ESA Mission Classification Update 2026

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BACKGROUND

- **ESA Mission Classification** with associated tailoring rules defined according to ESA's stakeholders **expectation of mission success** traded against mission **implementation schedule and cost**

- **Based on application of 4 criteria**,

- **Based on 4 classes of missions**

- **Define the pre-tailoring of (ECSS) requirements** for each class of mission (but not only…)

- **Establish the acceptable risk level**, for the mission as early as possible in the process and dependending on the type of mission, eg human space flight mission, small robotic mission etc.

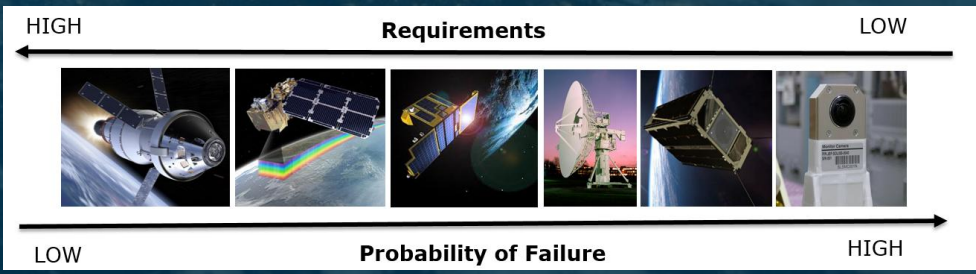
Main assumptions

- **Based** ESA mission classification encompasses one-off missions (man, non-manned missions), recurring operational spacecraft, IOD/IOV and cubesats.

- **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 (Ex. Comet-I and the Probe B2)

- More flexibility is given to industry as a function of class of the mission (**highest flexibility and associated risk for class Delta**), more simplification of the documentation and required reporting. All at the cost of less visibility given to ESA and more delegation of responsibility and of risk given to industry

- Additional tailoring (up and/or down) still possible by project



Status from ISD 2024

In January 2024, ESA's Board of Directors had confirmed:

Validation of 4 classes of ESA missions:

- **Alpha (α):** => Meeting performances whatever it takes α
- **Beta (β):** => Finding the best compromise between acceptable risk and cost
- **Gamma (Γ):** => Affordability, designing the mission vs hard time and cost limit
- **Delta (Δ):** => Almost full delegation to Industry

Mission Class for all ESA Missions to be identified:

- during Phase A
- to be re-confirmed at Integrated Project Review (IPRev)

Endorsement of ECSS Q-Branch the pre-tailoring and availability of Product Assurance Requirement Document (PARD) templates per Mission Class.

This was validated later in June 2025 by ESA Member States during the ESA Council Meeting and approval was given to start the 2nd phase of the ESA Mission Classification

Pre-tailoring: ECSS Q Branch
(Completed during Phase 1)

ECSS-Q / Q-Branch:

- Space Product Assurance ECSS-Q: covering product/Quality assurance, dependability & safety, materials & processes, SW product assurance EEE and RHA. Pre-tailoring completed.
- Pre-tailored PARD templates for each class of mission.
- Simplified PARD approval process flow for classified ESA missions and pre-tailored PARD.
- Since Q1 2024, a majority of ESA projects were piloted for ECSS Q-Branch for different applications (EOP, SCI, CSC, HRE, OPS…) and from different classes.

Retrofitting of ECSS-NG starting now with RAMS (ECSS-Q-ST-30) as pilot exercise

ESA Mission Classification Phase 2

Status & way forward of the ESA Mission Classification were presented to ESA Council in June 2025.
The following next steps were agreed and are now implemented like a project with different WPs

Agency 's Processes Streamlining

(DG-I, IPMA, SPMB)

- Management
  - •Procurement and contract management
  - •Planning control
  - •Reviews
  - •Risk and schedule management
  - •Reporting
- Technical
  - •ESA oversight
  - •Documentation
  - •Operations (including ground segment)
- Infrastructures
  - •Data Management
  - •Security Management

