

IST 302 Project Management

Upgradation of International Space Station of its Commercialization

Project Manager: Pradynesh Bhoir

Project Charter

1. Essential project information

Date: 14 September 2021

Project Name: UOISS (Upgradation of International Space Station)

Project Sponsor: NASA

US Government

Project Manager: Pradynesh Bhoir

Project Purpose Statement: To conduct more experiments in outer space and collect accurate data regarding the experiments

Project Objectives: To launch a vehicle to the space station with upgraded equipment's which are to be installed on ISI.

Businesses Case: Some important experiments can be conducted only in zero gravity and ISS is the best place to conduct these experiments. The equipment on ISS is almost 20 years old and since then technology has advanced. Old equipment may not give accurate readings and thus wasting precious time of astronauts on ISS.

Project Scope:

- Design equipment which can survive extreme weather in outer space
- Make them compact enough to fit them in the vehicle
- Launch the vehicle in outer space

Resources:

- Team of 500 people for R&D of the equipment's
- \$1.5 Billion

Project Charter

- Launch vehicle

Summary Milestone Schedule:

09/14/2021- Project Start Date

03/01/2022- First look at the design of new equipment

08/01/2023- The prototype of upgraded equipment

02/01/2024- Start planning of vehicle launch

07/01/2025- Final Product Deadline

10/01/2026- Vehicle Launch Date

10/02/2026- Installation of equipment on ISS

10/02/2026-11/02/2026- Testing of newly Installed equipment

Summary Budget- \$1.5 Billion

Duration: This documentary is valid until 12/01/2026 until it is renewed or changed.

Scope Statement

Project Name	UOISS (Upgradation of International Space Station)	Date	10/14/2021
Project Number	000000000000001	Project Manager	Pradynesh Bhoir

Business Need / Project Objectives

NASA is planning to upgrade its equipment and software of International Space Station to increase its commercial use for research and development. As a federal agency NASA receives all its funding from the government and the objective of this project is to reduce the government expenditure on NASA missions and to gain some profits from the commercialization of ISS. This project will foster new technologies to improve our lives.

Project Description

NASA is planning to develop new solar arrays for ISS to get more power for the experiments which will be done after its commercialization. Also, to increase the capacity of space toilets to accommodate more people on ISS at any moment, research and development of the solar arrays will be done by NASA.

Scope Statement

Project Benefits

1. Using ISS for commercial purposes
2. Increase development of new industrial capability
3. To provide services the government needs at a lower cost

Project Requirements

1. The newly solar arrays should have a life of 40 years
2. All the equipment should be fully developed 2 years before the launch

Project Deliverables

1. Upgradation of solar arrays
2. Upgrading the total capacity of space toilets
3. Delivery and installation of critical equipment's

Project Do Not Include

1. Everything that is not included in the scope

Success / Acceptance Criteria

1. Successful installation of new solar arrays
2. Successful increase in the total capacity of space toilets
3. Get a minimum revenue from commercialization of ISS

Scope Statement

Estimated Project Schedule	
Milestones	Estimated Date of Completion
1. Project Start - Project Start Date	09/14/2021
2. First look at the design of new equipment's	03/01/2022
3. Prototype of upgraded equipment's	08/01/2023
4. Start planning of vehicle launch	02/01/2024
5. Final Product Deadline	07/01/2025
6. Vehicle Launch Date	10/01/2026
7. Installation of equipment's on ISS	10/02/2026
8. Testing of newly Installed equipment	10/02/2026
9. Project Completion	11/02/2026
Total	5 years
Estimated Length of Project	

Scope Management Plan

General Scope Statement: The project is undertaken to foster new technologies. The scope of this project will be managed by a committee that consists of top scientists and government officials of the country. Whenever someone wants a change in the scope of the project, they must create a pitch with all the necessary documents. This pitch will be presented in front of the panel which will be held every 2 weeks.

The no-change date is Jan 2023

The decision will be taken by the committee

The scope change will be reviewed by the PP&C committee – Sponsors, stakeholders, and government officials.

