1st Issue | April 2024

Newsletter

"Accelerating the certification of disruptive innovation"

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DASSAULT AVIATION

Dear Reader,

I am delighted to present the inaugural issue of the CONCERTO Newsletter. CONCERTO, an EU-funded project under the Clean Aviation Joint Undertaking programme, is dedicated to shaping the future of aviation through innovative regulatory frameworks. Our primary objective is to craft draft regulatory material that paves the way for groundbreaking innovations.

Our dual focus involves developing a comprehensive set of regulations for aircraft certification, accompanied by a preliminary description of Methods of Compliance (MoCs) applicable to the three key pillars of Clean Aviation. Simultaneously, we aim to assess the feasibility of a digital certification framework that fosters collaboration and supports model-based certification.

Anticipated outcomes include an enhanced level of safety, streamlined timelines for introducing new products to market and into service, and the continued maintenance of European leadership and competitiveness. The results are designed to be transposable and scalable across diverse product lines and aircraft segments, including general aviation, rotorcraft, business jets, and commercial medium-to-long-range aircraft, ultimately impacting the entire fleet.

We invite you to delve into the insights shared in this newsletter and to stay connected with CONCERTO through our official communication channels.
Enjoy the read!

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The project is supported by the Clean Aviation Joint Undertaking and its members.

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CLEAN AVIATION

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The ambition

The ultimate vision is to establish a new certification framework tailored to disruptive technologies, thereby facilitating the rapid and secure integration of more sustainable aircraft into service.

The EU's Clean Aviation Joint Undertaking is paving the way for the EU's ambition of climate neutrality by 2050. Its primary ambition to go over decisive impactful steps in demonstrated disruptive aircraft performance compatible with 2035 EIS (entry-into-service) will only be possible if the future regulatory framework is not an impediment to innovation.

Pushing aeronautical science beyond its limits, the EU-funded CONCERTO project focuses on the certification needed to improve safety while bringing these new safe products to market and into service faster. Critical challenges, tackled through Proof of Concepts for the regional and short and medium range aircrafts, including hydrogen, may be easily transposable and scalable to different product lines and aircraft segments.

The project aspires to fortify the European aviation sector's global leadership in advancing and implementing sustainable aircraft technologies. To attain this goal, the project is dedicated to creating certification methods that are not only more efficient and effective but also more adaptable than current practices. These novel methods are being tailored to address the distinct challenges and prospects associated with disruptive technologies, prioritizing risk and performance factors. This shift allows airworthiness authorities to concentrate on the most critical safety aspects of new aircraft and technologies while simultaneously easing the administrative burden on manufacturers.

The CONCERTO initiative represents a tremendous opportunity to reinforce European leadership and sovereignty in leveraging our position as the forerunner of worldwide new certification frameworks. The composition of the project consortium reflects a smart mix of aircraft manufacturers, engine manufacturers, equipment manufacturers, research centres, universities, SMEs, and PLM experts. Maintaining close collaboration with airworthiness authorities, particularly EASA, is a key aspect of the initiative. **EASA** plays a pivotal role by bridging innovation and the development of safety, security, and environmental protection standards. The active engagement of EASA experts, working alongside industrial and research teams, is crucial for conceiving, endorsing new solutions, and enhancing international community acceptance.

Key challenges

The CONCERTO project endeavors to transcend the existing state of the art in aircraft certification by pioneering more efficient, effective, and adaptable methodologies. It also seeks to introduce risk-based and performance-oriented certification approaches, enabling airworthiness authorities to prioritize the most critical safety aspects while reducing administrative burdens on manufacturers.

The CONCERTO project faces several significant challenges. Between the primary ones is the necessity to devise new certification methods specifically adapted to the unique characteristics of **disruptive technologies**. Electric and hydrogen-powered aircraft, for instance, have fundamentally different propulsion systems than traditional aircraft, necessitating entirely new safety assessment methodologies.