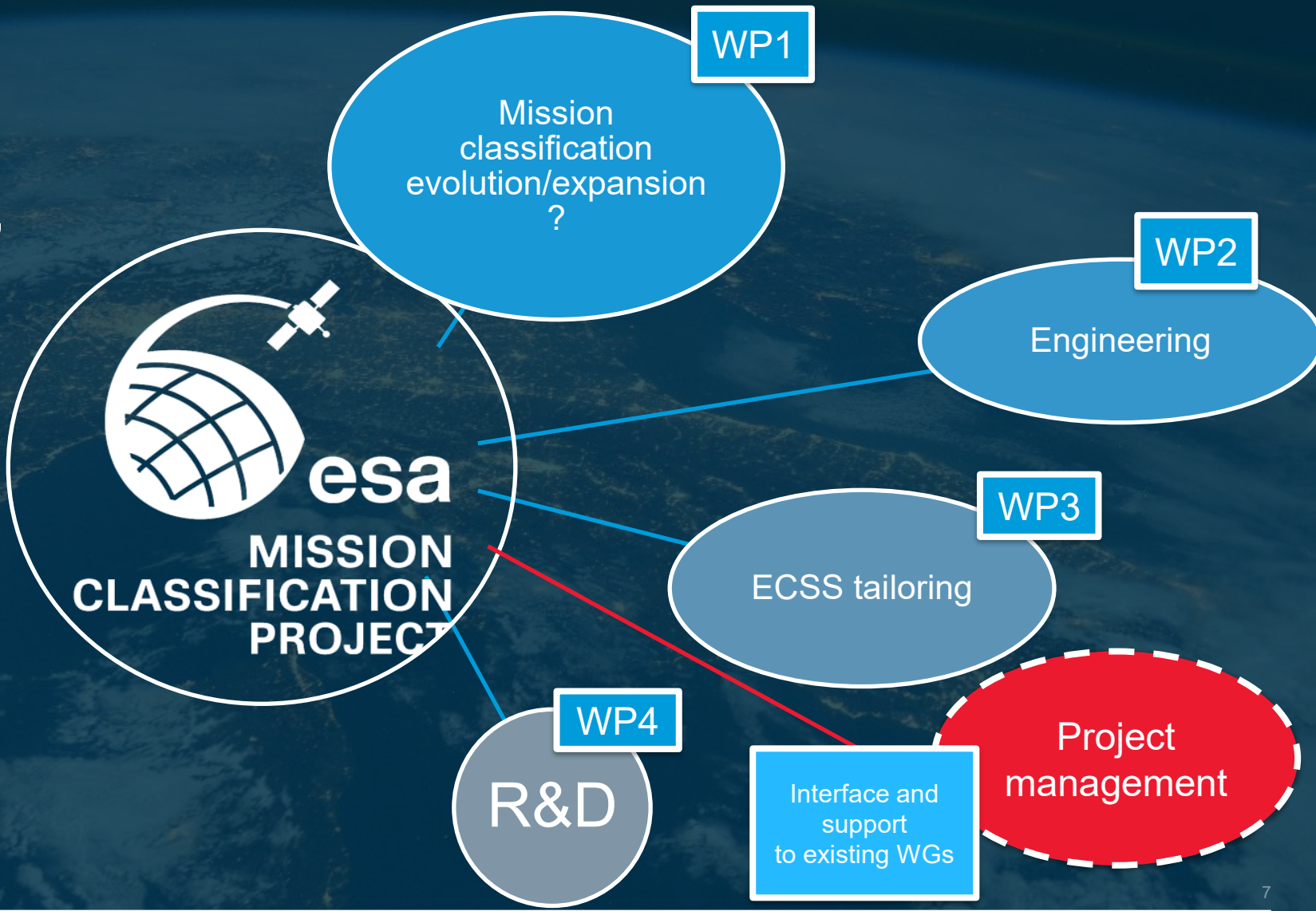
Technical Activities

(D-TEC)

- Expansion of ESA Mission Classification to Advanced Technology Developments;
- Retrofit of ECSS NG into ESA Mission Classification for ECSS Q & E branches for pre-tailoring;
- PARD (PA Requirements Document) templates made available to public;
- Definition / Qualification of Associated Risk.

ESA Mission classification Phase 2 Implementation project

Objective:
Implement ESA Mission Classification technical topics as outlined in ESA/C(2025)83, in coordination with WGs addressing processes improvement in the frame of ESA transformation (STARS, IPMA, SPMB, etc.)