The project planning and control committee should

- Ask questions and engage in conversations with all the teams on the project

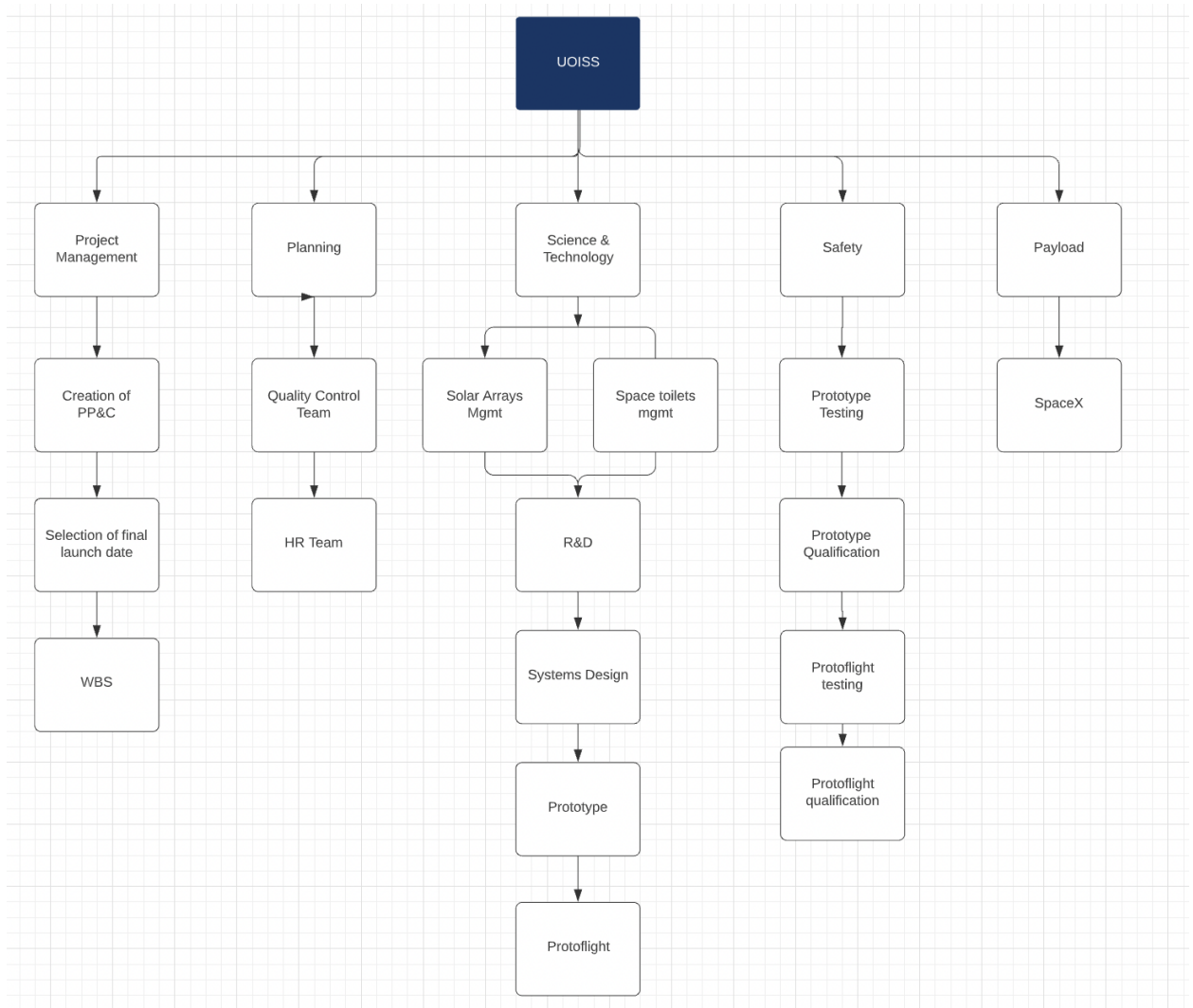
Scope Control

- Scope will be managed by submission of standard change request forms which will be reviewed by the PP&C.
- Measure and monitor changes to all over project scope.
- Make a list of risks that may derail the project

