ITP

MS TAS ASTRO

2024/2025

PROJECT MANAGEMENT REPORT

FILE N°001

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I. Introduction

1. Project Scope and Objectives

The Integrated Team Project 2024/2025 aims to design the whole space ecosystem around reusable shuttles, including a space station, launcher, astronaut training center and two shuttle models (3 and 7 pax capacity).

This project involves the design and development of a reusable Low Earth Orbit (LEO) space shuttle capable of transporting a crew of three astronauts. This shuttle aims to serve as a reliable, cost-effective vehicle for orbital missions, including space station resupply. Key objectives include minimizing costs, maximizing astronaut safety, and ensuring rapid turnaround for multiple missions. The shuttle will prioritize efficiency and sustainability, while adhering to rigorous international aerospace standards.

This project is also contingent with Dassault's Student Aerospace Challenge, for which this group has chosen the Applications work package and will focus on debris removal & retrieval as an annex mission. To facilitate the management of the two parallel projects, this group has chosen to link them and as such, the shuttle will be dimensioned and designed to incorporate debris management capacities.

Our goal is to produce a well-rounded shuttle design that respects ITP and Aerospace Challenge criteria, based on a systems engineering approach.

2. Team Forming and Rules

The first step of this project was to create a team. At the team forming stage, we conducted a Belbin Test to identify the preferred working styles and natural strengths of each team member. The profile repartition among our team is presented in the radar below:

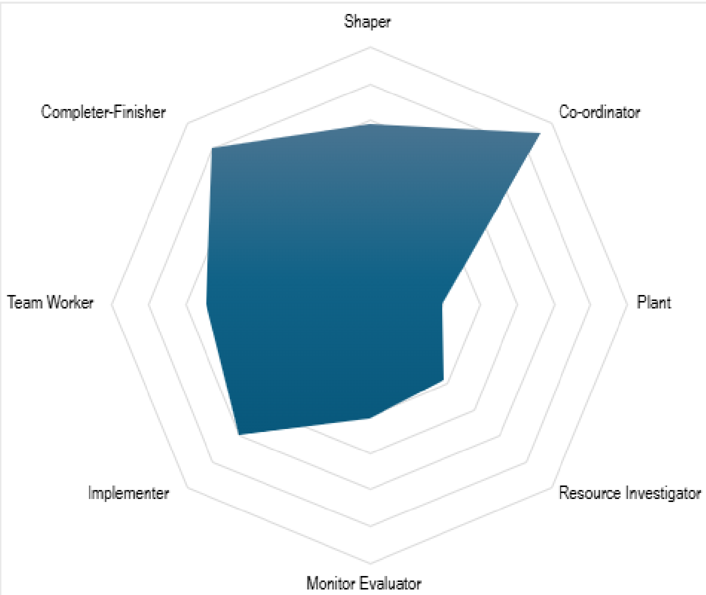

Figure 1 – Belbin Test Radar

Our team is composed of various personalities: 3 Complete Finisher (CF), 2 Implementer (IMP), 2 Co-ordinator (CO), 1 Monitor Evaluator (ME), 1 Team Worker (TW) and 1 Shaper (SH).

But we do not have any Plant (PL) or any Resource Investigator (RI). Not having them means missing a personality with a lot of imagination for the plant which can be balanced by all of us with our engineering minds. However, missing a Resources Investigator could be an issue in our team since this personality is a good communicator who bounces of other people ideas and is able to "to search for resources outside the group, and to carry out any negotiations that may be involved". This personality could be useful for working and exchanging with the other teams that work with us in a system engineering environment. Thus, the person with the most points in this personality is our co-ordinator with the other teams.

More than half of our Team is composed of Complete finishers (CF). This personality pays attention to detail and precision, which is good for system engineering since we think about every detail, this helps us to prevent any problem. However, this also leads to a reluctance to "let go" and delegation which could be problematic in the team's efficiency. But, in the other half of our team, we have two co-ordinator personality that can balance these points. Indeed, the co-ordinators help the team to work toward shared goals and delegate easily making it a well-balanced team. Moreover, we have also one monitor evaluator helping us to take reasonable decisions by thinking things over and being good for judging ideas. However, they tend to miss the ability to motivate the others. In response to this we have also one team worker who will help us to promote team spirit.

Finaly, our team is also made up of two implementer who have a sense of what is feasible and relevant and will do what needs to be done whatever it takes. They will help to organise the team. But they tend to have a lack of flexibility and a resistance to unproven ideas.

In conclusion, our team is composed of various personalities and skills, which enhances its efficiency. Despite the absence of a Plant (PL) and a Resource Investigator (RI), we compensate with our engineering mindset and strong coordination. This led us to define our team rules below, to maintain steady progress toward our shared objectives.

1. Working our subsystem together in the same room so that we can encourage creativity and brainstorming
2. Well defined meeting with someone in charge to preside them.
3. Track our meetings and our reflexion in subsystem design by taking notes.
4. Progress of each team member should be shared with the group at each meeting.
5. We plan at least 1 meeting with all the team members/week and 1 work session all together.
6. Team members should pay attention to listen each other during meetings.
7. Since no one will be available to be a fulltime project manager, organisation and decision will be made by the group during the meetings.

Figure 2 – Team Rules

II. Project Planning and Structure

1. Work Breakdown Structures and Work Packages Identification

To effectively organize and manage the development of the StarCheap, we structured the project into four main Work Packages (WPs), each targeting a specific area of expertise: Project Management (WP1), Systems Engineering (WP2), Technical Design (WP3), and Marketing (WP4). Each Work Package is broken down into focused tasks and deliverables, enabling a structured and collaborative workflow.

