Group 48 Envisioning Report

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1 Introduction

The precision and reliability of runway operations are paramount to the performance of an airport. This report describes the envisioning phase of a tool to assist in the calculations of runway parameters that are required in the event of an obstruction on the runway. The development is guided by a review scheme, emphasizing user understanding, requirements planning, project planning and project set-up.

2 Stakeholders analysis

2.1 Primary Stakeholder

We had one stakeholder that we analysed as primary, the **Qualified Calculators of Air Traffic Control**. These are the members of the ATC that are responsible for completing the calculations for the runway parameters. They are considered a primary stakeholder because they will directly input parameters of the runway and also use this software's output to aid their calculations on whether operations should continue, and whether performing the calculations is worthwhile. The tool will provide information including an estimate that could be crucial to making an educated decision on the runway.

2.2 Secondary Stakeholder

We have identified three secondary stakeholders. These stakeholders will either provide inputs or rely on outputs for this tool as one of their responsibilities for their work. The list of secondary stakeholders, their job descriptions and the reasoning of their stakeholder type are as follows:

- **Air Traffic Control (ATC)**- Their role encompasses updating runway information, coordinating operations, managing safety, ensuring regulatory compliance, and responding to emergencies. They are identified as secondary stakeholders as they will use the results generated by the system as an aid for deciding whether operations should be performed.
- **Pilot**- A pilot's role is to make informed decisions, ensure safety, comply with regulations, and optimise operational efficiency during flight operations to ensure flights are completed on time. They are a secondary stakeholder as they receive information indirectly via a member air traffic control (ATC) regarding the decision for landing/taking off.
- **Regulatory Authorities (CAA)**- This is the organisation that specifies the calculations and processes to determine runway parameters. All of their specified standards to calculate the parameters will be used by the system and therefore will be inputted into the system intially and when changes to the standards are made. The Civil Aviation Authority (CAA) serves as a critical stakeholder in ensuring the safety, compliance, and efficiency of aviation operations, particularly concerning runway parameters.

2.3 Tertiary Stakeholder

For tertiary stakeholders, many could be described however we narrowed the amount down to three. The three we identified are described below:

- **Passengers**- This includes passengers both on a current flight or waiting for a flight from the current airport and also airports where arriving planes are leaving from. The outcome of this tool may influence the passenger's travel as from the consequences of this tool, their flight may be delayed or cancelled. Delays or cancellations can lead to frustration, inconvenience, and potentially financial losses for passengers too.
- **Airport Management**- They are tasked with overseeing and upholding all aspects of the airport services, ensuring to improve and maintain the airport's reputation. They do not engage directly with the system or handle data exchange, however, the system's performance is a

reflection of the airport services' reliability and quality, therefore influencing the airport management team's operations. Airport management does directly interact with both primary and secondary stakeholders and therefore clear communication is important to uphold operational efficiency.

- **Airline Companies**- Airline companies are financially invested in the efficient functioning of airport operations. The performance of this tool will affect the quality of the services provided by the airport. Therefore, airlines seek reliable software solutions that optimise operational efficiency, ensuring smooth flight scheduling, prompt departures, and efficient turnaround times for aircraft.

3 Personas

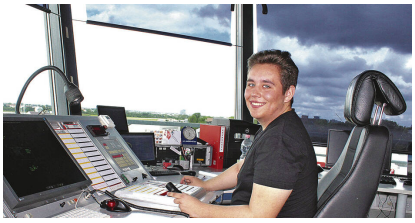
3.1 Qualified Calculator of Air Traffic Control, Ava

Ava, 38, is a seasoned Air Traffic Controller, specializing in runway calculations for 10 years. Calm under pressure, her sharp mind thrives on deciphering complex data to ensure flight safety and minimise delays. Ava craves accuracy and efficiency, relying on clear communication with pilots and colleagues. However, calculations involving integrating numerous variables like wind speed/direction, temperature, runway slope, aircraft weight, and tire friction can be too complex for her to give an accurate result within a short time. She believes that traditional calculation methods could be time-consuming or lack the capability to handle such complex scenarios effectively.