Process for creation and maintenance of WBS

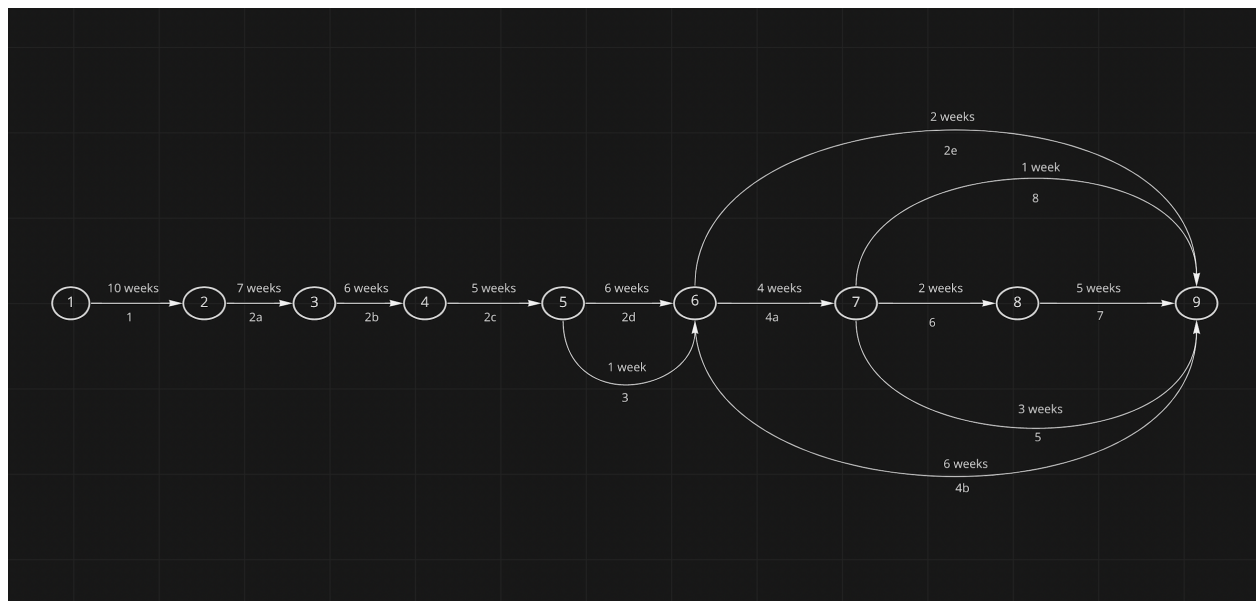
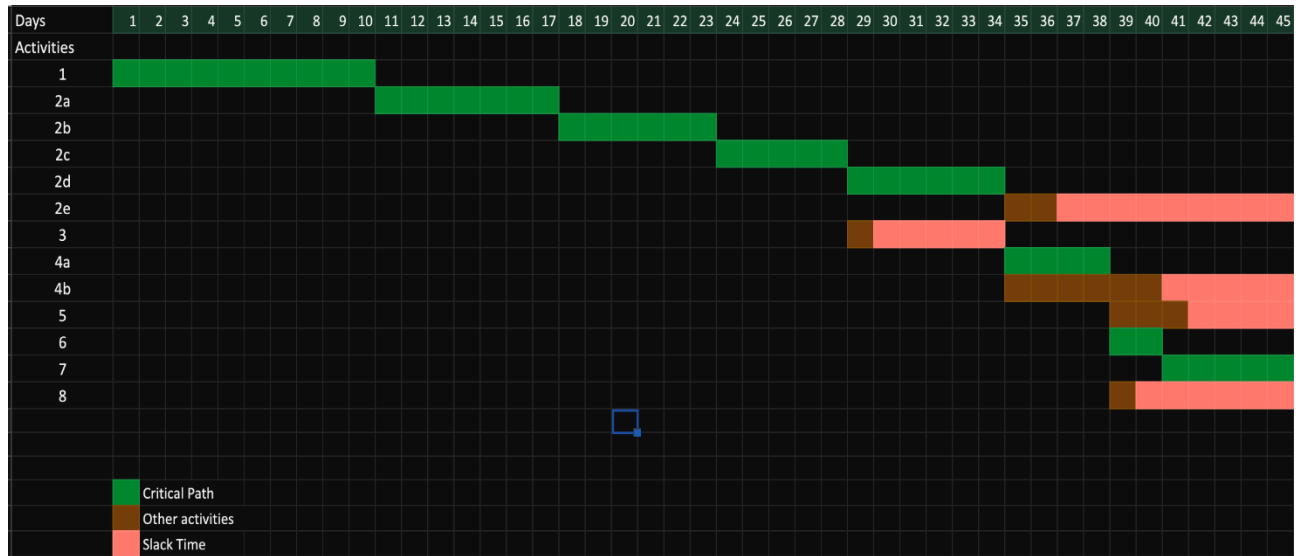
- PP&C will also be responsible for the creation of WBS.
- If the standard change request form is accepted PP&C will make changes to the WBS.