Another challenge is the need for harmonious **alignment with regulatory requirements**, involving close cooperation with airworthiness authorities. These authorities bear the responsibility for ensuring the safety of all aircraft operating within their jurisdictions and tend to be cautious in embracing new certification methodologies.

The third challenge is the project's capability to **quantify its impact** at the program level within the **Clean Aviation** initiative. Unlike other projects that can employ the Technology Readiness Level (TRL) to gauge the maturity of their technologies, CONCERTO focuses on certification methods rather than tangible products. To address this, the project is creating a **Certification Readiness Level (CRL) scale** complementing the TRL scale and consisting of nine levels representing distinct stages in the certification process. In that frame, given the close collaboration with **EASA** towards achieving optimization of certification timing and associated costs, the implementation will ensure alignment with Technology Readiness Level 6 at the aircraft level, in harmony with the Clean Aviation program's objectives.

The CRL scale

The CONCERTO project is poised to significantly influence the Clean Aviation aspirations by expediting the introduction of new, more sustainable aircraft into service. In that frame, the development of the novel **CRL scale** within the CONCERTO project is expected to play a pivotal role, ensuring that all projects within the Clean Aviation programme share a common certification framework. The ultimate objective of the scale is to enable the evaluation of the maturity of disruptive technologies, through a more precise measurement of the programme's cumulative impact on their certification.

In 2023, CONCERTO already delivered a key output with the preliminary CRL scale in close collaboration with the EASA, comprising 9 levels:

- **CRL1** *Safety regulator familiarization with techno and CONcept of OPerationS (CONOPS)*
- **CRL2** *Confirmation of the CONOPS assumptions and safety objectives by all stakeholders*
- **CRL3** *Identification of key regulations that would be mainly affected along with an identification of those that would need to be amended / developed in priority (Gap Analysis)*
- **CRL4** *Identification of the main principles for technical standards and roadmap for overall necessary rulemaking and/or recommended industry Standard Activities associated to the novelties/specificities of the design (stemming from the Gap Analysis)*
- **CRL5** *Identification of the roadmap/action plan for a comprehensive aviation framework readiness*
- **CRL6** *Confirmation of necessary technical (TRL) knowledge and availability of first draft of rule-making material ⟷ TRL3*
- **CRL7** *When applicable: Mature draft generic elements of a certification basis, in the form of published generic Special Conditions (SC), Interpretative Material or Means of Compliance ⟷ TRL6 (proto)*
- **CRL8** *Product certified - Integration of the technology*
- **CRL9** *Actual system proven in operational environment (design, operation, maintenance)*

Interfaces

Interfaces have been established with other pillars of Clean Aviation and relevant external projects related to the topics addressed in CONCERTO. Dedicated efforts have been made to gain a deep understanding of the other projects within Clean Aviation and better comprehend the interactions with CONCERTO. Extensive work was also completed to identify relevant partnerships and collaborative research projects that could interact with CONCERTO. Synergies analysis was performed between CONCERTO, and H2020 and Horizon Europe collaborative research projects. This effort resulted in one of the main achievements of 2023, the synthesis of CONCERTO needs and the establishment of a "light" collaboration agreement with linked projects, accompanied by the mapping of external projects to be interfaced with CONCERTO.

Furthermore, a draft legal framework for the exchange of non-public (confidential) information between CONCERTO and projects outside of Clean Aviation has been prepared. The ultimate goal is to ensure optimal results through collaboration at the European level.