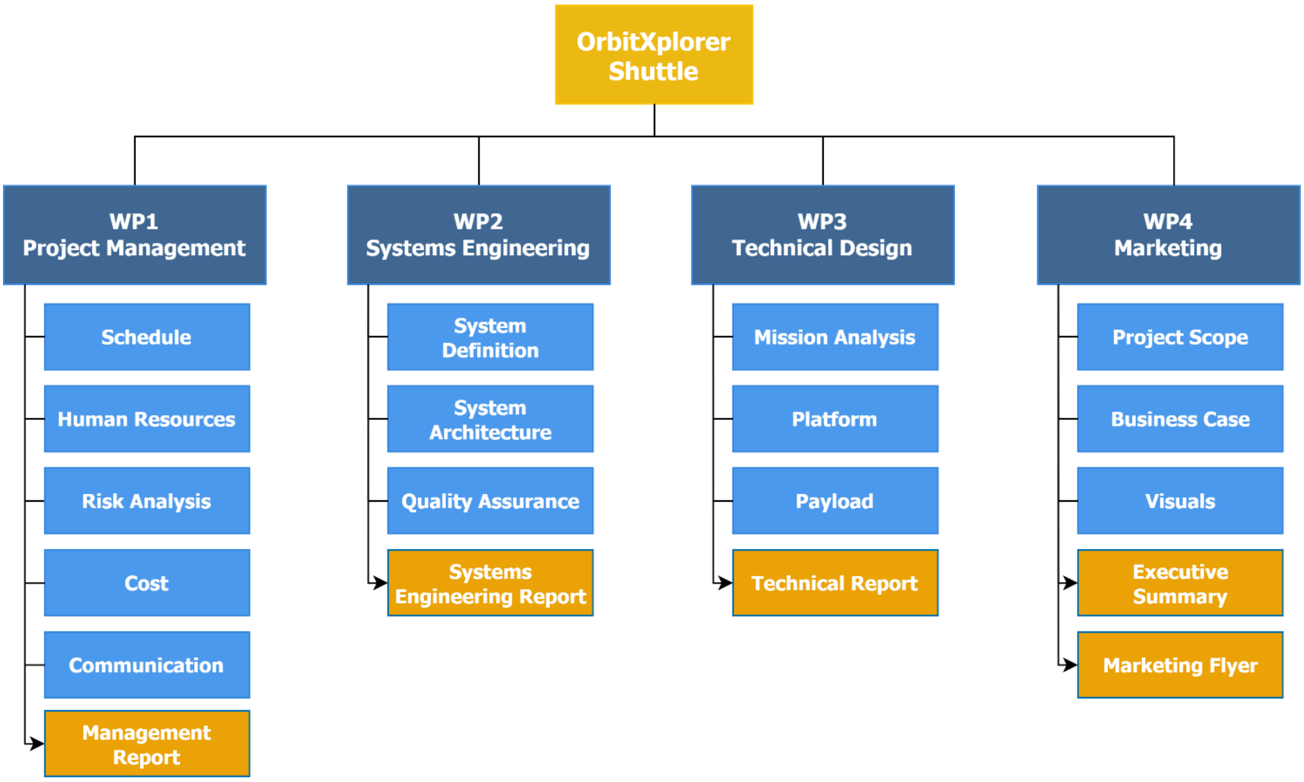

Figure 3 – Work Breakdown Structure (WBS)

For this project, we are expected to deliver five key documents:

- **Technical Report**: This document details the specifications of each subsystem of the StarCheap, the chosen technologies, and provides a preliminary design overview.
- **Project Management Report**: This document outlines the project scope, team organization, scheduling, and risk management strategy.
- **Systems Engineering Report**: This document describes the system life cycle, presents the functional and physical analyses of StarCheap, and explains the verification and validation processes applied to the system.
- **Executive Summary**: This document is a concise presentation of the company and its business case, highlighting its core team, strengths, and market opportunities.
- **Marketing Flyer**: This document outlines the strategy to promote the product and increase its visibility.

Each WPs has been further broken down into detailed activities to clearly define the scope of work, allocate responsibilities, estimate workload, and identify the necessary inputs and expected outputs for each task.

First, we have the management work package below:

Level	Code	Name	Description	Responsible	Input	Output	Estimated cost (h)
1	1	Project Management					150
2	1.1	Schedule	Define a detailed roadmap with all identified tasks	Maxence	WBS Cost estimations	GANTT chart	15
2	1.2	Human Resources	Assign resources and responsibilities to each tasks	Davia	WBS Belbin analysis	OBS RASCI matrix	10
2	1.3	Risk Analysis	Identify and assess potential project risks	Rémi	WBS	Risk matrix Risk register	5
2	1.4	Cost	Quantify the number of hours of work for each tasks	Maxence	WBS Workload record	Estimated cost matrix Real cost matrix	10
2	1.5	Communication	Schedule meeting and reviews and ensure coordination with other teams	Guillaume	GANTT chart	Minutes of meeting Internal reporting	100
2	1.6	Reporting	Outlines the processes involved in executing the project	Maxence	All	**Management Report**	10

Figure 4 – Management Work Package

Then, we have the systems engineering work package:

Level	Code	Name	Description	Responsible	Input	Output	Estimated cost (h)
1	2	Systems Engineering					135
2	2.1	System Definition		Maxence	High-Level Mission Analysis	High-Level System Definition	70
3	2.1.1	State of the Art		Charlotte	Project scope	State of the Art	10
3	2.1.2	Requirements	Specify requirements aligned with project objectives and needs	Charlotte	Project scope SOI	List of requirements	40
3	2.1.3	Product Timeline	Define development phases of the product	Maxence	Requirements Business Case	Life cycle	10
3	2.1.4	Stakeholders analysis	Define product relationships within the system of systems	Guillaume	Requirements	Entity Relationship Diagram	10
2	2.2	System Architecture	Develop the overall system design	Guillaume	System Definition	Architecture Block diagram	45
3	2.2.1	Functional Analysis	Analyze system functionalities and interactions	Guilaume	System definition	Functional diagrams	20
3	2.2.2	Physical Analysis	Define the physical structure and integration of system components	Davia	Funtional analysis Interface needs	PBS Interface Control Document	20
3	2.2.3	Technical Budget	Compute the mass and the dimensions of the system	Maxence	Technical design	Mass budget Dimensions	5
2	2.3	Quality Assurance	Ensures that the project meets defined standards, requirements and practices	Charlotte	Requirements	Quality Assurance Plan	10
3	2.3.1	RAMS analysis	Evaluates system to identify risks	Charlotte	System Definition	Risk mitigation	5
3	2.3.2	Verification & Validation	Track compliance with defined requirements and regulations	Charlotte	Requirements Technical design	Compliance matrix	5
2	2.4	Reporting	Outlines the processes involved in defining the project	Rémi	All	**Systems Engineering Report**	10

Figure 5 – Systems Engineering Work Package

We also have the marketing work package:

Level	Code	Name	Description	Responsible	Input	Output	Estimated cost (h)
1	4	Marketing		Davia	/		19
2	4.1	Project Scope	Identify the boundaries and the goals of the project	Maxence	Requirements	Scope statement	5
2	4.2	Business Case	Justify the project in terms of costs and benefits	Guillaume	Market analysis Financial data	Business case report ROI analysis	12
2	4.3	Visuals	Deliver visual content to support communication	Davia	/	Logo Template	2
2	4.4	Reporting	Outlines the processes involved in selling the project	Davia Maxence	All	**Marketing Flyer** **Executive Summary**	10

Figure 6 – Marketing Work Package

Finally, we have the technical design work package:

Level	Code	Name	Description	Responsible	Input	Output	Estimated cost (h)
1	3	Technical Design					476
2	3.1	Mission Analysis	Design the mission strategy	Guillaume	Requirements	Mission analysis report	81
3	3.1.1	Launch Strategy	Choose the launcher including interface, site and window	Guillaume	Technical budget	Launcher interface	6
3	3.1.2	Mission outline	Define the sequence of operations, mission phases, and critical events	Rémi	Requirements Life Cycle	Orbital analysis report Mission trajectory Operational scenarios	50
3	3.1.3	Environment	Analyze the external constraints impacting system performance	Maxence	Operational Timeline	Environment analysis	10
3	3.1.4	Ground Segment	Define the location of the ground segment and the control strategy	Maxence	Communication report	Ground segment report	5
3	3.1.5	Maintenance	Define the maintenance strategy	Charlotte	Life cycle System requirements Operational scenarios Environment analysis	Maintenance Plan	5
3	3.1.6	End-of-Life	Determine the EOL strategy including decommissioning and recycling	Davia	Requirements Life Cycle	EOL strategy Life duration	5
2	3.2	Platform	Design the shuttle platform to ensure the payload support	Maxence	Requirements	Platform design report	295
3	3.2.1	Propulsion	Define the propulsion subsystem	Rémi	Mission analysis report	Propulsion report	50
3	3.2.2	AOCS	Define the AOCS subsystem	Davia	Mission analysis report	AOCS report	50
3	3.2.3	Power	Define the power subsystem	Maxence	Power budget	Power report	30
3	3.2.4	Communication	Define the communication subsystem	Maxence	Link budget	Communication report	30
3	3.2.5	Structure	Define the structure subsystem	Rémi	Envronment analysis	Structure report	50
3	3.2.6	Thermal	Define the thermal subsystem	Charlotte	Thermal analysis	Thermal report	40
3	3.2.7	CDH	Define the CDH subsystem	Guillaume	Power budget	CD&H report	15
3	3.2.8	Life Support	Define the life support subsystem	Charlotte	Mission analysis report	Life Support report	30
2	3.3	Payload	Design the mission-specific payload	Davia	Project scope	Payload design report	80
3	3.3.1	Docking	Develop the docking system	Guillaume	State of the art	Docking system report	40
3	3.3.2	Grabbing	Develop the system's capability to capture debris	Davia	State of the art	Capture system report	40
2	3.4	Reporting	Outlines the processes involved in the specific design of the product's subsystems	Charlotte	All	**Technical Report**	20

Figure 7 – Technical Design Work Package

2. Organizational Breakdown Structure

An Organization Breakdown Structure (OBS) has been defined by the whole team. Each member was attributed a "managerial" role and technical roles.

