

ET

EINSTEIN
TELESCOPE



Risk Management

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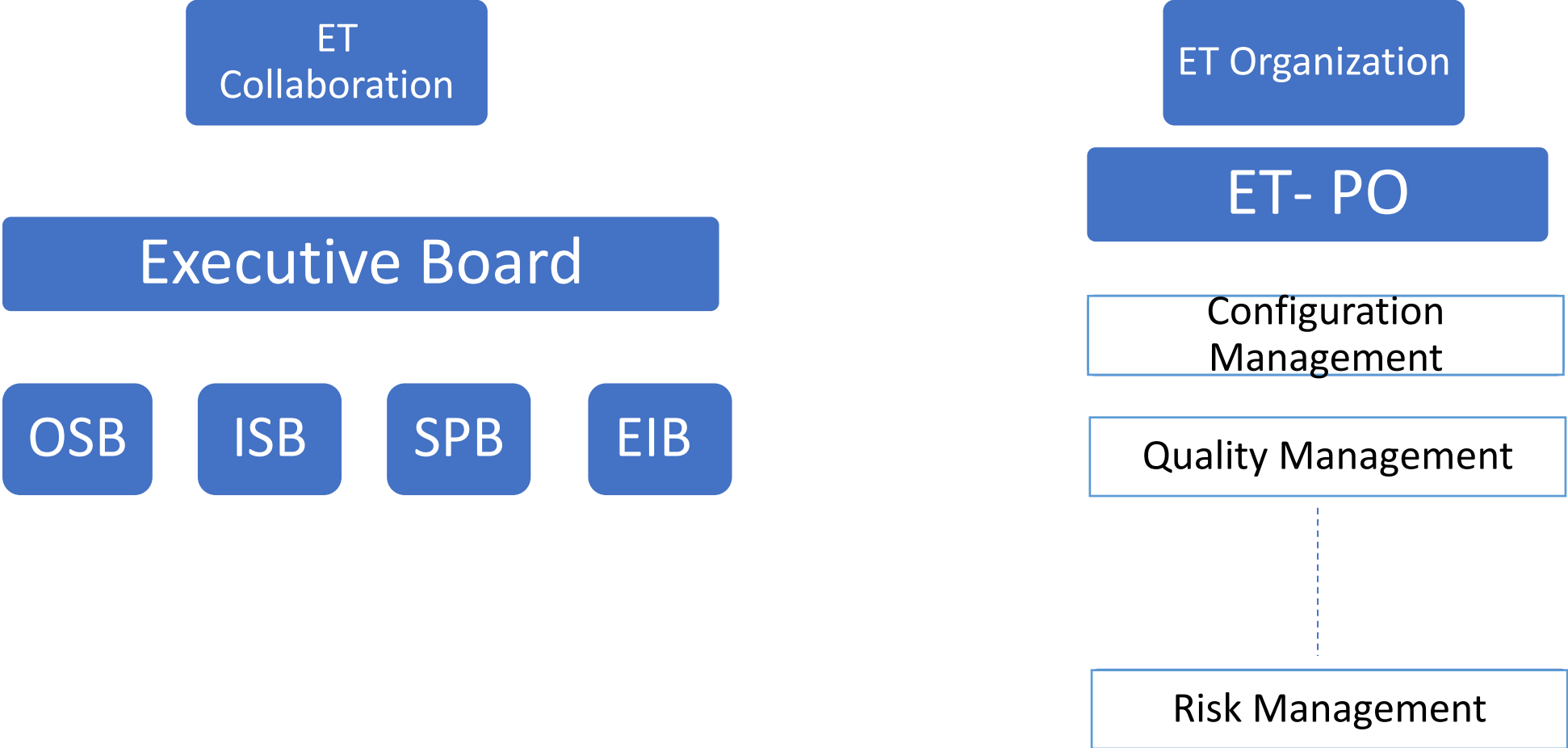
Introduction

In this Presentation:

- The Risk Management is introduced
- An example of a Risk Management Process and some Templates are presented

Context

Einstein Telescope



What is a Risk and what to do ?

