Final report on Communication and Dissemination Activities

Deliverable D8.4

morpho

Embedded Life-Cycle Management for Smart Multimaterials Structures: Application to Engine Components

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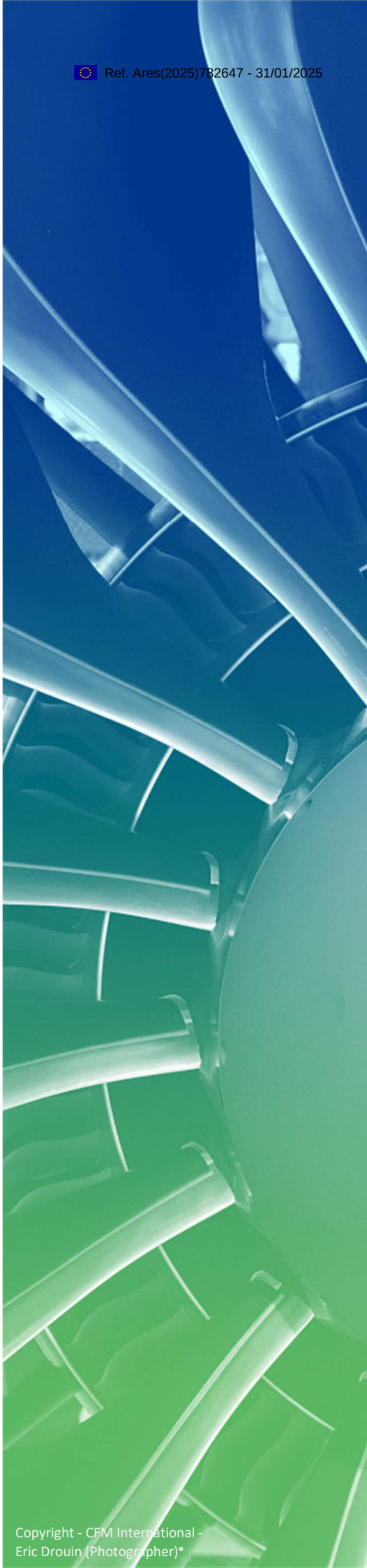

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Deliverable D8.4

Title: Final report on Communication and Dissemination Activities

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ABSTRACT

This deliverable, Final Report on Communication and Dissemination Activities, provides an overview of the MORPHO project's efforts to share its objectives and outcomes with stakeholders, including researchers, industry professionals, and the public. It details the use of communication channels such as social media (X, LinkedIn, Facebook, YouTube), the project website, printed materials, scientific publications, and conferences.

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1 Introduction

This document constitutes the Final Report on Communication and Dissemination Activities for the MORPHO project. It provides a comprehensive overview of the strategies, tools, and outcomes achieved in promoting the project's objectives, results, and impacts throughout its lifecycle.

Effective communication and dissemination are essential for raising awareness about MORPHO's innovations, engaging with diverse audiences, and ensuring the uptake of project outcomes across industry, academia, and the broader public. This report details the efforts undertaken to achieve these goals, including the use of social media platforms, printed materials, scientific publications, and participation in international conferences. It also highlights key metrics that demonstrate the success of these initiatives and reflects on lessons learned during the process.

The report highlights key metrics of engagement, the success of late-stage campaigns like #MORPHOworkshops and #MORPHOresults, and the impact of the final conference. While fewer journal publications were achieved than planned, the project demonstrated strong participation in conferences, with further publications expected post-project. This document reflects MORPHO's communication achievements and future dissemination potential.

As this deliverable is prepared at the conclusion of the project, it also outlines plans for sustaining communication and dissemination efforts beyond the project's lifetime, ensuring a lasting impact on the smart structures and materials community.

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2 Overall communication & dissemination activities

This chapter provides an overview of the communication and dissemination tools and instruments employed by the project from its inception through month 46 (January 2025). Greater detail is provided for the data spanning December 2022 to January 2025, as the earlier period (from the project's start until December 2022, month 22) has already been covered in Deliverable 8.2.

2.1 Website

The MORPHO website, which is accessible at https://morpho-h2020.eu/, played a central role in the project's communication strategy. It functioned as a comprehensive repository for project-related content, providing information about the project's goals, progress, and consortium activities. Additionally, it served as a dynamic news portal, showcasing the latest developments and actions undertaken by the consortium. In the latter half of the project, additional sections were added to the website, including a page dedicated to the mid-term conference and another for the final conference. These updates helped provide detailed information on key project events, further enhancing the website's role as a central hub for project dissemination.

From its launch, the website was designed and maintained with a focus on the following key principles:

- **Usability**: Ensuring an intuitive and user-friendly experience.
- **Clear and Accessible Structure**: Facilitating easy navigation and quick access to information.
- **Content Updates**: Keeping visitors informed with regularly refreshed and relevant material.

Throughout the project, there are 52 downloadable contents: 20 scientific publications, 8 media appearances, 5 newsletters and 21 graphic materials: posters, logo, brochure and paper airplanes. The sum of the news published for free consultation reaches 43 entries. These contents coexist with the tabs that from the beginning have provided information about the project, the consortium, the deliverables, the work packages, objectives and expected impact.

During this period, the project's communication and dissemination performance was analyzed using Metricool. The evaluation focused on daily and overall metrics to provide insights into audience engagement and geographic reach. On average, the project website recorded 16 daily

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page views, accompanied by 8 daily visits and 7 daily visitors. The average number of page views per visitor was 2.26, indicating moderate user engagement during each visit.

Figure 1 Website activity

In terms of geographic distribution, the website attracted a significant portion of traffic from France, with 934 page views accounting for 17.54% of total views. The United States followed closely with 905 page views (17.00%), while Spain contributed 848 page views (15.92%). Other notable regions included Germany (312 page views, 5.86%), the United Kingdom (237 page views, 4.45%), the Netherlands (223 page views, 4.19%), and China (203 page views, 3.81%).

Figure 2 Geographical distribution of visitors to the MORPHO website

The analysis of the most visited website pages revealed that the homepage (/) was the most accessed, with 4,209 views, representing 34.97% of the total traffic. The page dedicated to the final conference (/final-conference/) generated 807 views (6.70%), followed by the project overview page (/about/project-overview/) with 795 views (6.60%). The consortium page (/partners/consortium/) and news section (/news/) also performed well, receiving 677 views (5.62%) and 670 views (5.57%), respectively.

Regarding traffic sources, direct access accounted for the majority of visits, totalling 4,173 visits (60.61%). Search engines, particularly Google, generated 1,646 visits (23.91%), while social media platforms contributed smaller proportions of traffic, with LinkedIn generating 233 visits

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(3.38%) and Facebook bringing in 71 visits (1.03%). Bing, another search engine, contributed 131 visits (1.90%).

Blog posts on the project website also demonstrated varying levels of engagement. The most popular post, titled "MORPHO: Recycling Carbon Fiber for a Sustainable Aerospace Industry", published on March 17, 2023, garnered 302 views. Other notable posts included "Advances in SHM: Innovation and Value Creation in Aeronautics", published on November 26, 2024, with 98 views, and "Innovations in Sensor Technologies for Advanced Composites Manufacturing", published on November 11, 2024, which received 97 views. Additionally, the post "Morpho Mid-Term Conference Unites with ICCBMA: Pioneering Advances in Aerospace Maintenance Technology", dated March 13, 2024, accumulated 86 views, while "MORPHO Emerges as Top 3 Finalist in JEC Innovation Awards", published on January 11, 2024, attracted 66 views.

Since the implementation of the updated cookie policy, there has been a noticeable decrease in website traffic statistics. This change has led to a lower number of visits being recorded, resulting in the Key Performance Indicator (KPI) (1000 visitors/month in the last year of the project) not being met. It's important to note that the context has shifted since the target was initially set, and the full impact of the new policy on user behavior is still being assessed.

Additionally, the data for the most recent month is not yet complete, as analytics platforms typically require time to process and update statistics. For instance, Google Analytics reports a processing delay of 24-48 hours on average, with data for large websites being refreshed once daily.

Therefore, while the current data indicates a shortfall in the KPI, these factors—changes in cookie policy and data processing delays—should be considered when evaluating the website's performance.

The project website will remain active until April 2030, ensuring that all the information generated throughout the project is accessible to any interested parties. This will provide continued access to the project's outcomes, results, and resources, supporting ongoing dissemination and future research endeavors.

Table 1. Website progress on the quantitative objectives by the end of the project

Channel or activity	KPIs	Current state	Percentage achieved
Website	-10.000 visits with +2 min staying. -At least 30 news accumulated -1000 visitors/month in the last year of the project	24938 visits 43 news 2518 visitors in the last year	249% over the target 143% over the target 21%

2.2 Newsletter

The newsletter was released annually in alignment with the communication and dissemination strategy, with each issue providing a summary of the project's key achievements. For the newsletter, 78 out of the targeted 100 recipients were reached. However, this shortfall was compensated by prominently sharing the newsletter on the project website and across social media channels.