Work Breakdown Structure



Gantt Chart

The following graphs and diagrams are based on the data given by Professor in the class.



Critical Path Analysis

Activity Sequencing								
Activity	Duration	Precedence	Early Start	Late Start	Early Finish	Late Finish	Slack	CP?
1	10 weeks		1	1	10	10	0	Y
2a	7	1	10	10	17	17	0	Y
2b	6	2a	17	17	23	23	0	Y
2c	5	2b	23	23	28	28	0	Y
2d	6	2c	28	28	34	34	0	Y
2e	2	2d	32	43	34	45	11	N
3	1	2c	28	33	29	34	5	N
4a	4	2d,3	34	34	38	38	0	Y
4b	6	2d,3	34	39	40	45	5	N
5	3	4a	38	42	41	45	4	N
6	2	4a	38	38	40	40	0	Y
7	5	6	40	40	45	45	0	Y
8	1	4a	38	44	39	45	6	N

Activity List

Activity Number	Activity Name	Activity Description	Responsibility
1.1.1	Making a team	Make a team of relevant professionals who can work on R&D of solar arrays	PP&C
1.1.2	First team meeting	Meeting should cover all the things which are expected from the professionals during their time on the project.	PP&C
1.1.3	Requesting for resources	After the professionals have requested the resources, the list should be passed onto the PP&C resource distribution department	R&D team
2.1	Research	Extensive research should be done on the development of new solar arrays technology.	R&D team
2.2	Develop Prototype	A prototype should be presented before PP&C team on the expected scheduled date	Engineering team
3.1	Test prototype	The prototype should be tested extensively for knowing any kind of design flaws	Testing team
2.3	Develop protoflight	After the design has been passed, a protoflight, which has to be sent	Engineering team

Activity List

		with the payload should be developed	
4.1	Protoflight testing	The prototype should be test extensively for knowing any kind of flaws	Testing team
2.4	Develop software	Software should be developed for supporting new hardware	Software team
4.2	Software testing	Software should be tested for bugs	Testing team
5.1	Unpacking	After the payload has successfully reached ISS, it should be unwrapped/unpacked according to the given instructions only	ISS team
5.2	checking damage	All the equipment's and parts should be checked for damage during flight	ISS team
5.3	Assembly	All the parts should be assembled	ISS team
5.4	Installation	The equipment's should be installed	ISS team
5.5	Software Installation	Supporting software should be installed	ISS team
5.6	Damage check	Damage check should be done before running the tests	ISS team
5.7	Test runs	All the newly installed equipment's should be tested extensively for any kind of flaws	ISS team

Activity Sequencing

Activity Number	Activity Name	Activity Description
1.1.1	Making a team	make a team of relevant professionals who can work on R&D of solar arrays
1.1.2	First team meeting	Meeting should cover all the things which are expected from the professionals during their time on the project.
1.1.3	Requesting for resources	After the professionals have requested the resources, the list should be passed onto the PP&C resource distribution department
2.1	Research	Extensive research should be done on the development of new solar arrays technology.
2.2	Develop Prototype	A prototype should be presented before PP&C team on the expected scheduled date
3.1	Test prototype	The prototype should be tested extensively for knowing any kind of design flaws
2.3	Develop protoflight	After the design has been passed a protoflight which has to be sent with the payload should be developed