- Risks are caused by a particular hazard occurrence on a project.
- They can cause a **negative impact** on the project in terms of **cost, schedule, technical, safety**....
- A Risk is defined by its Criticality (will be developed in the following slides)



Risk Management Policies

Risk Identification

Risk Assessment

Risk Responses:
Accept/ Close / Avoid /
Transfer / Mitigate

Risk Monitoring

Risk Analysis :
Common convention that is adopted within a collaboration to study the risks and know how to deal with them .

It must be carried out at all the different phases of the project.

What is the Risk Management Plan?

- **Risk Management Plan** = is the **final document** that provides processes that should be followed, defines responsible of each activity, defines policies, delivers tools and templates
 - **Convention (Policies + Processes)**
 - **Templates** (Risk Register Template+ Risk Assessment Template + Mitigation Actions)
 - **Tools** (PM Softwares, Simulators ...)

Before we start we should keep in mind

Risk Management :

- **addresses** the uncertainty in project assumptions and estimates
- It's **not a substitute** for other project management processes
- It should be applicable **throughout a project's lifecycle**
- It may provide realistic expectations for the completion dates and cost of the project (Risk Analysis Modeling and Simulation)

Risk Criticality

Risk is defined by : **Criticality = Severity * Likelihood**

- **Likelihood** Represents the chance a particular hazard will occur
- **Severity** quantify the impact of this hazard occurrence on a project
- Likelihood and severity scale have to be defined and agreed on in the project and potentially revised from a phase to another.

Likelihood

Risk Index:
Combination of
Severity and Likelihood

E	Low	Medium	High	Very High	Very High
D	Low	Low	Medium	High	Very High
C	Very Low	Low	Low	Medium	High
B	Very Low	Very Low	Low	Low	Medium
A	Very Low	Very Low	Very Low	Very Low	Low
	1	2	3	4	5

Severity

Policies on Risk Criticality : Likelihood Scale

Likelihood Scale	Probability	Description
E	Extremely Likely	90 % probability of occurrence over the project life
D	Highly Likely	70 % probability of occurrence over the project life
C	Moderately Likely	50 % probability of occurrence over the project life
B	Unlikely	30 % probability of occurrence over the project life
A	Highly Unlikely	10 % probability of occurrence over the project life

Likelihood

Risk Index: Combination of Severity and Likelihood

E	Low	Medium	High	Very High	Very High
D	Low	Low	Medium	High	Very High
C	Very Low	Low	Low	Medium	High
B	Very Low	Very Low	Low	Low	Medium
A	Very Low	Very Low	Very Low	Very Low	Low
	1	2	3	4	5

Severity

Policies on Risk Criticality : Severity Scale

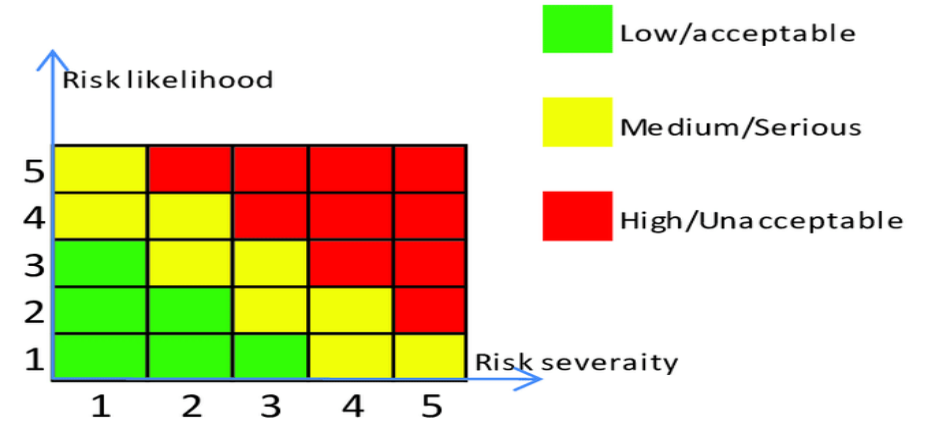
Likelihood

Risk Index:
Combination of
Severity and Likelihood

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A	Very Low	Very Low	Very Low	Very Low	Low
	1	2	3	4	5

