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Project Man. 412 Assignment 2

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Chapter 1

Executive Summary

This Project Plan Document details the project scope statement, baseline plan, risk plan and budget for a new product development project. The product to be developed incorporates the skill sets of all members in the multidisciplinary team. The product is a pressure vessel for industrial process oil refineries capable of sensing when the vessel is at risk of failure, thereby automatically releasing pressure to prevent catastrophic failure.

The scope statement begins by detailing the objectives for the product development project, which gives an indication of the desired end goal for the customer, and a base for the target plan. Thereafter the team developed milestones, deliverables and a work breakdown structure for the project plan, to achieve the objectives that were formulated. There are 12 milestones defined, which must be achieved by certain deadlines. These are summarised in table format, with specifications of the deadline dates and associated deliverables for each. The deliverables are expanded upon in a separate table, with their associated deadline dates and specific resource assignment. These deliverables, milestones and deadlines are represented graphically within the gantt chart for the whole project

The team each defined the technical requirements for the product development based on their expertise within their discipline. This is a summary for the customer of what they can expect, technically, from the finished product. The team has a diverse group of engineers, covering chemical, civil, mechanical, mechatronic and electrical disciplines. Thus, each member identified the aspects of the product development that pertained to their discipline, and outlined the technical requirements to achieve a successfully developed end product.

The limits and exclusions of the project scope are identified and outlined, as well as the customer approval procedure, which will be executed upon completion of the project to ensure that the customer's requirements for the product and project plan were met.

The data developed in the project scope statement is used to develop the baseline project plan, which will be used to measure the progress of the project. The plan is analysed to determine problems and mitigation strategies for the hiring, assigning and managerial actions of the resources, to ensure each deliverable is completed in the prescribed time.

Based on the resource assignment, managerial actions and training plan, a detailed budget for the project is formulated. The budget makes provision for unforeseen events and worker inefficiencies, so that a reasonably accurate project cost estimation can be presented to the customer. A detailed cost allocation according to individual deliverables is also put together.

The team developed an appropriate technique for collaboratively identifying risks for the project plan as a whole, and utilised their multidisciplinary nature to identify potential risks associated with each member's discipline. Each risk was assigned a mitigation and response strategy as well as a level-of-risk score. A risk matrix was developed to aid in assigning the level-of-risk score, which then facilitated the ranking of all the risks according to priority. The highest priority risks are identified and discussed in further detail, for both the team and the customer to refer to in the event of the risk occurring.

Chapter 2

Project Scope Statement

2.1. Introduction

2.2. Objectives

The objective of this project is to develop an industrial scale vessel for storing gaseous byproducts of petroleum refining under high pressures. subject to time and monetary constraints (specifically, 200 work days starting from 31/03/21 and \$380 000,00) specified by the customer while minimizing risk and maximizing stakeholder value. The product must be designed according to the the technical requirements specified by the multi-disciplinary team of engineers assigned to this project (Sec. 2.6), the limits/exclusions detailed in Sec. 2.7, and approved by the customer per the procedures outlined in Sec. 2.8.

The process for developing this product consists of evaluating the market to develop and execute a marketing plan based on these results. Using these results with the product specifications, the high-pressure vessel is designed, testing methods are derived and a risk analysis is conducted. The design's functionality is then tested by building a prototype that is subjected to the testing methods of the previous phase. These results are also used to determine if the prototype satisfies the design requirements.

If the prototype does not yield satisfactory results, the process is repeated until the requirements are met (given that the project's cost does not overrun). Once this step is reached, the manufacturing plan is developed and the product is advertised according to the marketing plan. Once sufficient materials are sourced, the manufacturing plan and the product is launched. This is also the point at which the project concludes.

2.3. Deliverables

The project consists of various deliverables that must be completed for the project to progress. The due dates of these deliverables and the resources responsible for them are listed in Tab. 2.1 below:

| Deliverable Date | Deliverable | Resources Responsible |
|------------------|---|------------------------------|
| 08/04/21 | Market Assessment Report | Yukio Ashida, Kurt Zollinger |
| 03/05/21 | Customer Preference Report | Yukio Ashida, Kurt Zollinger |
| 19/05/21 | Marketing Program | Yukio Ashida, Kurt Zollinger |
| 06/01/22 | Product Launch Presentation | Kurt Zollinger |
| 10/05/21 | Design and Development Plan | Junior Product Designer 1,2 |
| 25/05/21 | Detailed Technical Design Schematics | Junior Product Designer 1,2 |
| 01/06/21 | Product Tolerance and Liability Limits Report | Junior Product Designer 1,2 |
| 08/06/21 | Risk Analysis Report | Junior Product Designer 1,2 |
| 09/07/21 | Final Preliminary Design Plans | Junior Product Designer 1,2 |
| 13/07/21 | Initial Engineering Templates | Tom Bechur, Darryl Sandefur |
| 29/07/21 | Final Product Design | Tom Bechur, Darryl Sandefur |
| 05/08/21 | Pre-Production Specifications | Tom Bechur, Darryl Sandefur |

| Deliverable Date | Deliverable | Resources Responsible |
|------------------|----------------------------------|-----------------------------------|
| 24/08/21 | Product Prototype | Tom Bechur, Darryl Sandefur |
| 12/10/21 | Prototype Approval | Tom Bechur, Darryl Sandefur |
| 25/08/21 | Quality Assessment Report | Quality Engineer |
| 09/09/21 | Prototype Testing Protocols | Darryl Sandefur |
| 29/09/21 | Prototype Test Results | Quality Engineer |
| 14/10/21 | Prototype Test Result Evaluation | Quality Engineer |
| 30/08/21 | RFQ | Operations Specialist |
| 06/09/21 | Production Sample | Quality Engineer |
| 15/09/21 | Supplier Capability Report | Operations Specialist, Tom Bechur |
| 27/09/21 | Sample Approval | Tom Bechur |
| 28/10/21 | Supplier Notification | Quality Engineer |
| 22/10/21 | Production Plan | Operations Specialist |
| 25/11/21 | Production Control Plan | Operations Specialist |
| 02/12/21 | First-Run Product Assessment | Operations Specialist |
| 14/12/21 | Deliveries Contracts | Operations Specialist |
| 03/01/21 | Production Contract | Operations Specialist |
| 16/04/21 | Project Status Update | Tom Bechur, Darryl Sandefur |
| 14/05/21 | Project Status Update | Tom Bechur, Darryl Sandefur |
| 03/06/21 | Project Status Update | Tom Bechur, Darryl Sandefur |
| 21/07/21 | Project Status Update | Yukio Ashida |
| 11/08/21 | Project Status Update | Yukio Ashida |
| 24/08/21 | Project Status Update | Yukio Ashida |
| 14/09/21 | Project Status Update | Yukio Ashida |
| 20/09/21 | Project Status Update | Yukio Ashida |
| 12/10/21 | Project Status Update | Yukio Ashida |
| 21/10/21 | Project Status Update | Yukio Ashida |
| 01/12/21 | Project Status Update | Darryl Sandefur |
| 21/12/21 | Project Status Update | Darryl Sandefur |

