Mälardalen University
M.Sc.Eng. Dependable Aerospace Systems
Västerås, Sweden

Project Course in Dependable Systems
22.5 credits

Project Plan

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October 4, 2025

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DOCUMENT CHANGE RECORD

Version	Date	Reason for Change	Pages / Sections Affected
0.1	2025-09-29	Version for internal review	
0.2	2025-10-01	Version for review	
1.0	2025-10-04	Version for public release	All

Contents

Glossary

agent
A single UAV that is a member of a UAV swarm. 5

ARP4754A
Aerospace Recommended Practice (ARP) Guidelines for Development of Civil Aircraft and Systems, is a published standard from SAE International, dealing with the development processes which support certification of Aircraft systems, addressing "the complete aircraft development cycle, from systems requirements through systems verification.". 6, 12

CE
Chief Engineer. 7, 9, 15–17, 21

IRDS
Intelligent Replanning Drone Swarm. 4

kanban
A visual workflow management method that uses boards and cards to track tasks, limit work in progress, and improve process efficiency. 11

PR
Pull Request. 15

QCM
Quality & Configuration Manager. 7, 9, 16, 17, 21

RM
Requirements Manager. 7, 9, 16, 17, 19, 21

SAR
Search and Rescue. 4, 7

SM
Safety Manager. 7, 9, 16, 17, 21

SORA
JARUS guidelines on Specific Operations Risk Assessment (SORA). A structured methodology to assess and mitigate risks for specific UAS operations, ensuring safe conduct in complex or beyond-visual-line-of-sight environments. 6

UAS
Unmanned Aircraft System. 3

UAV
Unmanned Aerial Vehicle. 4, 5, 7–9

VVM
Validation & Verification Manager. 7, 9, 16, 17, 21

WBS
Work Breakdown Structure. 10, 23

1 Introduction

This Project Plan provides team members and stakeholders with an overview of the Intelligent Replanning Drone Swarm (IRDS) project. This plan explains the background, purpose and objectives of the project and introduces the overall management approach adopted by the team. In addition, it defines how the project will be structured and controlled to ensure that activities, roles, and deliverables align with the project's dependability and safety goals.

1.1 Background

The original idea behind this project is the development of a fail-operational Unmanned Aerial Vehicle (UAV) swarm designed for Search and Rescue (SAR) missions. Such a swarm can also be applied in both defence and civilian operations, where the ability to operate autonomously is crucial. This concept is based on the principles of collective and individual behaviour, enabling UAVs to function independently while also coordinating as a group.

A key aspect of this concept is autonomous navigation and control in dynamic and uncertain environments, where reliability and adaptability are essential. Previous research has introduced a novel conceptual architecture that bridges the critical gap between single-UAV fault tolerance and collective swarm fault tolerance. Although fault tolerance traditionally ensures that an individual UAV can withstand failures, fault tolerance at the swarm level emphasises the ability of the group as a whole to recover and continue operating even after losing an entire UAV.

This dual focus on individual and collective dependability forms the foundation for the development of UAV swarms capable of performing effectively in challenging real-world scenarios.

The purpose of this project is to implement a swarm-level coordination logic that will ensure that a SAR mission can continue with maximum efficiency, even when individual UAVs are compromised.

1.2 Document Purpose

The purpose of this plan is to define how the project will be managed and executed throughout its lifecycle. This document establishes the framework for planning, coordinating, communicating, and controlling project activities. In addition, it provides guidance for all team members and ensures that the work is carried out in a consistent way with the project's dependability, safety, and quality objectives.

1.3 Document Scope

This document defines the overall management framework for the IRDS project. It integrates and governs activities described in associated management plans (see section 2 Related Documents) to ensure consistency and coherence across all processes.

This plan applies to the entire project lifecycle and specifies how the project is organised, scheduled, and controlled. In addition, it establishes the interrelations between management roles, artefacts, and deliverables.

Specifically, this document defines the following:

- Project context, including stakeholders, objectives, and external dependencies.
- Scope of the project and deliverables to be produced by the project team.
- Methodology, tools and lifecycle approach used to execute and monitor the project.
- Organisation, including project roles, communication channels, and responsibilities.
- Integration of subordinate management plans to ensure consistent execution of safety, quality, requirements, configuration, and verification processes.
- Schedule, milestones, and risk management structure that guide the execution of the project.

This plan serves as the top-level governing document for all activities. All management plans, artefacts, and deliverables produced during the project shall conform to the framework and principles established in this document.

1.4 Objectives

- Modify simulation software (gym-pybullets-drone) so that faults can be injected (e.g., one UAV has degraded health).
- Investigate a robust consensus mechanism to ensure that all agents agree on a new plan in a secure way.
- Develop distributed algorithms that allow the swarm to collectively respond to a UAV's broadcasted 'degraded health' status.
- Design a decentralised protocol for secure and intelligent mission replanning.
- Design the logic for re-allocating the compromised UAV's tasks (e.g., its search area) to healthy agents.
- Design the logic to re-task the partially failed UAV to a less critical but still useful role, such as a communications relay, thereby maximising the utility of every UAV.
- Implement a robust consensus mechanism to ensure that all agents agree on a new plan in a secure way.
- Implement a decentralised protocol for secure and intelligent mission replanning.
- Validate the decentralised protocol using modified simulation software for secure and intelligent mission replanning by quantitatively measuring the improvement in mission continuity.

2 Related Documents

The following table is a collection of documents related to this project:

Document ID	Document Title
CM-01	Configuration Management Plan [1]
QM-01	Quality Management Plan [2]
RM-01	Requirements Management Plan [3]
SM-01	Safety Management Plan [4]
VV-01	Validation & Verification Management Plan [5]
IEEE Std 1012™-2024	IEEE Standard for System, Software, and Hardware Verification and Validation [6]
ISO/IEC/IEEE Std 29119-1:™-2022	Software and systems engineering - Software testing - Part 1: General Concepts [7]
ISO/IEC/IEEE Std 29119-4:™-2021	Software and systems engineering - Software testing - Part 4: Test techniques [8]
ISO/IEC/IEEE Std 15288:™-2023	Systems and software engineering - System life cycle processes [9]
ISO/IEC/IEEE 29148:2018	Systems and software engineering - Life cycle processes - Requirements engineering [10]
ISO 10007:2017	Quality management - Guidelines for configuration management [11]
ISO 9001:2015	Quality management systems — Requirements [12]
ISO/IEC 25002:2024	Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Quality model overview and usage [13]
IEEE 730-2014	IEEE Standard for Software Quality Assurance Processes [14]
JAR-DEL-SRM-SORA-MB-2.5	Specific Operations Risk Assessment (SORA) [15]
ARP4761™A	Guidelines for Conducting the Safety Assessment Process on Civil Aircraft, Systems, and Equipment [16]

Table 1: Related documents.