Severity Scale	1	2	3	4	5
Cost	Insignificant cost increase (< 20 K Euros)	Cost increase (20 K Euros < I < 100 K Euros)	Cost increase (100 K Euros < I < 750 K Euros)	Cost increase (750 M Euros < I < 3 M Euros)	Insight cost increase (> 3 M Euros)
Schedule	Insignificant Schedule Slippage	Overall Project Slippage < 1 Months	Overall Project Slippage 1-2 Months	Overall Project Slippage 2-5 Months	Overall Project Slippage > 5 Months
Performance	Quality Degradation Barely Noticeable	Only High Goals are affected	Does not meet the requirements in some areas	Does not meet the requirements	Performance Reduction is Not acceptable

Policies on Risk Criticality : Actions to be taken



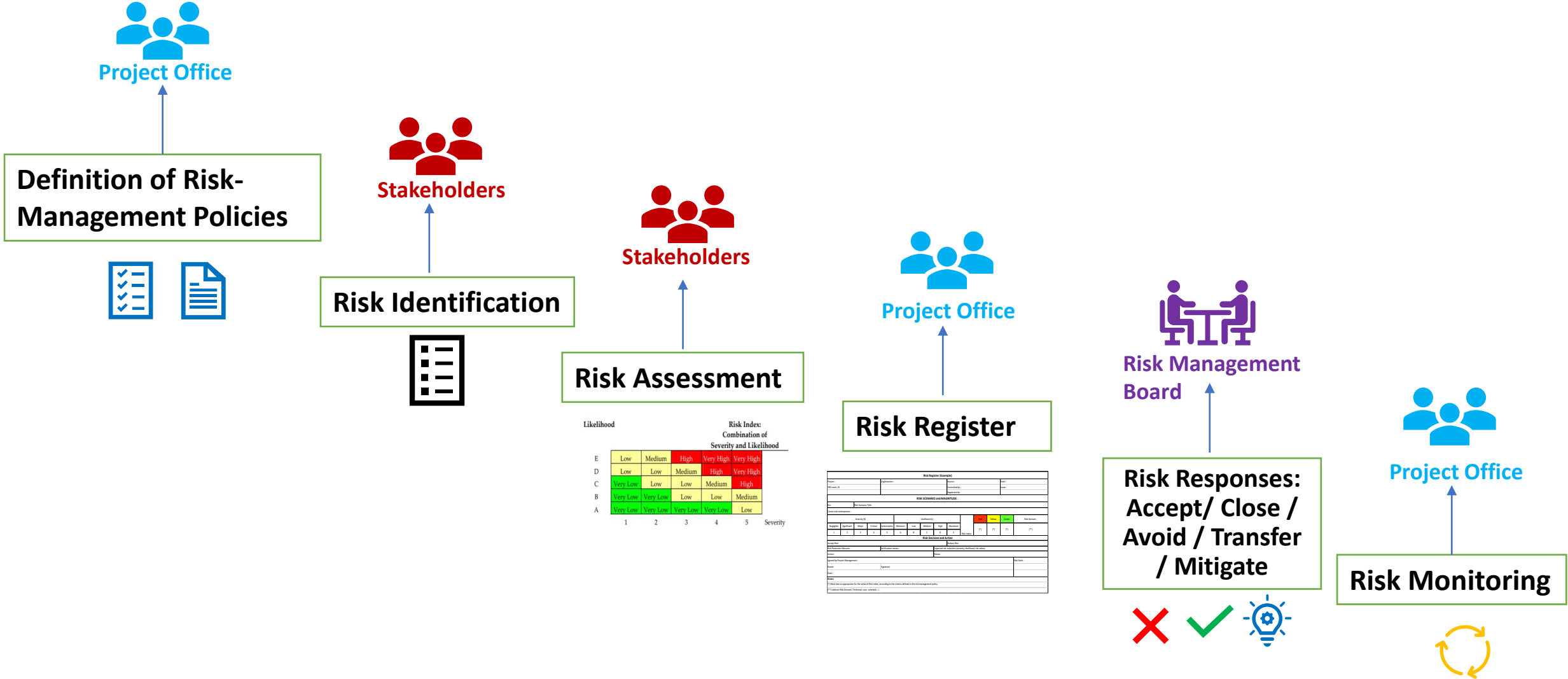
Risk Criticality	Risk Magnitude	Proposed Actions
E4, E5, D5	Very High Risk	Unacceptable risk: implement new team process or change baseline – seek project management attention at appropriate high management level as defined in the risk management plan.
E3, D4, C5	High Risk	Unacceptable risk: see above.
E2, D3, C4, B5	Medium Risk	Unacceptable risk: aggressively manage, consider alternative team process or baseline – seek attention at appropriate management level as defined in the risk management plan.
E1, D1, D2, C2, C3, B3, B4, A5	Low Risk	Acceptable risk: control, monitor – seek responsible work package management attention.
C1, B1, A1, B2, A2, A3, A4	Very Low Risk	Acceptable risk: see above.