Table 2.1: Deliverables with Delivery Date and Responsible Resources

2.4. Milestones

The project has been divided into twelve milestones, each with associated deliverables. This division can be seen in Tab. 2.2 below:

| Milestone | Deliverables | Date |
|-----------|---|----------|
| 1 | Market Assessment Report Customer Preference Report Project Status Update | 05/05/21 |
| 2 | Design and Development Plan Detailed Technical Design Schematics Marketing Program Project Status Update | 25/05/21 |
| 3 | Product Tolerance and Liability Limits Report Risk Analysis Report Project Status Update | 02/07/21 |

| Milestone | Deliverables | Date |
|-----------|--|----------|
| 4 | Final Preliminary Design Plans Initial Engineering Templates Project Status Update | 21/07/21 |
| 5 | Final Product Design Pre-Production Specifications Project Status Update | 11/08/21 |
| 6 | RFQ Product Prototype Quality Assessment Report Project Status Update | 30/08/21 |
| 7 | Production Sample Supplier Capability Report Prototype Testing Protocols | 15/09/21 |
| 8 | Sample Approval Prototype Test Results Trade Show Presentation Project Status Update | 06/10/21 |
| 9 | Prototype Approval Prototype Test Result Evaluation Project Status Update | 14/10/21 |
| 10 | Supplier Notification Production Plan Project Status Update | 12/11/21 |
| 11 | Production Control Plan First-Run Product Assessment Deliveries Contracts Project Status Update | 14/12/21 |
| 12 | Production Contract Product Launch Presentation Project Status Update | 06/01/22 |

Table 2.2: Milestones with Associated Deliverables and Dates

2.5. Work Breakdown Structure

The tasks assigned to every resource is given in the work breakdown structure in Fig.2.1 below:

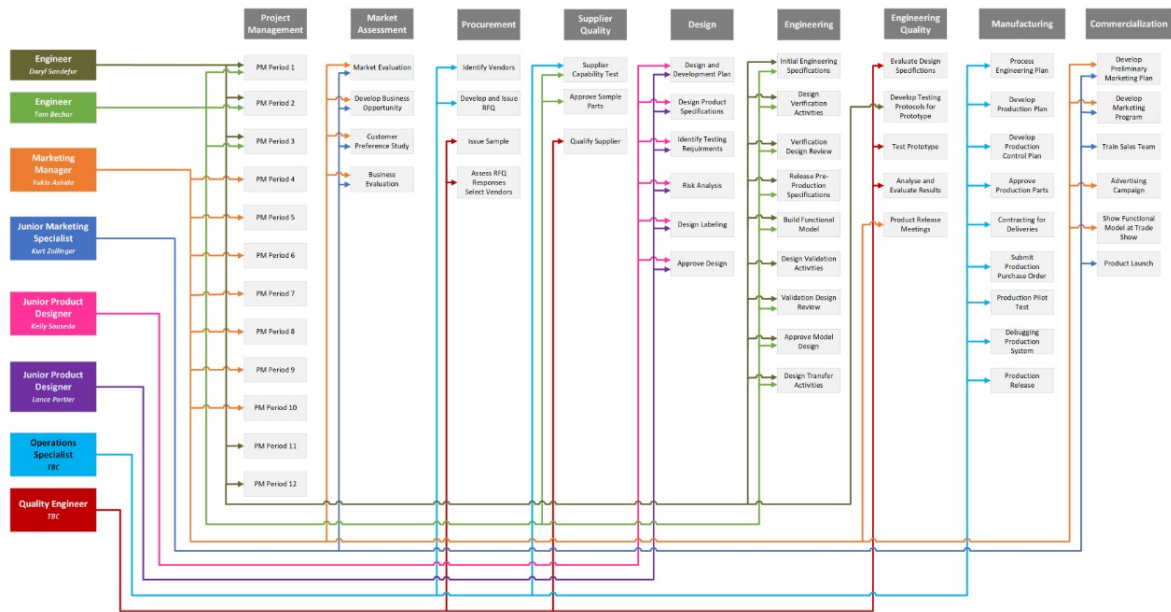


Figure 2.1: Work Breakdown Structure

2.6. Technical Requirements

This section describes the technical requirements determined by the multi-disciplinary team of engineers assigned to this project, subject to approval by the customer.

2.6.1. Chemical Requirements

The pressure within the vessel will be dependent on various factors. These factors include the physical and chemical characteristics of the fluid stored within the vessel, as well as the dependence of the pressure within the vessel on the fluid's temperature. It is a chemical engineers job to understand and account for these characteristics and fluctuations. The chemical engineer also has extensive knowledge regarding process control which would be used to develop the equipment and models that regulate pressure within the vessel within an acceptable range.

2.6.2. Civil Requirements

The pressure vessel will be a large steel construction. The design of the vessel and the structure supporting it will comprise several steel angles and sections. Sufficient foundation will be needed to support loads of the structure. The steel used for construction must be of a high grade so that it does not fail under the worst load case. Depending on the location of the vessel (inland or coastal) preventative measures must be taken to prevent corrosion causing structural failure and to ensure durability of the structure.

2.6.3. Electrical and Electronic Requirements

The high-pressure vessel must be monitored using a suite of analogue and digital sensors. This will be the purview of the electrical and electronic engineer.

This sensor suite must be designed and built using cost-effective and accurate components

that can withstand the pressure inside the pressure vessel to be developed. Redundant sensors must also be included to provide reasonably accurate measurements in the event of a component failure or if the pressure vessel moves outside of its normal operating parameters. All designs must follow industry best practice and safety standards.

2.6.4. Mechanical Requirements

The pressure vessel must be designed to have sufficient strength to resist failure under normal operating conditions. Theoretical stress and strain calculations must be performed to select the initial vessel material, dimensions and boundary conditions for the design. A finite element analysis can then be performed to refine these selections. The mechanical engineer will be charged with performing these calculations and analyses.

2.6.5. Mechatronic Requirements

The pressure vessel must be controlled properly to ensure it operates in a smooth and safe manner. Mechatronic engineers have a great understanding of control systems, and mechanical and electrical component interaction.

The mechatronic engineer must design, develop, and implement a control-and safety system to ensure mechanical and electrical components operates properly. The mechatronic engineer should also design a user interface. The user interface must display accurate real-time data. The client must be able to control the system through the user interface.