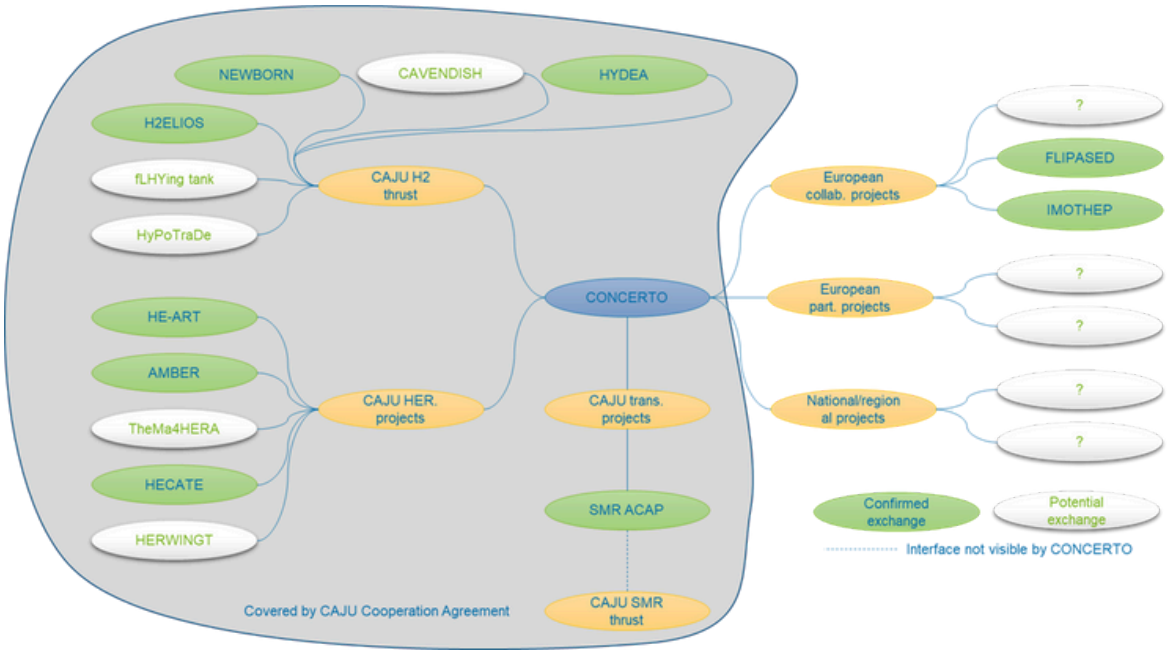


Figure 1. CONCERTO links with other projects

The 3 PoCs

The three Proof Of Concept (Active Wing, High Voltage Distribution, Hydrogen) initiatives comprise four core steps:

- **Generic concept definition**: The model should be specific enough to support safety and certification analysis, but also general enough to cover all potential applications.
- **Risks and gaps analysis**: Analysis of the existing regulations and Means of Compliance (MoC) for the technology (if any) and identification of gaps in the coverage of potential hazards and failures.
- **Proposition of "gap fillers"**: Development of possible solutions to the gaps identified, such as new regulations, MoC, simulation and test tools.
- **Drafting new regulations and rules for the technology**

During 2023, the three initial generic concepts have been modeled, as presented in the following figures.

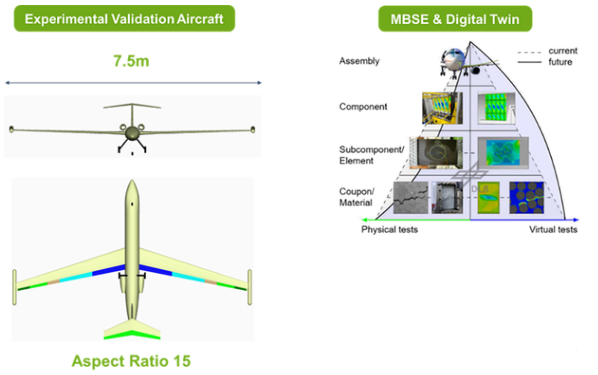


Figure 2. PoC AW Generic Concept

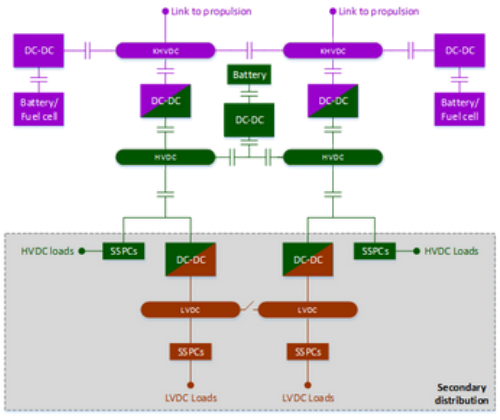


Figure 3. PoC HVD Generic Concept (left)