Example of a Risk Assessment Template

Likelihood		Risk Index: Combination of Severity and Likelihood				
		1	2	3	4	5
E	Low	Medium	High	Very High	Very High	
D	Low	Low	Medium	High	Very High	
C	Very Low	Low	Low	Medium	High	
B	Very Low	Very Low	Low	Low	Medium	
A	Very Low	Very Low	Very Low	Very Low	Low	

Risk No	Risk Index	Risk in color coding	PBS Level, ID	Sub-System/Equipment	Suggested Owner	Domain/Category	Potential Risk / Risk Title	Impact	Likelihood	Severity	Risk Mitigation	Notes	Originator
	A1 to E5	Very Low to Very High			Organisation, Institution	Tech, Fin, Sched..							
1	C4	Medium	Optics	Core Optics LF and HF	ET Collaboration	Schedule, Technical	A coating meeting the thermal noise and optical requirements of ET-LF has not been tested to date.	It doesn't fill the required specifications / it reduces the performance	C	4	Looking for a new coating technology that meets the thermal noise and optical requirements with the required diameters		G.M

Example of a Risk Management Process ?



Likelihood

	Low	Medium	High	Very High	Very High
E	Low	Low	Medium	High	Very High
D	Very Low	Low	Low	Medium	High
C	Very Low	Very Low	Low	Low	Medium
B	Very Low	Very Low	Very Low	Very Low	Low
A					
	1	2	3	4	5

Risk Index: Combination of Severity and Likelihood

Severity

Risk Register (Example)							
Project ID	Project Name						
Risk Register (Example)							
Risk ID	Description	Category	Severity	Likelihood	Impact	Owner	Status

Examples on Tools used in Risk Management

- **Risk Identification :**

- SWOT
- Delphi Technique : Each subject-matter experts identify their risks in their area of expertise, then a facilitator collects the input from experts, consolidates into a list and then send it again to the experts for them to add ideas until no more ideas can be added.
- The cause and effect Diagram (Ishikawa Diagram) : we go from the cause to the sub-causes to the source of a problem
- Checklists : Risk detected from similar projects

- **Risk Assessment:**

- Risk Assessment Templates

- **Risk Response:**

- Risk Response Planning
- Decision Tree

- **Risk Monitoring:**

- Risk Register

- **Risk Analysis Modeling and Simulation:**

- Monte Carlo Simulation ...