2.7. Limits and Exclusions

2.8. Customer Review and Approval Procedures

Chapter 3

Project Baseline

The baseline for this project has been calculated using Microsoft Project and can be seen in A.1 and B.1.

end date, before deadline

Analysing this network leads to several potential problem areas.

The first is that this project is sensitive to the hiring time of new resources. For example, if junior product designers are not hired by the time Phase 2 starts, the entire project will be delayed. To mitigate this potential problem, two engineers are hired that can cover a variety of specialities in the event that required resources are not obtained. The hiring strategy must also take this possibility into account, such as possibly hiring resources a period earlier than they are required.

There are also several places where tasks from the same department must be done in parallel (e.g. commercialization in Phase 3), this means that there must be at least two members of this department to finish the tasks in time, especially if one of the tasks is on the critical path.

The hiring strategy takes these concerns into account by hiring redundant resources for tasks that are on the critical path (e.g. hiring two junior designers for the design tasks on the critical path). Redundant bids are also placed on several resources in the event that a singular bid is not accepted. The loss in team longevity/cohesion is considered an acceptable sacrifice to mitigate the risk of not acquiring critical resources.

The managerial action strategy consists of regular pizza parties for all employees at the end of each phase. This is for improving team morale at a negligible cost. Furthermore, four management recognition awards are to be given at evenly spaced phase intervals to all employees to boost morale and team cohesion further. These awards are spaced evenly to ensure that once the effect of one award fades, the effect of the next award is activated.

It was decided that the benefit of training resources is not worth the associated costs (direct course costs and lost labour). Therefore, the training strategy consists of not sending any resources to training.

Chapter 4

Budget Breakdown

This chapter documents the budget that has been planned for this project. Resources that have not been hired as of Phase 1 have been assigned using generic resources and their cost has been calculated using average rates for their respective specialisation.

The cost breakdown of the project can be found in the Tab. 4.1 below:

| Cost Type | Cost (\$) |
|-------------------------|-------------------|
| Direct Resource Costs | 309 428,00 |
| Training Costs | 0 |
| Managerial Action Costs | 1 600,00 |
| Contingency | 6 220,56 |
| Overhead (20%) | 61 885,60 |
| Total: | <u>379 134,16</u> |

Table 4.1: Project Cost Breakdown

An overhead cost of 20% is added to account for unforeseen events and worker inefficiencies. A contingency fund of 2% of the direct costs is added. The use of this contingency fund is specified in the chapter regarding Resource Analysis (Ch.5).

The cost breakdown of the managerial actions planned for the project is found in Tab. 4.2 below:

| Managerial Action | Action Amount | Action Unit Cost (\$) | Cost (\$) |
|------------------------------|---------------|-----------------------|-----------------|
| Pizza Party | 12 | 50,00 | 600 |
| Management Recognition Award | 4 | 250,00 | 1000 |
| Total: | | | <u>1 600,00</u> |

Table 4.2: Managerial Actions Cost Breakdown

The managerial actions planned to be taken consist of a pizza party for all employees at every period as well as management recognition awards at regular intervals throughout the project. Further details regarding managerial action strategy can be found in Ch. 3.

It was decided that training resources was not worth the cost and lost hours for the relatively small gains in efficiency.

An overview of the cost status and distribution of the costs associated with the various tasks over the full project duration can be found in Fig. 4.1 below:

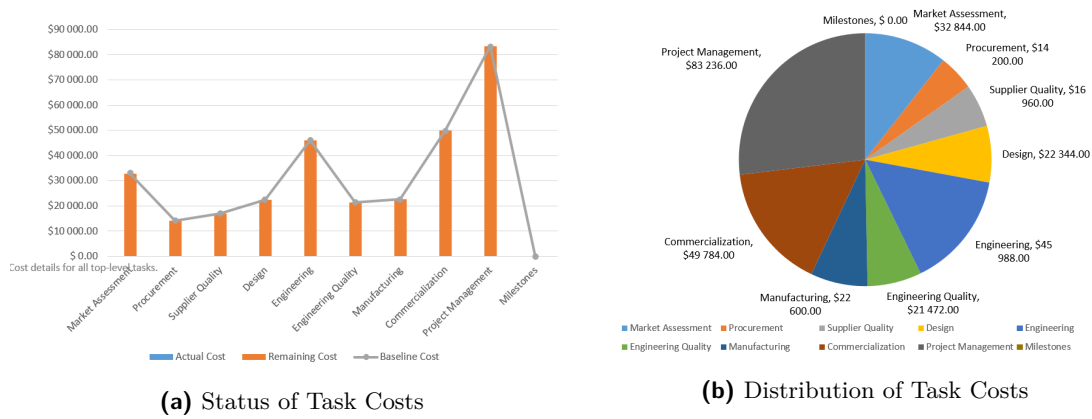


Figure 4.1: Status and Distribution of Task Costs

An overview of the cost status and distribution of the costs associated with the various resources over the full project duration can be found in Fig. 4.2 below:

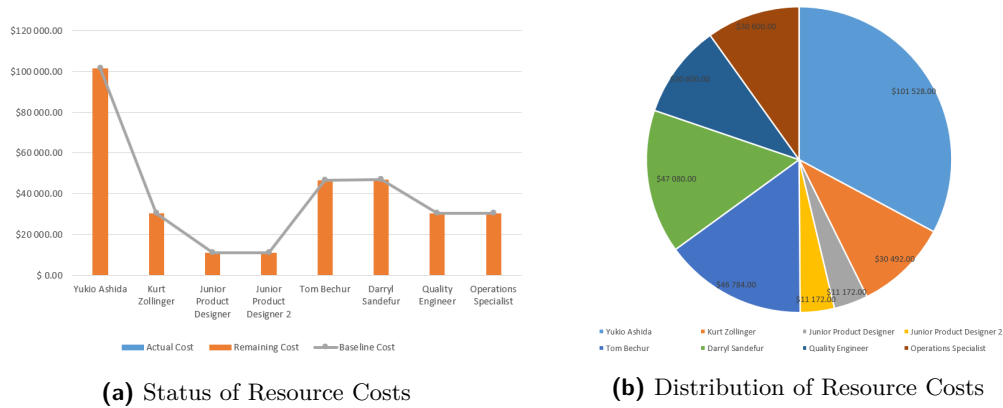


Figure 4.2: Status and Distribution of Resource Costs

The cumulative direct costs and direct cost per month is given in Fig. 4.3 below:

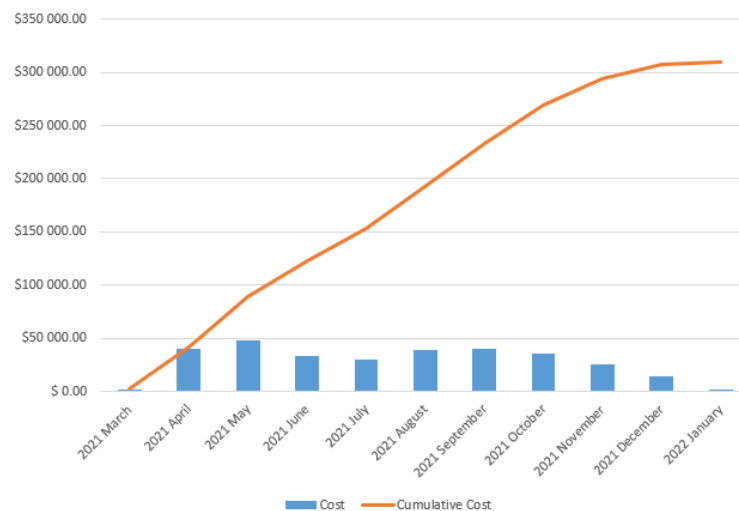


Figure 4.3: Direct Cumulative Cost and Direct Cost per Month

A detailed budget with task assignments, baseline budget and baseline duration can be found in A.1.

Chapter 5

Risk Analysis

5.1. Risk Identification and Analysis

Risks were identified at a special Risk Planning and Response meeting (ref appendix). The attendees of this meeting consisted of the multidisciplinary team of engineers assigned to this project. Using their respective areas of expertise, each of the attendees identified several possible risks (with their respective likelihood at impact) present in the project.

A qualitative risk analysis was then done on these risks using the risk matrix in Tab. 5.3 constructed with Tab. 5.1 and Tab. 5.2 below. Each of the identified risks is assigned a composite score by multiplying their equivalent probability and impact scores, creating the risk matrix. The risks were then arranged by descending score to create a prioritized risk register.

| Probability | Probability Percentage | Probability Score |
|-------------|------------------------|-------------------|
| Very High | 80-100% | 5 |
| High | 60-80% | 4 |
| Medium | 40-60% | 3 |
| Low | 20-40% | 2 |
| Very Low | 0-20% | 1 |

Table 5.1: Probability Scores Used for Risk Matrix

| Impact | Impact score |
|-----------|--------------|
| Very High | 5 |
| High | 4 |
| Medium | 3 |
| Low | 2 |
| Very Low | 1 |

Table 5.2: Impact Scores Used for Risk Matrix

| | | | | | | |
|-------|-----------|----------|-----|--------|------|-----------|
| Prob. | Very High | 5 | 10 | 15 | 20 | 25 |
| | High | 4 | 8 | 12 | 16 | 20 |
| | Medium | 3 | 6 | 9 | 12 | 15 |
| | Low | 2 | 4 | 6 | 8 | 10 |
| | Very Low | 1 | 2 | 3 | 4 | 5 |
| | | Very Low | Low | Medium | High | Very High |
| | | Impact | | | | |

Table 5.3: Risk Matrix Used for Risk Analysis

5.2. Priority Risks

Using the risk registers in C.1, priority risks are identified as risks with a score of more than 14. These risks require greater scrutiny and review to ensure that these risks do not come to pass, due to the combination of their high likelihood of occurrence or high impact on the project.

The priority internal risks can be separated into the two areas that they impact, namely financial and resources.

The priority resource risks concern the possibility and impact that Covid-19 would have on the project. The plan for mitigating and managing these risks will be three-pronged: to develop a response strategy for resources contracting the disease, developing procedures to continue work under an imposed lockdown and preventative measures to prevent the spread of the disease. Each of these plans and procedures will have a manager assigned at project launch to monitor the risk and provide regular status updates. The assigned managers will also be responsible to execute the respective plans in the event of the risk occurring.

The priority financial risks concern the possibility and impact of not meeting the specified budget, as a result of cost overruns or budget changes, or the specified project delivery date. It is imperative that these risks are mitigated to the fullest possible extent as these risks cannot be allowed to happen. These risks are semi-mitigated by the extensive planning done in this report such as more accurate cost and time estimates (WBS in Sec. 2.5 and milestone dates in Sec. 2.4) and contingency measures as seen in Ch. 4 (additional overhead and contingency fund). However, this alone is insufficient and does not fully account for the unforeseen changes in the project environment. Therefore, a manager must also be assigned to constantly monitor and revise the models used to predict time and resource costs as well as provide regular status updates. Plans must also be made to meet with the customer and executive level in the event of these risks occurring to prevent automatic early project termination

Appendix A

Detailed Budget

The detailed budget can be found on the following pages. Note that the image can be zoomed in to read details of the various tasks.