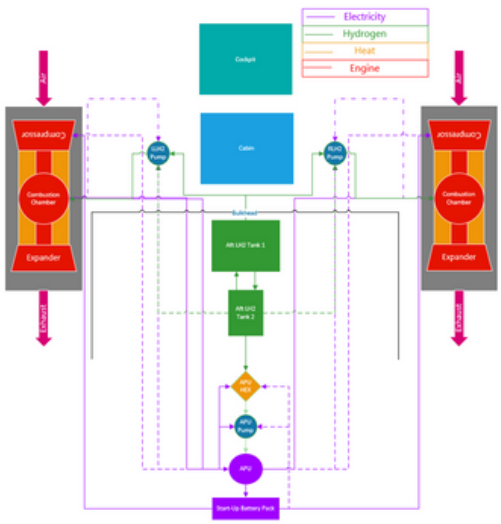


Figure 4. PoC H2 Generic Concept (right)

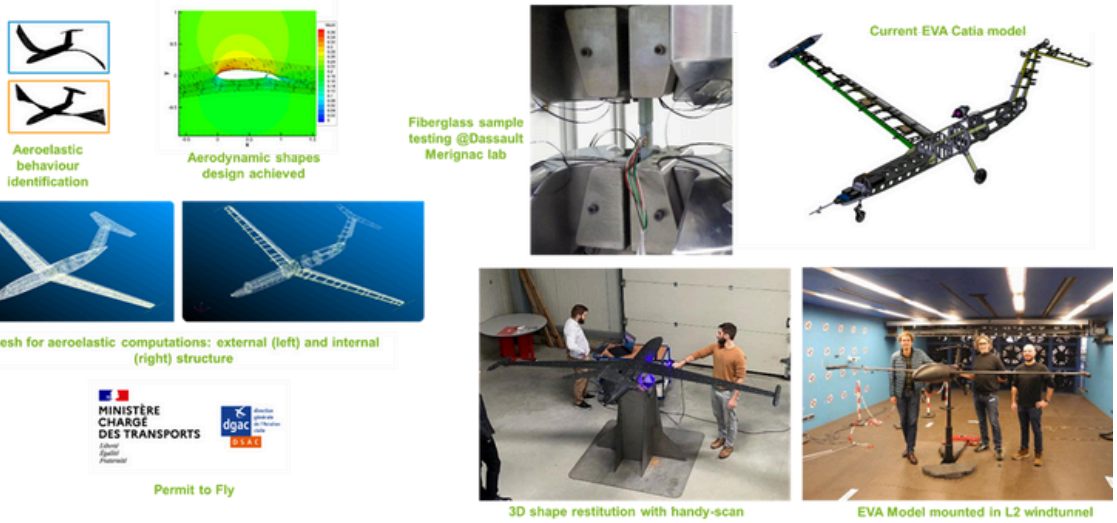
PoC Active Wing

For the particular case of the AW PoC, the team is building an Experimental Validation Aircraft (EVA), in order to experiment a flight test campaign and prepare the demonstration of this technology. A digital twin will also be created and, at each stage of the demonstrations, the tests with the real hardware and the results obtained with its digital twin (simulation) will be compared. The objective is to pave the way to certification for these functions in terms of equipment requirements, systems requirements, and demonstration.

Figure 5. Experimental Validation Aircraft model

Up to now, the aeroelastic behavior has been completed, and aerodynamic shapes have been designed. The EVA model has been mounted and the wind tunnel tests have already started at the facilities of ONERA.

Figure 6. Progress on the Experimental Validation Aircraft



PoC Hydrogen

The overall plan for H2 storage was completed with notable achievements, including:

- Collection and description of existing material data and constitutive laws.
- Implementation of modeling and simulation strategies across the test pyramid.
- Definition of key parameters to be considered for uncertainty quantification.

