ECSS: AN ADDED VALUE TOOL FOR THE EUROPEAN SPACE INDUSTRY

THE STRENGTHS AND LINES OF IMPROVEMENT OF A CRITICAL TOOL FOR EUROPEAN SPACE INDUSTRY PROCUREMENT

Table of contents:

Executive summary 2
1) ECSS is going through a period of changes and risks/uncertainties 3
2) The importance of ECSS for the European space industry 3
ECSS improves the robustness of the European space systems and their supply chain 3
ECSS standards are the result of an open process 4
The ECSS system is a major tool for industrial policy 5
ECSS is preparing the future 5
A major impact on space programmes procurement 6
A tool for international presence 6
Role of Eurospace 6
3) How can ECSS be improved 7
Simplification (ECSS NextGen) 7
Industrialisation and keeping up with new industry practices 7
4) Conclusion 7

Executive summary

ECSS (European Cooperation for Space Standardization) is the standardisation system used in Europe as a reference for the space industry. ECSS standards, and their companion standard and certification set of the ESCC[1], are developed jointly by the supplier industry and the customer entities, under the coordination and technical expertise of ESA. They are available to all European stakeholders, and regularly updated and maintained with the direct and voluntary contribution of the industrial community. Thus, ECSS (and ESCC) standards are driven by the community at large, to ensure they are implementable, efficient and aligned with both customer expectations and supplier capabilities.

ECSS standards provide a complete set of management, engineering and quality assurance requirements, ensuring that space systems are developed and produced towards high performance and reliability taking into account sustainability aspects, and in compliance with European applicable regulations. These standards are open-source and easily accessible.

The use of ECSS standards in a contract is the result of a process called **tailoring**, during which the customer/supplier will choose which standards and technical requirement will apply, depending on the risk assessment of the mission and the budget. **It is the customer who determines which standard and technical requirements the suppliers will have to comply with.**

Within the ECSS system, the supply chain shares the same standards and principles for management, engineering, test and quality assurance; it operates in a stabilised environment allowing predictability and trust with controlled risks for both the suppliers and the customers.

The ECSS system has proven to be a critical tool for industrial policy by ensuring robustness of European space systems and their supply chain, by becoming essential in procurement activities, and by being a major help for commercial and export customers.

This system is currently undergoing major improvements aiming to make it simpler to use, especially for new actors of the European space industry, as well as to update it to modern industry practices: most specifically industrialisation, mass production of space systems and the use of digital tools. **These changes are welcome, and the industrial stakeholders advocate for a continued support in that regard.**

In parallel, there are also a number of changes both at EU and ESA level that are expected to impact the ECSS. In this regard, the European space industry, represented by Eurospace, considered important to recall and promote its advantages while also proposing improvements.

This paper is organised in four parts:

1) The changes and risks ECSS is currently going through;
2) The importance of ECSS for the European space industry;
3) Proposed lines of improvement by the industry;
4) Conclusion with Industry recommendations;

[1] *European Space Components Coordination: the standardisation and certification body for European qualified space electronic and electrical components is notably in charge of the Q60 and E60 branches of ECSS standards*

1) ECSS is going through a period of changes and risks/uncertainties

Standards in the space sector have historically been considered a very technical topic; nevertheless, recent evolutions in the sector are giving it a **political dimension with expected significant impact on Industry activities.**

In particular, the Commission and the High representative of the Union for Foreign Affairs and Security Policy announced in their Joint Communication "An EU Approach for Space Traffic Management" (JOIN (2022)4) the intention to **"facilitate the development of STM standards… and promote their implementation"**; an intention confirmed in the more general Communication "An EU Strategy on Standardisation" (COM (2022)31). In addition, in the Joint Communication "European Union Space Strategy for Security and Defence" (JOIN (2023)9), the Commission also announced its intention to propose systematic integration of relevant security standards in the early design phase of space systems delivering essential services. **It is now expected that the Commission will propose to implement these intentions through the future "EU Space Act", to be issued in 2025.**

Meanwhile, **the ECSS system faces a certain number of flaws and rightful criticisms**. As a result of its large technical heritage, **ECSS has a very large number of technical requirements** that can be made applicable (almost 30 000). **Its documents architecture, based on disciplines rather than products[2], can be confusing**, with many documents referencing other documents. **For newcomers and small players especially, it is hard to follow and can be time-consuming to use.**

These criticisms may lead to **risks of a disinvestment in ECSS processes, from original stakeholders in industry and agencies**. Even if ECSS is engaging on a simplification of all existing standards as well as the development of a new branch of standards (i.e., the I-Branch, dedicated to industrialisation), there are tangible risks that this disinvestment **could reduce the financial and technical support, which is crucial to the proper function of ECSS.**

Moreover, this disinvestment risks of seeing the EU developing a set of new standards in space through dedicated processes outside the ECSS system. This is potentially a dangerous situation that would create uncertainties and complexity for the sector, justifying the expression of this Industry position. Industry needs to have a single space requirement referential, and must be involved in its elaboration and adoption.

