems engineering requirements for the three guide star lasers and the EOS 1.8m telescope. We knew that we didn’t have access to expensive systems engineering software like DOORS, so I developed a requirements database in LaTeX. This is where LaTeX is really nice compared to WYSIWIG editors.

Whenever someone added a requirement, they gave it a label and description, and these would automatically update the output in the big requirements list as we went along. The database would assign numbers between systems (Toptica, EOS, ANU, telescope) and sub-system (mechanical, optical, logical, electrical, environmental). This really helped to keep us on track, as we could see the list grow over time, and we didn’t have to update all the 150 numbers manually every time we changed something!

Another part of the project I took a lead on was effectively presenting and communicating our work. In Week 10 we had a Project Showcase event that was held as part of the “TechLauncher” framework of the College of Engineering and Computer Science. This is the course we all took that allowed us to work on this project in the first place. Taking inspiration from Gerard’s high-level interface diagrams, I reworked and refined a lot of the diagrams we had produced to make them more visually appealing and accessible to a wider audience of student engineers. It was interesting striking a balance between accessibility, while also producing useful work for an academic poster for the AITC. The poster is currently in the corridor next to Celine's office. Feel free to have a look if you haven't already!

Finally, our last team mate, Samson, unfortunately could not be here today due to family commitments. What I can do is talk a little bit about what he has done, because we worked on a lot of it together.

* Gathering other info about the dome:
  + No. of power points
  + Measured the available space on each level for equipment, head room, etc.
* Interviewing EOS staff to find info with Markus and Gerard
  + Chris: Detail about the dome, gave us pointers on where to go for some of our other questions.
  + Alex Pollard: Information about the observatory control system, how to interface with it etc. Info on the weather station at the dome. Worth noting that I already had a basic idea of how the OCS work from my internship.
  + Jack: More details about interfacing with the OCS and how Can bus works.

CONCLUSION:

So hopefully you now have a good idea of what we’ve been doing here for the last semester, and we hope that the work we have done will be useful to you. We’ve really enjoyed the project, as it has made a refreshing change to work on a project that actually means something in the real world. It’s also been pretty cool to be able to tell people that we’re working with space lasers!

This is obviously a large scale project, that we have made only a small dent in during our time here, and we are all interested in continuing the project further. To give you an idea of how we might stay involved with the project I’ll briefly go over our plans.

Jordan has already begun the process of organizing his final undergrad thesis to be based around this project, this will probably start next semester, meaning that he might be back here within a couple of months. Likewise Markus is looking to work on a research project, that will either begin next semester or the end of the year. Alex has pretty much finished his degree, but is looking into the possibility of doing a PhD based on the project. And I have already spoken to Celine about representing this project at the next TechLauncher project selection day next Semester. It’ll be my job to try and organize another team, hopefully of high performing students, to take over the project, and I would then tutor them through the semester. All things considered, you’re not completely free of us yet.

So finally, we’d like to thank you all for letting us work on this project this semester. Like I said, we have really enjoyed it. We’re especially grateful to Celine for taking time out of her week to meet with us, coming to ANU when we presented our work there, and just generally being as good a supervisor as we could have hoped for.