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- **Newsletter 3** was distributed in December 2023 and can be consulted here: https://mailchi.mp/74d851d227c3/a-year-of-progress-for-morpho-10504585?e=c08493cf72
- **Newsleter 4** was distributed in December 2024 and can be consulted here: https://mailchi.mp/357387829da5/a-year-of-progress-for-morpho-10976443?e=ac46770107

A fifth and final newsletter was launched following the final conference, summarizing the overall results of the project. This edition also included a link to the live streaming of the final conference, allowing broader access to the event.

- **Newsletter 5** was distributed in January 2025 and can be consulted here:

All issues of the newsletter are accessible on the project website, ensuring that not only newsletter subscribers but also the general audience can access the information shared in each edition. This approach maximized the reach of the project's key updates and achievements, making the content available to a wider public. All the newsletters can be found at: https://morpho-h2020.eu/dissemination/newsletters/

Table 2. Newsletter progress on the quantitative objectives by the end of the project

Channel or activity	KPIs	Current state	Percentage achieved
Newsletter	-4 newsletters -100 subscribers	5 newsletters 78 subscribers	125% over the target 78%

2.3 Videos

A total of 57 videos were produced and published on the project's YouTube channel, which currently has 54 subscribers. The handle of the project on YouTube is @morphoH2020 and the profile can be consulted here: https://www.youtube.com/channel/UC_h3JZ-HyGhA3l7AnhWkuNA

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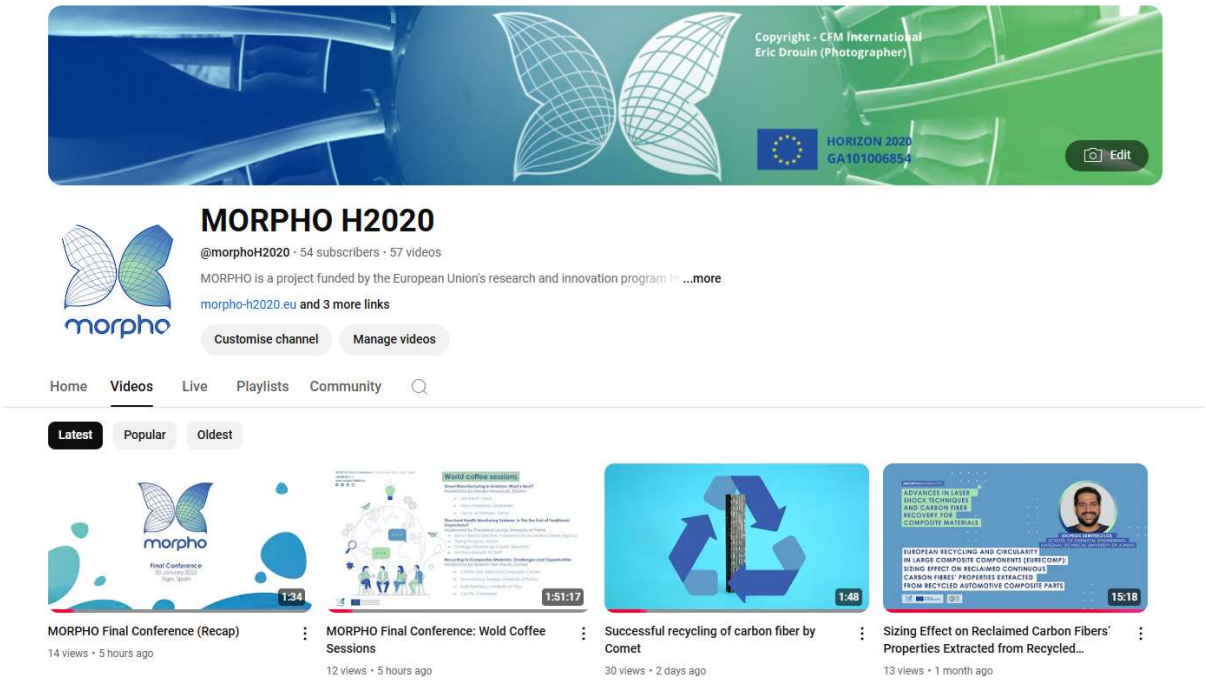

Figure 3. MORPHO's YouTube Channel

The MORPHO YouTube channel hosts a variety of videos, ranging from interviews with researchers to recordings of events and presentations, as well as animated graphic content showcasing the project's innovations and results.

Between April 27, 2021, and January 30, 2025 (a span of 1,375 days), the MORPHO project's YouTube channel achieved 59.1K impressions, with 64.6% of these resulting from YouTube's recommendations. The content had a click-through rate of 2.7%, leading to 1.6K views from these impressions. The average view duration was 1 minute and 19 seconds, resulting in a total of 35.2 hours of watch time generated from impressions.

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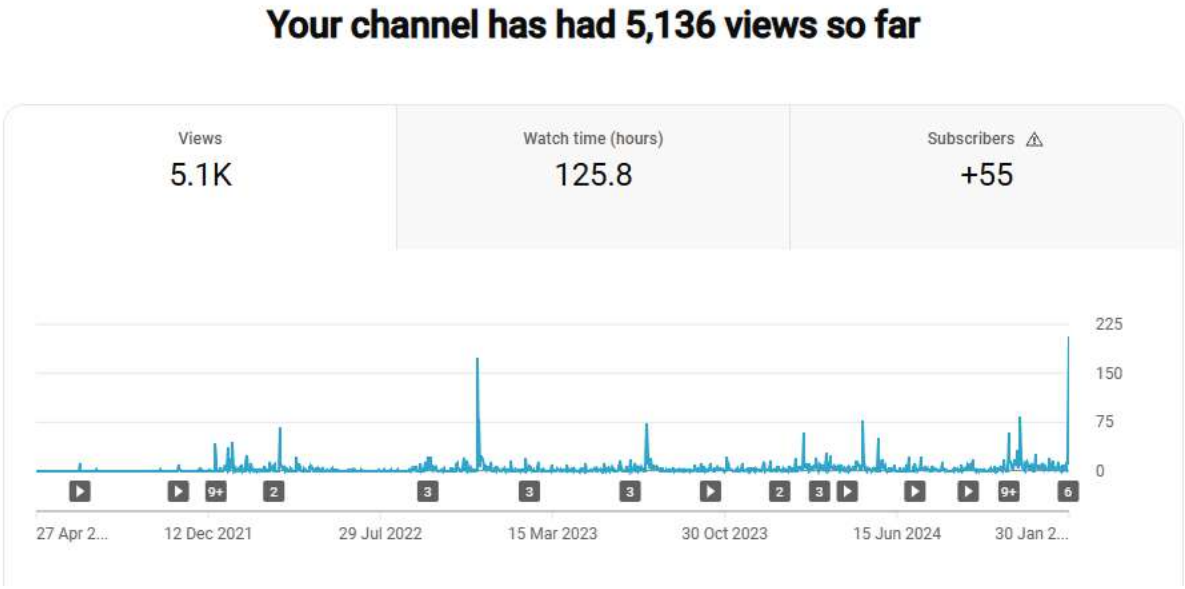

Figure 4 Lifetime YouTube views

Figure 5 YouTube views in 2024

Below is a table with all the videos published, their impact and their date as of 02/01/2023:

Table 3. MORPHO videos

Title	Visualisations	Date	Link
MORPHO H2020 - Circular Aviation for Green Growth	84	24/07/2021	https://youtu.be/2q5kaiVH5u4

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Title	Visualisations	Date	Link
The MORPHO project	166	02/11/2021	https://youtu.be/2-dDuVixgCo
Happy Holidays!	59	22/12/2021	https://youtu.be/dJZbiLPSfSU
Nazih Mechbal - ENSAM	214	27/12/2021	https://youtu.be/F-tFB85HKY4
Rafik Hadjria - SAFRAN - Foreing Object Damage (FOD) panel	59	27/12/2021	https://youtu.be/3ElYZLHSo_Y
Nikos Pantelelis - Synthesites	121	04/01/2022	https://youtu.be/pVATmilOHlo
Christos Nastos - TU Delft	130	04/01/2022	https://youtu.be/uKddJyC5OpA
Roberto López - ESI	209	04/01/2022	https://youtu.be/iqQ-tYZiUQA
Ingo Wirth - Fraunhofer IFAM	70	05/01/2022	https://youtu.be/GzKZQY7akpM
Rafik Hadjria - SAFRAN	163	05/01/2022	https://youtu.be/7JJNvZlY6xQ
Noelia Vilar - FEUGA	368	24/01/2022	https://youtu.be/RSZ1yiV020s
Elena Martín - Universidade de Vigo	123	24/01/2022	https://youtu.be/zVWBG-CRNDI
Eric Monteiro - ENSAM	67	24/01/2022	https://youtu.be/oYHJhAe2FNk
Rafik Hadjria - Final Public Workshop of SuCoHS project	214	09/03/2022	https://youtu.be/sopyO6uQQig
Christian Waltermann - FiSens	116	11/04/2022	https://youtu.be/dMzyhN8JFCQ
Resin Transfer Molding hybrid twin	106	30/09/2022	https://youtu.be/vH5EMXVD9Cs
ENSAM at the European Researchers' Night	116	30/09/2022	https://youtu.be/FAmou-VzpAo
Integration of sensors in aircraft FOD panels	124	30/09/2022	https://youtu.be/lvKfCehKb-M
MORPHO Embedded piezoelectric and FBGs sensors	104	13/02/2023	https://www.youtube.com/watch?v=2kQBKxTh0eA
Integration of fiber optical sensor in preform	81	13/02/2023	https://www.youtube.com/watch?v=GTBatX-hIII
Printed Piezo Sensor on fiber composite	109	14/03/2023	https://www.youtube.com/watch?v=BU0op73DGgQ