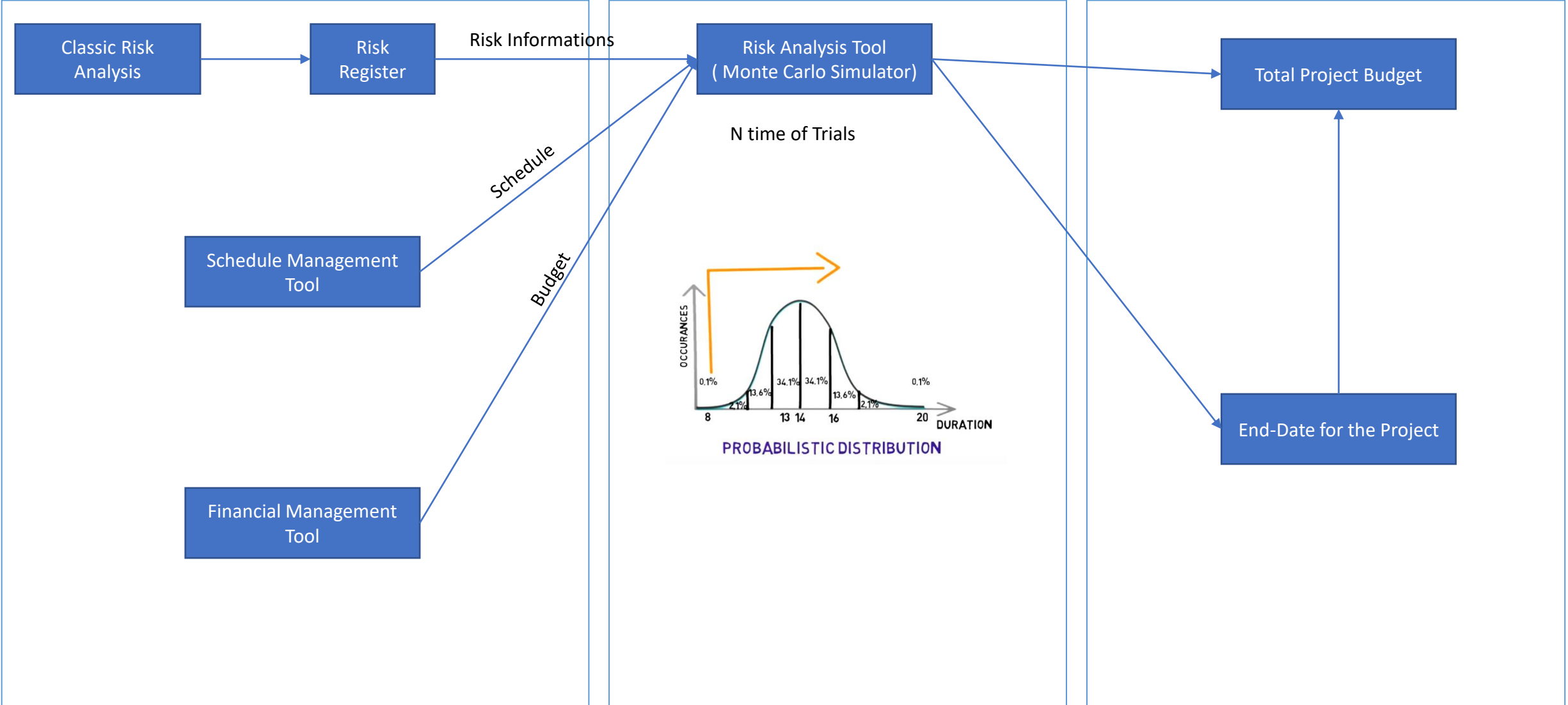
Conclusion :

- In this Presentation:
 - Risk Management was briefly explained,
 - Example of a Risk Management Process was presented

Discussion :

- Einstein Telescope is a huge Project where the amount of Risks is huge; different strategies can be applied to handle them, Example :
 - After classifying Risks by a Project domain (Cost, Technical, Schedule..) we can decide on Starting by Risk Register of a “TBD” number of the most important Risks by domain; To be discussed (?)
 - If this strategy is followed, At what level of PBS we should stop Taking Responsibility on Risk Analysis?
- Tools needed. Integrated in the PLM one?