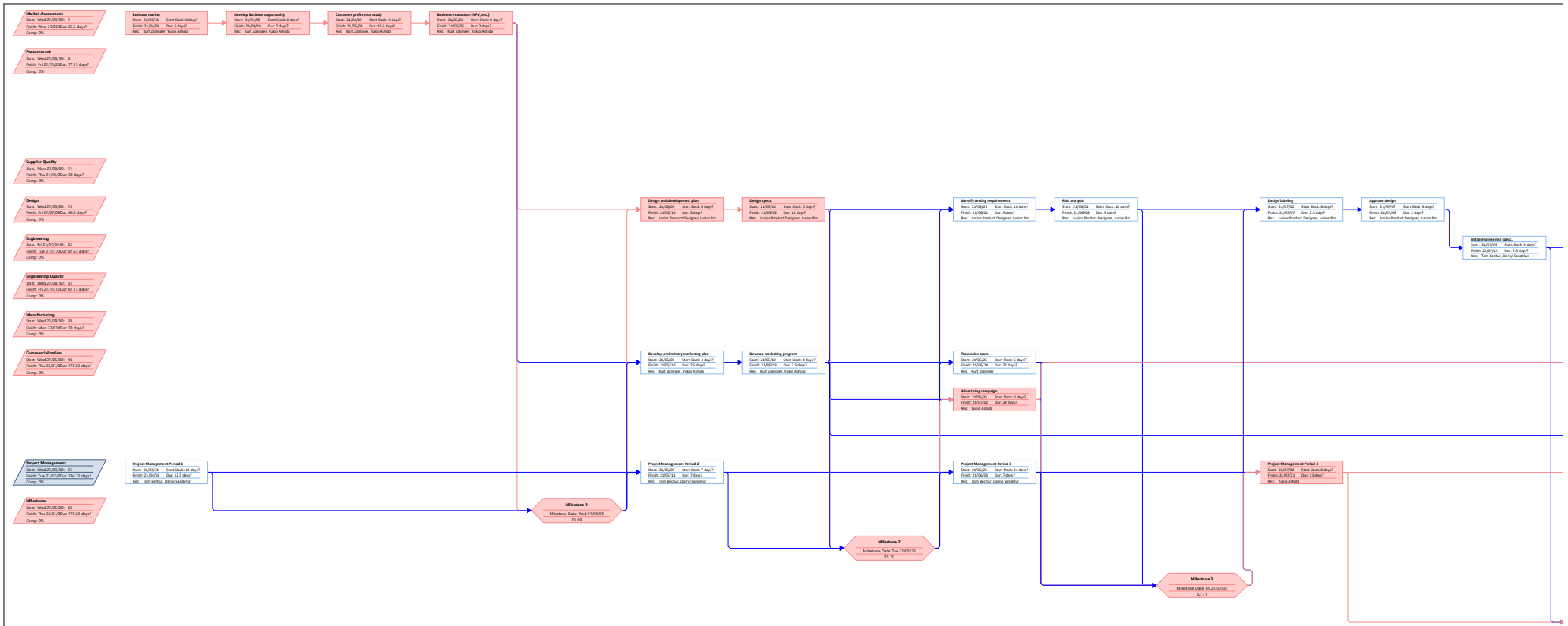
| ID | Task Name | Resource Names | Baseline Cost | Baseline Estimated Duration |
|----|---|---|--------------------|-----------------------------|
| 1 | Market Assessment | | \$32 844.00 | 25.5 days |
| 2 | Evaluate market | Kurt Zollinger,Yukio Ashida | \$7 728.00 | 6 days |
| 3 | Develop Business opportunity | Kurt Zollinger,Yukio Ashida | \$9 016.00 | 7 days |
| 4 | Customer preference study | Kurt Zollinger,Yukio Ashida | \$13 524.00 | 10.5 days |
| 5 | Business evaluation (NPV, etc.) | Kurt Zollinger,Yukio Ashida | \$2 576.00 | 2 days |
| 6 | Procurement | | \$15 552.00 | 84.13 days |
| 7 | Identify vendors | Kurt Zollinger | \$3 528.00 | 7 days |
| 8 | Develop and Issue RFQ | Kurt Zollinger | \$3 024.00 | 6 days |
| 9 | Issue sample (production equivalent) | Quality Engineer | \$3 000.00 | 5 days |
| 10 | Assess RFQ responses and select vendors | Quality Engineer | \$6 000.00 | 10 days |
| 11 | Supplier Quality | | \$15 952.00 | 45 days |
| 12 | Perform supplier process capability | Operations Specialist | \$5 600.00 | 14 days |
| 13 | Approve sample parts | Tom Becher | \$4 352.00 | 8 days |
| 14 | Qualify Supplier | Quality Engineer | \$6 000.00 | 10 days |
| 15 | Design | | \$22 344.00 | 46.5 days |
| 16 | Design and development plan | Junior Product Designer,Junior Product Designer 2 | \$2 352.00 | 3 days |
| 17 | Design specs. | Junior Product Designer,Junior Product Designer 2 | \$8 624.00 | 11 days |
| 18 | Identify testing requirements | Junior Product Designer,Junior Product Designer 2 | \$3 920.00 | 5 days |
| 19 | Risk analysis | Junior Product Designer,Junior Product Designer 2 | \$3 920.00 | 5 days |
| 20 | Design labeling | Junior Product Designer,Junior Product Designer 2 | \$1 960.00 | 2.5 days |
| 21 | Approve design | Junior Product Designer,Junior Product Designer 2 | \$1 568.00 | 2 days |
| 22 | Engineering | | \$45 988.00 | 94.63 days |
| 23 | Initial engineering specs. | Tom Becher,Darryl Sandefur | \$2 460.00 | 2.5 days |
| 24 | Design verification activities | Tom Becher,Darryl Sandefur | \$3 444.00 | 3.5 days |
| 25 | Verification design review | Tom Becher,Darryl Sandefur | \$1 968.00 | 2 days |
| 26 | Release pre-production specifications | Tom Becher,Darryl Sandefur | \$4 920.00 | 5 days |
| 27 | Build functional model | Tom Becher,Darryl Sandefur | \$8 856.00 | 9 days |
| 28 | Design validation activities | Darryl Sandefur | \$2 200.00 | 5 days |
| 29 | Validation design review | Tom Becher,Darryl Sandefur | \$1 968.00 | 2 days |
| 30 | Approve model design | Tom Becher,Darryl Sandefur | \$1 968.00 | 2 days |
| 31 | Design transfer activities | Tom Becher,Darryl Sandefur | \$18 204.00 | 18.5 days |
| 32 | Engineering Quality | | \$21 464.00 | 74.13 days |
| 33 | Evaluate design specifications | Quality Engineer | \$6 000.00 | 10 days |
| 34 | Develop testing protocol for prototype | Tom Becher,Darryl Sandefur | \$4 352.00 | 8 days |
| 35 | Test prototype | Quality Engineer | \$6 000.00 | 10 days |