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Title	Visualisations	Date	Link
Transforming Aviation: Integrated Sensors for Sustainable and Efficient Aircrafts	131	23/06/2023	https://www.youtube.com/watch?v=g0yTWA8EFnk&t=71s
MORPHO presentation at CertBond online workshop	77	11/07/2023	https://www.youtube.com/watch?v=rjwSL4vIV7A&t=126s
Transforming Aerospace Manufacturing for Smarter and Greener Airplanes	334	18/07/2023	https://www.youtube.com/watch?v=bPturJIo9qg
MORPHO : transformer l'industrie aérospatiale pour des avions plus intelligents et plus écologiques	155	11/10/2023	https://www.youtube.com/watch?v=nCYgshhfiac&t=3s
printed thermocouple	28	11/01/2024	https://www.youtube.com/watch?v=fmOZ6Yfqgyo
Lifecycle Management of Smart Structures at Delft University of Technology	188	12/02/2024	https://www.youtube.com/watch?v=h2bf9xR9gxo
Elevating Aviation: Pioneering Projects Transforming the Industry under Horizon 2020	157	04/03/2024	https://www.youtube.com/watch?v=kTG3t0_I_hE
Innovative SHM Systems in Action: Morpho Project's Engine Blade Monitoring	88	18/03/2024	https://www.youtube.com/watch?v=BheTOMr7Ipk&t=36s
Unveiling Aerospace Innovation: Sensorizing FOD Panels in the Morpho Project	114	28/03/2024	https://www.youtube.com/watch?v=NTXV_OnqvRM
Unveiling Aerospace Insights: Life Cycle Management in the Morpho Project	65	10/04/2024	https://www.youtube.com/watch?v=rUju_TgvPL0&t=175s
Automatic Composites Moulding System	47	09/07/2024	https://www.youtube.com/watch?v=Ns-EQut6N6Q
MORPHO Mid-Term Conference - 2nd International Conference for CBM in Aerospace	39	18/09/2024	https://www.youtube.com/watch?v=h8oXPEvyY6M&t=1s
MORPHOworkshop: Innovations in sensor technologies for	26	11/11/2024	https://www.youtube.com/watch?v=t8tzD569u3Y&t=452s

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Title	Visualisations	Date	Link
advanced composites manufacturing (INTRO)			
Development and Application of Fiber Optical Sensors for RTM and SHM	42	11/11/2024	https://www.youtube.com/watch?v=GWro-aq0OjU
Integration of FBG Sensors in CFRP RTM Parts and Data Analysis for Resin Flow Monitoring	28	11/11/2024	https://www.youtube.com/watch?v=uwJsLaJD8do
Printing of Sensors on Composite Components for Aerospace Applications	80	11/11/2024	https://www.youtube.com/watch?v=5DBB3iDyPzw
Intelligent and Reliable Monitoring for Composites Moulding	60	11/11/2024	https://www.youtube.com/watch?v=2VqcX5noXMQ
Hybrid twin for online monitoring of the Resin Transfer Molding process	52	13/11/2024	https://www.youtube.com/watch?v=zNHbwr7FSFk
MORPHOworkshop: Advances in SHM. Innovation and value creation in aeronautics (INTRO)	19	26/11/2024	https://www.youtube.com/watch?v=L8r8Ceg5HV4
SHM and Value Making for Aeronautics in an Evolving Environment	20	26/11/2024	https://www.youtube.com/watch?v=wo9kwRYZCYI
The Importance and Benefits of SHM for the Aerospace Industry	14	26/11/2024	https://www.youtube.com/watch?v=QaRWqqb2ntI
Lamb Wave-Based SHM of Composite Aeronautic Structures	47	26/11/2024	https://www.youtube.com/watch?v=1QuTHc3wj0M
A Deep Learning-Based Pipeline for Structural Diagnostics and Prognostics	43	26/11/2024	https://www.youtube.com/watch?v=6O2ZgVFH9n0
SHM Probability of Detection: certification outlook	28	26/11/2024	https://www.youtube.com/watch?v=iwVAjbpy3OU
MORPHOworkshop: Advances in laser shock techniques and carbon fiber recovery for composite materials	2	16/12/2024	https://www.youtube.com/watch?v=BHvS6VGxJeU

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Title	Visualisations	Date	Link
Laser Shock Disassembling: Fundamentals and Versatility for Reuse and Recycling	13	16/12/2024	https://www.youtube.com/watch?v=9LkGiirqnRo
Numerical Simulation of Laser Shock Disassembly of Adhesively Bonded CFRP/Metallic Parts	17	16/12/2024	https://www.youtube.com/watch?v=i2RjqnLZWak
Recovery of Carbon Fiber from Composite Aeronautic Components by Thermal Treatment at Industry Scale	10	16/12/2024	https://www.youtube.com/watch?v=b_ucs7ltky8
Evaluation of Resized Carbon Fibers for Reuse in Thermoset Composite Manufacturing	18	16/12/2024	https://www.youtube.com/watch?v=pbWe9X5eAZw
Sizing Effect on Reclaimed Carbon Fibers' Properties Extracted from Recycled Composite Parts	13	16/12/2024	https://www.youtube.com/watch?v=zSRvSk6ZZP8
Successful recycling of carbon fiber by Comet	30	29/01/2025	https://www.youtube.com/watch?v=Zx2PiStKqLU
MORPHO Final Conference: Wold Coffee Sessions	12	31/01/2025	https://www.youtube.com/watch?v=D7ogXn1M-Fc
MORPHO Final Conference (Recap)	14	31/01/2025	https://www.youtube.com/watch?v=Y8k2t9kbcm4

Table 4. YouTube and video progress on the quantitative objectives by the end of the project

Channel or activity	KPIs	Current state	Percentage achieved
Videos	At least 2: project launch and end of the project	57	2850% over the target
Youtube	1.000 visits	5136	513% over the target

2.4 Media communications and press releases

As part of the MORPHO project's dissemination activities, three final press releases were prepared and distributed on January 31st 2025, showcasing the project's key achievements and innovations. These press releases were published on the project website and included in the final global newsletter to maximize outreach and engagement:

- **Global Newsletter:** EU MORPHO Project Advances Structural Prognostics, Health Monitoring, and Manufacturing Efficiency for Aerospace and Beyond. This

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comprehensive release summarized advancements across all project areas, emphasizing the transformative impact of MORPHO's contributions to aerospace innovation.

- **Recycling-Focused Press Release**: MORPHO Project Pioneers Sustainable Carbon Fiber Disassembly and Recycling for Aerospace Applications. This release highlighted breakthroughs in recycling technologies, particularly the adaptation of pyrolysis processes for carbon fiber waste, underscoring MORPHO's commitment to sustainability.
- **Manufacturing-Focused Press Release**: MORPHO Project Advances Resin Transfer Molding with Real-Time Monitoring and AI Integration. This detailed the project's progress in manufacturing efficiency, including the integration of real-time monitoring and artificial intelligence in Resin Transfer Molding processes.

These press releases served to amplify MORPHO's impact by engaging diverse audiences across global and technical communities, ensuring the project's key advancements were widely communicated and accessible.

Table 5. Publications of the MORPHO's press release.

Title	Media	Date	Language	Link
Developing next-gen, smart engine composite fan blades	CompositesWorld	20/09/2021	EN	https://www.compositesworld.com/news/developing-next-gen-smart-engine-composite-fan-blades
Research Targets Embedded Fan Blade Sensor Manufacturing	Aviation Week	29/07/2021	EN	https://aviationweek.com/air-transport/aircraft-propulsion/research-targets-embedded-fan-blade-sensor-manufacturing
Arts et Métriers coordonne un project d'intégration de capteurs dans les aubes de soufflante des moteurs	Le journal de l'aviation	08/07/2021	FR	https://www.journal-aviation.com/actualites/46180-arts-et-metiers-coordonne-un-projet-d-integration-de-capteurs-dans-les-aubes-de-soufflante-des-moteurs
Arts et Métiers coordonne un nouveau projet de recherche européen sur la fabrication de structures aéronautiques 4.0	TraMetal	09/07/2021	FR	https://trametal.fr/arts-et-metiers-coordonne-un-nouveau-projet-de-recherche-europeen-sur-la-fabrication-de-structures-aeronautiques-4-0/

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Title	Media	Date	Language	Link
Arts et Métiers coordonne un projet d'intégration de capteurs dans les aubes de soufflante des moteurs	AeroContact	08/07/2021	FR	https://www.aerocontact.com/actualite-aeronautique-spatiale/62785-arts-et-metiers-coordonne-un-projet-d-integration-de-capteurs-dans-les-aubes-de-soufflante-des-moteurs
Developing next-gen, smart engine fan blades	TechExplore	16/08/2021	EN	https://techxplore.com/news/2021-08-next-gen-smart-fan-blades.html
Moulage automatique de composites	Machines Production	24/01/2024	FR	https://www.machinesproduction.fr/article/moulage-automatique-de-composites
The MORPHO project announces workshops on smart manufacturing, structural health monitoring and circular solutions for aviation	Euractiv	11/04/2024	EN	https://pr.euractiv.com/pr/morpho-project-announces-workshops-smart-manufacturing-structural-health-monitoring-and-circular

Throughout the MORPHO project, significant efforts were made to disseminate its advancements and innovations via press releases published in leading media outlets. These publications helped raise awareness among global and technical audiences about MORPHO's contributions to aerospace innovation.