For more information on related documents, see section 4.1 Deliverables.

2.1 Management Plans

Several specialised management plans support this project. Each addresses a critical aspect of the project lifecycle in more detail than this project plan can provide. Therefore, this project plan only references these areas at a high level, while dedicated management plans define the processes, responsibilities, and tools used.

- **Configuration Management Plan** [1] – Defines the processes, tools, and responsibilities to manage project configurations and change management. Since the project involves multiple deliverables and contributions from several team members, strict configuration management is essential.
- **Quality Management Plan** [2] – Defines the standards, procedures, and responsibilities to maintain quality in processes, deliverables, and documentation. This is particularly important because the project is carried out in the dependability domain, where consistency and reliability are critical.
- **Requirements Management Plan** [3] – Because requirements specification is a major activity in the dependability domain, the team has decided that the requirement specification belongs to the execution phase rather than the planning phase. The Requirements Management Plan therefore governs how requirements are captured, analysed, prioritised, and tracked throughout the project.
- **Safety Management Plan** [4] – During the execution phase of the project, activities are organised according to SORA [15] and a modified version of ARP4754A's [17] V-model, where safety management is a central element. The Safety Management Plan specifies the procedures, responsibilities, and controls to identify, assess, and mitigate safety risks.
- **Validation & Verification (V&V) Management Plan** [5] – In the modified ARP4754A V-model adopted for this project, the V&V process ensures both that the system is built correctly (verification) and that it meets the needs of the stakeholders (validation). It defines the approach, methods, and responsibilities for V&V activities.

Together, these management plans provide the detailed guidance required to ensure that configuration, quality, requirements, safety, and validation & verification are handled systematically throughout the project lifecycle.

3 Project Context & Stakeholders

3.1 Team Members

Name	Main Role	Support Role
Andrea Haglund	Chief Engineer (CE)	
Claire Namatovu	Requirements Manager (RM)	
Emily Zainali	Validation & Verification Manager (VVM)	
Esaias Målqvist	Safety Manager (SM)	
Yonatan Michael Beyene	Quality & Configuration Manager (QCM)	

Table 2: Team members

3.2 Stakeholders

Name	Role	Responsibilities	Contact Info
Luiz Giacomossi	Project Owner	Defines project objectives, approves scope and decisions, ensures expected value	luiz.giacomossi@mdu.se
Luciana Provenzano	Course Coordinator	Ensures compliance with course framework, provides academic oversight, evaluates results	luciana.provenzano@mdu.se
Julieth Castellanos	Project Advisor	Provides guidance and feedback, supports theory application, ensures academic standards	julieth.castellanos@mdu.se

Table 3: Stakeholders

3.3 SWOT Analysis

Strengths

- All team members are deeply committed to this project.
- The team collectively has a good level of competency and knowledge.
- Team members have previous experiences that are advantageous for this project.

Weaknesses

- Lack of experience in project planning and management.
- Time constraint.
- Lack of hardware specification.

Opportunities

- Unmanned Aerial Vehicle (UAV) swarm Search and Rescue (SAR) is a not deeply explored area.
- Opportunity to broaden team members' professional networks.

Threats

- Sudden illness among team members.

3.4 Dependencies & External Factors

This project is influenced by several external factors and dependencies that may affect scheduling, risk, or deliverables:

- Deadlines, Working Days and Hours
  - This project must align with submission deadlines and seminar dates.
  - Delays in intermediate activities (e.g., requirements validation and simulation results) could affect final delivery.
  - The project schedule is based on regular weekdays and standard working hours, and work is assumed to progress only during these periods, excluding weekends and public holidays.
  - Any deviations (e.g., reduced team availability) could delay milestone achievement.
- Simulation Software Availability
  - This project depends on access to a specific UAV simulation software (gym-pybullets-drones) that will be modified according to project needs.
  - If modification of the software is delayed, testing may be delayed or scaled back to adhere to delivery dates.
- Reference to UAV Specifications
  - Requirements and performance constraints are based on Harris Aerial's Carrier H6HL specifications.
  - If those specifications are updated or incomplete, assumptions may have to be revised.
- External Regulations & Standards
  - Although no physical UAV will be built, simulations must still follow standard UAV safety and performance guidelines for validity.
  - Changes in regulatory requirements may impact this project.

Several of these dependencies and external factors present potential risks to this project's timeline and quality. For example, delays in modification of the simulation software could directly impact milestone achievement. These risks, along with mitigation strategies, are further detailed in Risk Analysis & Management.

4 Scope

The scope defines the project's deliverables, the assumptions made, the constraints in place, and the main activities to be carried out.

4.1 Deliverables

ID	Deliverable	Responsible
CE-01	Project Plan	CE
CE-02	System Description (Baseline – Current system before solution)	CE
CE-03	System Architecture	CE
CE-04	Final Report	CE
CE-05	Presentation	CE
CM-01	Configuration Management Plan	QCM
CM-02	Configuration Log Report	QCM
QM-01	Quality Management Plan	QCM
QM-02	Review Protocols	QCM
QM-03	Review Report	QCM
QM-04	Quality Impact Report	QCM
RM-01	Requirements Management Plan	RM
RM-02	Requirements Specification	RM
RM-03	Requirements Report	RM
SM-01	Safety Management Plan	SM
SM-02	Preliminary Safety Analysis	SM
SM-03	Flight Safety Analysis	SM
SM-04	Safety Analysis	SM
SM-05	Safety Goals	SM
VV-01	Verification & Validation Management Plan	VVM
VV-11	Design Specification	VVM
VV-25	Risk Analysis	VVM
VV-26	Validation Protocols	VVM
VV-27	Verification Protocols	VVM
VV-28	Test Specification	VVM
VV-29	Validation Report	VVM
VV-30	Verification Report	VVM

Table 4: Deliverables

4.2 Assumptions & Constraints

Since certain specifications require reference to an actual Unmanned Aerial Vehicle (UAV), the team has designated Harris Aerial's Carrier H6HL [18] as the reference model. This project does not encompass hardware development, and no physical UAV will be available for testing. Instead, validation of the UAV swarm will be conducted through simulations using fault injections.