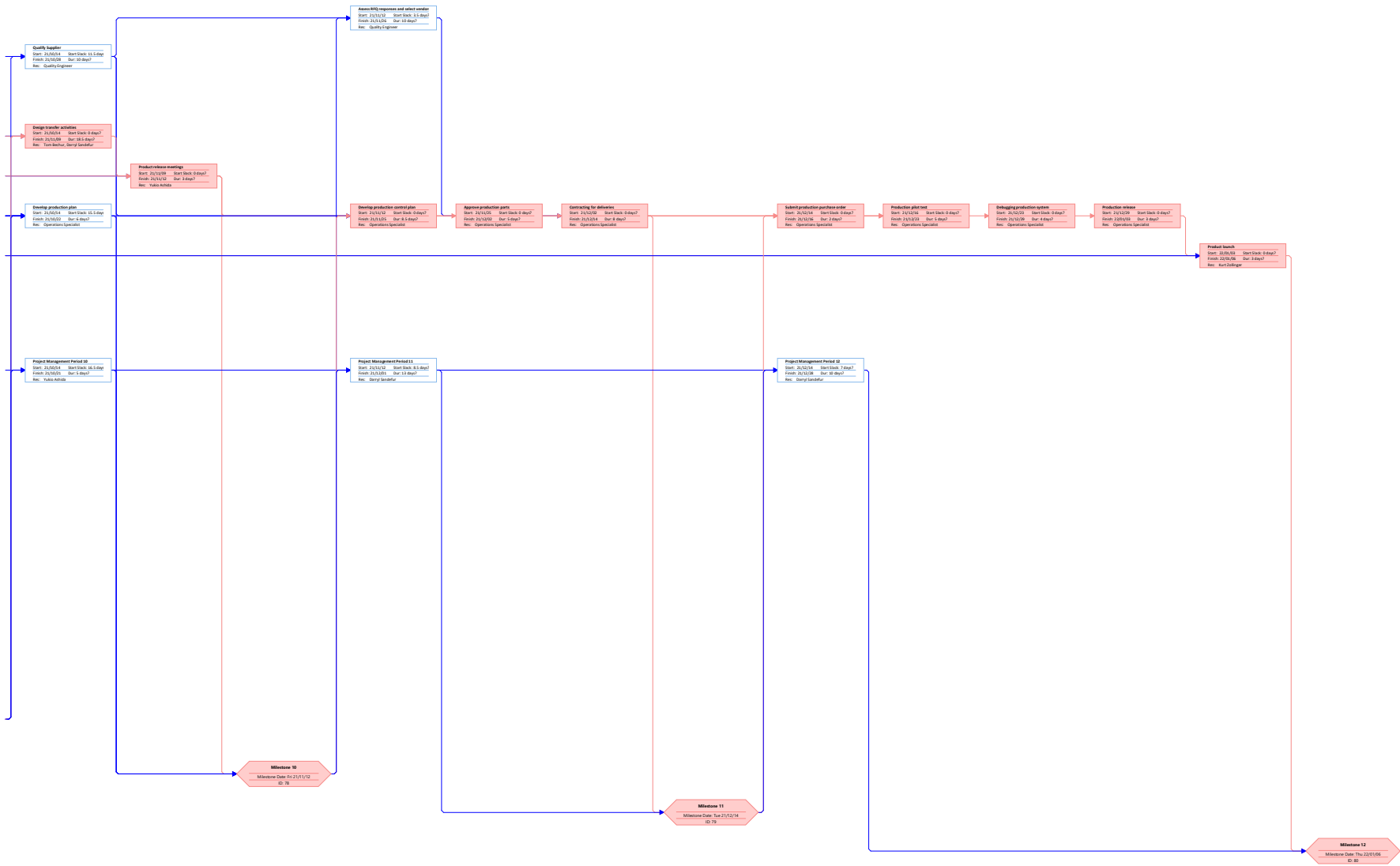
| ID | Task Name | Resource Names | Baseline Cost | Baseline Estimated Duration |
|----|---|------------------------------|--------------------|-----------------------------|
| 36 | Evaluate results of tests and identify weaknesses | Quality Engineer | \$3 600.00 | 6 days |
| 37 | Product release meetings | Kurt Zollinger | \$1 512.00 | 3 days |
| 38 | Manufacturing | | \$22 600.00 | 78 days |
| 39 | Process engineering plan | Operations Specialist | \$6 000.00 | 15 days |
| 40 | Develop production plan | Operations Specialist | \$2 400.00 | 6 days |
| 41 | Develop production control plan | Operations Specialist | \$3 400.00 | 8.5 days |
| 42 | Approve production parts | Operations Specialist | \$2 000.00 | 5 days |
| 43 | Contracting for deliveries | Operations Specialist | \$3 200.00 | 8 days |
| 44 | Submit production purchase order | Operations Specialist | \$800.00 | 2 days |
| 45 | Production pilot test | Operations Specialist | \$2 000.00 | 5 days |
| 46 | Debugging production system | Operations Specialist | \$1 600.00 | 4 days |
| 47 | Production release | Operations Specialist | \$1 200.00 | 3 days |
| 48 | Commercialization | | \$48 944.00 | 182.63 days |
| 49 | Develop preliminary marketing plan | Kurt Zollinger, Yukio Ashida | \$3 220.00 | 2.5 days |
| 50 | Develop marketing program | Kurt Zollinger, Yukio Ashida | \$9 660.00 | 7.5 days |
| 51 | Train sales team | Kurt Zollinger | \$11 088.00 | 22 days |
| 52 | Advertising campaign | Yukio Ashida | \$21 952.00 | 28 days |
| 53 | Show functional model at trade show | Kurt Zollinger | \$1 512.00 | 3 days |
| 54 | Product launch | Kurt Zollinger | \$1 512.00 | 3 days |
| 55 | Project Management | | \$91 148.00 | 201.13 days |
| 56 | Project Management Period 1 | Tom Becher, Darryl Sandefur | \$12 300.00 | 12.5 days |
| 57 | Project Management Period 2 | Tom Becher, Darryl Sandefur | \$6 888.00 | 7 days |
| 58 | Project Management Period 3 | Tom Becher, Darryl Sandefur | \$6 888.00 | 7 days |
| 59 | Project Management Period 4 | Yukio Ashida | \$10 192.00 | 13 days |
| 60 | Project Management Period 5 | Yukio Ashida | \$11 760.00 | 15 days |
| 61 | Project Management Period 6 | Yukio Ashida | \$7 056.00 | 9 days |
| 62 | Project Management Period 7 | Yukio Ashida | \$8 624.00 | 11 days |
| 63 | Project Management Period 8 | Yukio Ashida | \$2 352.00 | 3 days |
| 64 | Project Management Period 9 | Yukio Ashida | \$3 136.00 | 4 days |
| 65 | Project Management Period 10 | Yukio Ashida | \$3 920.00 | 5 days |
| 66 | Project Management Period 11 | Yukio Ashida | \$10 192.00 | 13 days |
| 67 | Project Management Period 12 | Yukio Ashida | \$7 840.00 | 10 days |
| 68 | Milestones | | \$0.00 | 182.63 days |

Appendix B

Network Diagram

The network diagram can be found on the following three pages. Note that the diagram is read left to right, the pages are contiguous and the images can be zoomed in to read details of the various tasks.