Key publications include early announcements about the development of next-generation smart engine composite fan blades, featured in outlets like CompositesWorld (20/09/2021) and TechExplore (16/08/2021). Other articles, such as those in Aviation Week (29/07/2021) and

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French media like Le Journal de l'Aviation and TraMetal, focused on MORPHO's embedded sensor technology and 4.0 manufacturing approaches.

Later updates highlighted specific advancements, such as automatic composite molding in Machines Production (24/01/2024) and workshops on smart manufacturing, structural health monitoring, and circular solutions for aviation, announced in Euractiv (11/04/2024).

These press releases, available in both English and French, ensured MORPHO's achievements were widely disseminated across international audiences, reinforcing its role as a leader in aerospace innovation.

Figure 6 MORPHO final press release

Table 6. Progress on the quantitative objectives by the end of the project

Channel or activity	KPIs	Current state	Percentage achieved
Scientific publications	-**3** publications in **sector-specific magazines**	6	200% over the target
Press releasse	-1,000 people reached by country	1500 audience reached	150% over the target

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2.5 Communication campaigns

In D8.1, the project set a target of four communication campaigns to be carried out throughout its duration, aligning with Subtask 8.2.1 "Overall communication activities." In the previous deliverable, submitted in December 2022, two campaigns had already been completed.

- **Project Launching Campaign**: This campaign introduced MORPHO by sharing a press release in five specialized media outlets, creating a project introduction video, and showcasing the project website. It also included the first newsletter, a poster, and a brochure, effectively establishing an audience familiar with MORPHO's objectives and research.
- **#MorphoExplains**: Focused on producing content to simplify complex project concepts (e.g., Structural Health Monitoring, carbon fiber in aerospace), this campaign targeted both general audiences and the scientific community. It included initiatives like "Morpho Influencer Month," where partners highlighted their contributions through news and social media, and hashtags like #MorphoRecommends (engaging with major events) and #TeamMorpho (presenting consortium members).

During the second half of the project, two additional communication campaigns were conducted:

- The third campaign showcased the project's research achievements, featuring interviews with several researchers involved. It also included the organization of #MORPHOworkshops to raise awareness about the project's advancements.

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Figure 7 Some of the posts of MORPHO's 3rd campaign on X

- The fourth and final campaign centered on promoting the final conference and highlighting the project's overall results. As part of this campaign, hashtags such as #MORPHOFinal and #MorphoResults were actively employed to boost engagement and visibility.

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Figure 8 Some of the posts of MORPHO's 4rd campaign on X

Table 7. Progress on the quantitative objectives by the end of the project

Channel or activity	KPIs	Current state	Percentage achieved
Communication campaign	4	4	100 %

2.6 Scientific publications

By the time this deliverable was prepared, the following scientific papers in journals had been published. All are available in the dedicated section of the project website and on Zenodo:

1. "Towards simulation of disassembly of bonded composite parts using the laser shock technique"
   Published in *IOP Conference Series: Materials Science and Engineering, Volume 1226*.
2. "An efficient numerical model for the simulation of debonding of adhesively bonded titanium/CFRP samples induced by repeated symmetric laser shocks" Published in *The Journal of Adhesion, 1–25*.
3. "A Laser Shock-Based Disassembly Process for Adhesively Bonded Ti/CFRP Parts" Published in *MDPI Special Issue "Design of Adhesive Bonded Joints"*.
4. "Parametric Damage Mechanics Empowering Structural Health Monitoring of 3D Woven Composites" Published in *MDPI Special Issue "Virtual Sensors for Industry 4.0 Era"*.
5. "Single atom convolutional matching pursuit: Theoretical framework and application to Lamb waves based structural health monitoring" Published in *Signal Processing*.

The number of journal publications is currently below the committed target of 12; however, additional scientific publications are expected in the coming months. Both UPatras and ENSAM are planning to publish at least two papers each.

Despite the lower-than-anticipated number of journal publications, project partners have been highly active in contributing to conference proceedings, ensuring widespread dissemination of MORPHO's research findings across various platforms. This demonstrates the consortium's

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strong commitment to engaging with the scientific community and sharing advancements made within the project.

All the publications achieved are available at the following address: https://morpho-h2020.eu/dissemination/scientific-publications/

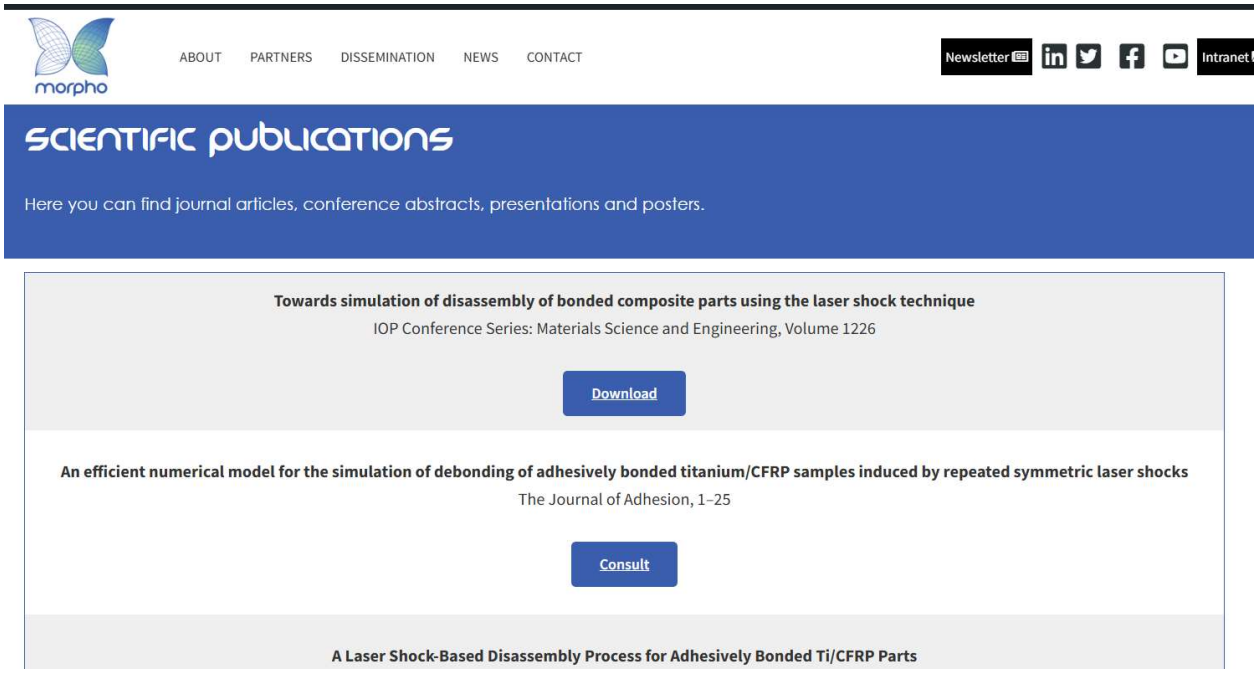

Figure 9 Scientific publications section on the MORPHO website

The Zenodo profile of the project has also been consistently updated and can be consulted here: https://zenodo.org/communities/morpho_h2020/records?q=&l=list&p=1&s=10&sort=newest