4.3 Work Breakdown Structure

This WBS desribes the main activities that have been or will be performed during the project's life cycle:

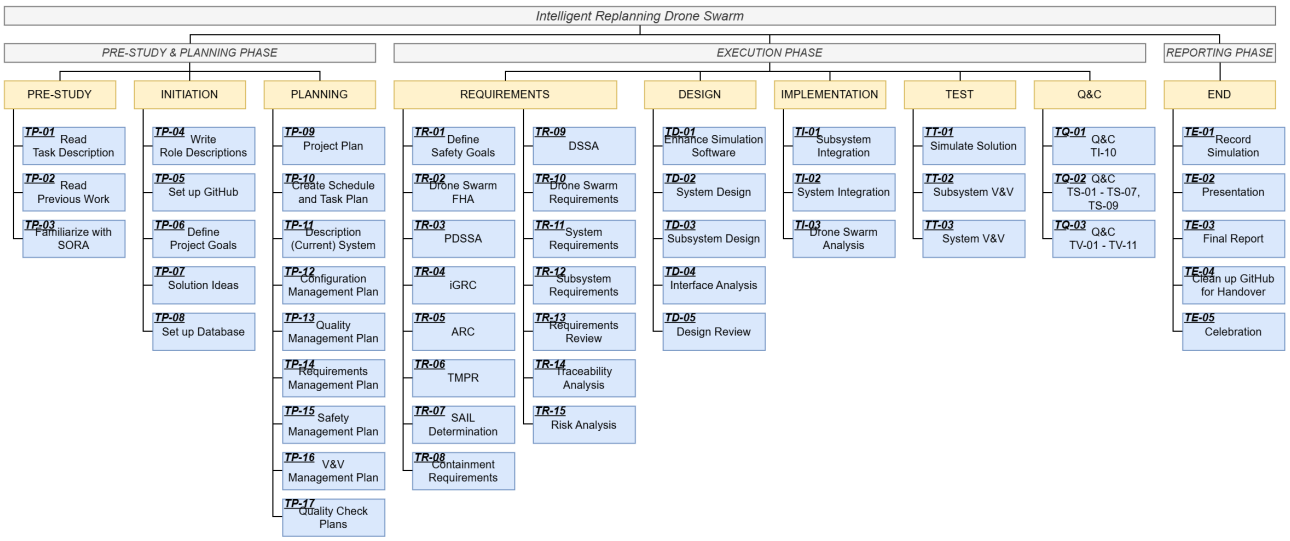

Figure 1: Work Breakdown Structure.

A larger version of this WBS can be found under Figures in Appendix (figure 9).

5 Methodology

5.1 Tools & Techniques

This project relies on a comprehensive set of tools and techniques that support communication, coordination, development, and rigorous documentation:

Tool / Technique	**Usage**
Project management model	Framework derived from [19]
Agile Management	Overall project management approach; applied via Scrum and Kanban in Jira
Daily Scrum	Daily stand-up meetings for team synchronisation and progress tracking
Weekly Scrum	Weekly meetings for sprint planning and progress review
Jira	Tracking progress, manage activities, and break activities into tasks
Discord	Everyday communication and update announcements
GitHub	Main repository for source code, approved project documents, and the project's requirements database
SharePoint	Storage for larger files, documents waiting for review, protocols, and documents less suited for GitHub
Visual Studio Code	Main environment for local development integrated with Git and GitHub
Modelio	Formal system modelling
draw.io	Flexible diagrams and illustrative modelling
gym-pybullet-drones	Simulating solution and testing scenarios
Overleaf (LaTeX)	Preparing plans and formal reports

Table 5: Tools and techniques

5.2 Project Lifecycle & Phases

The activities carried out in this project are organised according to a combination of phases given in a course guide [20] (figure 2) and a general project management model (figure 3) found in [19]. The resulting project management model from this combination can be seen in figure 4.

Figure 2: Project phases according to given course guide.

Figure 3: Project phases according to general project management model.

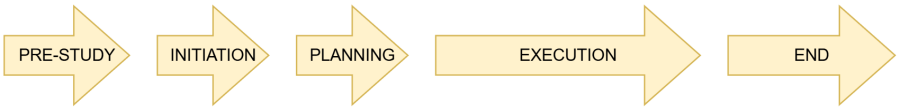

Figure 4: Project phases according to the project's modified project management model.

The project will follow a structured approach, with all key activities—quality, configuration, safety, requirements, and verification & validation—managed through their respective plans: Quality Management Plan [2], Configuration Management Plan [1], Requirements Management Plan [3], Safety Management Plan [4], and V&V Management Plan [5]. Change management and quality assurance will follow the Configuration and Quality Management Plans. Given the critical role of requirements in the dependability domain, requirements specification will occur during the execution phase, with the Requirements Management Plan governing how they are captured, analysed, prioritised, and tracked. Safety, verification, and validation activities will be carried out according to the Safety and V&V Management Plans. The project execution will follow a modified ARP4754A V-model (figure 13), ensuring systematic planning, oversight, and control throughout the lifecycle.