DG-I, IPMA, SPMB…

D-TEC

2026 - 2027 Timeline

WP1: applicability of mission classes

COMPLETED

DG-I Management activities: MARD

COMPLETED

now

WP3: ECSS NG tailoring

E Branch and Q Branch. Ongoing, to be completed by Q4 2026 / Q1 2027 (depending on publication of ECSS Issue D (ECSS NG)

WP2: additional processes: Engineering and Procurement

Q4/2026: reporting, procurement, OIRD, SRD, etc.

WP4: R&D

Ramp-up in 2027: tailoring of requirements for technology developments based on targeted mission classes

WP1 Key outcomes 1/3: Applicability of mission classification

Question:

- Is the ESA mission classification applicable to other ESA project types (PPP, service procurement..)? If applicable, how? To which extent?

Recommendations:
Notion of mission class can be applied to all projects where ESA is involved in the development of space segment asset (irrespective of final ownership).

Rationale:
- Benefit: common reference/benchmark across the Agency
- PPP represents a significant part of ESA activity (~20%, budget-wise)

But **implications** of mission classes on projects set-up is not necessarily the same for all project categories (see next slide)

WP1 Key outcomes 2/3: Applicability of mission classification

- Default approach is to apply mission assurance framework commensurate with risk exposure, but up- or down-grading can be decided/proposed, also per area (“Risk posture”) → specific project tailoring
- Importance of ESA role in the project set-up, beside mission class
- Natural correlation expected: “cooperative” <-> Gamma or Delta. This is confirmed by assessment of current ESA portfolio
- For Class Delta, the driver for some reliability/quality requirements may come from ESA policies (space debris, 90% reliability..)
- For industry-led projects, the ESA ECSS pre-tailoring per class can be used to benchmark against industry proposed standards

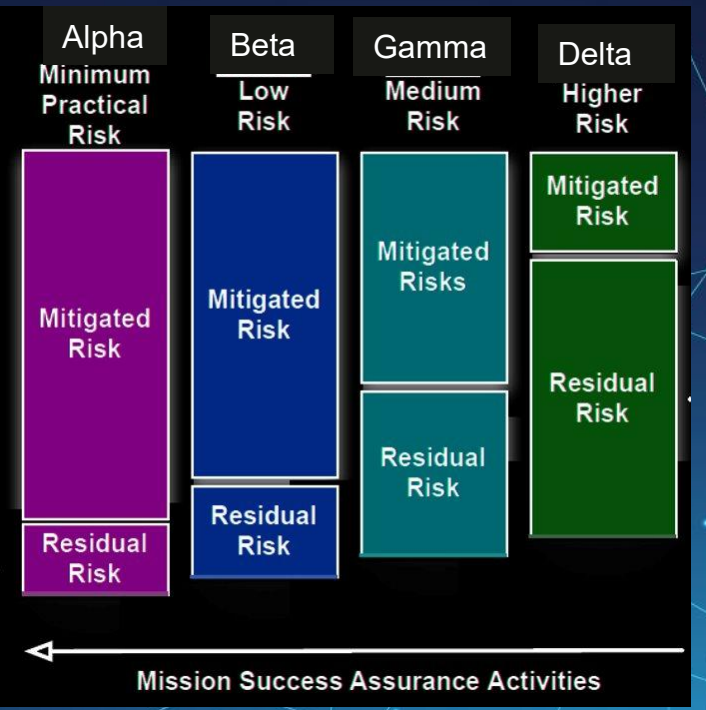
WP1 Key outcomes 3/3: Mission classification criteria

Questions:

- Is there a need to evolve/add criteria in the mission classification?