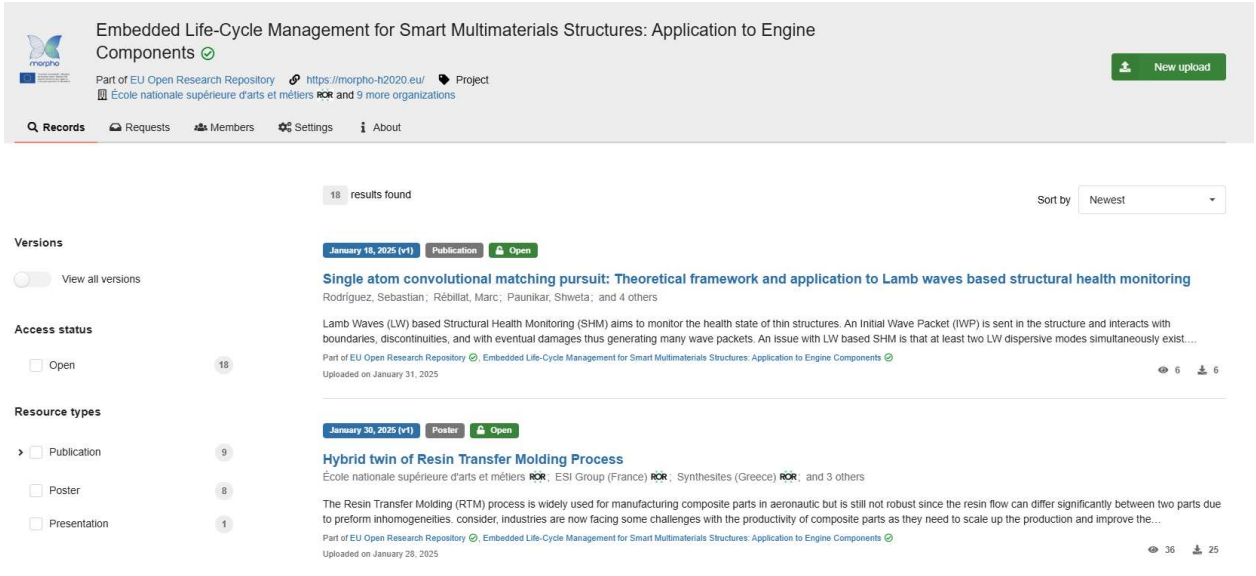

Figure 10 ZENODO page of the project

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Table 8. Publication progress on the quantitative objectives by the end of the project

Channel or activity	KPIs	Current state	Percentage achieved
Scientific publications	-At least **12 publications** (min 1 per technical WP)	5	42%

2.7 Social Media

Social media was a key tool for engaging a broad audience. The MORPHO project used Twitter and LinkedIn to share achievements, news, and outcomes. Managed by FEUGA, these platforms exceeded expectations, effectively reaching diverse audiences. A detailed overview of the work and audience engagement on each platform is provided below. After the first review meeting, a Facebook profile was also added to the MORPHO communication channels to further expand its outreach and engagement. The MORPHO project previously had a profile on ResearchGate. However, in March 2023, ResearchGate discontinued its "Projects" feature, which led to the removal of all associated pages, including the MORPHO project's profile.

The metrics presented in this report were extracted using Metricool.

2.7.1 X

The project's X profile can be consulted here: https://x.com/MorphoH2020 and was regularly updated with the latest news and achievements.

Since January 2023, the MORPHO project's X profile has grown to 338 followers, with 33 posts made during this period. This equates to an average of 0.16 new followers per day and 0.37 followers per post. The project maintained an average of 0.44 posts per day, totaling 3.06 posts per week. The X profile was regularly updated to keep the audience informed about the project's progress and achievements.

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Figure 11 Statistics of the MORPHO X account

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2.7.2 LinkedIn

The LinkedIn profile of the project can be consulted here: https://www.linkedin.com/company/morpho-h2020/ LinkedIn has become the most popular social media channel for the MORPHO project, with a total of 569 followers. Since January 2023, the project gained 344 new followers. The LinkedIn profile has shown strong engagement, with an average of 0.45 daily new followers, 1.25 followers per post, and 103.95 daily impressions. Additionally, the project enjoys 287.66 impressions per post and an average of 0.36 daily posts.

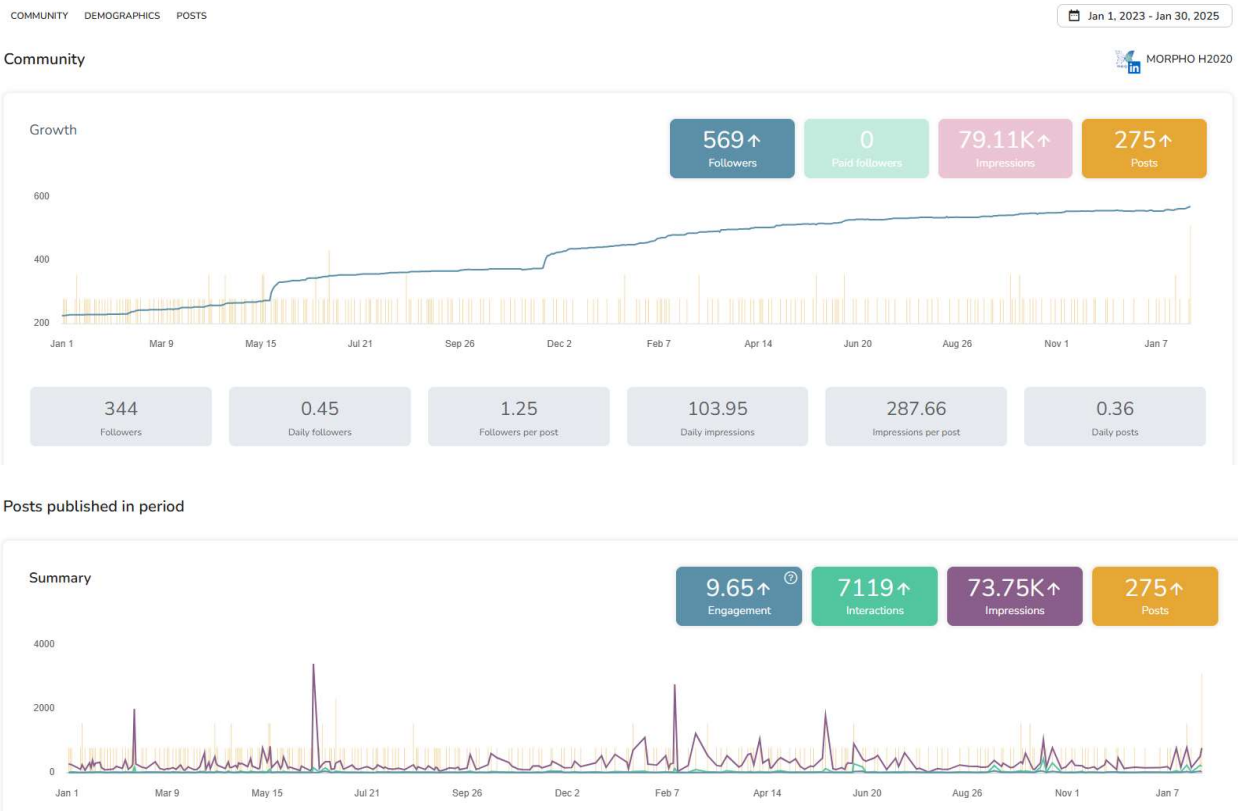

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Figure 12 Statistics of the MORPHO LinkedIn account

2.7.3 Facebook

The project's Facebook profile can be accessed here: [MORPHO Facebook Profile](#).

The MORPHO project's Facebook profile, while not performing as strongly as LinkedIn, still contributes to website traffic. Since its creation, the page has accumulated 44 likes, 48 followers, 10.08k impressions, and 643 page visits. It has shared a total of 210 pieces of content. However, the frequency of posts has been lower due to issues with Facebook removing posts it deemed inappropriate. Despite these challenges, the platform continues to provide visibility and drive visits to the project's website.

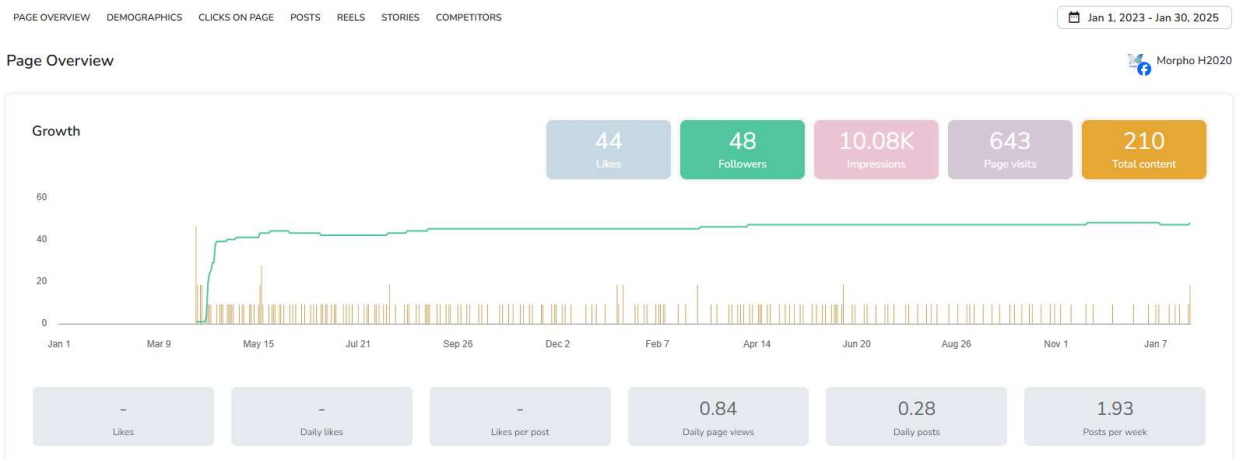

Figure 13 Statistics of the MORPHO Facebook account

Table 9. Social media progress on the quantitative objectives by the end of the project

Channel or activity	KPIs	Current state	Percentage achieved
General Social Media	400 followers in total.	957	239% over the target
Linkedin	100 followers	571	571% over the target
X	200 followers	338	169% over the target

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2.8 Offline communication and dissemination tools

Physical supports have played a crucial role in the effective communication of the project at various levels. From the beginning, MORPHO prepared materials that were continuously used throughout the project. A roll-up, designed by FEUGA and kept by ENSAM, was showcased at several events where the project was present. The image below shows the roll-up design.