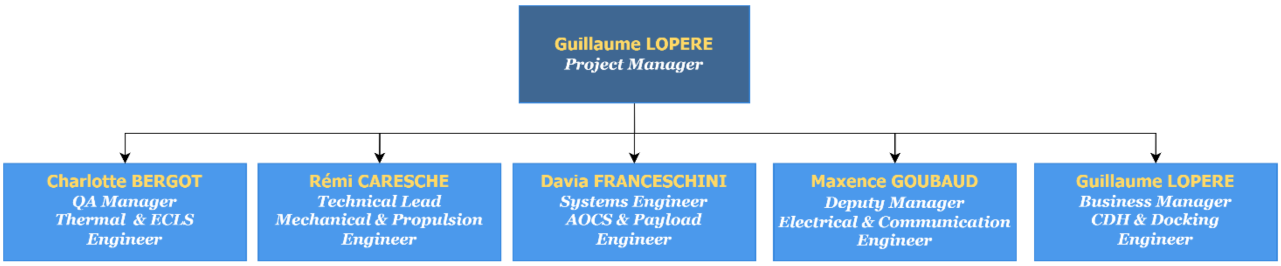

Figure 8 – Organizational Breakdown Structure (OBS)

We have established the following roles:

- **Project Manager**: Oversees the project's planning, organization, and timely delivery. They are the main contact for external stakeholders.
- **Deputy Manager**: Supports the PM and ensures daily coordination between team members. They step in when the PM is unavailable
- **Systems Engineer**: Ensures the consistency of the system architecture and manages interfaces and V&V.

- **QA Manager**: Reviews the requirements and ensures their clarity, traceability, and compliance. They ensure that project decisions are traceable.
- **Technical Lead**: Supervises technical development and supports subsystem integration. They help to solve complex design issues.
- **Business Manager**: Develops the business case and manages marketing strategy.

3. Resources Allocation

We developed a RASCI matrix, which maps the WBS to the OBS. This model helps define who is Responsible, Accountable, Supportive, Consulted, and Informed for each activity. It clarifies team expectations and avoids overlaps or gaps in task ownership.

	Charlotte	Davia	Guillaume	Maxence	Rémi
WP1 - Project Management					
1.1. Schedule	C	S	C	R	C
1.2. Human Resources	S	R	C	S	C
1.3. Risk Analysis	C	C	C	C	R
1.4. Cost	S	S	S	R	S
1.5. Communication	I	I	R	S	I
1.6. Reporting	I	I	I	R	I
WP2 - Systems Engineering					
2.1. System Definition	I	I	I	A	I
2.1.1. State of the Art	R	I	I	I	I
2.1.2. Requirements	S	I	I	S	R
2.1.3. Product Lifecycle	I	I	I	R	I
2.1.4. Stakeholders analysis	I	I	R	I	S
2.2. System Architecture	I	I	A	I	I
2.2.1. Functional Analysis	I	S	R	S	C
2.2.2. Physical Analysis	I	R	S	I	C
2.2.3. Technical Budget	I	I	I	R	S
2.3. Quality Assurance	A	I	I	I	I
2.3.1. Verification & Validation	R	S	I	I	I
2.3.2. RAMS analysis	R	C	C	C	C
2.4. Reporting	I	I	I	I	R
WP3 - Technical Design					
3.1. Mission Analysis	I	I	A	I	I
3.1.1. Launch Strategy	I	I	R	I	S
3.1.2. Mission Outline	I	C	S	S	R
3.1.3. Environment	S	I	I	R	I
3.1.4. Ground Segment	I	I	I	R	S
3.1.5. Maintenance	R	S	I	I	I
3.1.6. End-of-Life	I	R	I	I	S
3.2. Platform	I	I	I	A	I
3.2.1. Propulsion	I	S	I	I	R
3.2.2. AOCS	I	R	S	I	I
3.2.3. Power	S	I	C	R	I
3.2.4. Communication	C	I	S	R	I
3.2.5. Structure	C	I	I	S	R
3.2.6. Thermal	R	I	I	S	C
3.2.7. CDH	S	C	R	I	I
3.2.8. Life Support	R	S	C	I	I
3.3. Payload	I	A	I	I	I
3.3.1. Docking	I	R	S	I	I
3.3.2. Grabbing	S	R	I	I	I
3.4. Reporting	R	S	S	S	I
WP4 - Marketing					
4.1. Project Scope	I	I	I	R	I
4.2. Business Case	C	I	R	I	I
4.3. Visuals	I	R	I	I	I
4.4. Reporting	I	R	R	I	I

R = Responsible - complete the task
A = Accountable - approve the work
S = Support - provide assistance
C = Consulted - give advice (before)
I = Informed - must be notified (after)

Figure 9 - RASCI Matrix

4. Project Costs Assessment

In engineering projects, estimating the time required for each task is essential, as time directly impacts cost and resource planning. Lacking prior experience with similar projects, we based our estimations on an overall time budget rather than trying to predict task durations individually.

We assumed an average of 4 hours per person per week during the academic period and 7 hours per person per day during the final project-dedicated month. This global time allocation was then distributed across the project activities proportionally, depending on their complexity and expected workload.

		Estimated Time [h]	Time Allocation
WP1	Project Management	150	19.2%
WP2	Systems Engineering	135	17.3%
WP3	Technical Design	476	61.0%
WP4	Marketing	19	2.4%
	TOTAL	780	

Figure 10 - Estimated Time per WPs

The table below highlights the discrepancies between the initially estimated hours for each Work Package (WP) and the actual hours spent. Significant deviations can be observed, particularly for technically complex activities.

		Charlotte		Davia		Guillaume		Maxence		Rémi		TOTAL HOURS WP	
		Estimated hours [h]	Actual hours [h]	Estimated hours [h]	Actual hours [h]	Estimated hours [h]	Actual hours [h]	Estimated hours [h]	Actual hours [h]	Estimated hours [h]	Actual hours [h]	Estimated hours [h]	Actual hours [h]
Project Management	TOTAL [h]	22	22	31	32.5	30	27	48	51.5	25	22	156	155
	DIFFERENCE [h]	0		1.5		-3		3.5		-3		-1	
	DIFFERENCE [%]	0.00%		4.84%		-10.00%		7.29%		-12.00%		-0.64%	
Systems Engineering	TOTAL [h]	27	17.5	21	25.5	28	15.5	26	46	35	8	137	112.5
	DIFFERENCE [h]	-9.5		4.5		-12.5		20		-27		-24.5	
	DIFFERENCE [%]	-35.19%		21.43%		-44.64%		76.92%		-77.14%		-17.88%	
Technical Design	TOTAL [h]	99	151.5	125	157	51	100.5	78	90	123.2	195.5	476.2	694.5
	DIFFERENCE [h]	52.5		32		49.5		12		72.3		218.3	
	DIFFERENCE [%]	53.03%		25.60%		97.06%		15.38%		58.69%		45.84%	
Marketing	TOTAL [h]	0	0	7	3	17	11.5	5	2	0	0	29	16.5
	DIFFERENCE [h]	0		-4		-5.5		-3		0		-12.5	
	DIFFERENCE [%]	0.00%		-57.14%		-32.35%		-60.00%		0.00%		-43.10%	
TOTAL HOURS MEMBERS	TOTAL [h]	148	191	184	218	126	154.5	157	189.5	183.2	225.5	798.2	978.5
	DIFFERENCE [h]	43		34		28.5		32.5		42.3		180.3	
	DIFFERENCE [%]	29.05%		18.48%		22.62%		20.70%		23.09%		22.59%	

Several factors explain these differences:

- **Underestimation of technical workload**: During the planning phase, some technical tasks were underestimated. The full scope of work required became clearer only during the implementation phase in March/April.
- **Strategic reorientation**: As the project progressed, we chose to prioritize the quality of the "ITP" student project (reports, deliverables) over the Dassault Challenge. As a result, less effort was dedicated to the marketing aspects.