Activity Sequencing

4.1	Protoflight testing	The prototype should be test extensively for knowing any kind of flaws
2.4	Develop software	Software should be developed for supporting new hardware
4.2	Software testing	Software should be tested for bugs
5.1	Unpacking	After the payload has successfully reached ISS, it should be unwrapped/unpacked according to the given instructions only
5.2	checking damage	All the equipment and parts should be checked for damage during flight
5.3	Assembly	All the parts should be assembled
5.4	Installation	The equipment should be installed
5.5	Software Installation	Supporting software should be installed
5.6	Damage check	Damage check should be done before running the tests
5.7	Test runs	All the newly installed equipment should be tested extensively for any kind of flaws

Activity Resource Estimate

Activity Number	Activity Name	Resource Estimates
1.1.1	Making a team	50 R&D professionals
1.1.2	Kick-Off meeting	
1.1.3	Requesting for resources	
2.1	Research	Office space, R&D professionals
2.2	Develop Prototype	Team of 20 engineers with program managers & support staff
3.1	Test prototype	Team of 10 equipment testing professionals
2.3	Develop protoflight	Team of 20 engineers with program managers & support staff
4.1	Protoflight testing	Team of 10 equipment testing professionals
2.4	Develop software	Team of 10 software developers with project managers
4.2	Software testing	Team of 5 software testing professionals
5.1	Unpacking	9 Astronauts on ISS

Activity Resource Estimate

5.2	checking damage	9 Astronauts on ISS
5.3	Assembly	9 Astronauts on ISS
5.4	Installation	9 Astronauts on ISS
5.5	Software Installation	9 Astronauts on ISS
5.6	Damage check	9 Astronauts on ISS
5.7	Test runs	9 Astronauts on ISS

Activity Duration Estimate

Activity Number	Activity Name	Activity Description	Duration
1.1.1	Making a team	make a team of relevant professionals who can work on R&D of solar arrays	1 week
1.1.2	First team meeting	First team meeting should cover all the things which are expected from the professionals during their time on the project.	2 days
1.1.3	Requesting for resources	After the professionals have requested the resources, the list should be passed onto the PP&C resource distribution department	1 week
2.1	Research	Extensive research should be done on development of new solar arrays technology.	2 years
2.2	Develop Prototype	A prototype should be presented before PP&C team on the expected scheduled date	2 years
3.1	Test prototype	The prototype should be test extensively for knowing any kind of design flaws	2 months
2.3	Develop protoflight	After the design has been passed a protoflight which has to be sent with the payload should be developed	5 months

Activity Duration Estimate

4.1	Protoflight testing	The prototype should be test extensively for knowing any kind of flaws	2 months
2.4	Develop software	Software should be developed for supporting new hardware	1 year
4.2	Software testing	Software should be tested for bugs	2 months
5.1	Unpacking	After the payload has successfully reached ISS, it should be unwrapped/unpacked according to the given instructions only	10 days
5.2	checking damage	All the equipment and parts should be checked for damage during flight	2 days
5.3	Assembly	All the parts should be assembled	15 days
5.4	Installation	The equipment should be installed	3 days
5.5	Software Installation	Supporting software should be installed	2 days
5.6	Damage check	Damage check should be done before running the tests	2 days
5.7	Test runs	All the newly installed equipment should be tested extensively for any kind of flaws	2 months

Project Schedule

Estimated Project Schedule	
Milestones	Estimated Date of Completion
1. Project Start - Project Start Date	09/14/2021
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Estimated Budget

Purpose: The purpose of this document is to estimate the budget required for this project. The allotted funds for this project are \$1.5 billion. Some of the major milestone estimates are given below.

Deliverables	Description	Estimated Budget
Kick-off	Hiring/ allocating personals/resources to specific teams	100 million
R&D	Research & developing new solar arrays and space toilets	150 million
Prototype	Building prototype	3 million
Protoflight	Building protoflight	2 million
Software	Coding new software for new equipment's	5 million
Payload launch	Sending new equipment's to ISS	700 million

Quality Plan

Project information

This quality control plan is written to meet the requirements of the project UOISS. The purpose of this quality control plan is to assist Consultants in following the standard of quality during the Project Development. The Consultants will achieve this by providing adequate time in the schedule for thorough reviews of the deliverables, using appropriately skilled personnel, and documenting review processes.