Additionally, brochures were designed to provide a quick overview of the project for the public at different events. Since their initial printing, around 2500 copies have been distributed at events such as the Paris Air Show and the SustainAir final conference, among others.

All the materials are available for consultation on the website, here:
https://morpho-h2020.eu/dissemination/materials/

Instead of a project infographic, a series of posters summarizing the results of each work package was created. A total of eight posters were developed, which are available on the project website, on Zenodo, and were showcased in printed form at the poster exhibition during the final conference.

Figure 14 MORPHO poster during the final conference

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Table 10. Progress on the quantitative objectives by the end of the project

Channel or activity	KPIs	Current state	Percentage achieved
Leaflets	2500 print units	2500 printed units	100%
Infographics	1	0	0%, more posters produced instead
Poster	1	10	1000% over the target

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3 Dissemination events & networking activities

This chapter outlines the key dissemination events and networking activities undertaken during this phase of the MORPHO project. Emphasis was placed on fostering collaboration with sister projects and engaging with industry, academia, and other stakeholders to maximize the project's impact and visibility.

Networking activities were central to this effort, with two significant collaborative videos produced in partnership with Horizon 2020 sister projects. These videos showcase the collective advancements and shared vision of the participating projects toward a sustainable and digitally transformed aviation industry.

Additionally, this chapter highlights the consortium's efforts to organize events that disseminate project results, foster innovation, and encourage stakeholder participation. Notable events include the MORPHO mid-term conference, hosted as part of the 2nd International Conference for Condition-Based Maintenance (CBM) in Aerospace, and a series of workshops covering key topics such as sensor technologies, structural health monitoring (SHM), and sustainable recycling solutions.

Additionally, the MORPHO project's final conference served as a significant milestone, bringing together experts and stakeholders to celebrate the project's achievements and reflect on its contributions to the future of aerospace and manufacturing. The event provided a platform for showcasing the project's results and their potential to drive sustainability and innovation in the sector.

3.1 Networking activities

During this phase of the project, networking activities placed a great importance. Two new videos were done in collaboration with sister projects. One created by FEUGA and involving its direct sisters project DOMMINIO and SustainAir. A second one was produced by GENEX including MORPHO, DOMMINIO, Caelestis and Infinite.

The video produced by FEUGA, titled *"Elevating Aviation: Pioneering Projects Transforming the Industry under Horizon 2020,"* highlights the collaborative efforts of the MORPHO, SUSTAINair, and DOMMINIO projects. Released on March 4, 2024, and garnering 157 views so far, the video showcases how these cutting-edge initiatives, supported by the European Union's Horizon 2020 programme, are revolutionizing aviation.

It emphasizes advancements in eco-friendly aircraft components, waste reduction in the manufacturing value chain, and the deployment of innovative Structural Health Monitoring systems. These technologies are designed to detect and address damage, contributing to longer-lasting, high-performing aircraft while paving the way for a more sustainable aviation industry.

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Figure 15 Elevating Aviation

The video produced by GENEX, titled *"Crafting the Future of Manufacturing in Aviation: A Collaborative Approach,"* has achieved 311 views since its release seven months ago. The video highlights the urgent need for innovation in aviation to address two major challenges set by the European Commission: achieving net-zero carbon emissions by 2050 and fully digitalizing the aviation sector.

This collaborative effort features six Horizon 2020 projects—GENEX, DOMMINIO, INFINITE, CAELESTIS, SUSTAINAir, and MORPHO—working together to transform how airframe and engine parts are designed, manufactured, repaired, and recycled. By utilizing advanced digital technologies, these projects aim to create a more sustainable and smart aviation industry.

The video showcases the coordinators of each project, who present their unique contributions and shared vision, emphasizing the importance of teamwork to achieve these ambitious goals. Watch the full video to learn how these projects are reshaping the future of aviation: *Crafting the Future of Manufacturing in Aviation: A Collaborative Approach*.

Figure 16 Post on MORPHO's X account about the video: Crafting the Future of Manufacturing in Aviation

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Other notable networking activities are detailed in the sections below, highlighting how project-organized events facilitated collaboration with various initiatives. Examples include MORPHO's final event and the workshop on recycling, where meaningful engagement with other projects took place.

Figure 17 MORPHO final event photocall

3.2 Consortium-organised events

3.2.1 Mid-term conference

The mid-term conference for the MORPHO project took place as part of the 2nd International Conference for Condition-Based Maintenance (CBM) in Aerospace, which was held on Wednesday, September 11, 2024, at ENSAM University in Paris. The event provided a platform for participants to discuss the latest advancements in Condition-Based Maintenance (CBM) technologies, with a special focus on the MORPHO project's progress and key contributions to the aerospace sector.

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Figure 18 Photographs of the Mid-Term Conference

The conference began with the Opening Ceremony, chaired by Nazih Mechbal, the Project Coordinator and Director of the Processes and Engineering in Mechanics and Materials Laboratory at Arts et Métiers (Paris). Professor Mechbal welcomed the attendees and set the stage for the discussions. The keynote speech was delivered by Professor Fu-Kuo Chang from Stanford University, USA, who addressed the importance of Structural Health Monitoring for Condition-Based Maintenance, emphasizing the critical role of CBM in ensuring the longevity and reliability of aerospace structures.

The afternoon session featured the MORPHO mid-term conference, where consortium members presented their latest research and findings under the theme Embedded Life-Cycle Management for Smart Multimaterials Structures. Chaired by Dr. Theodoros Loutas, Associate Professor at the University of Patras, and Professor Mechbal, the session showcased innovative advancements in SHM and CBM techniques for the aerospace industry.

The conference proceedings, along with a video summary, are available on the MORPHO project website: https://morpho-h2020.eu/mid-term-conference/ . These resources provide a comprehensive overview of the presentations and discussions that took place during the 2nd International Conference for Condition-Based Maintenance (CBM) in Aerospace, including the MORPHO mid-term conference. The video summary highlights key moments from the event, while the proceedings contain detailed abstracts and insights into the cutting-edge research presented by the consortium members.

A stand showcasing the MORPHO demonstrator was placed at the lunch venue during the 2nd International Conference for Condition-Based Maintenance (CBM) in Aerospace. This display allowed attendees to engage with interactive presentations of the project's progress. The stand featured videos that provided an in-depth look at the innovative technologies and solutions being developed as part of the MORPHO project, particularly in the areas of Structural Health Monitoring (SHM) and Condition-Based Maintenance (CBM) for aerospace applications.

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Figure 19 MORPHO's stand during the 2nd International Conference for Condition-Based Maintenance (CBM) in Aerospace

The conference was a significant milestone for the MORPHO project, bringing together experts and professionals from academia and industry to further the adoption of CBM technologies in aerospace, contributing to safer and more efficient operations in the sector.

3.3 Project workshops

A final series of online workshops were organised in November 2024 to showcase the significant advancements made by its consortium members in key areas such as smart manufacturing, structural health monitoring (SHM), and sustainable end-of-life solutions for airplane structures. These workshops marked a key action towards disseminating the project's outcomes and engaging stakeholders in the aerospace and manufacturing sectors.

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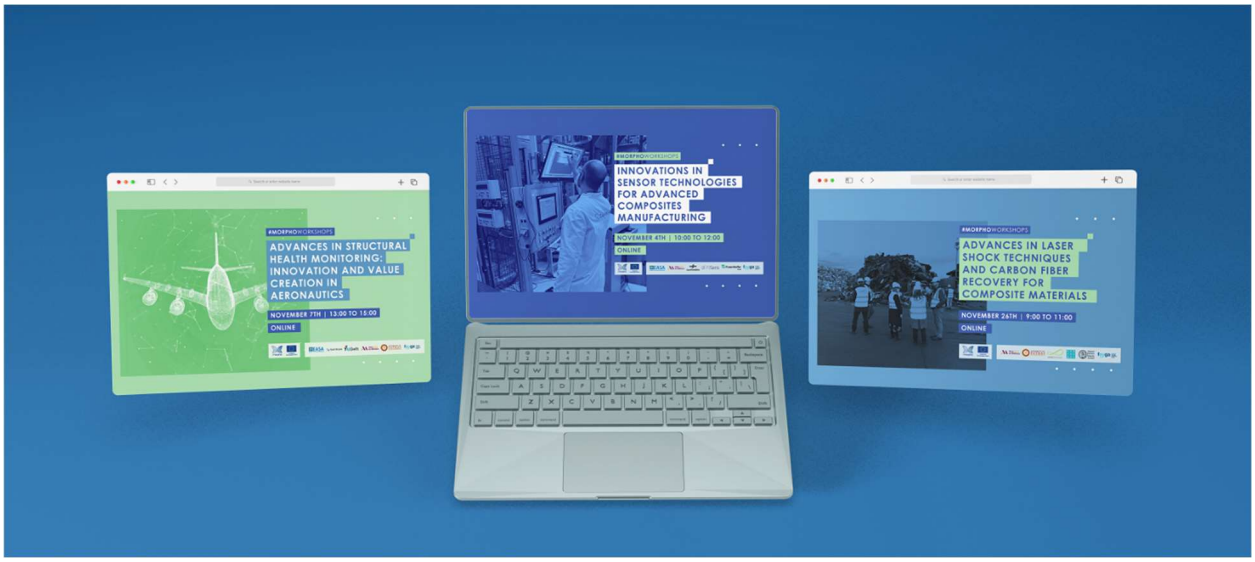

Figure 20 Online Workshop of the MORPHO Project

All three workshops were hosted on **Microsoft Teams**, which enabled the participation of a diverse audience from across Europe and beyond. The online format made it possible for industry experts, researchers, and other stakeholders to attend, exchange ideas, and learn about the latest developments within the MORPHO project. These workshops served as an important platform for sharing knowledge and engaging the wider aerospace community in discussions about the future of aerospace manufacturing, structural health monitoring, and sustainability.