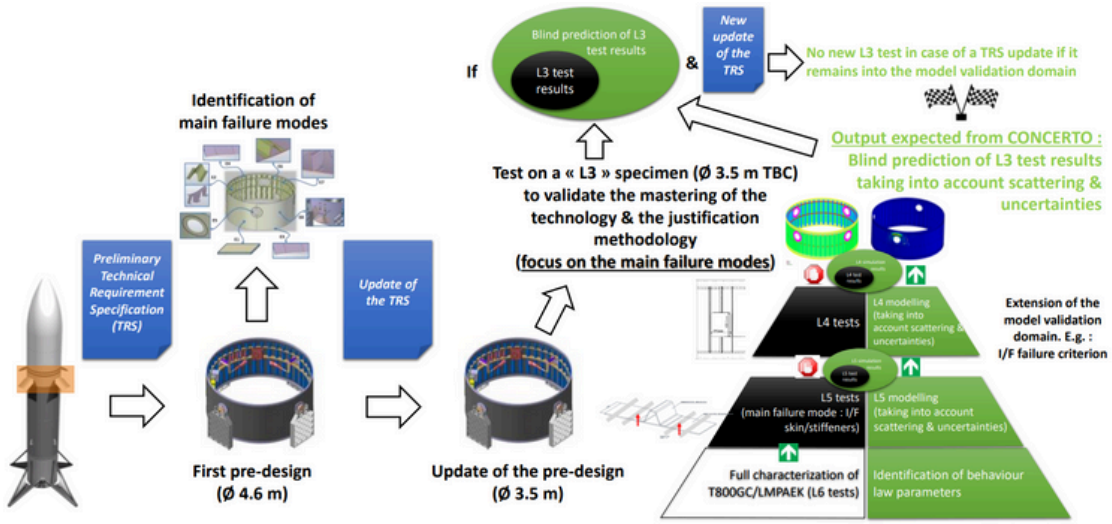


Figure 7. Macro-logic of synergy between CONCERTO project and Flight Control Bay development

- Simulation of leaks in closed volumes with natural ventilation in 1m3 and 2m3, comparing hydrogen and helium. Similarities were observed for small leaks, while differences were noted for higher flow rates (still ongoing). Additionally, a helium leak with forced ventilation is being simulated, with the modeling strategy identified.
- Ongoing H2 flame simulation, with Computational Fluid Dynamics (CFD) performed based on Sandia H2 flame tests. Simulations are still running to identify the best modeling practices for flame temperature and OH emission.

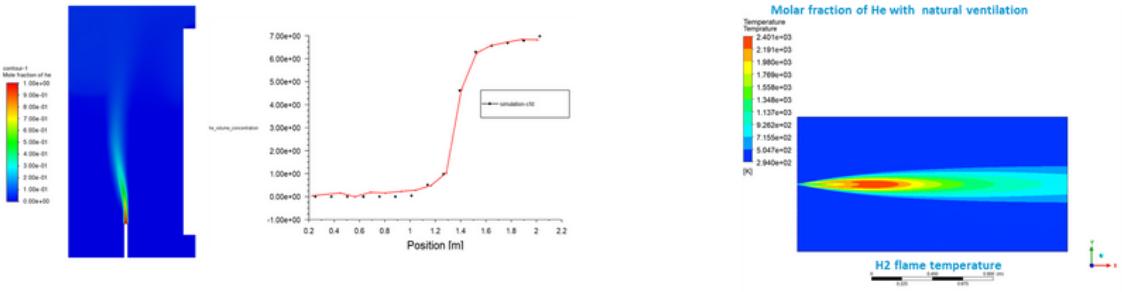


Figure 8. PoC H2 Progress on leak simulation and flame simulation

Digital Certification Framework

The exchange of data constitutes another significant challenge in the certification process that is time- and money-consuming. To address this challenge, CONCERTO leverages the benefits of digital transformation in order to establish a digital certification framework in close collaboration with EASA. The purpose of this framework is to streamline access to information by evolving data formats and enhancing traceability. As a result, the digital certification framework is expected to ease access to information, introduce new practices compatible with all actors, enhance collaborative work, foster incremental certification, and support the integration of novel certification practices into digital design processes.