Appendix C

Prioritized Risk Registers

The network diagram can be found on the following three pages. Note that the diagram is read left to right, the pages are contiguous and the images can be zoomed in to read details of the various tasks.

| Risk | Area Impacted | Impact | Prob | Score | Consequences | Mitigation | Response |
|--|------------------|-----------|-----------|-------|--|--|---|
| Budget cuts | Financial | High | High | 16 | Project cost may overrun | Add contingency, ensure adequate overhead | Cut costs, review hiring strategy |
| Going over budget | Financial | Very high | Medium | 15 | Project may be terminated | Proper planning | Cut costs |
| Going over time | Financial | Very High | Medium | 15 | Project may be terminated | Proper planning | Assign more resources |
| Covid-19 lockdown restrictions | Resources | Medium | Very High | 15 | Project tasks may be delayed | Define contingency for operating under lockdown conditions | Operate as far as possible under lockdown conditions |
| Resources contracting Covid-19 | Resources | High | Medium | 12 | Project may be delayed or risk the health of employees | Ensure correct Covid-19 measures are followed. | Infected or exposed individuals must self-isolate |
| Project purpose not well defined | Financial | Very High | Low | 10 | Project may be delayed or terminated | Define proper project objectives | Revise project objectives |
| Scope creep | Financial | Very High | Low | 10 | Project may be delayed or going over budget | Proper definition of scope | Deviate as little as possible from baseline plan |
| Cost estimating errors | Financial | Medium | Medium | 9 | Project may be delayed. | Ensure estimations are done properly, use more accurate methods | Revise and recalculate estimations |
| Task duration estimate errors | Financial | Medium | Medium | 9 | Project may go over budget. | Ensure correct project planning. | Redefine project schedule |
| Bid unsuccessful | Resources | Medium | medium | 9 | Project delays | Redundant and reasonable bids | Reassign resources |
| Design errors | Technical | Medium | Medium | 9 | Project may be delayed | Add contingency (on time and money) | Assign more designers |
| Manufacturing errors | Technical | Medium | Medium | 9 | Project may be delayed or go over budget | Add contingency (on time and money) | Assign more operations specialists |
| Material supply delays | Procurement | High | Low | 8 | Project may be delayed | Vet suppliers | Consider alternative supplier |
| Resource resignation | Resources | High | Low | 8 | Project may be delayed | Ensure resources receive an appropriate offer | Offer a better package, hire replacement resource |
| Resources on critical path unavailable | Resources | High | Low | 8 | Project Delays, Bench cost for other resources | Redundant resources on critical path | Assign another resource to path, review hiring strategy |
| Ineffective resource assignment | Resources | Low | High | 8 | Resource not functional to fullest potential | Hire effective resources for each task | Assign more effective resources |
| Labour strikes | Resource | Very High | Very Low | 8 | Resources unavailable, project may be delayed | Ensuring employees work under proper conditions, Contingency fund. | Negotiate with employees. |
| Resource mismanagement | Financial, Legal | High | Low | 8 | Project may be delayed | Hire manager with good reputation | Replace manager |
| Financial mismanagement | Financial, Legal | High | Low | 8 | Project may be delayed or budget overrun. | Hire manager with good reputation | Replace manager |
| Resource not available for hire | Resources | Medium | Low | 6 | Project delay | Good hiring strategy, regular review | Reassign resources |
| Unplanned work that must be accommodated | Financial | High | Very Low | 4 | Project may be delayed or go over budget. | Contingency funds. | Hire additional resources. |
| Team conflict | Resources | Low | Low | 4 | Task delays, cohesion loss | Pre-emptive Managerial actions | Review planned managerial actions |
| Resource unavailability due to lockdown restrictions | Resources | Low | Low | 4 | Project may be delayed. | Proper planning | Assign another resource, review hiring strategy |
| Sick Leave | Resources | Low | Low | 4 | Project delay | Proper planning for resources | Assign another resource, review hiring strategy |
| Maternity Leave | Resources | High | Very Low | 4 | Project may be delayed | Proper planning for resources | Assign another resource, review hiring strategy |
| Injury at work | Resources | Medium | Very Low | 3 | Extra costs, task delays | Proper safety protocols | Have emergency protocols, reassign resources |
| Unskilled Resource | Resources | Low | Low | 2 | Task delays | Vet hires | Review training strategy |
| Managerial actions ineffective | Resources | Very Low | Low | 2 | Inefficient spending | No mitigation | Review planned managerial actions |

Table C.1: Prioritized Internal Risk Register

Appendix D

Meeting Minutes

The minutes transcribed at the various meeting preceding this report in given on the following pages.

Minutes of the Meeting 1 of Group I-2

Project Management 412

on 12/04/2021 @13h00-13h30 at Chalkboard

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Rorisang (RL)
- Apologies: Philip (PK)

2. Minutes of the previous meeting

N/A

3. Agenda

The following agenda was approved before the meeting:

- Talk through the Gantt chart as prepared by EV.
- Decide on hires and other bidding decisions.
- Discuss assignment 2 format.
- Discuss strategy and approach for assignment 2.
- Brainstorm fictitious product idea to use for assignment 2.

4. Discussion according to agenda

1. Organized the same strategy for the marketing phase as was done in the demo run.
2. Discussed replacing the project manager with a marketing manager or engineer. Decided on testing the effectiveness of an engineer in this role by assigning him/her in parallel for the first phase.
3. Discussed hiring and assigning two junior product designers to speed up execution, since design tasks are budgeted for \$50 / hour.
4. Discussed switching the project manager role from the engineer to a marketing manager (after phase 1 when engineer must be assigned to other tasks), since this strategy was effective in the demo.
5. Discussed bidding strategy regarding bidding additional 50 cents to win a bid over a team who might bid the same amount.
6. Reviewed budget analysis (as prepared by EV) for bidding decisions.
7. Discussion about having enough space in budget to hire at 30%-40% above the standard rate.
8. Discussed organizing a collaboration document (eg. google doc) for the 'rough work'.
9. Discussed the compiling of the final document on LaTeX (EV volunteered to take on this task).
10. Decided on approach for assignment 2 to be everyone working collaboratively on every task (on the google doc). There was a

discussion about setting short-term deadlines to ensure even contribution by each team member.

11. Each group member will brainstorm and contribute ideas for the fictitious product on the google doc.
12. EV will do baseline and share the repository with mpp file (on GitHub) through the MS teams channel, so that every team member has access to the Gantt chart and its continuous updates.
13. Final bidding decisions were made and submitted at the meeting for bid 1 (due 12/04/2021 @ 20h00). Bidding decisions were as follows:

| Name | Category | Quality level | Standard rate | Offered rate | Intended assignment for phase 1 |
|--------------------|-----------------------------|----------------------|----------------------|---------------------|--|
| Tom Becher | Engineer | Mid-level | \$55 | \$67.50 | Project management |
| Kurt Zollinger | Junior Marketing Specialist | High-level | \$59 | \$62.50 | Market assessment / commercialization |
| Jane Gavette | Junior Marketing Specialist | Mid-level | \$52 | \$60.50 | Market assessment / commercialization |
| Yukio Ashida | Marketing manager | Mid-level | \$91 | \$97.50 | Market assessment / commercialization |
| Fulberto Eberstark | Marketing manager | Low-level | \$78 | \$91.50 | Contingency |
| Kelly Doe | Project manager | Low-level | \$100 | \$100.00 | Project management / contingency |

5. Next meeting

The next meeting is planned for 12/04/2021 @20h15 on MS Teams, to evaluate whether the first round of bidding was successful or not. If not successful, the meeting will be used to discuss and make bids for round 2.