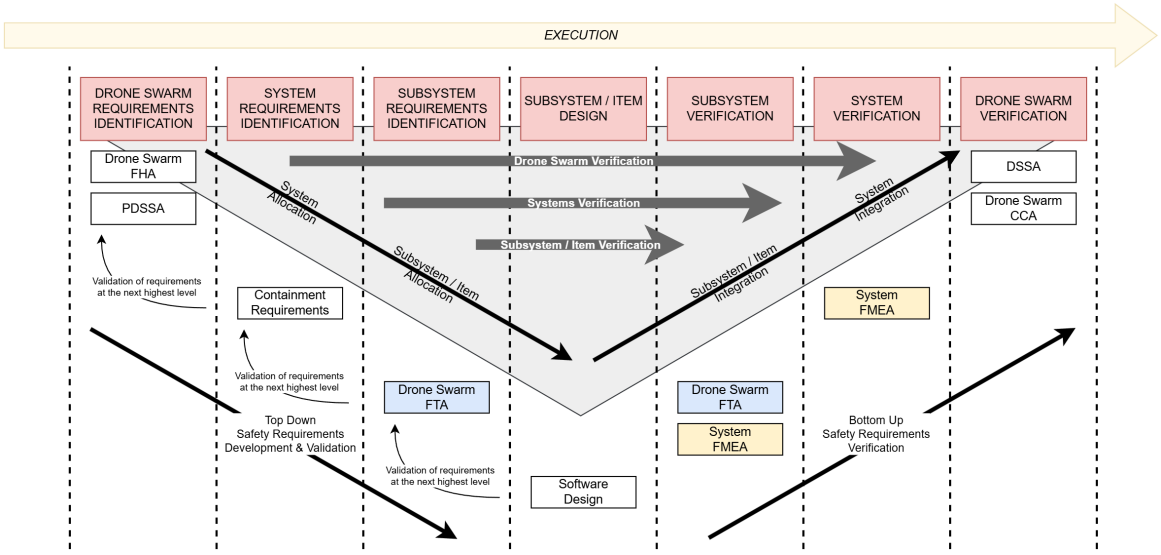

Figure 5: V-model based on ARP4754A.

Larger versions of the above figures can be found under Figures in Appendix (figures 10, 11, 12, and 13.

6 Project Organisation & Communication

6.1 Project Roles

Role	Responsibilities	Authority	Dependability Focus
Chief Engineer	Lead overall project execution; integrate all activities; maintain schedule; make technical trade-off decisions; ensure dependability requirements are met	Approve major technical changes; assign responsibilities and resources; sign off on final system-level deliverables	Ensures overall system reliability, safety, and robustness by integrating dependability considerations across all activities
Requirements Manager	Capture, analyse, prioritise, and track requirements; ensure clarity, feasibility, and verifiability; maintain traceability; coordinate with Safety, V&V, and Q&C Managers	Approve changes to requirements baseline; reject incomplete or untestable requirements; request clarifications from team members	Ensures that dependability requirements (safety, reliability, availability) are correctly captured and traceable throughout the project
Validation & Verification Manager	Develop and execute verification and validation plans; ensure traceability between requirements, design, and V&V results; document outcomes; support dependability assessments	Approve completion of V&V activities; reject deliverables failing verification/validation; recommend corrective actions	Confirms that system functions as intended and meets dependability requirements through systematic verification and validation
Safety Manager	Identify hazards and perform risk assessments; define and maintain safety requirements; ensure compliance with safety standards; coordinate with Requirements and V&V Managers	Approve safety-related design changes; halt project activities violating safety requirements; require corrective actions for hazards	Protects system and users by mitigating risks and ensuring all safety-critical aspects of dependability are addressed
Quality & Configuration Manager	Define quality standards; ensure deliverables meet quality criteria; manage configuration control and change management; monitor process adherence; maintain project documentation	Approve changes to controlled documents and baselines; enforce quality standards; reject outputs not meeting quality criteria	Ensures consistent quality and integrity of project outputs, supporting reliability, maintainability, and traceability of the system

Table 6: Project roles.

6.2 Communication

The types of communication that will be used during the project will be:

- Daily in-person scrum meetings with a duration of approximately 15 minutes that handle:
  - **Yesterday's achievements:** Describe what you were able to do yesterday.
  - **Today's achievements:** Describe what you intend to do today.
  - **Blockers:** Describe anything that you need answering or unblocking.
- Weekly in-person scrum meetings with a duration of approximately one hour that will handle:
  - **Progress:** Review all activities and tasks done.
  - **Slowed down:** Activities and tasks that have not made the progress the team was expecting.
  - **Stopped:** Activities and tasks stopped in their tracks.
- Discord for written communication, with text channels:
  - **general**: For any communication about the project that does not belong in any other channel.
  - **digital-spaces**: To keep track of which digital spaces we use and direct links to them.
  - **github**: For announcing updates about the project's GitHub repository and its branches.
  - **sharepoint**: To announce when files have been uploaded to SharePoint.
  - **latex**: For LaTeX templates, acronyms used, etc.
  - **irrelevant**: For anything else.

6.3 Task Management

Managing, assigning, and breaking down activities and tasks shall be done in Jira to make it easier to track progress and to get a graphical representation of the project's timeline and progress.

In Jira, the progress of tasks and activities will be kept track of by using a kanban approach (figure 6), where:

- **TO DO** is for tasks that have not yet been started,
  - or for tasks with outputs that did not get approval from a review and ***need*** adjustments.
- **IN PROGRESS** is for tasks that are currently being worked on,
  - or for tasks with outputs that did not get approval from a review and are ***getting*** adjustments.
- **TO BE REVIEWED** is for tasks that have outputs that need to be reviewed,
  - or for tasks with outputs that did not get approval from a review, have been adjusted, and are then ***waiting for additional*** reviewing.
- **IN REVIEW** is for tasks with outputs that are currently being reviewed
  - or for tasks with outputs that did not get approval from a review, have been adjusted, and are then ***getting additional*** reviewing.
- **DONE** is for tasks that are finished and tasks with outputs that have been approved through a review.

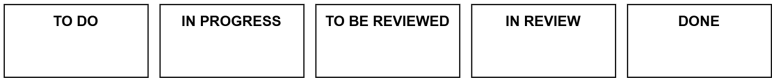

Figure 6: Kanban board.

6.4 File Management

- The project's GitHub repository stores source code, approved documents, and the project's requirements database.
- SharePoint is used as storage for files not suitable for GitHub, documents waiting for review, and protocols.

6.5 Git

6.5.1 Pull Requests

- All changes to the main branch must go through a Pull Request (PR).
- A PR may only be merged if:
  - It has been approved by the Chief Engineer.
  - It has been approved by at least one other reviewer who is not the author of the change.
- All PRs must include:
  - A clear description of the change and its purpose.
  - References to related activities or tasks.
- The author of the PR is responsible for resolving all review comments before merging.
- Squash merges are preferred to keep the commit history clean, unless there is a reason to preserve individual commits.