- **Reassignment of responsibilities**: Midway through the project, we reallocated several Work Packages to better match each member's skills. This decision helped accelerate progress and balance the workload more effectively, but also led to changes in individual contributions across WPs.

This table is thus a key tool for analyzing our project management. It helps identify areas for improvement, both in initial workload estimation and in our ability to adapt the organization dynamically during the project.

To gain deeper insight into how time was allocated within each Work Package, we produced detailed charts showing the number of hours spent per activity. These visualizations help us to identify where most of the effort was concentrated.

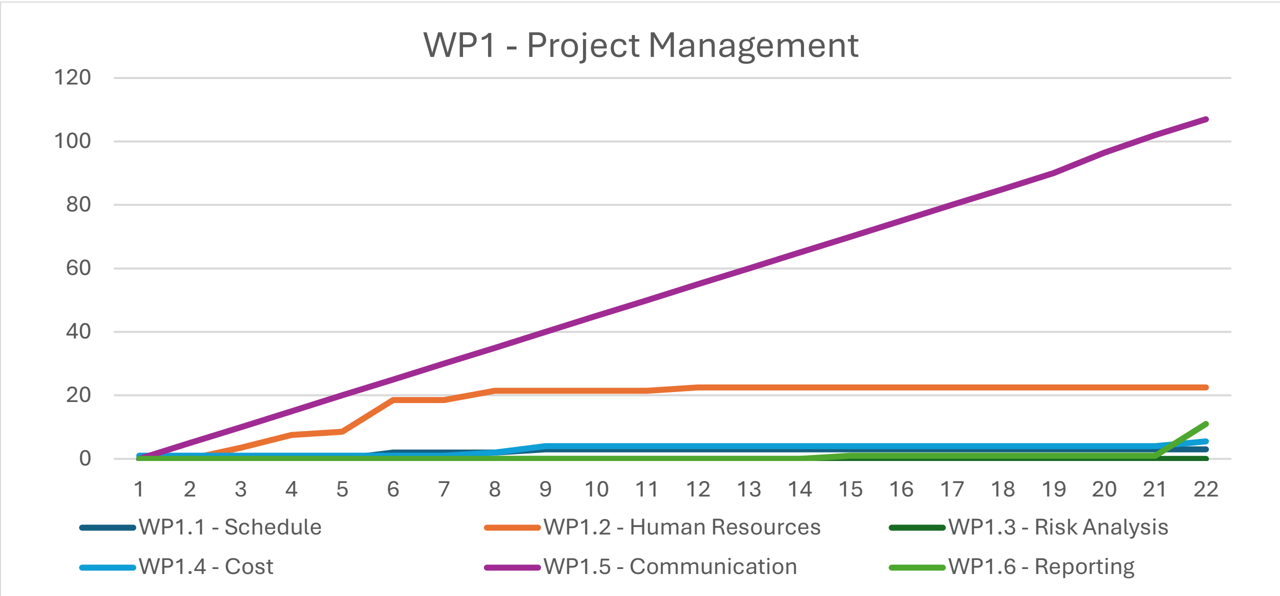

Figure 11 - Workload per activity in WP1

