ESA Mission Classification Status and Next steps

esa mission classification

Laurent Marchand
Laurent.Marchand@esa.int

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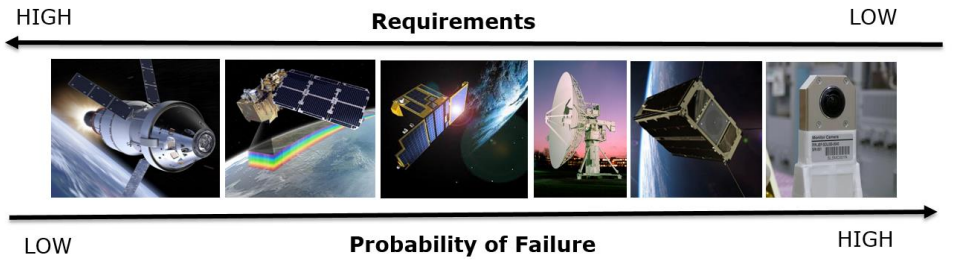
ESA Mission Classification (EMC): Objectives

ESA Mission Classification provides

- ESA programme and project managers a framework to define the appropriate management, engineering and product assurance controls, tailored to the profile of the mission
- A systematic approach for optimising resources in accordance with mission objectives
- A basis for the introduction of novel elements (e.g. Commercial Off The Shelf) and working methods aiming at reducing development time and cost while balancing risk
- ESA & its Member States a new structured framework to manage the programmatic risks

EMC: Main assumptions

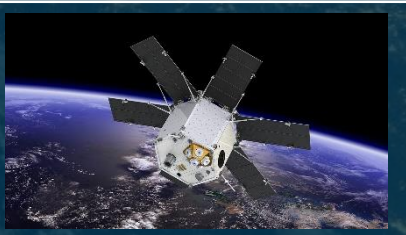
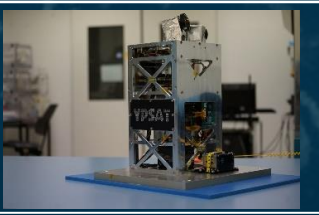
- ESA mission classification encompasses one-off missions (man, non-manned missions), recurring operational spacecraft, IOD/IOV and cubesats.
- Satellite mega-constellations and launchers are not addressed
- A specific mission class can contain units/payloads with different classes. Namely, mission class is originally defined at project/mission level, but it's possible to conceive different classes for different mission elements on-board the same S/C.
- More flexibility is given to industry as a function of class of the mission (highest flexibility and associated risk for class Delta), but also more reliance of ESA on contractor's internal processes, more simplification of the documentation and required reporting, at the cost of the less visibility given to ESA and more delegation of responsibility and of risk is given to industry
- Requirements do not necessarily depend if an equipment is recurrent or not. Heritage will be reflected in equipment category defined during EQSR (Equipment Qualification Status Review)
- Possibility to combine deliverable documents mainly for class Gamma and Delta missions
- Security and safety (comprising space debris requirements/policy) are not subject to tailoring
- Additional tailoring (up and down in addition to pre-tailoring) still possible at project level



ESA Mission Classification (EMC)

EB 159 January 2024 major outcomes:

- 4-class ESA Mission Classification instead of 5
- For all new ESA missions: **mandatory classification** (Alpha, Beta, Gamma, Delta) during the phase A (to be re-confirmed at IPRev).

MISSION ALPHA: Top class missions, Extremely critical and strategic for ESA. Budget > 400 M€ Lifetime > 7 Years. Requirements are high, risk is very low.	
MISSION BETA: High class missions, Highly critical and strategic for ESA Budget 200 to 400M€, Lifetime 5 to 7 Years, Requirements are relatively high, and the risk is low.	
MISSION GAMMA: Medium class missions, usually hosting New Space type of mission. Medium critical and strategic for ESA Budget 25 to 200M€ Lifetime 2 to 5 Years, Requirements are moderate with a non-negligible risk.	
Mission DELTA: Low class mission, Low critical and strategic for ESA budget < 25M€, Lifetime <2 years. Requirements are very limited with a high risk.	