6.5.2 Branching Strategy

- The main branch represents the public-ready state of the project and is visible to the public.
- All changes must be done in feature branches.
  - Naming convention: feature/<short-description> (e.g., feature/id-list).
- Optionally, a develop branch may be used to integrate multiple changes before merging into main.
  - This branch represents the ”next public-ready candidate.”
  - There can only be one develop branch at a time.
- Branches should be deleted after merging to avoid clutter.

6.5.3 Commit Standards

- Commits should be small, focused, and logically grouped.
- Commit messages must:
  - Use imperative mood (e.g., ”Add login validation” instead of ”Added login validation”).
  - Clearly describe the purpose of the change.

7 Project Schedule & Milestones

7.1 Milestones

ID	Description	Target End Date	Responsible
INL1	Pre-study & Planning Phase	2025-10-05	All team members
INL2	Execution & Validation Phase	2025-11-16	All team members
INL3	Reporting Phase	2025-12-07	All team members
SEM3	Presentation	2025-12-11	All team members

Table 7: Milestones

7.2 Timeline

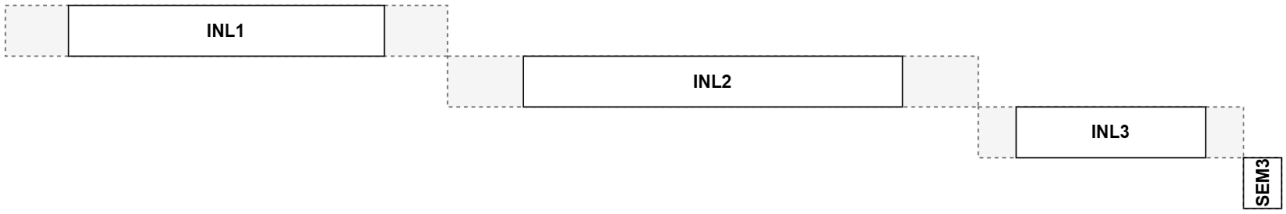

Figure 7: Timeline of milestones.

7.3 Activities

Time is given in days, where one day equals eight hours.

ID	Activity	Time	Dependency	Responsible
TP-01	Read Task Description	1/2	Project assigned	All
TP-02	Read Previous Work	1	TP-01	All
TP-03	Familiarize with SORA	1	TP-02	All
TP-04	Write Role Descriptions	1	TP-03	All
TP-05	Set up GitHub	1	TP-07	CE
TP-06	Define Project Goals	1/2	TP-04	All
TP-07	Solution Ideas	2	TP-06	All
TP-08	Set up Database	10	TP-07 & V-model	RM
TP-09	Project Plan	10	TP-07	CE
TP-10	Create Schedule and Task Plan	2	TP-09	CE
TP-11	Description (Current) System	1	TP-07	CE
TP-12	Configuration Management Plan	2	TP-07	QCM
TP-13	Quality Management Plan	4	TP-07, & Quality requirements from standards & within project	QCM
TP-14	Requirements Management Plan	12	TP-07	RM
TP-15	Safety Management Plan	8	TP-07 & standards chosen	SM
TP-16	V&V Management Plan	12	TP-07	VVM
TP-17	Quality Check Plans	4	TP-13	QCM

Table 8: List of Activities

ID	Activity	Time	Dependency	Responsible
TR-01	Define Safety Goals	2	TP-07	SM
TR-02	Drone Swarm FHA	2	TP-15	SM
TR-03	PDSSA	2	TR-02	SM
TR-04	iGRC	2	TP-15	SM
TR-05	ARC	2	TP-15	SM
TR-06	TMPR	2	TR-04, TR-05	SM
TR-07	SAIL Determination	2	TR-04, TR-05	SM
TR-08	Containment Requirements	2	TR-04, TR-05, TR-06, TR-07	SM
TR-09	DSSA	2	TR-01, TT-01	SM
TR-10	Drone Swarm Requirements	2	TP-08, TP-14	RM
TR-11	System Requirements	4	TRR-02	RM
TR-12	Subsystem Requirements	5	TRR-03	RM
TR-13	Requirements Review	-	-	VVM
TR-14	Traceability Analysis	-	-	VVM
TR-15	Risk Analysis	-	-	VVM
TD-01	Enhance Simulation Software	6	TP-07 & PC for simulation	CE
TD-02	System Design	2	TRR-03	CE
TD-03	Subsystem Design	4	TDV-01	CE
TD-04	Interface Analysis	-	-	CE
TD-05	Design Review	-	-	VVM
TI-01	Subsystem Integration	1	TDV-02	CE
TI-02	System Integration	1	TIV-01	CE
TI-03	Drone Swarm Analysis	-	-	VVM
TT-01	Simulate Solution	6	TD-01, TIV-02	CE
TT-02	Subsystem V&V	-	-	CE
TT-03	System V&V	-	-	CE
TQ-01	Q&C TI-10	1/2	TI-10	QCM
TQ-02	Q&C TR-01 - TR-07, TR-09	6	TR-01 - TR-07, TR-09	QCM
TQ-03	Q&C TRR-01 - TDV-03	6	TRR-01 - TDV-03	QCM
TE-01	Record Simulation	1/2	TT-01	CE
TE-02	Presentation	5	TP-10, TR-01, TR-08, TT-01	All
TE-03	Final Report	10	TT-01	All
TE-04	Clean up GitHub for Handover	1	TT-01	CE
TE-05	Celebration	0	TE-03	All

Table 8: List of Activities

7.4 Network Schedule

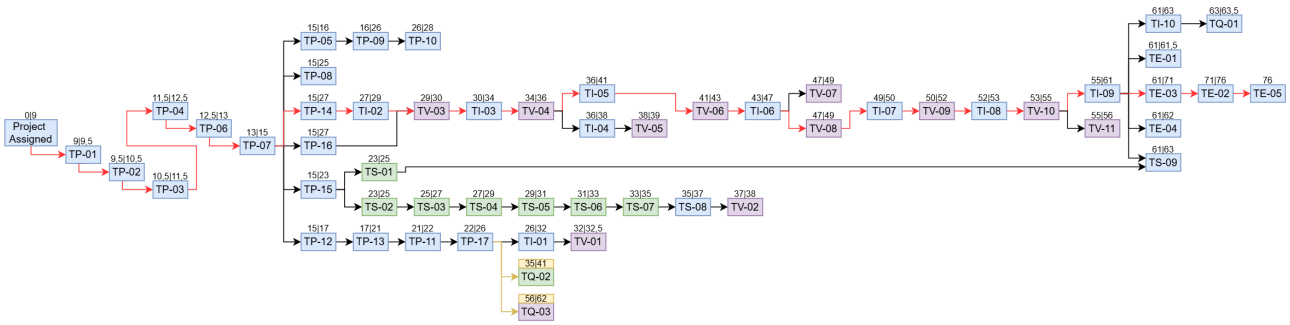

Figure 8: Network schedule of activities within the project. Red arrows indicate the path of criticality. Activity TQ-02 is dependent on other activities of the same colour (green). Activity TQ-03 is dependent on other activities of the same colour (purple).