3.2 Pilot, James

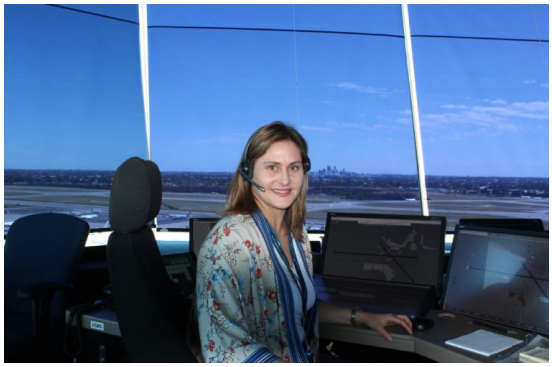
James is a 49-year-old pilot for a commercial airline that deals with both domestic and international flights. James has 13 years of experience flying and is very enthusiastic about his job, always excited to be flying to new places. However, James often faces long delays based on the uncertainty caused by needing to recalculate the revised runway parameters and having to circle around airports waiting for this information. James finds this to be a very stressful task, as airport airspace can be congested meaning he cannot be assisted by automation, increasing work load.

3.3 Junior Qualified Calculator Air Traffic Controller (Trainee), Alex



Alex, a 26-year-old Junior Air Traffic Controller, recently entered the field with a degree in Aviation Management. Eager to embark on a promising career, Alex is in the early stages of training to become proficient in various aspects of air traffic control, including runway calculations. As a Junior Air Traffic Controller in training, Alex is learning the ropes of coordinating air traffic and is currently focused on understanding and performing basic runway parameter calculations. This involves working closely with mentors and senior controllers to gain hands-on experience in managing flight safety and efficiency. However, his mentors are sometimes unavailable due to busy schedule so he needs to learn them by himself and he wishes that any tool with proper tutorials or any help documents could can help him with a better understanding on the runaway calculations.

3.4 Qualified Calculator of Air Traffic Controller With Disability, Maria



Maria, a 53-year-old Air Traffic Controller, brings a wealth of experience to the aviation industry, specializing in air traffic management and runway calculations. Diagnosed with color-blindness, Maria is committed to overcoming challenges related to visual perception in the high-stakes environment of air traffic control. Maria faces challenges in quickly distinguishing between certain color-coded elements in the air traffic control software. Maria seeks solutions to address the impact of color-blindness on interpreting critical information in air traffic control systems to enhance efficiency, accuracy, and overall safety during operations.

3.5 Regulatory Authorities(CAA), Lisa

Lisa is a 58-year-old working for CAA (Civil Aviation Authority). Her position requires her to regularly assess the regulations that are in place for airport runway parameters. She has a large team that does this and reports their findings to her where she reviews everything. This process is very time-consuming as calculations need to be precise. She then has to publish these results, with all airports implementing them straight away. She finds her job very stressful because if any of the processes, that she overviews, are incorrect, it may result in hazardous operations of the airport. She works with a team that collectively reviews all aspects.

4 User Stories

In this section, we will use user stories that follows the INVEST principle to analyse user requirements. The INVEST principle stands for Independent, Negotiable, Valuable, Estimable, Small and Testable. Each user story will be given an ID and be explained in detail here. Then, in the later section, the user stories will be given a shorthand codename for easier communication and to make them more memorable.

- **ID:** Identification of the user story
- **User:** The role of the user.
  - Air traffic Control (ATC)
  - Airport Operations Manager (AOM)
  - Civil Aviation Authority (CAA)
- **Story:** The description of the user story. It follows the format of I want ... So that ...