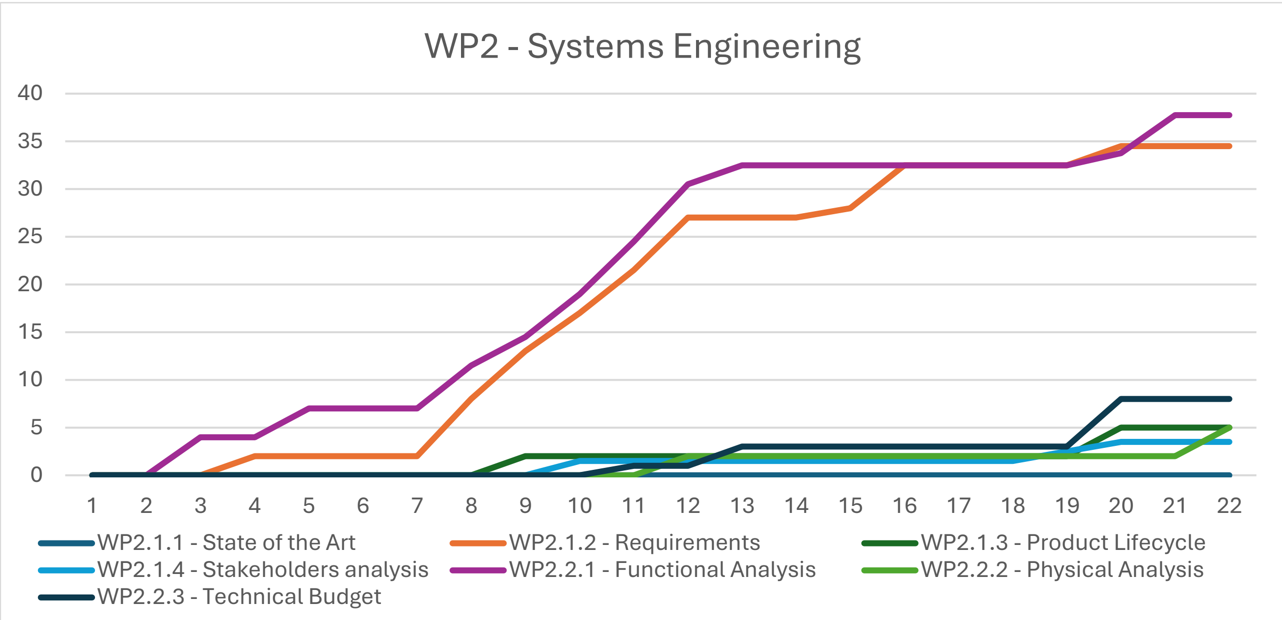

Figure 12 - Workload per activity in WP2

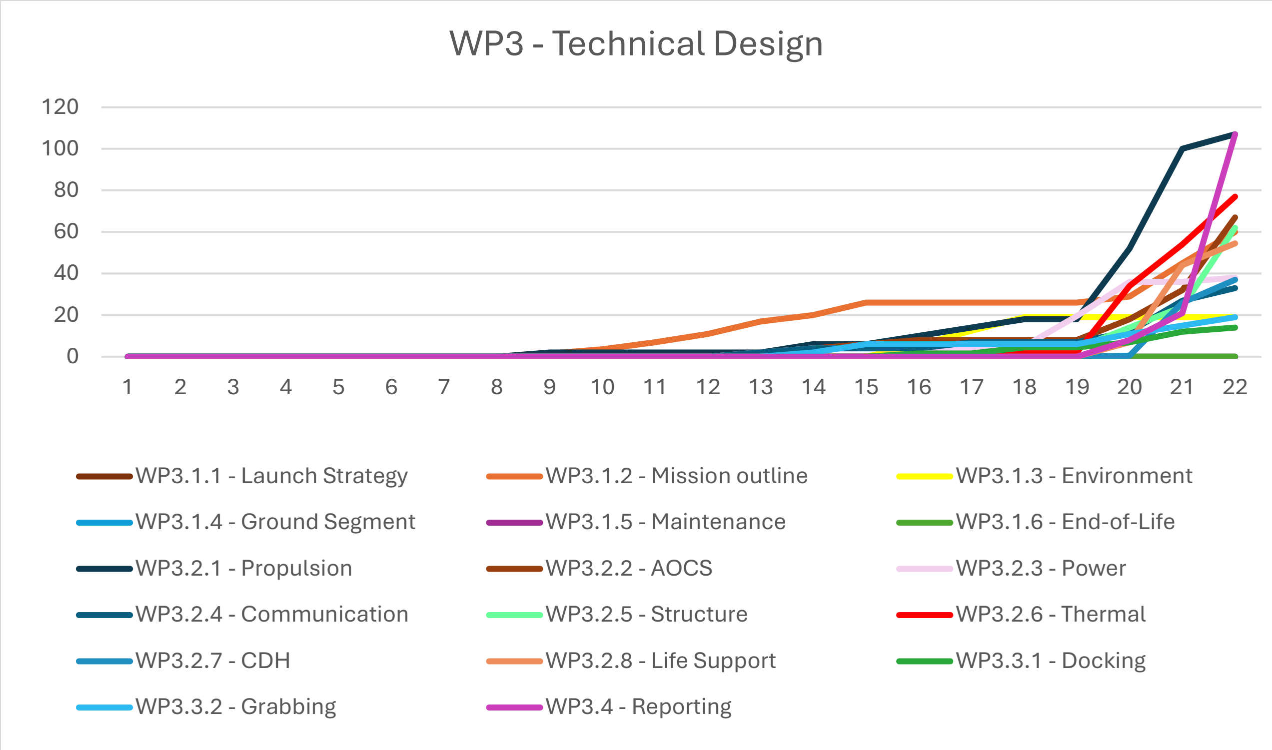

Figure 13 - Workload per activity in WP3

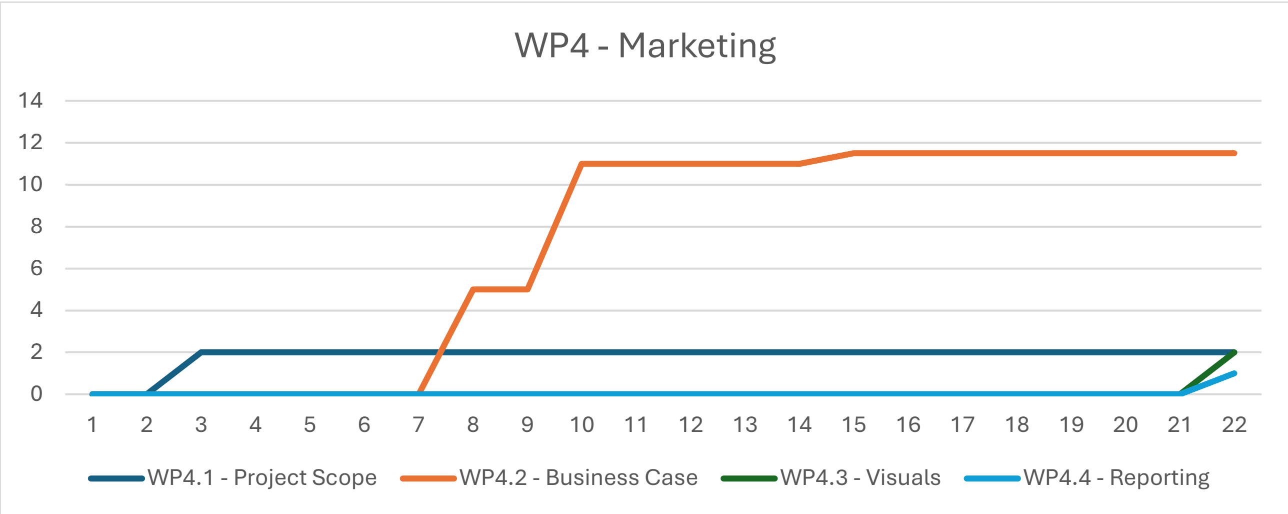

Figure 14 - Workload per activity in WP4

The pie charts below illustrate the distribution of hours spent by each team member across the various Work Packages. This visualization provides a clear overview of how the workload was divided within the team. This allows us to highlight each member's main areas of involvement.

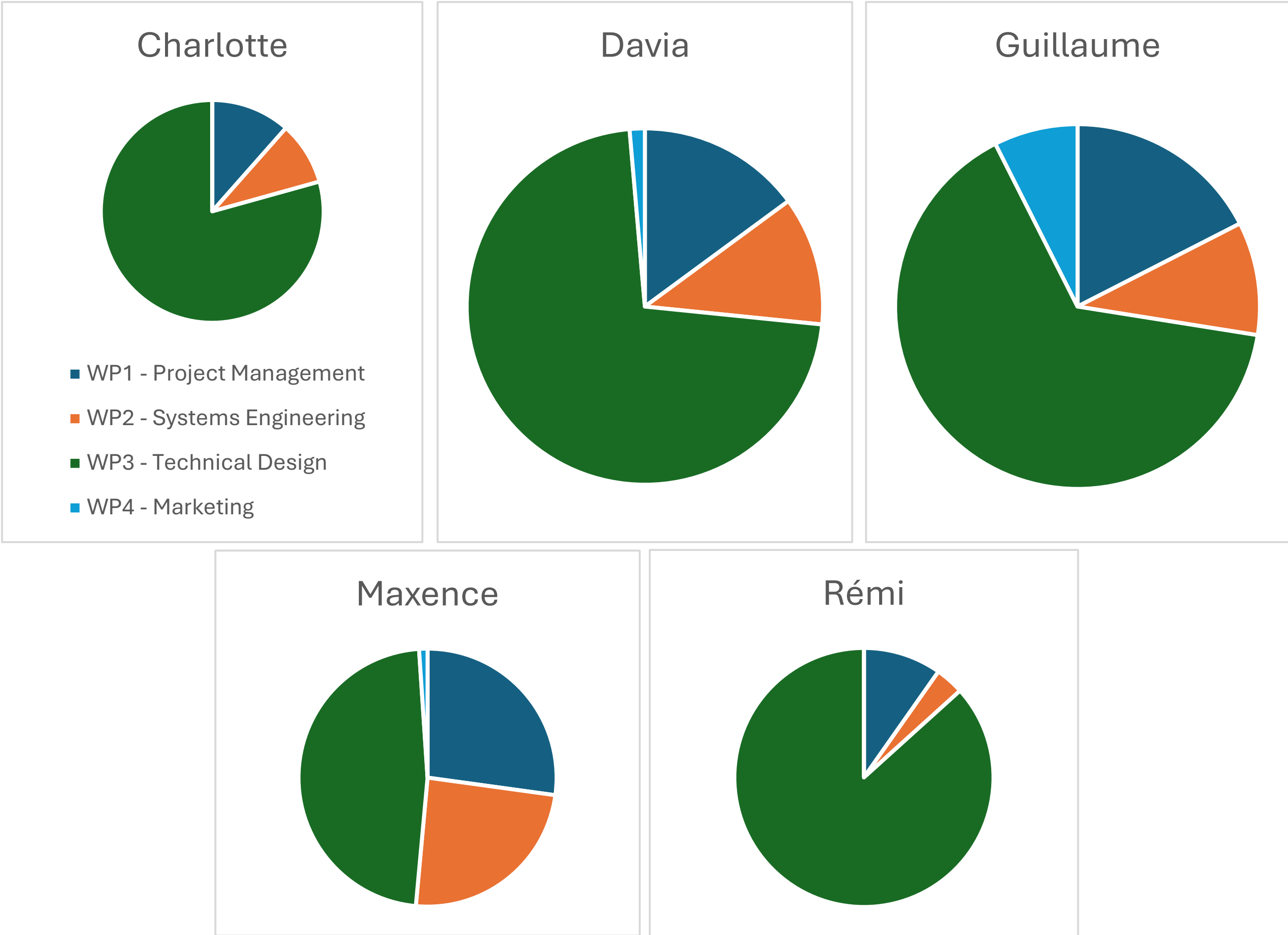

Figure 15 - Workload per WP per member

III. Scheduling and Milestones

1. Master Schedule with Key Deliverables and Milestones

The timeline below represents the master schedule of the project, broken down into five main phases. Each phase is aligned with key internal and external milestones.