Recommendation:
Update the thresholds of the cost criteria for each class of mission:

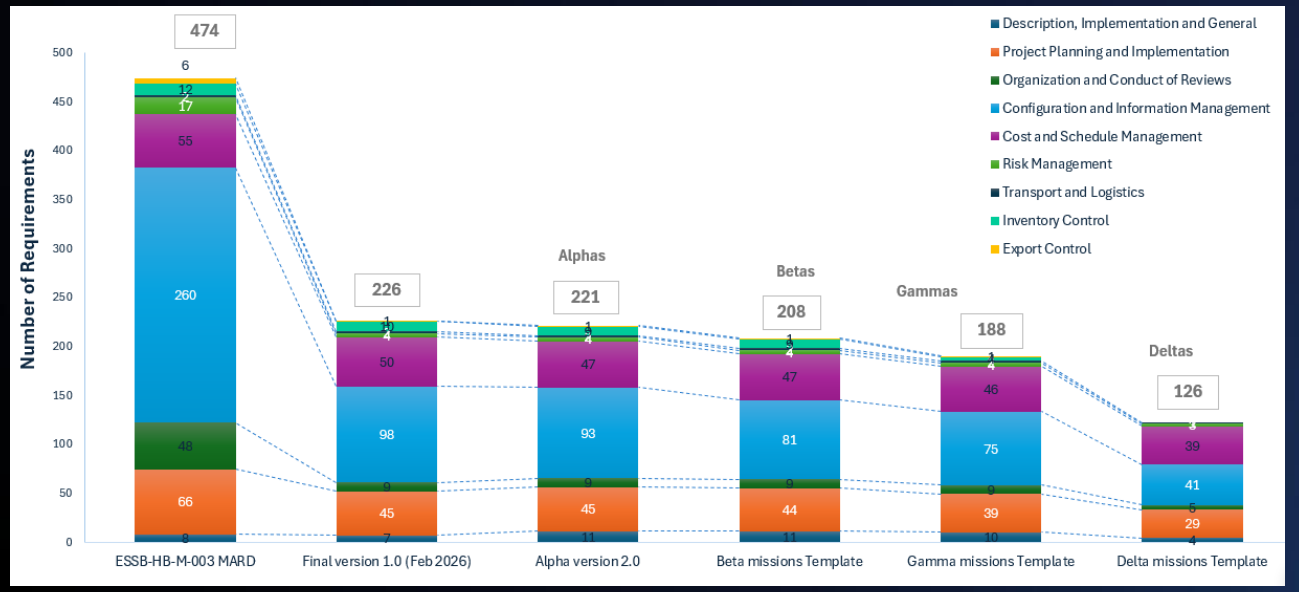
Acceptable Risk *Risk of not fulfilling some or all of the mission objectives*	LOW → ACCEPTABLE RISK → HIGH Alpha	Beta	Gamma	Delta
Criticality to Agency Objectives, Strategy and Image *Flagship mission, international cooperation, impact on strategic ESA goals and image*	Extremely Critical	Highly Critical	Medium Criticality	Low Criticality
Cost *Cost at completion to ESA, e.c. 2026, excluding launch cost*	> 700 M€ Was > 400	350 – 700 M€ Was 200 -400	40 – 350 M€ Was 25 - 200	< 40 M€ Was < 25
Mission Lifetime *Nominal mission life duration*	> 7 years	5 – 7 years	2 – 5 years	< 2 years
Mission complexity *Technical challenges, tech maturity, interfaces complexity*	Extremely Complex	Highly Complex	Medium Complexity	Low Complexity