ID	User	Story (I want ... So that ...)
1	ATC	I want both top-down and side-on visualization displayed simultaneously or separately So that I can either focus on one window or view both depending on my current choice.
2	ATC	I want to customize the runways on the software So that I can have it accurately depict the airport where I work.
3	ATC	I want to be able to select different runways from both views So that I can save more time.
4	ATC	I want to save presets of various obstacles So that I don't have to manually reinput each one every time I enter a different view.
5	ATC	I want a simple interface that displays both the current calculation and the previous calculation So I don't have to keep repeating the same values to compare.
6	ATC	I want the obstacles displayed on both views if present so that I can see intuitively what actually is the obstacle and report more efficiently.
7	AOM	I want a secure authentication system with different access levels stored in a database so that only designated individuals can successfully log in and view data, while critical system changes are restricted to senior staff for enhanced security and control.
8	AOM	I want to refer back to the historical data on obstructions and calculations for specific runways So that I can analyze trends.
9	ATC	I want to recalculate values when a (new) obstruction is present So I can view how this impacts the runway.
10	ATC	I want a top-down view to display the runway centerline So I can more easily visualize the situation.
11	ATC	I want to save images of all information regarding an obstruction So that I can view it at a later date.
12	ATC	I want the threshold with the lowest value to be furthest on the left So that I can quickly see which is the lowest of the list.
13	ATC	I want to be able to change the colour schemes of the software So that I can still see it with my colour-blindness disability
14	ATC	I want the system to display notifications when errors occurs So that I can accurately diagnose any issues
15	ATC	I want to be able to import preset obstacles with specific details using XML files So I don't need to waste time manually creating each obstacle
16	ATC	I want to be able to compile all calculations down, including inputs and results So that I can compare easily with paper results and official process
17	ATC	I want runway strips to be displayed on both views So that it's more intuitive to manage the system.
18	ATC	I want a threshold indicator displayed in both views so that it's more intuitive to tell whether the plane is safe to take off/land.
19	ATC	I want threshold designators displayed in both views so that I can distinguish the runways easily.
20	ATC	I want TODA and ASDA displayed in both views so that I can inform the pilot about the total distance an aircraft can safely use for takeoff.
21	ATC	I want to visualize the landing direction So that I can inform the pilot whether the runway is clear to land.
22	ATC	I want to have indicators to visualize the RESA, LDA, and TORA So that I can inform the pilot of the safety distance extending the runway when there is an emergency situation.
23	CAA	I want to visualize the cleared and graded areas in top-down view So that I can authorize this runway to compile regulations.
24	ATC	I want to visualize the displaced thresholds So that I can understand the changes that are caused by the obstacles more intuitively.

ID	User	Story (I want ... So that ...)
25	ATC	I want to visualize the offsets caused by RESA and stop angles So that I can inform the pilot whether the runway is clear to land.
26	ATC	I want to visualize the ALS and TOCS in a side-view So that I can tell which direction the plane is leaving and whether the area is clear of obstacles.
27	ATC	I want to be able to rotate the display of the system So that I can visualize it from different angles.
28	ATC	I want the system to print a textual report based on the system's parameters so that it can be saved as a future reference.
29	ATC	I want to be able to pan and zoom with the map So that I can more easily understand the situation.
30	ATC	I want a 3D visualization of the airfield So that it enhances user experience with the system.

5 Product Backlog

Product backlogs are summarised from the user stories, MoSCoW prioritisation with different colours is used to classify the tasks: **Must** This is the colour to represent the most prioritised tasks that must be completed for this project; **Should** This is the colour to represent the second important tasks; **Could** This is the colour to represent less essential tasks; **Won't** This is the colour for the least important tasks, and they will not be implemented for this project.

6 Envisioning Backlog

Task	Workforce	Estimated Hours	Actual Hours
Stakeholders	Sam H, AJ	5	5
Personas	Sam H, Muhammad	5	5
User Stories	AJ	4	3
Product Backlog	Eric, AJ	3	3
Increment Plan	Eric	3	1
Risk Assessment	Eric, Sam H, Muhammad	2	2
Burndown Chart	Eric	2	1
Envisioning Backlog	Eric, AJ	3	3
Report	All	5	5

7 Increment Plan

User stories are spread across three increments. It also follows the MoSCoW prioritisation:

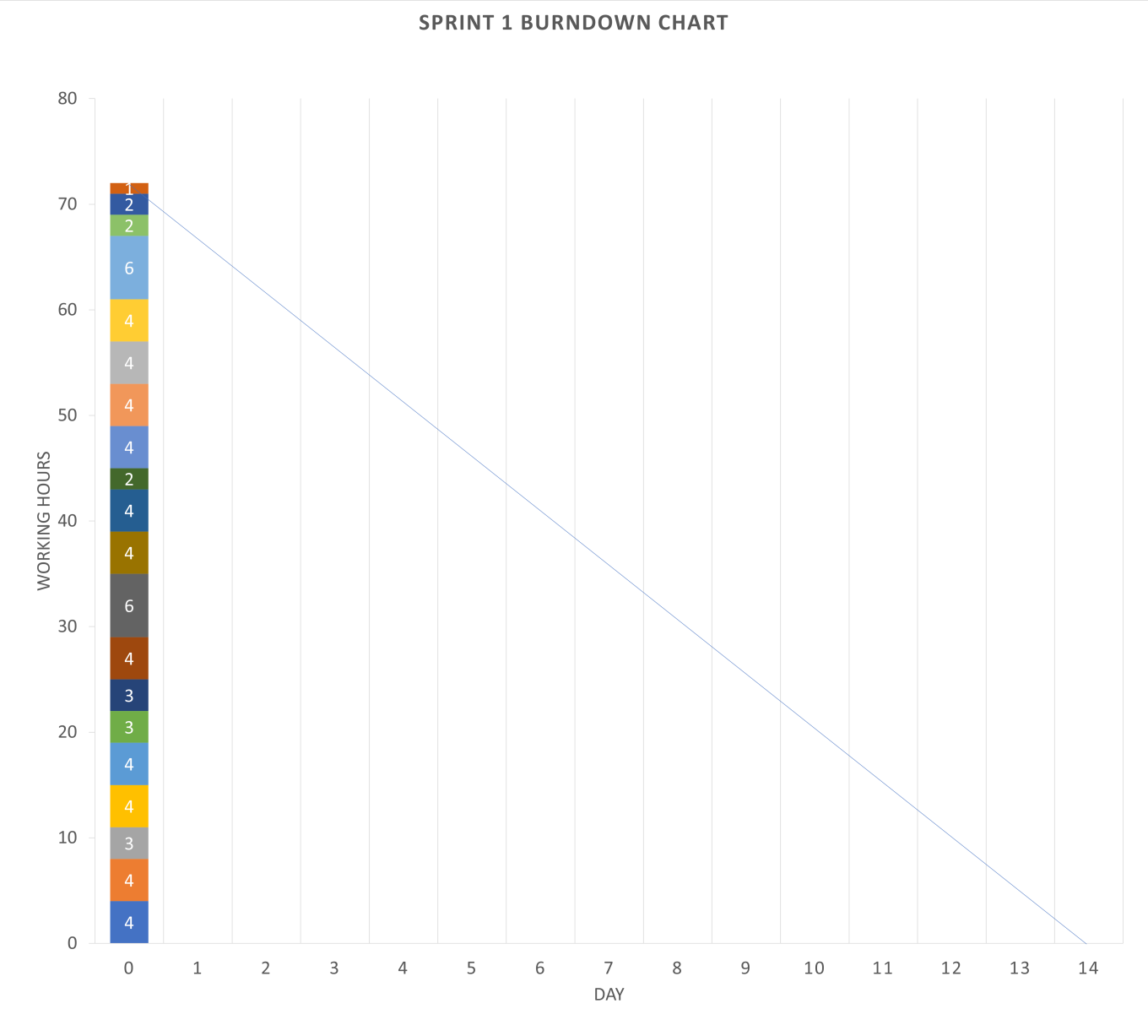
- **Must**
- **Should**
- **Could**

Certain tasks are prioritized ahead of essential ones due to their direct relevance to the tasks within their respective increments. This incremental plan, derived summarily from user stories, serves primarily as a consultative guide. It will be further refined and modified in subsequent phases.

Increment 1	Increment 2	Increment 3
Story ID: 1 Working Hour: 8	Story ID: 5 Working Hour: 7	Story ID: 2 Working Hour: 8
Story ID: 3 Working Hour: 4	Story ID: 6 Working Hour: 4	Story ID: 7 Working Hour: 10
Story ID: 4 Working Hour: 3	Story ID: 9 Working Hour: 6	Story ID: 12 Working Hour: 8
Story ID: 10 Working Hour: 4	Story ID: 16 Working Hour: 5	Story ID: 14 Working Hour: 8
Story ID: 17 Working Hour: 4	Story ID: 18 Working Hour: 8	Story ID: 15 Working Hour: 8
Story ID: 19 Working Hour: 6	Story ID: 24 Working Hour: 8	Story ID: 8 Working Hour: 8
Story ID: 20 Working Hour: 8	Story ID: 25 Working Hour: 8	Story ID: 27 Working Hour: 6
Story ID: 21 Working Hour: 2	Story ID: 26 Working Hour: 5	Story ID: 11 Working Hour: 5
Story ID: 22 Working Hour: 10	Story ID: 13 Working Hour: 4	Story ID: 29 Working Hour: 6
Story ID: 23 Working Hour: 4	Story ID: 28 Working Hour: 6	
Total Hour: 53	**Total Hour: 61**	**Total Hour: 77**