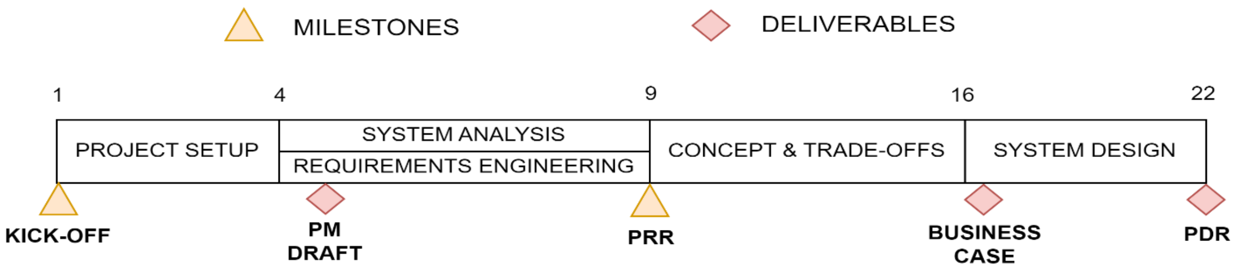

Figure 16 - Master Schedule

A Project Management draft was produced early in the project to establish the initial planning framework and define team roles, submitted to an external advisor (M. Guermonprez) for review and feedback. A Preliminary Requirements Review (PRR) was conducted internally to ensure consistency between the system-level analysis and the requirements defined. A Business Case was developed and submitted as a summary report to Dassault, outlining the mission value.

2. Gantt Chart

The Gantt chart below presents the overall project timeline, detailing the planning, execution, and delivery phases. It illustrates the start and end dates of each Work Package, as well as key milestones and interdependencies. This visual tool helped us to structure the project over time and set clear deadlines for each task.

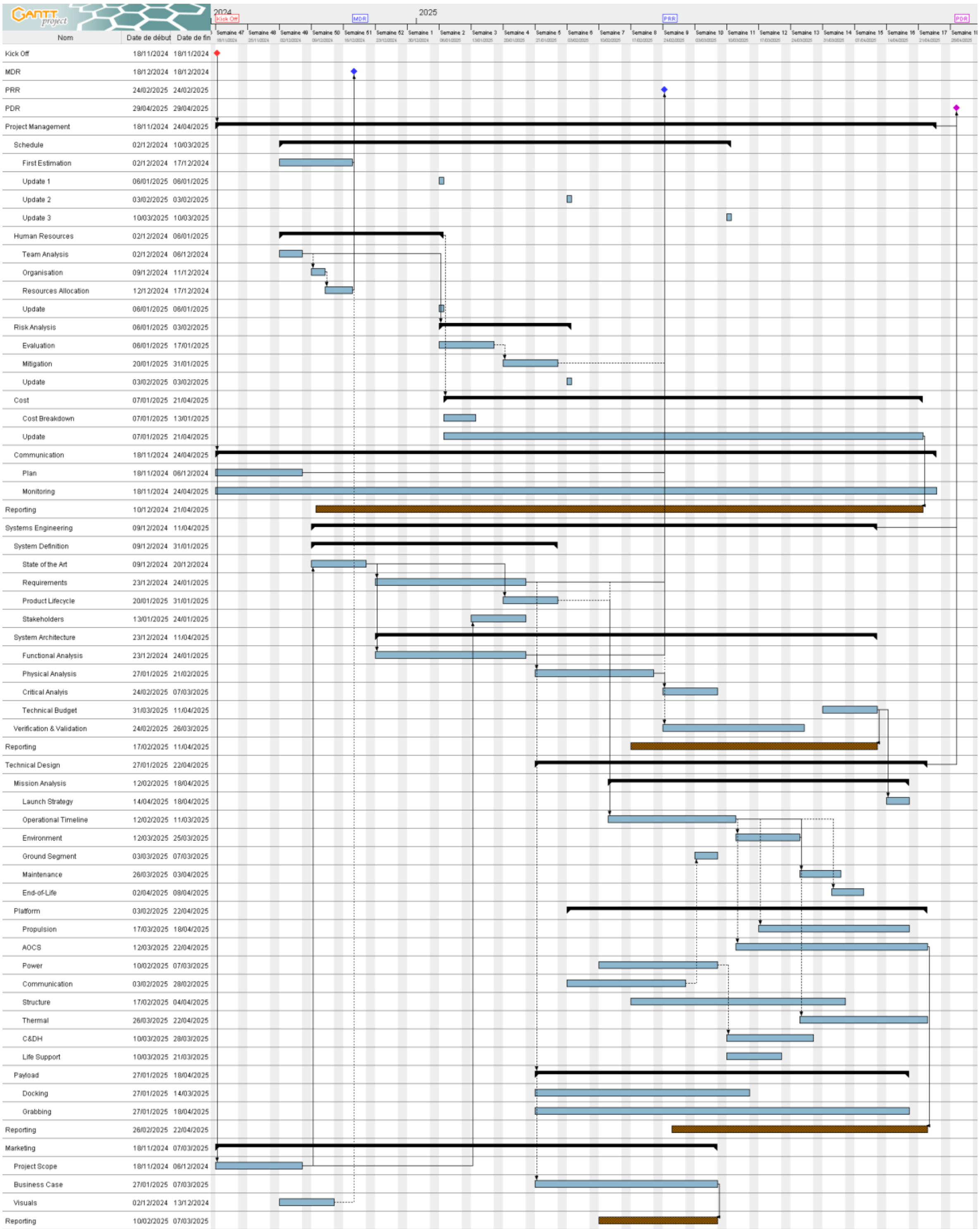

Figure 17 - Initial Gantt Chart

It was initially intended to serve as a reference point during team meetings to keep everyone aligned with upcoming objectives. However, in practice, it was only partially used for this purpose, as the team relied more heavily on informal communication channels and weekly oral updates to stay on track.

3. Schedule Evolution

While the total workload allocated to the system definition and requirements phase was not excessive – in fact, slightly lower than initially estimated – the main issue came from how this effort was distributed over time. Early in the project, this phase progressed slowly, as the team took time to fully grasp the mission objectives and align on a common vision. Several key decisions were postponed or took longer to mature, and as a result, the work on system architecture and requirement formalization remained fragmented and lacked momentum during the first half of the project.

This gradual and delayed engagement with the system definition had a significant impact: although the overall effort stayed within budgeted hours, a large portion of the work was pushed closer to the final weeks. By the time the team was fully committed to the technical design phase, the time left was limited, forcing an accelerated pace to deliver a coherent and complete system definition before the final reviews. This mismatch between the expected schedule and the actual dynamics of engagement led to a stressful final period and fewer opportunities for in-depth review or optimization of the design.

This shift in project rhythm was also reflected in the fact that the Gantt chart was never formally updated, despite the significant deviation from the initial timeline. While the overall quality of the work was preserved, this compressed timeline inevitably increased the workload and limited opportunities for iteration and optimization.

IV. Risk Analysis

1. Identification of Risks

Risk management is a process to identify, analyze, treat and monitor the risks continually. It is a disciplined approach to dealing it uncertainty that is present throughout the entire life cycle. There are four basic approaches to treat risks.