Minutes of the Meeting 2 of Group I-2

Project Management 412

on 12/04/2021 @20h15-20h30 on MS Teams

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Rorisang (RL)
- Apologies: Philip (PK)

2. Minutes of the previous meeting

Refer to Meeting 1 above.

3. Agenda

The following agenda was approved before the meeting:

- Review results of bidding round 1.
- Discuss decisions for bidding round 2.

4. Discussion according to agenda

1. Discussed bidding for a second engineer, to secure for when engineering tasks begin, as we anticipate needing at least two engineers to reduce the workload and time spent.
2. Discussed whether to bid for another project manager, given that we did not get the previous bid for Kelly Doe (project manager).
3. Final bidding decisions were made and submitted at the meeting for bid 2 (due 13/04/2021 @ 20h00). Bidding decisions were as follows:

| Name | Category | Quality level | Standard rate | Offered rate | Intended assignment for phase 1 |
|------------------|-----------------|---------------|---------------|--------------|---------------------------------|
| Darryl Sandefur | Engineer | Low-level | \$46 | \$55.5 | |
| Darryl Mendieta | Project manager | High-level | \$140 | \$140 | Project management |
| Shinchi Ishikawa | Project manager | High-level | \$143 | \$130 | Project management |

5. Next meeting

The next meeting is planned for 13/04/2021 @20h15 on MS Teams, to evaluate whether the second round of bidding was successful or not. If not successful, the meeting will be used to discuss and make bids for round 3.

Minutes of the Meeting 3 of Group I-2

Project Management 412

on 13/04/2021 @20h15-20h30 on MS Teams

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Philip (PK), Rorisang (RL)
- Apologies: N/A

2. Minutes of the previous meeting

Refer to Meeting 2 above.

3. Agenda

The following agenda was approved before the meeting:

- Review results of bidding round 2.
- Discuss decisions for bidding round 3.

4. Discussion according to agenda

1. Discussed further actions regarding the project management tasks, given that all bids for a project manager thus far were unsuccessful.
2. Decided not to bid for another project manager because the only remaining was too high in price per hour.
3. Decided to fire one Junior Marketing Specialist (Jane Gavette) and one Marketing Manager (Fulberto Eberstark), since they were originally intended as contingencies. These two people were over-bid for, and were thus chosen to be fired.
4. Final bidding and firing decisions were made and executed at the meeting (due 14/04/2021 @ 20h00).
5. The fictitious product was discussed and decided upon. To incorporate all engineering disciplines of the group members, the decision was made for the product to be a pressure vessel for industrial processes (with sensors).
6. The whole team was tasked with contributing to the google doc for assignment 2, over the next few days.

5. Next meeting

The next meeting is planned for 16/04/2021 @09h00 on MS Teams, to check on the progress for assignment 2.

Minutes of the Meeting 4 of Group I-2

Project Management 412

on 16/04/2021 @09h00-09h30 on MS Teams

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Philip (PK), Rorisang (RL)
- Apologies: N/A

2. Minutes of the previous meeting

Refer to Meeting 3 above.

3. Agenda

The following agenda was approved before the meeting:

- Review results of run 1 and the bids made:

| Name | Category | Quality level | Standard rate | Offered rate | Intended assignment for phase 1 |
|----------------|-------------------------|---------------|---------------|--------------|---------------------------------|
| Kelly Sauseda | Junior Product Designer | Mid-level | \$49 | \$55.25 | Product design |
| Raimund Vogel | Junior Product Designer | Low-level | \$42 | \$50.25 | Contingency |
| Douglas Rutten | Junior Product Designer | Low-level | \$44 | \$52.25 | Contingency |
| Lance Portier | Junior Product Designer | Mid-level | \$53 | \$60.25 | Product design |

- Review progress for assignment 2.
- Plan a date and time for a special risk planning and response meeting.

4. Discussion according to agenda

1. Decided to fire 2 out of the 4 junior product managers that were successfully hired. The 2 lowest costs were chosen to be fired.
2. Reviewed the results of phase 1. The team had 100% on cost and time, but 0% on functionality and stakeholders. This was due to the decision to not hire a project manager (to save cost) and instead assign 2 engineers to the project management task for phase 1. The team decided to stick to this decision, with predictions that it will improve later.

3. Discussed keeping the 2 junior product designers for phase 2 (as their tasks are on the critical path), but spoke about firing one of them before the next phase because there is a lot of slack and so we might not require 2 people on the task.
4. Walked through the assignment 2 doc together, discussing each section (what still needs to be added, what can be improved) and ensuring each group member was on track with the sections they were charged with doing.
5. The main task the team is concerned with is the project risk analysis section, and so it was decided that the whole group will work on this.
6. The team will all read over the content for risk management in preparation for the special risk planning and response meeting.

5. Next meeting

The next meeting is planned for 17/04/2021 @10h00 on MS Teams, to have the special risk planning and response meeting.

Minutes of the Meeting 5 (Risk Planning and Response meeting) of Group I-2

Project Management 412

on 17/04/2021 @10h00-??h?? on MS Teams

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Philip (PK), Rorisang (RL)
- Apologies: N/A

2. Minutes of the previous meeting

Refer to Meeting 4 above.

3. Agenda

The following agenda was approved before the meeting:

- Develop an appropriate technique to identify risks.
- Collaboratively identify risks. Includes each person identifying risks associated with their discipline of engineering.
- Develop a risk assessment technique (and a level of risk for each identified risk).
- Develop a prioritized risk register including detailed discussion on the priority risks.
- Compile risk management plan.

4. Discussion according to agenda

- a. Designed a technique for quantifying risks using a matrix comprising the probability (score out of 5) and impact (score out of 5).
- b. Collaboratively identified risks to the project as a whole (both internal and external) by describing the risk, area impacted, impact score, probability score, consequences, mitigation and response for each.
- c. AV identified the following risks associated with his chemical engineering discipline:
 - i. Flammable substances igniting
 - ii. Substances spilling into the environment
- d. EV identified the following risks associated with his electrical engineering discipline:
 - i. The product's sensors failing
 - ii. Power loss to the product

- e. RL and LE identified the following risks associated with their mechatronic disciplines:
 - i. The pressure limit control system failing
 - ii. Valve control having an error/failing
- f. BK identified the following risk associated with her mechanical engineering discipline:
 - i. Tank deformation or failure
- g. PK identified the following risk associated with his civil engineering discipline:
 - i. Structural failure
 - ii. Tank support structure failing due to fatigue

5. Next meeting

The next meeting is planned for 18/04/2021 @10h00 on MS teams, to review progress.