ESA Mission Classification:
4 Mission Classes scheme (EB January 2024)

Mission Characteristics Criteria & Related Weighting Factors		Class Level: Alpha	Beta	Gamma	Delta	Input Score (1/2/3/4)	Weighted Score	
Acceptable Risk Risk of mission failure which is agreed acceptable to management		LOW →			HIGH			
Criticality to Agency Strategy Flagship mission, international co-operation, impact of strategic ESA goals and image.		Extremely Critical	Highly Critical	Medium Criticality	Low Criticality			
WF (10/20/30 %):	20		x			2	0.40	
Mission Objectives Directorate priority and purpose e.g. In orbit demonstration, educational.		Top Priority	High Priority	Medium Priority	Low Priority			
WF (10/20/30 %):	20		x			2	0.40	
Cost Cost at completion inc. Phase E1		> 400 M€	200 - 400 M€	25 – 200 M€	< 25 M€			
WF (10/20/30 %):	20				x	4	0.80	
Mission Lifetime Nominal mission life duration		> 7 years	5 -7 years	2-5 years	< 2 years			
WF (10/20/30 %):	20		x			2	0.40	
Mission complexity Design interfaces, unique payloads, new technology development.		Extremely Complex	Highly Complex	Medium Complexity	Low Complexity			
WF (10/20/30 %):	20				x	4	0.80	
Total % (must be 100):	100					**Total (*):**	**2.80**	
						CLASS:	**Gamma**	<<< Resulting Mission Class

WF: Weighting Factor (10, 20, 30)

>>> Use pull-down menu to select value

Alpha: Critical strategy/safety (e.g. manned missions) (High level of requirements and low risk). Performances should be met whatever it takes

Beta: Finding the best compromise between risk and cost to deliver the mission

Gamma: Mission is designed according to a hard cost limit (affordability approach)

Delta: Almost full delegation to industry (Minimum requirements but increased risk)

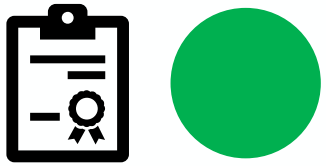
The class of the Mission obtained here is only an indicative recommendation. ESA Project Team may still decide to justify a higher or lower class during IPRev.

Expectation on Mission Classification

Class	Alpha	Beta	Gamma	Delta
*only indicative typical	JUICE	Harmony	IOD/IOV/Cheops New Space	EDU / Nano / IOD/IOV CubeSats
Success Prob	max	95%	80%	40%
Nominated saving	0%	15%	40%	90%
Schedule Savings	0%	20%	50%	80%
Requirements =Q+E Branch				
ESA Mgmt involvement = M-Branch				
ESA Team Risk Mindset = M-Branch + int l processes				

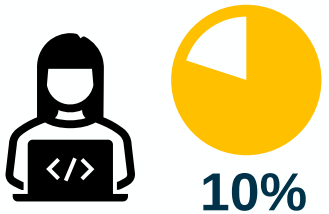
*all numbers are only indicative

Status of pre-tailoring Q, E, M



ECSS-Q / Q-Branch:

- Space Product Assurance ECSS-Q: covering product/Quality assurance, dependability & safety, materials & processes, SW product assurance req, recently revisited SW PA, some effort s still required for M&P (in particular Assembly)