The critical path analysis states that this project needs at least 76 work days to complete. The number of work days available until the final report shall be submitted is 70, and the number of work days available until the date of presenting the project is 73 - this means that activities on the path of criticality must be tracked closely and any deviations must be noted and handled as soon as possible, and if possible: complete the activities in less time than what has been estimated for them.

8 Risk Analysis & Management

8.1 Identified Risks

Risk ID	Risk Description	Source	Impact	Likelihood	Mitigation Strategy
R-01	Outdated or incomplete UAV specifications	Reference UAV Specifications	Medium	Low	Validate Carrier H6HL specs early; adjust assumptions if updates occur
R-02	Regulatory changes affecting UAV assumptions	External Regulations & Standards	Low	Low	Monitor relevant UAV standards; adapt simulations if required
R-03	Reduced progress due to limited time	Time Constraint	High	Medium	Plan internal deadlines with buffer time; avoid scheduling critical activities in parallel
R-04	Sudden illness among team members	Health and Work Environment	Medium	Low	Keep stress levels low, Ensure breaks
R-05	Delayed ”Read Task Description” (TP-01)	Time Estimation	High	Low	Adhere to project schedule
R-06	Delayed ”Read Previous Work” (TP-02)	Time Estimation	High	Low	Adhere to project schedule
R-07	Delayed ”Familiarize with SORA” (TP-03)	Time Estimation	High	Low	Adhere to project schedule
R-08	Delayed ”Write Role Descriptions” (TP-04)	Time Estimation	High	Low	Adhere to project schedule
R-09	Delayed ”Define Project Goals” (TP-06)	Time Estimation	High	Low	Adhere to project schedule
R-10	Delayed ”Solution Ideas” (TP-07)	Time Estimation	High	Low	Adhere to project schedule
R-11	Delayed ”Set up Database” (TP-08)	Time Estimation, Programmer Availability	High	Medium	Adhere to project schedule, plan work properly, more than one person carries out the task
R-12	Delayed ”Requirements Management Plan” (TP-14)	RM	High	Low	Adhere to project schedule
R-13	Delayed ”Enhance Simulation Software” (TI-01)	Programmer Availability	High	Low	Adhere to project schedule, Start activity early
R-14	Delayed ”Drone Swarm Requirements” (TI-02)	Time Estimation, Database issue	High	Medium	Adhere to project schedule, more than one person carries out the task
R-15	Delayed ”System Requirements” (TI-03)	Time Estimation, Database issue	High	Medium	Adhere to project schedule, more than one person carries out the task
R-16	Delayed ”Item Requirements” (TI-05)	Time Estimation, Database issue	High	Low	Adhere to project schedule, more than one person carries out the task
R-17	Delayed ”Item Design” (TI-06)	Time Estimation	High	Low	Adhere to project schedule
R-18	Delayed ”Item Integration” (TI-07)	Time Estimation	High	Medium	Adhere to project schedule, more than one person carries out the task
R-19	Delayed ”System Integration” (TI-08)	Time Estimation	High	Medium	Adhere to project schedule
R-20	Delayed ”Simulate Solution” (TI-09)	Time Estimation, Simulation Software	High	Low	Adhere to project schedule
R-21	Delayed ”Drone Swarm Req. Validation” (TV-03)	Time Estimation	High	Low	Adhere to project schedule
R-22	Delayed ”System Req. Validation” (TV-04)	Time Estimation	High	Low	Adhere to project schedule
R-23	Delayed ”Item Req. Validation” (TV-06)	Time Estimation	High	Low	Adhere to project schedule

Table 9: Risk Log

Risk ID	Risk Description	Source	Impact	Likelihood	Mitigation Strategy
R-24	Delayed ”Item Verification” (TV-08)	Time Estimation	High	Low	Adhere to project schedule
R-25	Delayed ”System Verification” (TV-09)	Time Estimation	High	Low	Adhere to project schedule
R-26	Delayed ”Drone Swarm Verification” (TV-10)	Time Estimation	High	Low	Adhere to project schedule
R-27	Delayed ”Presentation” (TE-02)	Time Estimation	High	High	Adhere to project schedule, work continuously with presentation framework during project
R-28	Delayed ”Final Report” (TE-03)	Time Estimation, Delayed Deliverables	High	High	Adhere to project schedule, work continuously with report framework during project

Table 9: Risk Log

8.2 Monitoring & Control

- Risks will be reviewed and identified during weekly scrums, and updates and/or additions will be made in table 9.
- High-impact and medium to high likelihood risks (R-03, R-11, R-14, R-15, R-18, R-19, R-27, and R-28) will be prioritised and closely monitored.
- Mitigation actions will be assigned to specific team members to ensure accountability.
- Any risk escalation beyond the control of the team will be reported to the project owner and the course coordinator.
- Team availability will be monitored regularly to prevent scheduling conflicts. Internal deadlines will be adjusted in advance if reduced working days are expected.