2) The importance of ECSS for the European space industry

ECSS improves the robustness of the European space systems and their supply chain

The large majority of industrial stakeholders considers ECSS to be "a strength for the European space industry"[3], and to have a vastly positive impact on their work. They recognise the necessity of the work to feed it, to simplify it, and to improve it so that it stays relevant with current industry practices. The importance of ECSS is valued inside their companies and its evolutions are scrutinised closely.

The ECSS standardisation is helping the space sector to:

[2] *It is important to note that this discipline-based type of architecture, while inducing flaws, also allows for more flexibility depending on the context, and that the time-consuming aspect can be partially addressed through the initiatives on mission-classification.*

[3] *Eurospace interviewed ECSS stakeholders in September 2024 and gathered direct feedback from a representative array of companies. Quotes are extracted from these interviews.*

- **Achieve more cost-effective space programmes and projects** in Europe in terms of technical performance, life cycle cost-effectiveness and on-time deliveries;
- **Improve the competitiveness of the European space sector**, thanks to a high level of quality and a sharing of best practices;
- **Improve the quality and safety of space projects and products**: Industrial stakeholders are unanimous in expressing that ECSS offers a set of **well proven guidelines on how to do things**. It guarantees a **very good level of** confidence with its requirements ("when ECSS is followed, good quality is ensured"). ECSS ensures that the quality level of newcomers in the industry is high enough, while giving them access to relevant high-level guiding material. It allows to achieve the expected system performance with a **very low level of risk** on any given mission;
- **Reduce risk and guarantee interoperability and interface compatibility** by applying proved and recognised requirements and methods;
- **Facilitate clear and unambiguous communication between all parties involved** in space systems development and operation, in a form suitable for inclusion in legally binding documents: The ECSS system offers a **clear common reference in the industry** between customers and suppliers, throughout the supply chain. It is **"widely recognised and accepted by European institutions and their global partners (NASA, JAXA, etc)".** It allows for **better and more efficient comprehension and collaboration** between partners, which is an absolute necessity in the European space industry;
- Reflect user needs and feedback of experience from programmes, projects and other appropriate sources to improve ECSS standards.

As opposed to other space standardisation systems (e.g., ISO), **the ECSS standards are available for free to** ECSS members for their own use, for their contractors and subcontractors[4]. Together with the numerous Handbooks, the ECSS system promotes the spread of best practices in engineering and quality throughout the European space systems supply chain. The structured technical body of information embedded in the ECSS system facilitates the emergence of new entrants and reduces the barriers to entry. Compared to other standardisation systems where standards provided at a rather high cost, ECSS is very open and accessible considering that **all its documents can be accessed for free** following the user's registration[5] and respect of copyright.

ECSS standards are the result of an open process

ECSS, both in its instances and its resulting standards, is an open process to the whole supply chain. The Steering Board and Technical Authority, which are the ECSS places of decision, are institutions open to agencies and European industry. **Any stakeholder can nominate experts to take part in the drafting of standards, the public reviews, the change requests, etc, no matter their size or maturity.** To ensure proper representation of industry concerns at ECSS decision bodies, industry prepares its coordinated positions in advance to the ECSS TA and SB meetings in the Eurospace Standardisation Working Group (STWG), **which is open to non-Eurospace members**. Voting rights are balanced between Agencies and Eurospace members, so that no decision can be imposed to the other party.

As a result, ECSS standards are the product of discussion, consensus and technical expertise.

[4] *ECSS standards also provide a lot more technical content (stakeholders consider other standards such as ISO ones to be a lot less detailed).*

[5] *Registration on: https://ecss.nl/*

The ECSS system is a major tool for industrial policy

The ECSS standards forms the basis of a regionally-accepted system promoting the supply of responsible, safe, compliant and reliable space systems. The ECSS system creates a stronger relationship between space systems customers and manufacturers, and contributes to a healthier European market place.