Project Objectives

1. Upscale the services provided by ISS by upgrading some equipment on ISS.
2. Foster new technologies
3. Raise some funds for future space exploration missions of NASA by commercializing ISS.

Project Deliverables

1. Upgradation of Solar Arrays
2. Upgradation of Space Toilets
3. Delivery and installation of critical equipment which is necessary for future experiments on ISS.

Project Schedule

Quality reviews will be held every 2 weeks and before the submission of milestones. All the milestone dates can be found in the PP&C handbook. The dates are subject to change and a;; the final decisions will be made by PP&C.

Quality Plan

Responsibilities

A quality control team will be put together at the start of each phase. Each team will have a project manager along with a quality project manager & 4 consultants. All the deliverables will be reviewed by this team before submission. They're responsible for the completeness & accuracy of the deliverables.

Specific responsibilities of each team member are mentioned below:

Project Manager: The project manager will be responsible to administer the quality control plan. The responsibilities are as follows:

- Coordinate and lead the quality control process.
- Ensure only qualified professionals are performing tasks on any team.
- Ensure that all the professionals are aware of the project schedule and are involved in performing tasks having a clear understanding of the scope of the project.
- Make sure that all the quality control processes are followed and document them properly.

Quality Manager: The quality control manager's responsibility is to coordinate with project managers of all the teams personally and make sure that all the quality control processes are followed. The quality control manager should document all the inspections and make sure to report any kind of irregularities to the quality control team. Also, the quality control manager

Quality Plan

should review the checklist made by the consultants before the start of each task.

Consultants: The consultants are individuals who work with the quality manager to maintain all kinds of documentation. They are responsible for any kind of documentation work done by the quality control team. Any issues raised by the PP&C regarding quality control will be addressed by them. They will also be responsible for making sure that all the quality assurance plans and checklists are explained to all the teams at their kickoff meeting. The checklist should be made by the consultants before the start of each task and this checklist should be reviewed by the quality control manager.

HR Plan

NASA Vision ►

To improve life here, To extend life to there, To find life beyond.

NASA Mission ►

To understand and protect our home planet To explore the Universe and search for life. To inspire the next generation of explorers ... as only NASA can.

Goals of HR

The primary goal of HR is to help ensure that businesses can meet strategic goals by finding suitable employees and then managing them effectively. It does this by

- Becoming a strategic business partner within the company
- Acting as an agent for change
- Being a champion for employees
- Fulfilling an important administrative role

Functions of HR

- Recruitment of new staff and internal selection to vacant positions if necessary.
- Develop a staffing plan that will budget the costs of manpower, reduce costs of recruitment, and allow existing employees to be promoted (or moved) to vacant positions.
- A properly scheduled leave and company holidays plan.
- Termination of employment procedures that relate to both firing and resignation.

HR Plan

Structure of HR team

1. Recruitment
2. Training and career development
3. Administration of compensation and benefits
4. Health and safety
5. Employee relations
6. Compliance

Responsibilities

1. Recruitment: Develop and track goals for the recruiting and hiring process. Coordinate and implement college recruiting initiatives. Handle administrative duties and recordkeeping. Collect data on cost per hire and time-to-hire.
2. Training and career development: manage training programs to ensure they are delivering results. They prepare schedules, allocate instructors to different courses, and monitor costs to keep programs within budget. They prepare progress reports for the senior management team and maintain employees' training records.
3. Administration of compensation and benefits: Keep the workforce motivated. It helps give benefits to employees based on their performance and actions and brings the best out of the employees at the workplace.
4. Health and safety: ensure that the organization invests in a proactive safety culture; that investment, when done right, will prevent injuries, incidents, and other issues. A key

HR Plan

piece of this is training and development that helps workers to be safe.

5. Employee relations: Offering counseling services to employees. Participating in recruitment and firing processes. Performing employee background checks and verifying information. Communicating policies pertaining to Human Resources, compensation, and benefits.
6. Compliance: Responsible for ensuring that employees and teams are in place to address compliance issues. They are also responsible for thoroughly understanding compliance laws, as well as providing adequate communication to managers and employees about such laws.

Communication Plan

Communication goals:

- Keep stakeholders informed of the project timeline, budget, and project needs.
- Provide clear insight into decisions needed or roadblocks.
- Provide structured opportunities for feedback from sponsors.