- Acceptance, accept the risk and do no more.
- Avoidance, avoiding the risk through change of requirement or redesign.
- Control, taking actions to reduce the risk by expending budget and/or other resources to reduce likelihood and/or consequence over time.
- Transference, transfer the risk by agreement with another party that it is in their scope to treat. Look for a partner that has experience in the dedicated risk area.

For high-risk technical tasks, risk avoidance is insufficient and can be supplemented by the following approaches: Early procurement, Initiation of parallel developments, Implementation of extensive analysis and testing, and Contingency planning.

Consequence rating					
	A1	A2	A3	A4	A5
	B1	B2	B3	B4	B5
	C1	C2	C3	C4	C5
	D1	D2	D3	D4	D5
	E1	E2	E3	E4	E5
	Likelihood rating				

2. Risk Mitigation Actions

The generic consequence/likelihood matrix in figure above is a way to display risks according to their consequence and their likelihood, and to combine these characteristics to display a rating, low-to-high likelihood rating scale [1-5].

Risk	Description	Potential Impact	Mitigation Strategies	Risk Degree
Programmatic Risk				
Policy Change	Changes in government priorities or support.	Delays, cancellation, or reduction in funding.	Maintain close communication with stakeholders and diversify funding sources.	B3-A4 (Significant)
Regulatory Non-compliance	Non-compliance with international or national space regulations.	Sanctions, delays, or launch prohibitions.	Ensure rigorous compliance and conduct regular audits.	B2-A4 (Significant)
Coordination Issues	Poor coordination between teams and partners.	Operational delays and inefficiencies.	Improve communication and use collaborative project management tools.	B3-A3 (Moderate)

Risk	Description	Potential Impact	Mitigation Strategies	Risk Degree
Cost Risk				
Cost Overrun	Costs exceeding initial estimates.	Budget depletion, requiring additional funding.	Conduct regular cost analyses and maintain a reserve for contingencies.	B3-A3 (Moderate)
Material Cost Fluctuations	Variations in the prices of construction materials.	Increased production costs.	Secure long-term contracts with suppliers.	B2-A2 (Minor)
High Maintenance Costs	Unexpected costs related to maintenance and repairs.	Impact on operational budget.	Plan regular inspections and preventive maintenance.	B3-A3 (Moderate)

Risk	Description	Potential Impact	Mitigation Strategies	Risk Degree
Technical Risk				
Critical System Failure	Failures in propulsion, life support systems, etc.	Mission failure, risks to crew safety.	Implement redundant systems and conduct rigorous testing.	B4-A5 (Catastrophic)
Compatibility Issues	Incompatibility between shuttle and space station systems.	Failure in rendezvous or cargo transfer.	Conduct thorough integration testing.	B3-A4 (Significant)
Debris Recovery Failure	Technical issues during debris handling.	Risks to crew safety and failure of secondary mission.	Develop robust protocols and train crew for various scenarios.	B4-A4 (Critical)
Re-entry Issues	Failures during the re-entry phase.	Risks to crew safety and loss of shuttle.	Use proven technologies and conduct frequent simulations.	B4-A5 (Catastrophic)

This risk assessment table provides a structured approach to identifying, evaluating, and mitigating risks associated with the space shuttle project. By addressing these risks proactively, the project aims to ensure the safety of the crew, the success of the mission, and the sustainability of the space shuttle.

V. Project Execution and Monitoring

1. Project Tracking Tools and Methods

To monitor the team's working hours throughout the project, a dedicated tracking tool was implemented via the Teams application. It consisted of a shared Excel spreadsheet accessible and editable by all team members in real time. After each work session, members recorded the number of hours they had worked directly onto the sheet.

This tool proved particularly valuable when building the Cost Breakdown Structure (CBS) at the end of the project. It enabled us to compare the actual hours spent with the initial estimates defined in the Work Breakdown Structure (WBS).

Below is a screenshot of the tracking tool used within Teams to log completed hours:

New Work

Warning: open it in the application

Work Package	Activity	Member	Duration [hours]	Week Number
WP3 - Technical Design	WP3.2.4 - Communication	Guillaume	2	22
WP3 - Technical Design	WP3.1.2 - Mission outline	Guillaume	10	22
WP3 - Technical Design	WP3.3.1 - Docking	Guillaume	2	22
WP3 - Technical Design	WP3.4 - Reporting	Guillaume	10	22
WP3 - Technical Design	WP3.4 - Reporting	Guillaume	10	22
WP3 - Technical Design	WP3.2.7 - CDH	Guillaume	5	22
WP3 - Technical Design	WP3.2.7 - CDH	Guillaume	5	22
WP3 - Technical Design	WP3.2.4 - Communication	Guillaume	2	22
WP3 - Technical Design	WP3.4 - Reporting	Charlotte	10	22
WP3 - Technical Design	WP3.4 - Reporting	Charlotte	7	22
WP3 - Technical Design	WP3.2.8 - Life Support	Charlotte	2.5	22
WP3 - Technical Design	WP3.4 - Reporting	Maxence	10	22
WP3 - Technical Design	WP3.2.4 - Communication	Maxence	2	22
WP2 - Systems Engineering	WP2.3.1 - Verification & Validation	Maxence	2	22

Figure 18 - Cost Tracking Tool

We also experimented with the Microsoft Teams "Planner" interface to assign and track individual tasks. However, this tool proved to be less relevant over time and was eventually abandoned after a few weeks due to limited engagement and redundancy with our existing tracking methods.

2. Progress Review Meetings and Tutor Feedback

Throughout the project, the team held weekly meetings involving all members to ensure continuous coordination and progress tracking. Each session followed a structured agenda presented in a shared PowerPoint document. During these meetings, every member reported on the tasks completed during the past week, and the team collectively discussed and defined the objectives for the upcoming week.

Throughout the project, we benefited from several feedback. Mr. Guermonprez provided feedback on our project management practices. On the technical side, Mr. Le Grelle offered valuable advice regarding subsystem design and implementation. As part of the Dassault Challenge, we also received expert input from Ms. Bernelin, who answered our questions and provided feedback via email.

3. Team Coordination and Interface Management

To manage project documentation and ensure team coordination, we used a dedicated Teams channel with a shared file structure organized by Work Packages. This allowed all team members to access and synchronize documents in real time according to their responsibilities.

For internal communication, we maintained a WhatsApp group chat to quickly share important decisions, updates, and meeting schedules.

Regarding inter-group communication, the team members responsible for coordination from each group were part of a dedicated Teams channel and WhatsApp group, where they could exchange key information, align progress, and organize joint meetings when necessary.

VI. Project Closure

1. Comparaison of Planned vs. Actual Results

The project generally followed its intended structure, but several deviations emerged between the initial planning and actual execution. One of the most noticeable discrepancies was in the project timeline. The system-level analysis took longer than expected to fully engage the team. As a result, technical decisions and detailed design work were postponed and had to be completed during the final weeks, leading to a compressed and intense design phase. This dynamic was further exacerbated by the fact that the Gantt chart was never formally updated, making it difficult to adjust the planning based on real progress.

From a workload distribution perspective, some adjustments were made throughout the project. Team members shifted responsibilities mid-project to better align with individual competencies and ensure smoother execution. This led to some discrepancies compared to the initial WBS.

In terms of deliverables and documentation, the plan was to produce key documents progressively throughout the project. However, due to the shifting priorities and timing constraints, many major deliverables were finalized during the last few weeks. While the content met the expected quality standards, this last-minute workload limited opportunities for peer review and iterative improvement.

Finally, regarding project management tools, the team initially intended to use structured resources such as Teams Planner and an evolving Gantt chart to coordinate tasks and timelines. In practice, these tools were underused: Planner was abandoned after a few weeks, and the Gantt was not updated to reflect actual progress. Instead, weekly meetings supported by PowerPoint agendas and a WhatsApp group chat became the most effective channels for coordination, providing a more agile and responsive way to manage the project.