9 Approvals

Item ID	Item Title	Responsible	Approval Method	Status
CE-01	Project Plan	CE	Review	Pending
CE-02	System Description	CE	Review	Pending
CE-03	System Architecture	CE	Review	Pending
CE-04	Final Report	CE	Review	Pending
CE-05	Presentation	CE	Review	Pending
CM-01	Configuration Management Plan	QCM	Review	Pending
CM-02	Configuration Log Report	QCM	Review	Pending
QM-01	Quality Management Plan	QCM	Review	Pending
QM-02	Review Protocols	QCM	Review	Pending
QM-03	Review Report	QCM	Review	Pending
QM-04	Quality Impact Report	QCM	Review	Pending
RM-01	Requirements Management Plan	RM	Review	Pending
RM-02	Requirements Specification	RM	Review	Pending
SM-01	Safety Management Plan	SM	Review	Pending
SM-02	Preliminary Safety Analysis	SM	Review	Pending
SM-03	Flight Safety Analysis	SM	Review	Pending
SM-04	Safety Analysis	SM	Review	Pending
SM-05	Safety Goals	SM	Review	Pending
VV-01	Verification & Validation Management Plan	VVM	Review	Pending
VV-11	Design Specification	VVM	Review	Pending
VV-25	Risk Analysis	VVM	Review	Pending
VV-26	Validation Protocols	VVM	Review	Pending
VV-27	Verification Protocols	VVM	Review	Pending
VV-28	Test Specification	VVM	Review	Pending
VV-29	Validation Report	VVM	Review	Pending
VV-30	Verification Report	VVM	Review	Pending

Table 10: Items needing approval.

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Appendix

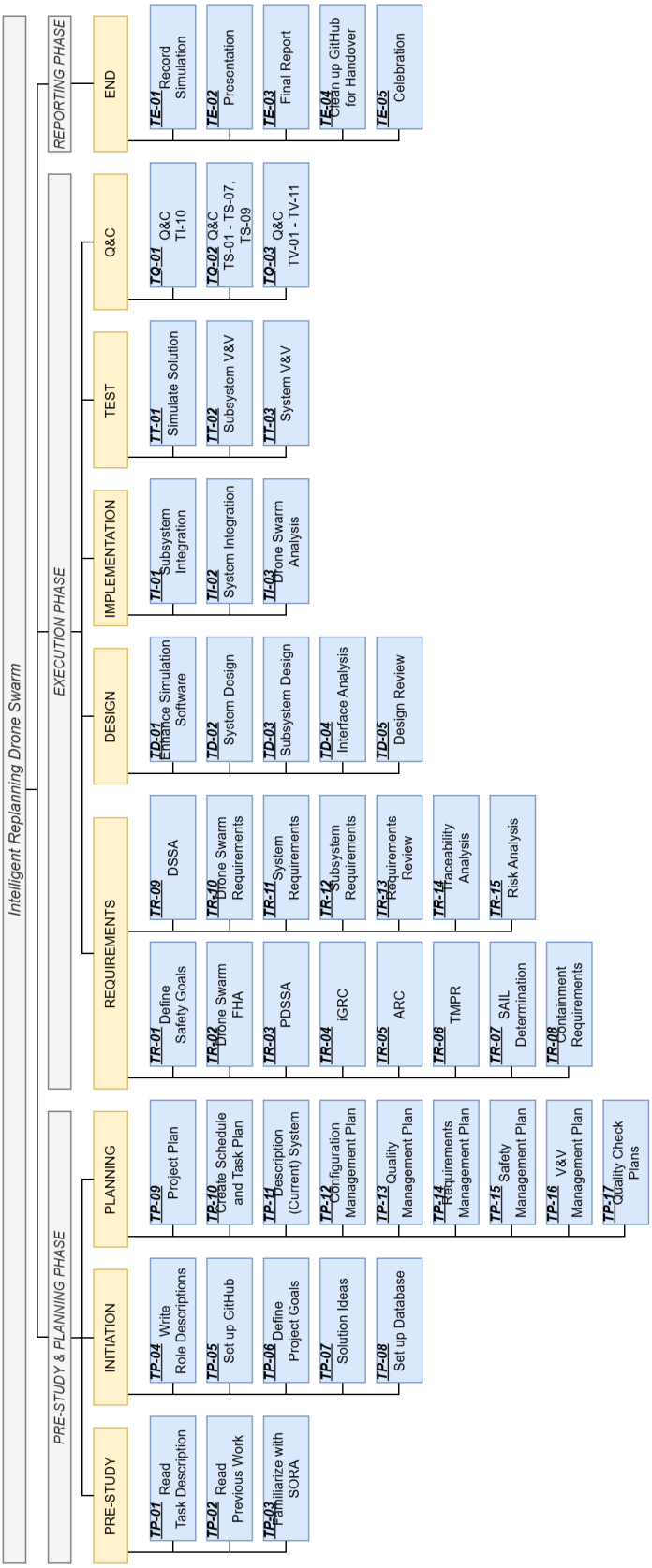

Figure 9: Work Breakdown Structure.

Figure 10: Project phases according to given course guide.

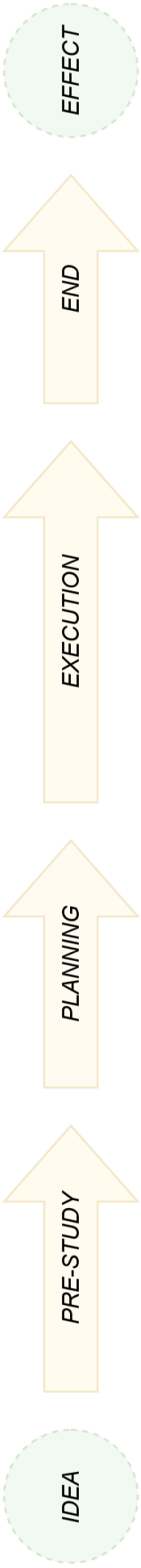

Figure 11: Project phases according to general project management model.

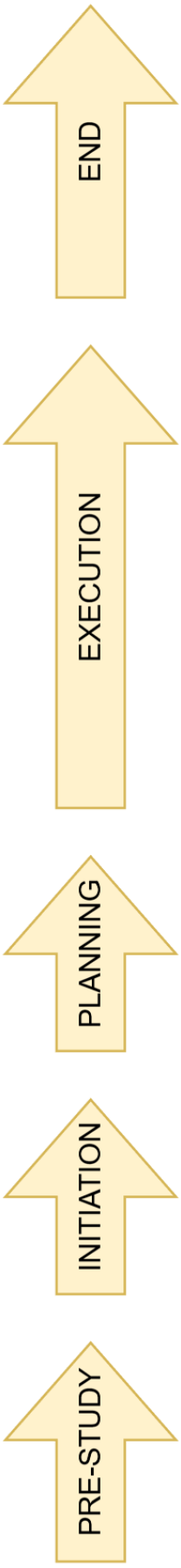

Figure 12: Project phases according to the project's modified project management model.