3.3.1 Workshop 1: Innovations in Sensor Technologies for Advanced Composites Manufacturing

On November 4, 2024, the MORPHO project hosted its first online workshop titled "Innovations in Sensor Technologies for Advanced Composites Manufacturing." The event served as a platform for experts to present the advancements made by consortium members in smart manufacturing, particularly in the integration of fiber optic sensors, FBG sensor technology, and functional printing techniques for aerospace applications.

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Figure 21 Promotional banner for Workshop 1

The workshop commenced with welcoming remarks from Nikos Pantelelis, Director at Synthesites, and Simon Waite, Senior Expert at the European Union Aviation Safety Agency (EASA), who chaired the session. Their introductions set the stage for an in-depth exploration of innovative sensor technologies developed under the MORPHO project, highlighting their potential to transform composites manufacturing in the aerospace sector.

The first presentation, titled "Development and Application of Fiber Optical Sensors for RTM and SHM," was delivered by Vladislav Reimer, Scientific Project Manager at FiSens. He discussed how fiber Bragg grating (FBG) sensors are being used to monitor the Resin Transfer Molding (RTM) process in real time, providing essential data for both the manufacturing of composite materials and the Structural Health Monitoring (SHM) of aerospace components. Reimer emphasized the sensors' role in enhancing manufacturing efficiency, improving product quality, and ensuring the long-term reliability of composite materials.

Following this, Andreas Krenz, Research Scientist at Fraunhofer IFAM, introduced a real-time monitoring system for Resin Transfer Molding using embedded FBG sensors in carbon fiber reinforced plastic (CFRP). His presentation demonstrated how these sensors, tailored for aerospace applications such as turbine blades, enable the precise monitoring of resin flow and temperature during the RTM process—critical for maintaining the integrity of composite parts.

Ingo Wirth, Project Manager at Fraunhofer IFAM, then presented on "Printing of Sensors on Composite Components for Aerospace Applications." He discussed how the growing demand for Structural Health Monitoring (SHM) in aerospace, particularly for CFRP, has driven the development of innovative printing technologies. Wirth introduced methods like screen printing and Aerosol Jet printing to embed piezoelectric (PZT) and temperature sensors directly into CFRP components, providing a new way to integrate smart sensors without compromising the mechanical properties of the composites.

The next presentation, "Intelligent and Reliable Monitoring for Composites Moulding," was delivered by Nikos Pantelelis from Synthesites. He showcased Synthesites' advanced sensor

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technology, which is embedded into composite molds to monitor resin flow, viscosity, and curing processes in real time. This technology optimizes cycle times and ensures consistent product quality, offering significant advancements in the efficiency and reliability of the RTM process.

The final presentation of the workshop, "Hybrid Twin for Online Monitoring of the Resin Transfer Molding Process," was presented by Eric Monteiro, Associate Professor at Arts et Métiers Institute of Technology. Monteiro introduced a hybrid model for real-time optimization of the RTM process, combining a reduced multiphysics finite element model and a data-driven ignorance model to predict the position of the resin flow front. This hybrid approach enhances the robustness of the RTM process, making it more reliable and adaptable in aerospace manufacturing.

The session attracted significant attention, with **118 page views** on the registration platform and **48 participants** registering for the event. Ultimately, **44 participants** attended the workshop, with one attendee not identified. The participants of the MORPHO project's workshop came from a diverse range of prestigious institutions and industry leaders spanning across academia, research, and aerospace manufacturing. Key institutions included **UC San Diego**, **Imperial College London**, and **TU Delft**, while notable aerospace companies such as **Delta Air Lines**, **Safran Group**, and **Leonardo Company** were also represented. Research and technology centers like the **National Composites Centre (NCC)**, **AMRC Composite Centre**, and **AIMEN Centro Tecnológico** contributed to the event's collaborative spirit. The workshop also attracted organizations focused on advanced materials and sensor technologies, including **Fisens**, **Com&Sens**, **Millfield Composites Group**, **Vestas**, and **Q-LAB**. Additionally, European research institutes such as **DLR**, **ISQ**, **IMDEA**, and the **Fundación para la Investigación, Desarrollo y Aplicación de Materiales Compuestos (FIDAMC)**, as well as companies like **Efacec**, **Cidetec**, and **Invent Gmbh**, participated. This diverse group of participants underscored the international and interdisciplinary nature of the workshop, bringing together experts from academia, industry, and innovation-driven organizations from across Europe and the United States.

The average attendance time was **1 hour, 53 minutes**, reflecting strong engagement from the audience.

Figure 22 Audience of Workshop 1

The full **recording of the session** is available on the **MORPHO project's YouTube channel**, where it has already gathered **288 views**.

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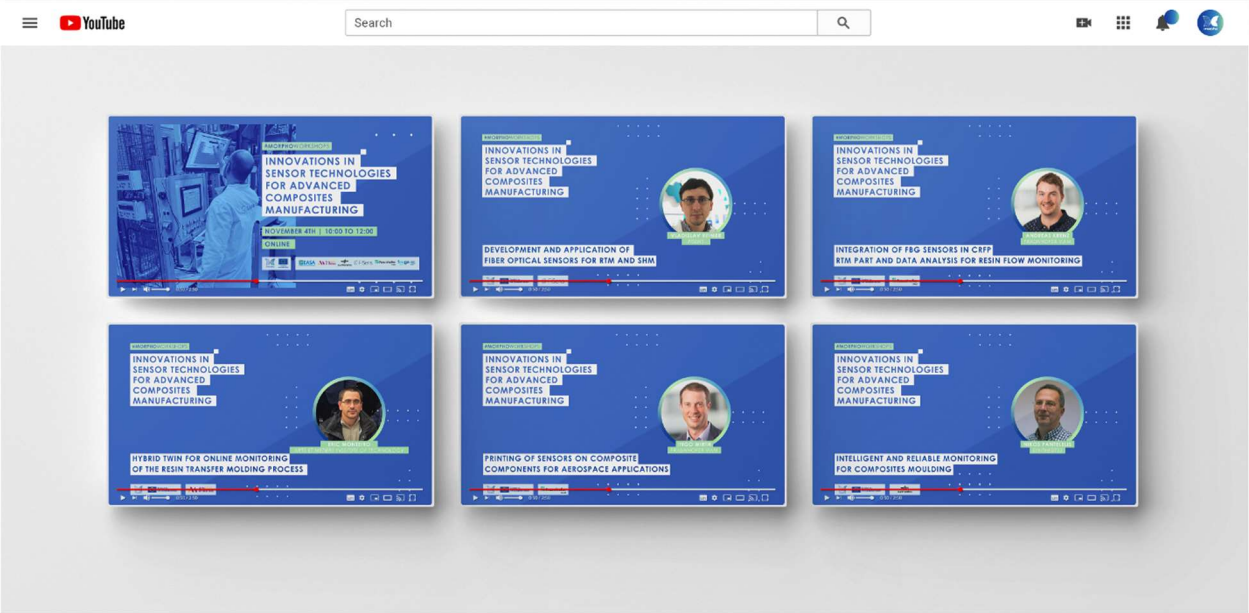

Figure 23 Videos from Workshop 1 on the MORPHO YouTube channel

Additionally, a blog post on the project's website provides an overview of all the presentations including links to the PDF or PPTs presented, making the knowledge shared during the event accessible to a broader audience. This page has been visited gathers one hundred views and can be consulted trough this link: https://morpho-h2020.eu/morphoworkshop-innovations-in-sensor-technologies-for-advanced-composites-manufacturing/

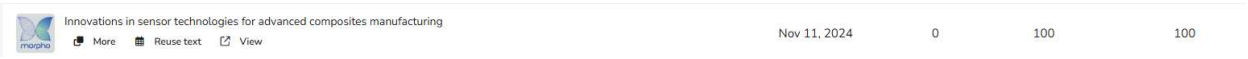

Figure 24 Visits to the Workshop 1 blog page

3.3.2 Workshop 2: Advances in Structural Health Monitoring (SHM): Innovation and Value Creation in Aeronautics

On November 7, 2024, the MORPHO project hosted its second online workshop titled "Advances in Structural Health Monitoring (SHM): Innovation and Value Creation in Aeronautics." The workshop brought together expert speakers to present the latest advancements in SHM and its role in the aerospace industry, focusing on the ways in which SHM technologies contribute to innovation and value creation in aeronautics.