Despite these deviations, the project achieved its core technical and organizational objectives, and the lessons learned from this gap between planning and execution will be valuable for future projects.

2. Challenges Encountered and Key Achievements

As part of our retrospective analysis, an anonymous team survey was conducted using Google Forms to assess individual experiences and identify opportunities for improvement. The results offer valuable insights into both the team's satisfaction and the challenges faced during the OrbitXplorer project.

Team Engagement and Satisfaction

According to the first chart, 60% of team members enjoyed working on the project (20% "Strongly Agree", 40% "Agree"), while the remaining 40% remained neutral. Notably, no respondent reported negative feelings, indicating a generally positive experience. This reflects a solid team dynamic and intrinsic motivation despite the workload and complexity.

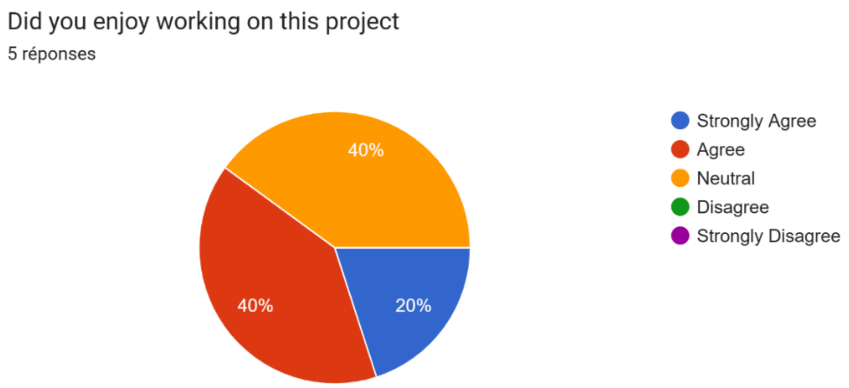

Figure 19 - First Chart (Engagement)

In terms of outcomes, the second chart reveals a more nuanced picture: while 20% of team members reported being strongly satisfied, 80% responded "Neutral". This suggests that, although the project was completed and objectives were met, a large portion of the team remained ambivalent about the results. Rather than a sign of dissatisfaction, this may reflect unmet expectations or a feeling that the potential of the project was not fully realized. This highlights the importance of better alignment between individual contributions and team goals.

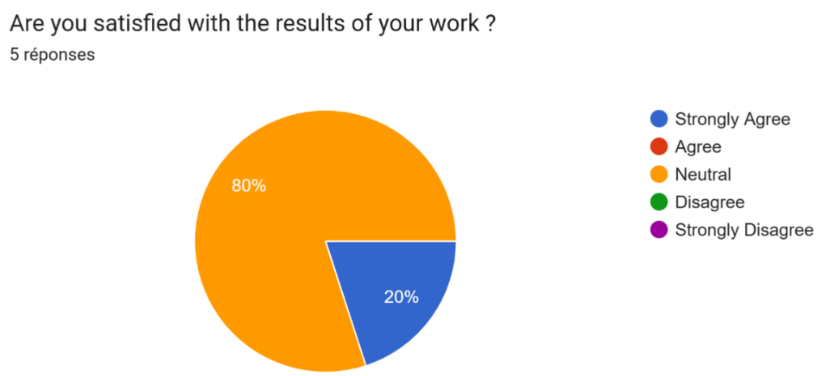

Figure 20 - Second Chart (Satisfaction)

Interdisciplinary Collaboration

The third question received unanimous agreement: 100% of respondents declared that the project improved their ability to work in a multidisciplinary team. This is a strong achievement of the project, as it confirms that members effectively engaged with various subsystems (thermal, power, propulsion, etc.), promoting a systems-level mindset.

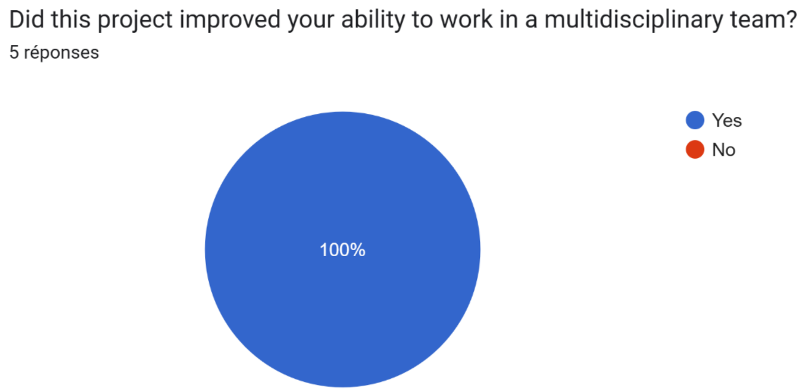

Figure 21 - Third Chart (Collaboration)

Project Management Challenges

The fourth chart identifies areas for potential improvement. The most significant challenges reported were:

- **Meeting Efficiency** and **Retroactive Planning** also scored high on "minor" to "major" improvement needs. While meetings were frequent, their structure or outcome may have lacked consistency, and planning sometimes occurred reactively rather than proactively.
- **Communication**: Both *internal group communication* and *inter-group coordination* received mixed feedback. Although not a major blocker, this signals the need for improved documentation habits, shared tools and clearer communication channels, and mostly for the interaction between groups.
- **Work Repartition**: All responses indicated this as needing *minor improvement*. This suggests that the workload was maybe not well adapted to the expertise of each member. Future projects should consider clearer RASCI matrix and more regular task reviews.
- **Tool Usage** and **Team Building** received varied answers but showed no critical issues. This suggests that while tools were in place, better standardization might have helped.

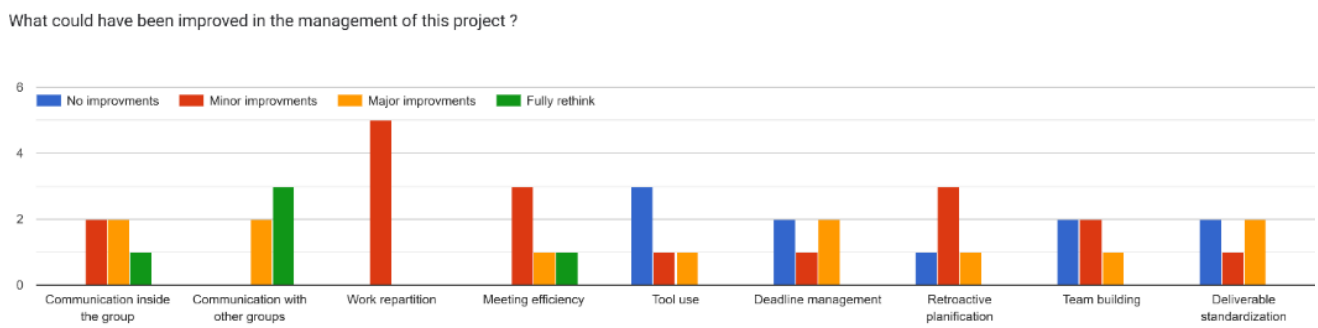

Figure 22 - Fourth Chart (Improvments)

In conclusion, the OrbitXplorer project has provided a valuable learning experience, combining technical development with the complexities of team-based project management. While the system engineering process led to the successful definition and structuring of a technically sound and innovative solution, the post-project feedback survey revealed areas for improvement in internal organization, notably regarding task distribution, meeting efficiency, and communication.

These findings emphasize the importance of robust project governance practices to complement engineering expertise. Moving forward, the lessons learned from this experience will serve as a foundation for refining collaborative methods and enhancing the efficiency and coherence of future projects. The OrbitXplorer initiative thus represents not only a technical achievement but also a meaningful contribution to the professional growth of its participants.