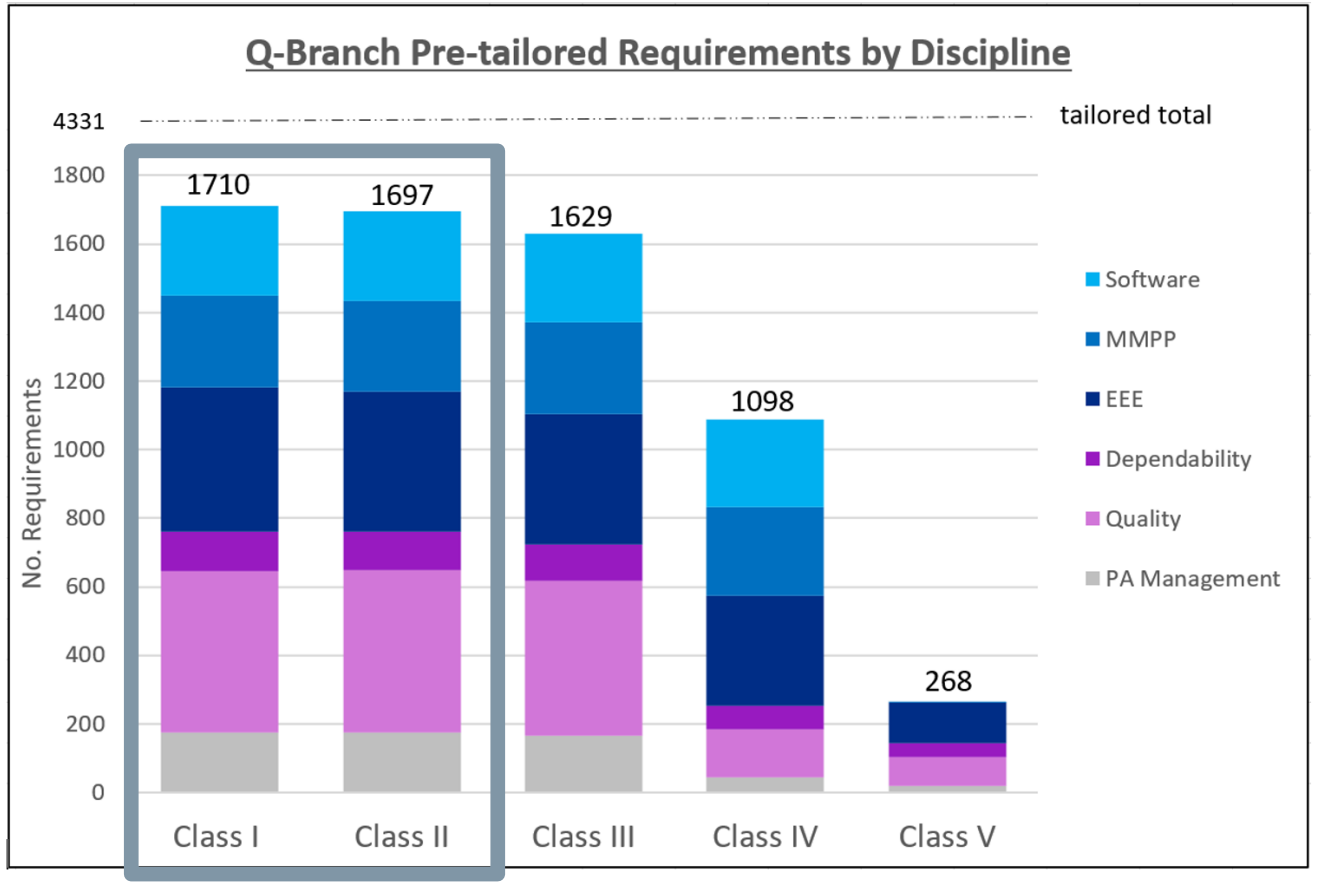
ECSS-E / E-Branch:

- Space Engineering: covering testing, electrical engineering, structures and fracture control: **results can still be optimised; expanding the exercice and asking industry ECSS NG to do it under ESA guidance**

ECSS-M / M-Branch:

- Space Project Management: covering project planning and implementation, organization/conduct of **reviews, configuration management, cost & schedule management, risk management WG in progress**.