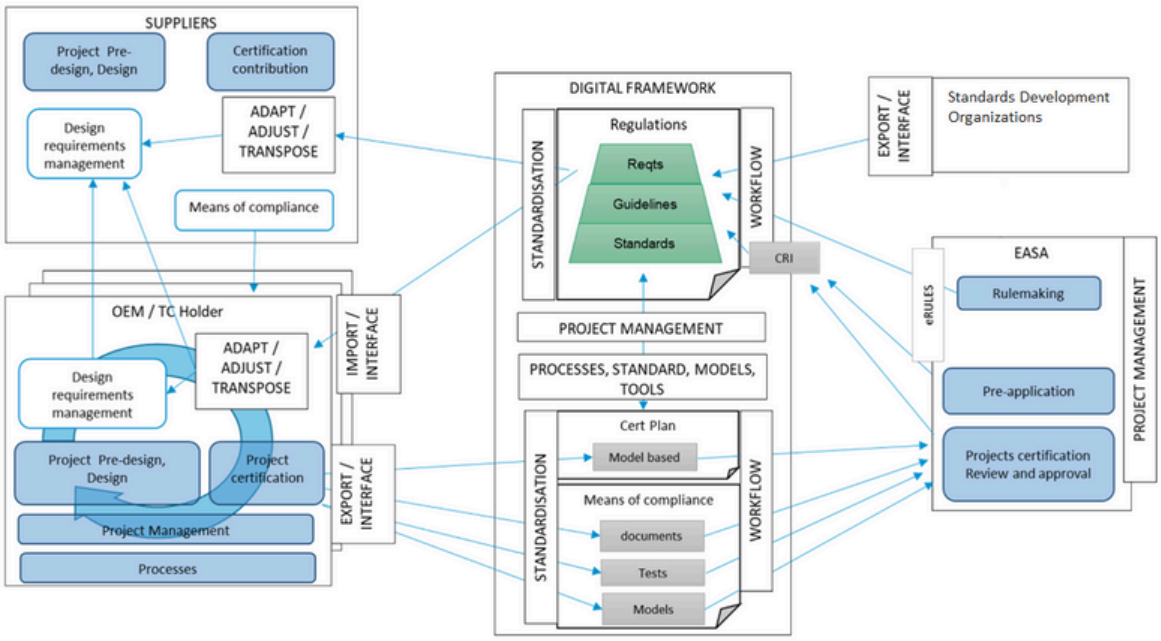


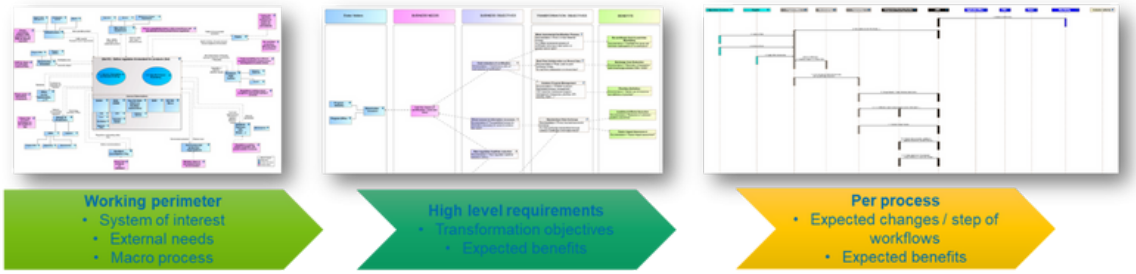
Figure 9. Digital Certification Framework

- certification lead time
- certification workload for authority and applicant airworthiness office
- risk criticality
- total cost of certification for applicant

Digital Certification Framework *cont'd*

A methodology derived from systems engineering to structure the information related to digital transformation is used (called "System Thinking"). A core achievement was delivered with the application of the methodology to align actors on Who, Why and What to change.