Name of meeting or update	Participants	Purpose	Frequency	Type
Individual Team meetings	Team members	Status review	bi-weekly	physical meeting
project manager status meeting	Project manager with team members	Review status of deliverables, alignment, project planning	weekly	physical meeting
PP&C meetings	PP&C team members	Status update	weekly	physical meeting

Communication Plan

PP&C with individual teams	PP&C team with individual Team members	Status update	monthly	physical meeting
PP&C with stakeholders	Steering stakeholders	Status update, approval of extra budget	monthly	physical meeting
PP&C for scope management	PP&C, stakeholders, sponsors	Scope Management	monthly	physical meeting
Organizational project status update	Everyone on the organization	Information	monthly	email update
Team update meetings	Team members	Status update	daily	Netmark

Risk Analysis

Purpose:

The purpose of risk analysis is identifying and analyzing potential issues that could negatively impact the project. This process is done to help organizations avoid or mitigate those risks. The main purpose of this document is to help risk analysts analyze properly find and analyze possible risks and plan to avoid them or make a mitigation strategy.

Team Structure:

The risk analysis team will have a project manager to head the team along with 4 risk analysts and 5 consultants. The responsibility of risk analysts is to make mitigation strategies and get them to the PP&C team. The consultants will help them in the procedure.

Risk Analysis:

In the qualitative risk analysis phase, a probability and an impact score is given to each risk. Since risk has two components, probability, and impact, both need to be considered.

$\text{Risk} = \text{Probability} \times \text{Impact}$

Probability

Assessing the probability of an uncertain event is a difficult task. In the insurance industry, actuaries use similar events with known statistical outcomes to determine a standard “distribution” for an unknown event. Here are some ideas to determine the probability of an event happening:

Risk Analysis

Determine how often the event occurred on previous projects. Many projects have tasks that have been performed on other projects.

Some of the risks related to this project are as follows, but they are not limited to this list.

Risk	Probability	Impact	Score
Physical risks	4	3	12
Economic risks	5	6	30
Loss of confidentiality	6	5	30
Space radiation	4	6	24
Damage to payload	3	10	30
Delay in R&D	7	5	35
Refusal from SpaceX	4	4	16

Request for Proposal

December 9, 2021.

SpaceX

1 Rocket Road, Hawthorne,
CA 90250, US.

NASA is planning to commercialize International Space Station through its Low-Earth Orbital program. NASA has been following SpaceX's success with Falcon 9, a two-stage reusable rocket. This letter is a Request of Proposal to SpaceX for submitting their quotes for use of Falcon 9 by NASA for delivery of its payload to the International Space Station. A description of the project and the services needed are as follows:

Project: NASA is planning to upgrade some equipment and software of the International Space Station to increase its commercial use for research and development. We will be upgrading solar arrays which power the International Space Station along with the space toilets. We also must deliver some critical equipment that will be used for some critical experiments in the future.

Services needed by SpaceX: SpaceX must deliver all the payload along with 4 astronauts to International Space Station in February 2026. The approximate weight of the payload is 20,000 lb. NASA wants SpaceX to use its Dragon cargo capsule for delivery of the payload. A suitable launch place and launch place will be decided soon.

Project Monitoring Plan

The objective of project monitoring is to:

- Maintain accurate and up-to-date information about the project status and performance throughout the project lifecycle.
- Evaluate the actual performance of a project versus the desired and planned performance.
- Offer project estimations and performance insights that can be used to update the schedule and budget.
- Determine if corrective or preventive measures are required.

PP&C will be responsible for monitoring the project. PP&C will be any kind of change to the scope of the project.

Postmortem

This was a very fun topic to work on. I learned so many things about space exploration and since this project was related to NASA and ISS, I also realized the kind of expectation big institutes/companies have from project managers. The quality and standards which they expect from project managers are very high and it takes years to master them.

Initially, I thought working on this project would be very easy but as I started researching the topic, I realized that the project was very big, and I had to narrow down my scope to upgrading very specific things on ISS. The number of deliverables on was very high and very detailed quality, risk analysis, and communication plans were needed. I tried to simplify all things by reducing my deliverables.