The commitment of European space procurement agencies, and major commercial customers [6], to ECSS standards creates a ring-fenced environment for European space systems suppliers, and acts as technical supplement to the European procurement policies and regulations. **The ECSS system thus helps to enforce European policies for strategic independence and promotes the development of a solid and reliable supply chain.**

The ECSS is used in the procurement of more than 60% of European space systems, where it has a strong positive and structuring impact on the European space sector by ensuring a **common and easily-accessible reference for the whole supply chain. The tailoring process is there to ensure the customers gets products answering their needs.**

ECSS is preparing the future

The ECSS system is undergoing a major rehaul, to stay abreast with the rapid evolutions of the space systems market, and the evolving competitive landscape. In particular, with the pressure on cost and schedule and the growing interest in satellite constellations, a part of the market is shifting towards larger orders of identical items with shorter timelines and expectations for a faster development-to-launch calendar. The industry is thus adapting its manufacturing processes to embrace the challenges of series manufacturing.

To start, the currently available standards are being simplified towards a new set dubbed "**ECSS NextGen**". This simplification involves the full review of existing requirements to streamline the approach, implement modern digital tools for their implementation, and introduce greater flexibility and reactiveness.

> ***ECSS NextGen*** *proposes a new organization of documents within ECSS. It is the result of a benchmark of other Standardisation systems used in the world. The inspiration that was chosen is from EASA (European Union Aviation Safety Agency), for its proven efficiency.*
> *While not altering the technical substance, ECSS NextGen is dealing with the categorisation of the existing ECSS based on the following:*
> - *Binding requirements,*
> - *Means of Compliances (which ensures compliance if followed)*
> - *Technical specification (fully required if applicable)*
> - *Technical procedure.*
>
> *ECSS is currently working on a digital tool aiming at a more efficient system with easier access to requirements and for education/best practices.*
> *This exercise needs to be continued in the normal ECSS maintenance in order to further simplify the binding requirements.*

In parallel, **a brand-new standardisation branch is in development: the "Industrialisation Branch"** (I-Branch). The I-Branch standards will give to the European space supply chain the means to achieve the best levels of quality and reliability in the production of space systems in larger volumes. The I-branch will ultimately enable the use of automation, allow seamless integration in digital design and supply chain tools, and promote new manufacturing techniques (e.g., additive manufacturing) and industrial processes. **With the I-Branch, the industry will aim to achieve higher economies of scale while guaranteeing to its institutional, commercial, and international customers the expected levels of quality and performance without risks.**

[6] *E.g. Eutelsat, SES, Immarsat, Intelsat, JCSat, …*

ECSS standards are also embracing the **growing environmental sustainability requirements** stemming from global and European policies. The European space sector needs standards that enable the compliance with orbit protection regulations (and the requirement for timely and safe de-orbiting), and with environmental protection regulations (such as the RoSH and REACH regulations).

A major impact on space programmes procurement

ECSS standards play a major role in the European supply chain: they are called in ESA procurements, including the ones delegated from the European Union and from Eumetsat. Moreover, ECSS standards are baselined in the majority of national programmes in European countries (e.g., CNES, DLR), and are customarily called into the procurement of the large global satellite operators (such as Eutelsat, SES, Intelsat, Inmarsat, JCSAT). **As a result, we estimate that the ECSS framework is associated to the majority of European space programmes procurements[7], or about 5B€ (61%) of the European space manufacturing industry turnover in 2024[8].**

A tool for international presence

The ECSS system enables the European space sector to develop a coordinated strategy for space standardisation, and promote it at European and international levels through the relevant channels.

The existence of a complete set of publicly available European standards for space systems development and manufacturing helps the European space sector to maintain its positions on the international scene. **ECSS standards can be baselined for international procurement, and support the exports of European systems.** Moreover, they provide a basis for negotiating and developing international standards.

For instance, the ECSS acts as a forum for the coordination of European companies in the frame of the elaboration of the national positions in the relevant working bodies of ISO where space standards are the subject of growing interest. ECSS creates a situation where all European national delegations to ISO have a pre-agreed technical baseline to discuss the development and adoption of any international space systems related standard. This gives a political advantage as it provides a consensus among multiple voting members.

Similarly, the ECSS system is baselined for the CEN/CENELEC[9] in all areas relevant to space systems, through a specific agreement[10] established in 2013.

Role of Eurospace

Eurospace provides coordination means for industrial players and spreads information within the supply chain of the European space industry. It is coordinated with relevant national standardisation bodies, such as DIN and BNAE and interfaces with regional and international bodies, such as the ECSS, CEN and ISO. It also keeps an active relationship with ASD-Stan when coordination in the whole aerospace community is needed.