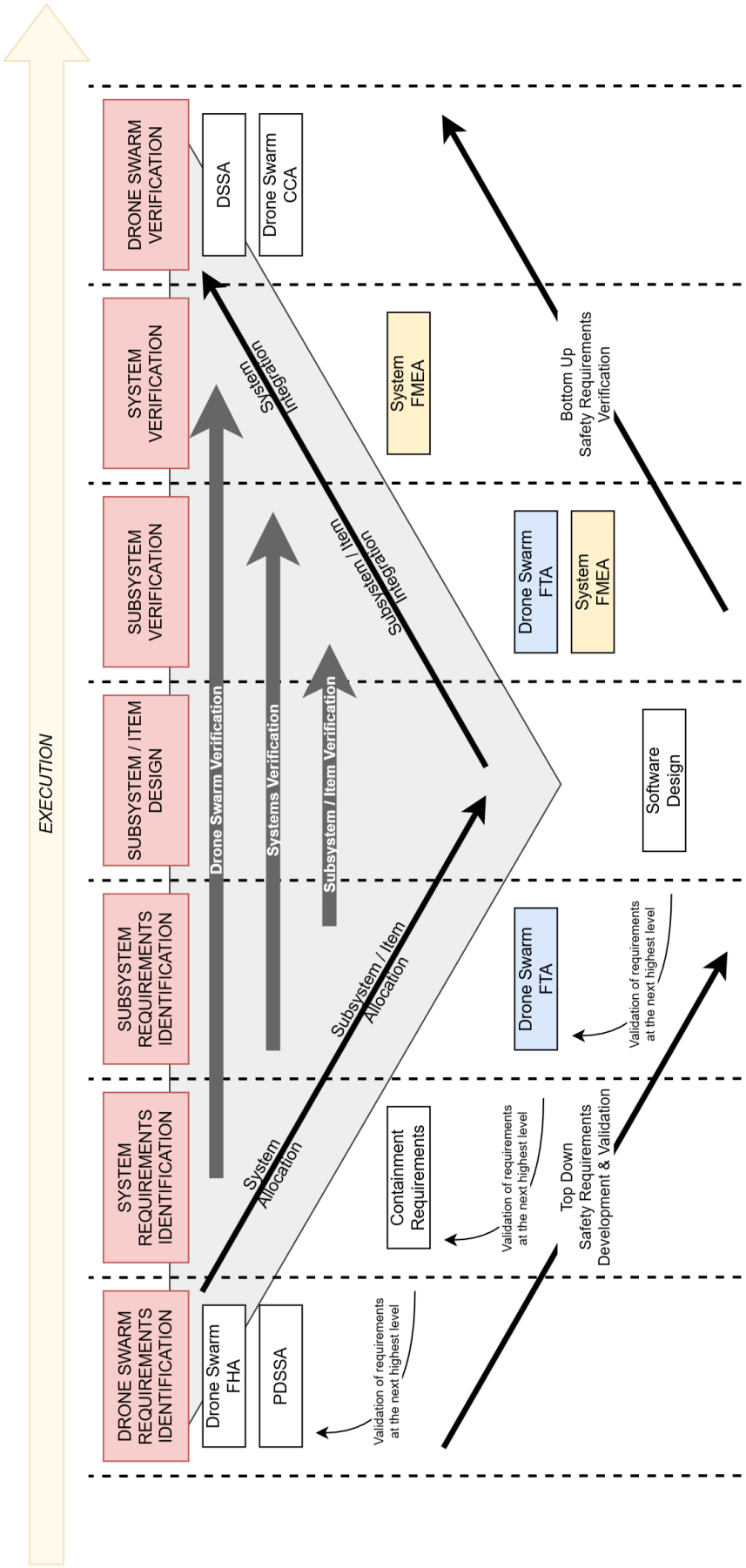

Figure 13: V-model based on ARP4754A.

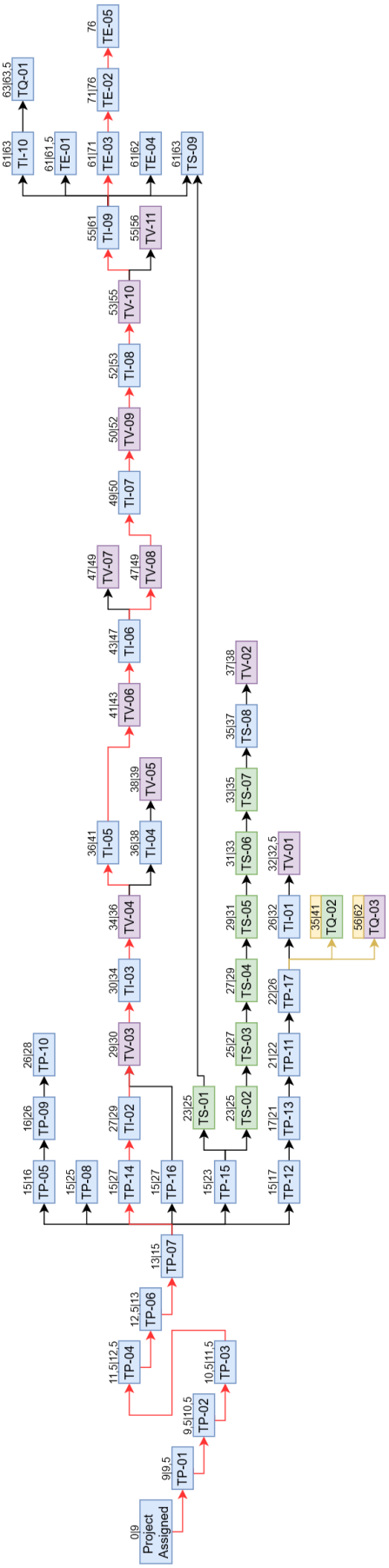

Figure 14: Network schedule of activities within the project. Red arrows indicate the path of criticality. Activity TQ-02 is dependent on other activities of the same colour (green). Activity TQ-03 is dependent on other activities of the same colour (purple).