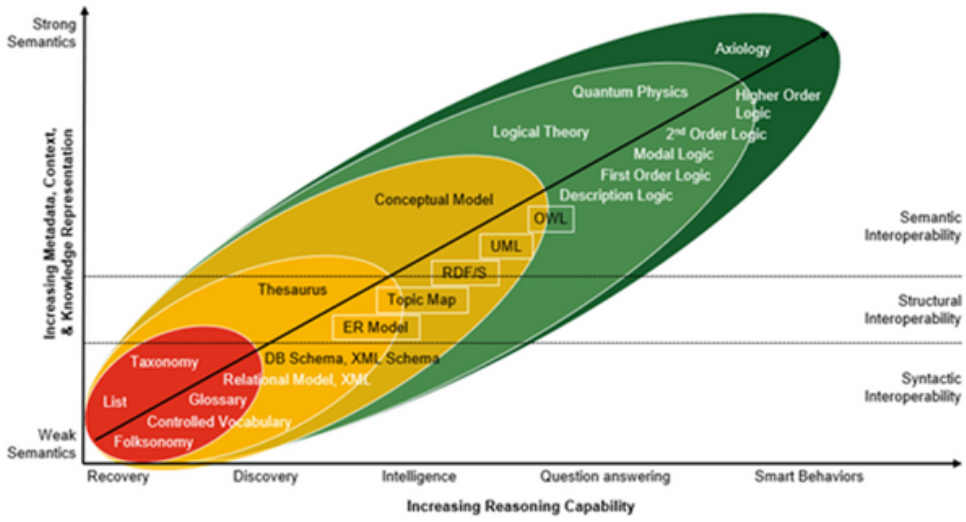
Figure 10. Who, Why and What to change



Another main achievement was the convergence on the ontology methodology. The first step towards the ontology was the delivery of the glossary with 259 terms. A trial on a first use case application has been implemented, while a potential for further use apart from data exchange, such as the digital assistance, has been acknowledged.

Figure 11. Strong vs. Weak Semantics

Source: Dr Leo Obrst, Mitre; Mills Davis, Project 10X



Events & Conferences

AMADE - Universitat de Girona actively advocated for CONCERTO during the 11th International Conference on Composite Testing and Model Identification (**CompTest 2023**) in Girona, Spain, held from May 31 to June 2, 2023.

Clean Aviation showcased the latest advances on disruptive technologies for sustainable aviation during the prestigious **Paris Air Show 2023**.
CONCERTO was at the spotlight of certification and innovation, providing valuable insights into how these technologies can revolutionize the aviation industry and contribute to reducing its environmental footprint. Watch **here** project-dedicated video that was displayed at the Clean Aviation joint stand.

This year's **AIAA SciTech Forum** took place in Orlando, USA, in January 2024, and CONCERTO was there. Apart from the project's presentation during the Clean Aviation Special Session: "**Future Aircraft Architecture, Technology Integration & Novel Certification**", sharing the stage with notable projects like HERA, HERWINGT, and HECATE, CONCERTO was featured among the top spotlight presentations in the Electrified Aircraft Rolling Recap Session.

Events & Conferences

Last February, our esteemed partners from **ISAE-SUPAERO** and **Airbus** took the stage at the **More Electric Aircraft 2024** conference in Toulouse, France, to present their outstanding work, entitled ***"Hydrogen Aircraft Certification: Determination of Regulatory Gaps"***. This study sets out to identify and bridge the regulatory gaps that currently hinder the certification of hydrogen-powered aircraft.

CONCERTO has also been showcased at the **Clean Aviation Annual Forum 2024** in Brussels, Belgium. This event's highlights included a captivating project overview by **Dassault Aviation**, and an insightful presentation on **EASA**'s approach to innovative certification processes, making a compelling link to CONCERTO.

Upcoming events

TRA Dublin

AERO Friedrichshafen

ILA Berlin

EASN conference

Our team

COORDINATOR

THIRD PARTY

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