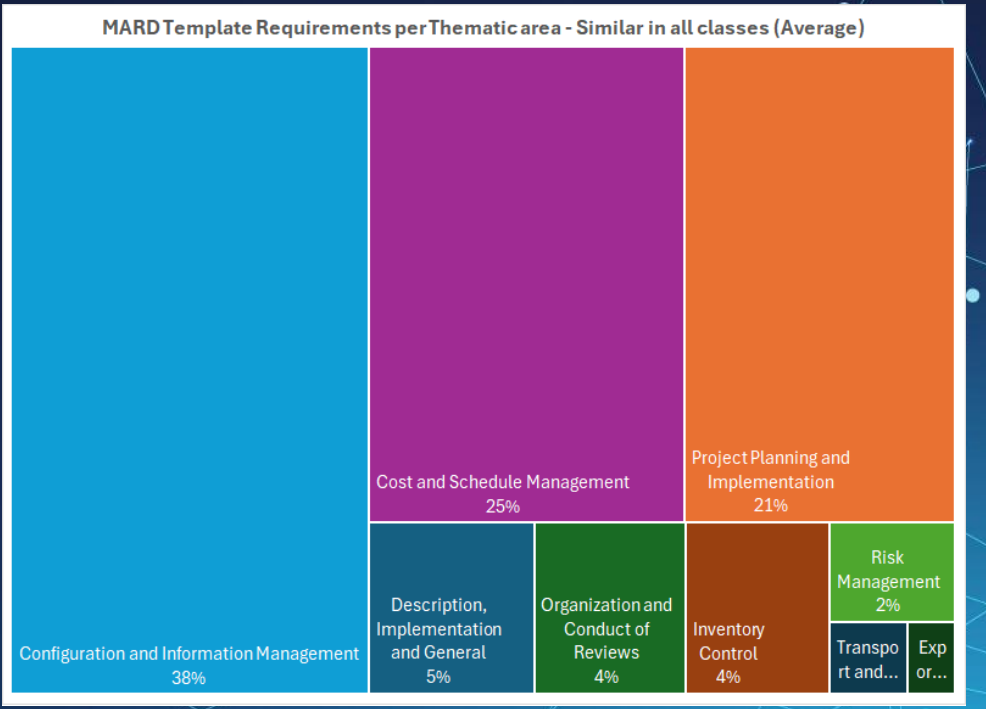


WP Project Management
Key outcomes 1/2

- Pre-tailoring of MARD (Management Requirement Document) for each class of mission. Lead by ESA Inspector General Office (DG-I). Alignment completed with process owners and representatives from Contracts, Security, Trade Control, Inventory Management, Financial Audit → **modification identified to introduce in alpha template as well + key outcomes:**

- Requirements distribution similar in all mission classes





WP Project Management
Key outcomes 2/2

- Limited difference between Alpha and Beta classes.
  - ➢ Not surprising for Management Requirements that are general.
  - ➢ Similar feedback in other (technical) tailoring working groups

- Beta and Gamma Class have a wide range (350-700 M€ and 40-350M€, excluding launch) → **single 'cover all' approach difficult.**

- Importance of DRD (Documents Requirement Definition):
  - ➢ Focused on content and not structure
  - ➢ Balance between prescription and 'educational' value

WP3 ECSS Pre-Tailoring

ECSS Pre-tailoring (WP3) encompasses:

- **Completed:** Pilot case: pre-tailoring one of the ECSS E-branch (engineering) based on ECSS issue D = ECSS Next Generation (NG) to be published. ECSS-E-ST-10-03 issue D / Testing. Overall results: next 2 slides
- **On-going:** Pre-tailoring of a first batch of ECSS E-branch standards based on the ECSS NG (Issue D)
- **To be KO:** Pre-tailoring of the 2nd (final) batch of ECSS E-branch standards based on the ECSS NG (Issue D)
- **Just starting:** Retrofit of ECSS NG for ECSS-Q branch (PA/QA and associated disciplines) format (Requirements vs Means of Compliance - MoC) in the available PARD templates: work just started for RAMS based on final draft ECSS-Q-ST-30D (In approval with ECSS TA)

WP3 ECSS Pre-Tailoring:
Normative Provisions categories identified in ECSS NG:

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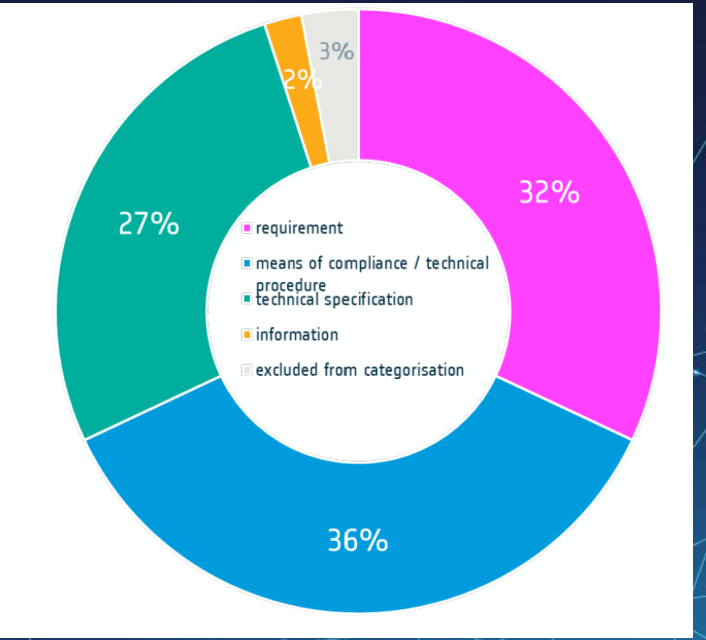
	NORMATIVE PROVISION	SET OF NORMATIVE PROVISIONS
WHAT WHEN WHO	**Requirement (ST)** Normative provisions, not categorised as MoCs, TPs, TS, addressing: → A specific need → Can be made directly applicable through contracts → Answering the questions *What*, *When*, and *Who*	**Technical Specification (TS)** Comprehensive set of normative provisions that define specific interfaces, technical characteristics, capabilities or protocols, environment, or provide prescriptive and/or normative definitions of interfaces, protocols, other controlling standards such as encoding approaches, or terminology. NOTE: TS are identified at clause level and/or document level.
HOW	**Means of Compliance (MoC)** Normative provisions providing ways to support compliance with the parent requirement(s).	**Technical Procedure (TP)** Comprehensive set of normative provisions describing a sequence of steps that provide ways to support compliance with the parent requirement(s). NOTE: TP are identified at clause level and/or document level.
	If MoC/TP are not tailored up by the customer, the supplier has two options: 1. apply the MoC/TP as they are; 2. propose Alternative Means of Compliance (AltMoC) to be approved by the customer. Compliance with the parent requirements is demonstrated by showing equivalence between the AltMoC and the MoC/TP.	
CONTEXT	Informative content provided within standards and handbooks, to support the application of the normative provisions.	



WP3 ECSS Pre-Tailoring: Pilot Case ECSS-E-ST-10-03 issue D
Key outcomes

A

APPLICABLE / The associated requirement is Applicable to the relevant Mission Class.

T ALT

TAILORED / The associated requirement can be Tailored down, as per text in the Note.

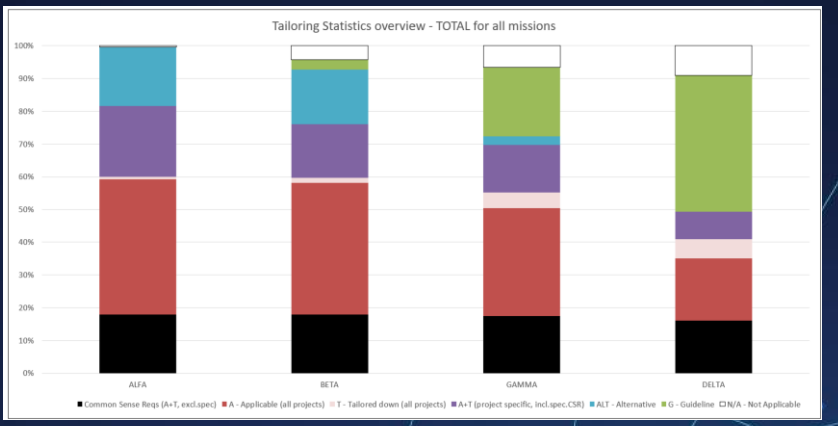
ALTERNATIVE / Alternative Means of Compliance can be proposed: it will become the baseline for the specific Project only if and once approved by the Customer (*note: the ALT tailoring option is used only for Means of Compliance*).

G

GUIDELINE / The associated requirement is indicated as Guideline for the relevant Mission Class.

N/A

N/A / The associated requirement is considered Not Applicable for the relevant Mission Class.



Total	ALFA		BETA		GAMMA		DELTA	
A	356	80.5%	325	73.5%	279	63.1%	179	40.5%
T	5	1.1%	11	2.5%	29	6.6%	39	8.8%
ALT	79	17.9%	74	16.7%	12	2.7%	0	0.0%
G	0	0.0%	13	2.9%	93	21.0%	184	41.6%
N/A	2	0.5%	19	4.3%	29	6.6%	40	9.0%
Total	442	100.0%	442	100.0%	442	100.0%	442	100.0%