Annex : ET Probabilistic Risk Analysis Process



Annex : Examples on Technical Risks collected from an ongoing Exercise for testing our Templates

Risk No	Risk Index	Risk in color coding	PBS Level, ID	Sub-System/Equipment	Suggested Owner	Domain/Category	Potential Risk / Risk Title	Impact	Likelihood	Severity	Risk Mitigation	Notes	Originator
	A1 to E5	Very Low to Very High			Organisation, Institution	Tech, Fin, Sched..							
1	D5	Very High	Optics	LF Control Noise	ET Collaboration	Technical	Excess low frequency noise from control loops	Degraded sensitivity, missing the science targets for low frequency GW signals	D	5	Enough diagnostic tools for noise budgeting		J.D
2	D4	High	Interferometer	Control ET-HF	ET Collaboration	Technical	Difficulties to increase the circulating power in the arm cavities due to instabilities	Operation of the detector at risk	D	4	Reduce the circulating power, new control strategy		J.D
3	C4	Medium	Optics	Squeezed Light	ET Collaboration	Technical	Lower level of squeezed light than expected	Sensitivity degraded	C	4	Decrease the optical loss on the path of the squeezed beam		J.D
4	C4	Medium	Optics	Core Optics LF and HF	ET Collaboration	Schedule, Technical	A coating meeting the thermal noise and optical requirements of ET-LF has not been tested to date.	It doesn't fill the required specifications / it reduces the performance	C	4	Looking for a new coating technology that meets the thermal noise and optical requirements with the required diameters	This is a random example	G.M
5	C4	Medium	Optics	Core Optics LF	ET Collaboration	Technical	ET-LF, substrates for the main mirrors do not meet the requirement in size or optical quality	Degraded sensitivity or we must run at lower optical power in case of excess absorption	C	4	More R&D for substrate production. Contact various providers	This is a random example	G.M
6	B3	Low	Optics	Laser ET-HF	ET Collaboration	Technical	Laser not powerful enough, deliver less than the required 700W at 1064 nm (with the good properties)	Can not reach the nominal arm cavity optical power	B	3	Find alternative design		J.D

Annex : Example of a Risk Management Board:

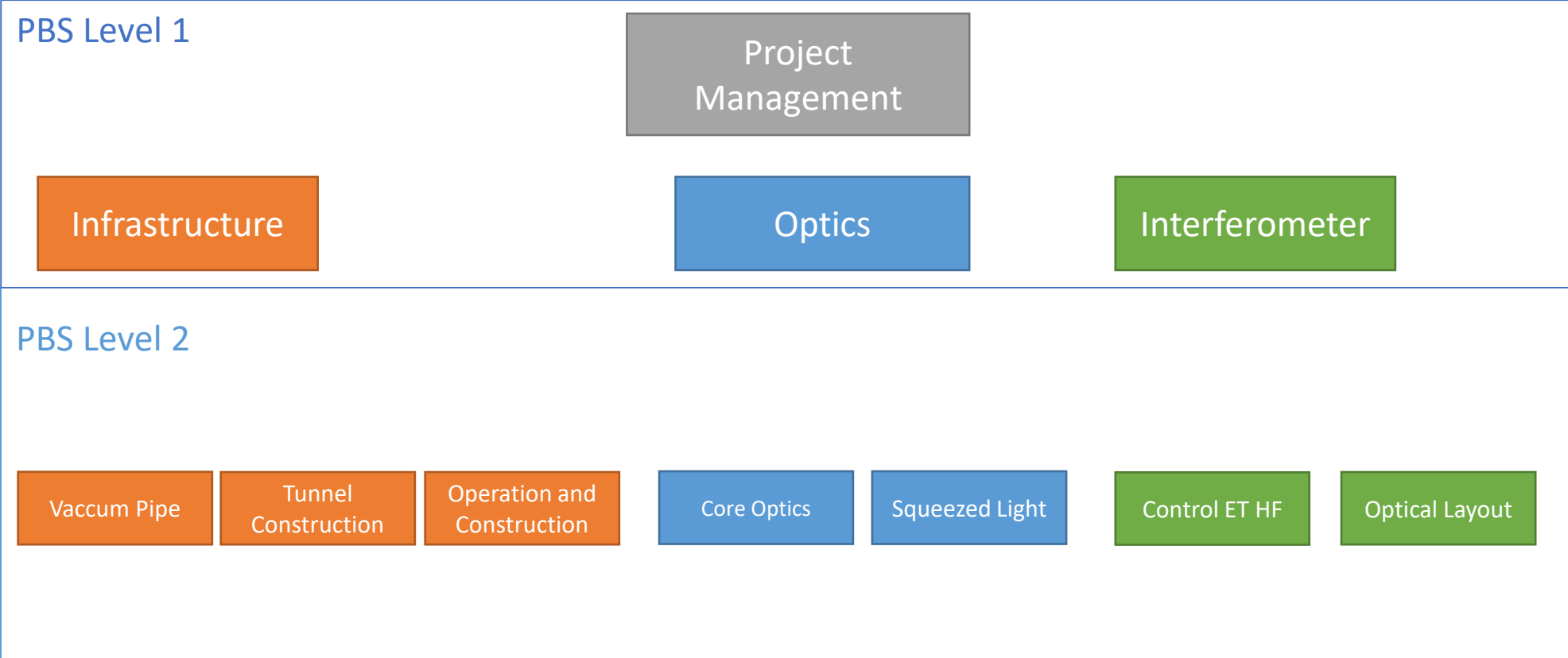
Risk Management Board RMB

Project
Manager (PO)

Risk
Manager

PBS Level 2
Managers (Risks
Owners/
systems)

Experts



Annex : Risk Register Template

Risk Register (Example)														
Project :				Organization :				Source :				Date :		
PBS Level, ID.								Controlled by :				Issue :		
								Supported by :						
RISK SCENARIO and MAGNITUDE :														
No.		Risk Scenario Title:												
Cause and consequence :														
Severity (S)					Likelihood (L)					Risk Index:	Red	Yellow	Green	Risk Domain :
Negligible	Significant	Major	Critical	Catastrophic	Minimum	Low	Medium	High	Maximum		(*)	(*)	(*)	(**)
1	2	3	4	5	A	B	C	D	E					
Risk Decision and Action														
Accept Risk							Reduce Risk							
Risk Reduction Mesures :				Verification means :				Expected risk reduction (severity, likelihood, risk index):						
Action:							Status:							
Agreed by Project Management :											Risk Rank :			
Name:				Signature:										
Date :														
Notes:														
(*) Mark box as appropriate for the value of Risk Index, according to the criteria defined in the risk management policy.														
(**) Indicate Risk Domain (Technical, cost , schedule ..)														

Risk No	Risk Color Code	Risk Title	Assigned to	Category	PBS Level, ID	System/Equipemen	In Progress	Released on	Reviewed On	Resolved On
1	High	A coating meeting the thermal noise and optical requirements of ET-LF has not been tested to date.	Person 1	Schedule, Technical	Core Optics	ET -LF Coating	In Progress	15/09/2023		
2										
3										

Annex : Risk Assessment Template

Risk No	Risk Index	Risk in color coding	PBS Level, ID	Sub-System/Equipment	Suggested Owner	Domain/ Category	Potential Risk / Risk Title	Impact	Likelihood	Severity	Risk Mitigation	Notes	Originator
	A1 to E5	Very Low to Very High			Organisation, Institution	Tech, Fin, Sched..							
1	D4	High	Core Optics	ET -LF Coating		Schedule, Technical	A coating meeting the thermal noise and optical requirements of ET-LF has not been tested to date.	It doesn't fill the required specifications / it reduces the performance	D	4	Looking for a new coating technology that meets the thermal noise and optical requirements with the required diameters	This is a random example	G.M
2	E2	Medium				Cost	Personnel or machine safety incident occurs during project (e.g.laser incident, fire ...)	Project costs and schedule may be Consequenced..	E	2	Safety engineering and procedures included in the design phase. Facility operating plans already include laser and machine safety and personnel training	This is a random example	G.M
3	E3	High				Schedule, Finance	Subsystems not ready to start installation on time, particularly those with long lead procurement and/or long lead assembly/test phases.	Schedule could be delayed and costs may increase.	E	3	Plan for adequate scheduled time and contingency in fabrication/assembly phase.	This is a random example	G.M