Status ECSS-Q (Level1 stds)Branch Pre-tailoring

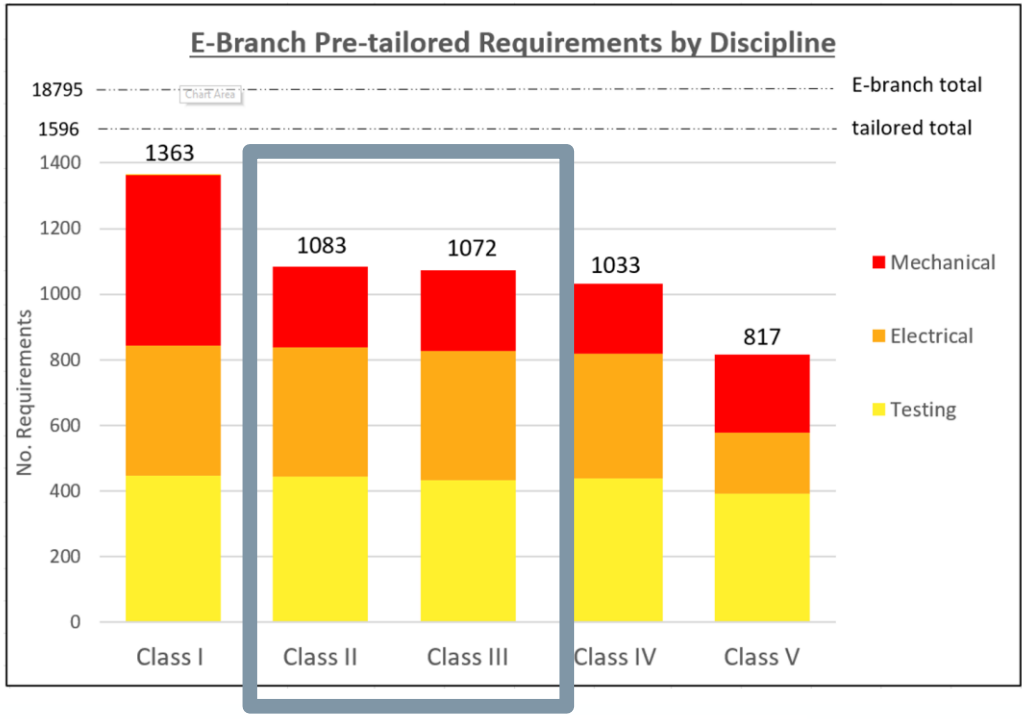


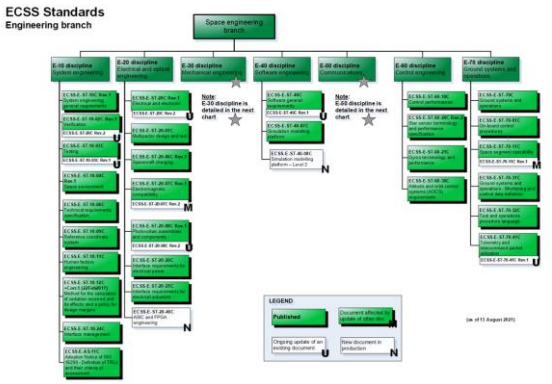
Important: Not only pre-tailoring is available , TEC-Q have also simplified the PARD approval process and process flow ESA missions having used the mission Classification PARD Template for their specific class.

The ESA Mission Classification allows to reduce the number of Approval required for the PARD by a factor 6 and time of Approval by ~ 1/3!!!

Today Q-Branch completed but we are still following up with PA SW and M&P requirements to see if figures can still be reduced.

Status ECSS-E (Level 1 Stds) Branch Pre-tailoring





Only E Branch standards that were expected to have the largest impact in terms of cost and time saving were pre-tailored (ie 4 stds/63; 1596 requirements out of 17568) and the classification work was done when it was not yet fully clear what is the level of risk that can be taken for a certain class of mission.

This partly explains the small difference between the five classes.

It was therefore decided to have a second look at those 4 standards and see if the pre-tailoring of outstanding standards that have not been looked at would allow a better distribution of the number of requirements / class of mission. It is expected that those tasks will be carried out by the industrial body which will be selected for ECSS NG.

ECSS-M (Level 1 Stds) Branch Pre-tailoring

- Standard ESA Mission Classification ECSS-M Branch pre-tailoring for each class of mission. Working Group has been KO with a mixed of Project Managers and Project Cost Controllers.
- Decision to start with one standard only: ECSS-M-ST-10C Rev.1 Project planning and implementation
- Work started but progress a bit slow so far and some focus on classes Gamma, Delta. tbc if no tailoring applicable to Alpha and Beta?
- Expected work duration 6 months

Conclusion 1/2

- The ESA Mission Classification scheme is now driven by a Steering Board co-chaired by D-TEC Director and ESA Inspector General DG-I, with Program Managers (NAV, HRE, EOP) and Contracts H/Dep + TEC-Q.
- With regards to Q-branch a majority of new ESA projects now used the pre-tailoring results for establishing their PA requirements: NGGM, HARMONY (class Beta -EOP), EnVision (Class Beta - SCI), MicroGeo (Class Gamma – CSC), AURORA & VISDOMS (Class Gamma – OPS), AOS-P, RAMSES (Class Gamma – TEC).

Timeline: E Branch and M branch pre-tailoring to be completed by the end of 2024. Next communication to ESA Executive, Q1 2025. Endorsement of ESA Mission Classification full applicability during Ministerial Council 2025.

- Other parallel initiatives related to the Mission Classification:
  - Adapting ESA Projects corporate reviews composition and procedure to the class of the mission
  - Adapting ESA review team & structure for review and selection of project Industrial proposals to the class of the mission
  - Adapting the project team composition and size to the class of the mission

Conclusion 2/2

Alpha	Beta	Gamma	Delta
Ariel	EnVision	ARRAKHS	Comet-I Probe
ARGONAUTE	Smile	ALTIUS	YPSAT
VIGIL	Comet-I (S/C)	SCOUTs	AcubeSat
EarthCARE	S1CD	EPS-Sterna	UCAnFly
NGGM	S2CD	Greek	LEDSAT
MTG	S3CD	Camila	3Cat-4
MetOP-SG	S4	ESCA	ISTsat-1
Aeolus-2	S5		
IRIDE	S6 AB		
	S6 C		
	CO2M		
	CIMR		
	CRISTAL		
	CHIME		
	LSTM		
	ROSE-L		
	S1NG		
	S3NG-A		
	BIOMASS		
	FLEX		
	FORUM		
	HARMONY		
	TRUTHS		

WORK IN PROGRESS
Exercise to be redone and extended to other Application Domains

THANK YOU !

QUESTIONS ?