Total	ALFA		BETA		GAMMA		DELTA	
Common Sense Reqs (A+T, excl.spec)	79	17.9%	79	17.9%	77	17.4%	71	16.1%
A - Applicable (all projects)	183	41.4%	178	40.3%	146	33.0%	84	19.0%
T - Tailored down (all projects)	3	0.7%	7	1.6%	21	4.8%	26	5.9%
A+T (project specific, incl.spec.CSR)	96	21.7%	72	16.3%	64	14.5%	37	8.4%
ALT - Alternative	79	17.9%	74	16.7%	12	2.7%	0	0.0%
G - Guideline	0	0.0%	13	2.9%	93	21.0%	184	41.6%
N/A - Not Applicable	2	0.5%	19	4.3%	29	6.6%	40	9.0%
Total	442	100.0%	442	100.0%	442	100.0%	442	100.0%

WP3 ECSS Pre-Tailoring
ECSS-E Branch (issue D / NG) pre-tailoring

- Identification of 2 batches in 2026, among ECSS-E documents that are not (quasi) entirely technical specifications

Batch 1: in progress: all documents covering general requirements per domain

ECSS-E-ST-10-02D	Verification
ECSS-E-ST-10D	System engineering general requirements
ECSS-E-ST-20D	Electrical and electronic
ECSS-E-ST-20-08D	Photovoltaic assemblies and components
ECSS-E-ST-31D	Thermal control general requirements
ECSS-E-ST-32D	Structural general requirements
ECSS-E-ST-33-01D	Mechanisms
ECSS-E-ST-35D	Propulsion general requirements
ECSS-E-ST-40D	Software
ECSS-E-ST-50D	Communications
ECSS-E-ST-60-30D	Satellite Attitude and Orbit Control system requirements

Batch 2: KO Q4 2026: remaining documents that are not (quasi) entirely technical specifications

ECSS-E-ST-10-24D	Interface management
ECSS-E-ST-20-01D	Multipaction design and test
ECSS-E-ST-20-06D	Spacecraft charging
ECSS-E-ST-20-07D	Electromagnetic compatibility
ECSS-E-ST-20-40C	ASIC, FPGA and IP Core engineering
ECSS-E-ST-31-02C Rev.1	Two-phase heat transfer systems
ECSS-E-ST-32-01C Rev. 2	Fracture control
ECSS-E-ST-32-02C Rev.2	Structural design and verification of pressurized hardware
ECSS-E-ST-32-03C	Structural finite element models
ECSS-E-ST-32-08C Rev. 1	Materials
ECSS-E-ST-32-11C	Modal survey assessment
ECSS-E-ST-35-01C	Liquid and electric propulsion for spacecraft
ECSS-E-ST-35-02C	Solid propulsion for spacecraft and launchers
ECSS-E-ST-35-06C Rev.2	Cleanliness requirements for spacecraft propulsion hardware
ECSS-E-ST-35-10C	Compatibility testing for liquid propulsion systems

Expected completion of the work: between now and beginning of 2027 depending on the WGs. Propulsion already completed. Common feedback: ECSS NG was a categorization of the requirements but we could go much further in reducing them by proper maintenance of the existing standards!

Conclusions

Status of other WPs:

- WP2: Engineering = Generic system requirements, Operations related requirements (OPS from ESOC), Documentation requirement (linked to ECSS item). Preliminary categorisation of operational requirements completed by ESOC, linkage to ESA Mission Classes remains to be done.
- WP4: R&D activity = Methodology to classify R&D activity; customisation of product/service technical requirements to targeted mission class. Preliminary work done but need to ramp up in 2027.

Other activities:

- Procurement: WG lead by ESA contract department to look at legal and contractual requirements and processes as a function of the mission class (timeframe 2026)
- ESA Projects corporate reviews composition and procedure (first outcomes from DG-I available internally but not only dependent on the class of mission)
- ESA review team & structure for review and selection of project Industrial proposals to the class of the mission (discussed in the context of the procurement WG)
- Project team composition and size adaptation to the class of the mission (DG-I/IPRM.SPMB discussions)

Take away

- All WGs and statistics report the Limited difference between Alpha and Beta classes in terms of final number of requirements after pre-tailoring

=> potential to reduce to three classes with ‘flagships’ / ‘ad-hoc’ for large projects (currently Alpha)????

ESA Mission Classification

Acknowledgement:
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Thank you!

Questions?