[7] *With the exception of launch systems procurements*

[8] *It is worthy to note that even if ECSS is not used directly in some cases, many companies' internal qualification processes are directly inspired from ECSS, often being simplified versions.*

[9] *Cen and CENELEC are two official standardisation bodies of the European Union, they publish and promote the "EN" standards.*

[10] *In 2013 ECSS and CEN/CENELEC signed a MoU. With this agreement, they establish a collaboration to develop standards for the space sector in which: Both organisations could develop jointly standards in which case UPSTREAM standards would be led by ECSS while DOWNSTREAM standards would be led by CEN/CENELEC. ECSS standards already in existence were granted a EN status.*

Eurospace is the trade organisation of the European space industry. Its members represent more than 60% of the European space industry workforce, and include all the largest players in the sector. **Eurospace is a signatory of the ECSS charter and has representation mandates in the relevant ECSS bodies.** Eurospace members are actively involved in the global space systems standardisation effort by their direct contribution to the standards drafting processes at ECSS and ISO levels. Eurospace provides the means to coordinate these efforts, and favours the link with other relevant entities, such as the European Commission and ASD-Stan. Eurospace also disseminates information on ECSS standards and contributes to their acceptance within the European supply chain. **It is important to note that Eurospace STWG is fully open to non-Eurospace members.**

3) How can ECSS be improved

Simplification (ECSS NextGen)

ECSS NextGen aims to simplify the use of ECSS, while achieving the expected quality for the product. **There is a strong consensus among industrial stakeholders that this simplification is vital for increasing the competitiveness of the European space industry actors.**

While industrial stakeholders are unanimous in expressing that ECSS offers a set of **well-proven guidelines on how to do things**, this level of quality also implies **a volume of technical requirements and qualification processes which can be heavy at times** for the supplier (some may call it "over-specification"). The constant work of updating, as well as the current simplification undertaken in the ECSS NextGen help to lessen that aspect.

To keep it as open as possible, continuing the effort to draft and update standards should be supported, as some stakeholders consider ECSS documentation to be **difficult to navigate at times** (filtering and gathering relevant requirements for transmission in the industrial chain **can be very time consuming**). There is still a certain level of heterogeneity between standards, with some "less flexible than others, or drafted differently depending on whether they are older or newer".

Through ECSS NextGen, the standards will separate Contractual Requirements from the Means of Compliance[11] (MoC). **Eurospace members in ECSS instances work actively to promote a drastic simplification.** This new ECSS could also still enable customers to use the full extent of requirements, which means the Industry will have to **promote to agencies' programme managers to trust companies on their ability to deliver a good product without impeding them.**

Industrialisation and keeping up with new industry practices

Industry stakeholders commonly agree that simplifying and updating ECSS standards to be in line with industry practices would have a "clear positive impact on production cost and time". Updating and simplifying would also **make the use of ECSS by smaller companies and new entrants more welcoming**. These stakeholders do not tend to rely on ECSS as much as primes because **"their logic of time and money constraints appears opposite to the ECSS main priorities as they are right now".**

4) Conclusion

ECSS standards, while having some flaws, have a **vastly positive impact on the European space sector**. A continued support is recommended to keep improving it and reducing the most-commonly agreed upon

[11] *It is of paramount importance that the tailoring process in future programmes does not make applicable those MoC, opening for competitive alternatives while not compromising technical substance.*

downsides of the system. Although some flaws are present and recognised by all ECSS stakeholders, **it is much more beneficial to the Industry to work on fixing and updating ECSS, rather than resort to another system of standards, which European stakeholders would have a lot less control upon.**

ECSS NextGen and the new Industrialisation branch, are **widely supported by industrial stakeholders**.

- ⇒ The current evolutions of ECSS (ECSS NextGen and the Industrialisation branch) are essential for the European space industry to be competitive in a rapidly changing environment. Therefore, **it is vital to support these processes in the long run, even after they are finalised at ECSS level.**
- ⇒ ECSS NextGen **will be a great success if tailoring performed in contracts support actual simplification by tailoring within requirements (and not making applicable the Means of Compliance).**

Standards will be required in the development of the EU's space role, for regulation on safety and security, and in the framework of the industrialisation process which will be needed for the development of IRIS². **Industry recommends that the future developments of standards stay in the frame of the ECSS process, as the single referential for space standards, with balanced involvement of industry and institutions in the drafting process.**

It is vital to continue supporting ECSS standardisation activities for improving space industry competitiveness.