8 Sprint 1 Burndown Chart

Additional to the sprint plan for the first increment, auxiliary tasks such as UML diagrams, scenarios and storyboards could further support the development of progress. Although these tasks are not included in the user stories, they are planned to be implemented in the first increment. The total working hours for the first increment is planned to be 72 hours. Here is the initial burndown chart for the first sprint with working hour for each task represented in each cell:



9 Risk Assessment

Table column description:

- Risk - Brief description of the task
- P - Probability of the risk occuring. Rated 1 to 5, 1 is very unlikely and 5 is very likely.
- S - Severity of the risk if it were to occur. Rated 1 to 5, 1 is very unlikely and 5 is very likely.
- E - (Risk) Exposure, the overall risk value, where E = P X S
- Prevention Plan - A plan that could be implemented to prevent the occurance of the risk.
- Backup Plan - A plan that should be put into place if the risk were to ocur.

Risk	P	S	E	Prevention Plan	Backup Plan (Mitigation)
Tasks are more complex than expected	4	4	16	Ensure you thoroughly assess tasks initially in the planning phase.	Focus on completing high-priority elements first to ensure essential aspects are not compromised and continue unfinished tasks in the next sprint.
Debugging takes longer than expected	4	4	16	Research debugging platforms and how to use them prior to coding and also ensure commenting is done throughout.	Conduct a post-mortem analysis after the completion of the project to identify root causes of the extended debugging period.
Misunderstand client's requirements	2	5	10	Engage is regular structured communication with the client, using requirement feedback sessions.	Schedule a meeting to discuss and confirm requirements and regularly share progress with the client to catch any misunderstandings early in the development cycle.
Unfamiliar programming techniques / API	3	4	12	Research the techniques before use and make sure all team members are familiar with it.	Schedule extra time to understand the new programming techniques or APIs and seek for expertise for a better understanding.
Lack of team engagement / poor communication	3	4	12	Foster a positive work environment, allowing any ideas to be shared without judgement and also have an easy communication platform.	Conduct an assessment to understand the reasons behind lack of engagement and address any issues that may be present.
Extreme weather conditions	2	5	10	Ensure the system isn't completely relied upon, instead only used to assist the calculations.	Redo calculations without the use of the system to account for the weather conditions.
Loss of files	1	5	5	Utilise version control and have regular file backup procedures.	Determine the extent of the data loss, identify which files or directories are affected and assess the impact on the project and check if the lost files were committed and tracked in previous versions.
Loss or change of team member / supervisor	1	4	4	Have regular meetings to address individual concerns, making sure all members are motivated	Immediately assess the tasks and responsibilities of the departing team member and review the project

10 Tools

Type	Tool	Description	Reason
Communication	WhatsApp	WhatsApp is where our group meetups are planned and discussed ahead of time. Also any work that we were completing individually, we could easily ask for help or clarification from other members.	Everyone is already familiar and it is always available for instant access on both phones and desktop.
Communication	Teams	Teams is primarily used to communicate information to our supervisor.	Teams is well supported by the university and files can be shared more easily and also allows us to easily look back at any information that's needed (for example room bookings).
Testing	JUnit	JUnit is a unit testing framework for Java programming.	All team members have learnt and used it in Programming II.
Agile Scrum	Jira	Jira is used to visualise each increment sprint more effectively organise tasks so our group stays focused.	It automatically compiles backlogs and sprints and it has many tools within the software to help planning run smoothly.
IDE	IntelliJ	IntelliJ is an IDE for software development widely used for Java.	Java and JavaFX Will be used in this project. All team members are familiar with this IDE from previous usages in programming I and II.
Version Control	Gitlab	Gitlab is a version control tool that provides a Git repository	It's well supported by school accounts and accepted by all members.
Text Editor	Overleaf (LaTeX)	Overleaf is a collaborative platform for creating LaTeX documents	All team members have learnt and used it in Data Management
Spreadsheet	Excel	Excel provides numerous helpful functions for tables and graphs	It's well supported by school accounts and familiar to everyone
Slideshow	PowerPoint	This helps us organise our ideas concisely on small slide to present	It is supported by school accounts and everyone has experience with it