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Figure 25 Promotional banner for Workshop 2

The session was introduced by the project coordinator, Nazih Mechbal, Professor and Director of the Processes and Engineering in Mechanics and Materials Laboratory (PIMM – UMR CNRS) at Arts et Métiers Institute of Technology (Paris), alongside Elena Sánchez García, Aeronautical Engineer at EASA, co-moderated the workshop.

The first presentation, titled "SHM and Value Making for Aeronautics in an Evolving Environment," was delivered by Oscar D'Almeida, Program Manager at Safran. In his presentation, D'Almeida discussed the importance of a global approach to SHM that balances safety, sustainability, and compliance. He highlighted the necessity of acquiring and analyzing sensor data to ensure effective condition-based maintenance for the aerospace sector, outlining how SHM systems must evolve to meet the future needs of the industry.

Following this, George Glanopoulos, Post Doctoral Researcher at TU Delft, presented "The Importance and Benefits of SHM for the Aerospace Industry." Glanopoulos explored how SHM systems can increase safety and availability by providing real-time data for predictive maintenance. He highlighted the challenges in deploying SHM for condition-based maintenance and shared insights from a case study on aircraft engine blade subcomponents, demonstrating the use of Fiber Bragg Grating (FBG) sensors to monitor degradation.

Marc Rebillat, Associate Professor at Arts et Métiers Institute of Technology, then provided an in-depth look at "Lamb Wave-Based SHM of Composite Aeronautic Structures." Rebillat discussed the application of Lamb wave technology for in-situ health monitoring of composite aeronautical structures, focusing on damage detection, localization, and quantification. He also touched on the challenges faced in transitioning this technology from the laboratory to industrial use and the potential offered by new printed transducer technologies.

Next, Giannis Stamatelatos, PhD Student at the University of Patras, presented "A Deep Learning-Based Pipeline for Structural Diagnostics and Prognostics." Stamatelatos proposed a novel data-driven approach for predicting the Remaining Useful Life (RUL) of composite

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structures, leveraging sensor data and pre-trained models. This innovative method allows for real-time operations without the need for extensive manual feature engineering.

The final presentation, titled "SHM Probability of Detection: Certification Outlook," was given by Elena Sánchez García from EASA. Sánchez García provided an overview of the SAE ARP document on the probability of detection in SHM and its relevance to certification processes in the aerospace sector.

The workshop attracted 163 page views on the registration platform, with 74 participants registered for the event. Participants came from a wide range of renowned institutions and companies, including Efacec, ITAINNOVA – Aragon Technological Institute, AGH University of Krakow, Com&Sens, Safran, Arts et Métiers (Ensam), University of Patras, FEUGA, AMRC Composite Centre, Qantas, Testia, BAE Systems, Imperial College London, Aimen Technological Centre, Embraer, Germany Aerospace Center, Delta Air Lines, IMDEA, INEGI, Politecnico di Milano, ISQ, University of the Basque Country, TU Delft, INVENT GmbH, Fraunhofer IFAM, National Composites Centre, Science and Technology Park of Crete, ACT Venture, and ANPM Bucuresti. This wide-reaching participation highlighted the workshop's broad appeal across academia, research institutions, and aerospace industry leaders.

The full recording of the session is available on the MORPHO project's YouTube channel, where it has gathered 170 views.

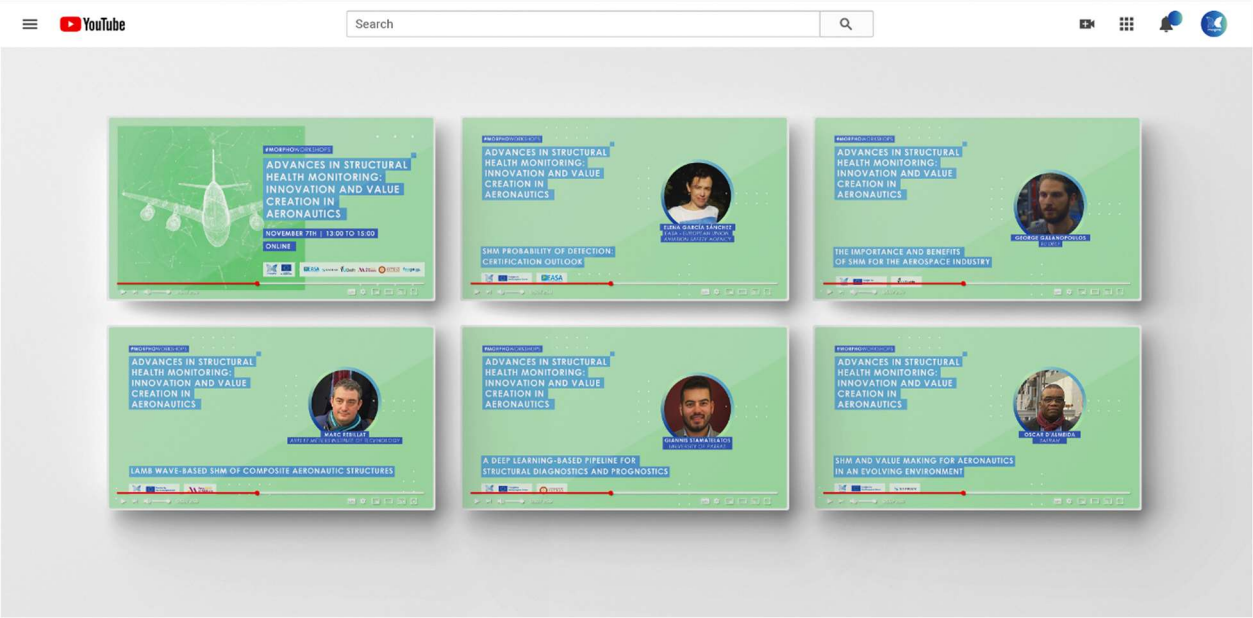

Figure 26 Videos from Workshop 2 on the MORPHO YouTube channel

Additionally, a blog post on the project's website provides an overview of all the presentations, including links to the PDF or PPTs presented, allowing a broader audience to access the insights shared during the event. This blog page has garnered 100 views and can be accessed trough the following link: https://morpho-h2020.eu/advances-in-shm-innovation-and-value-creation-in-aeronautics/

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Advances in SHM: Innovation and value creation in aeronautics More Reuse text View	Nov 26, 2024	0	100	100

Figure 27 Visits to the Workshop 2 blog page

3.3.3 Workshop 3: Advances in Laser Shock Techniques and Carbon Fiber Recovery for Composite Materials

On November 26, 2024, the MORPHO Project hosted its third and final online workshop titled "Advances in Laser Shock Techniques and Carbon Fiber Recovery for Composite Materials." This workshop focused on the latest advancements in recycling and sustainability within the composite materials sector, particularly related to laser shock techniques and the recovery of carbon fiber from aeronautical components.

Figure 28 Promotional banner for Workshop 3

The session was introduced by Ángela Muñíz, Project Manager at Fundación Empresa-Universidad Gallega – FEUGA, alongside Borja Rodríguez, Innovation & EU Programmes Manager at FEUGA, co-moderated the workshop.

The first presentation, titled "Laser Shock Disassembling – Fundamentals and Versatility for Reuse and Recycling," was delivered by Laurent Berthe, Senior Researcher at CNRS, PIMM Laboratory in Paris. Berthe discussed the use of laser plasma shocks for material dismantling, covering various applications such as coatings stripping, laminate dismantling, and controlled laser damage. He also touched on process development and future challenges, aiming to improve the efficiency of composite material recycling through predictive approaches.

Next, Kormpos Panagiotis, Mechanical and Aeronautics Engineer at the University of Patras, presented "Numerical Simulation of Laser Shock Disassembly of Adhesively Bonded CFRP/Metallic Parts: From Coupon Scale to Structural Part Scale." Panagiotis demonstrated the debonding process of a Foreign Object Damage (FOD) panel using laser shock, simulating the

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process in three steps. His findings showed that the composite material could be successfully disassembled with minimal damage to the fibers, a crucial aspect for material recovery.

Pierre Fiasse, European Funding Coordinator at Comet Group, and Xavier Ngungu, Research Engineer at Comet Group, then showcased their presentation on the "Recovery of Carbon Fiber from Composite Aeronautic Components by Thermal Treatment at Industrial Scale." They highlighted promising results from lab and pilot-scale thermal treatments, which effectively recover carbon fiber, although slight reductions in mechanical properties were observed (10-15%). They also noted the challenges of scaling this process for large composite parts, especially due to variability in waste feedstock.

Following this, Jun Yin, Researcher of Sustainable Functional Fibers & Plastics at CENTEXBEL, presented "Evaluation of Resized Carbon Fibers for Reuse in Thermoset Composite Manufacturing: A Study of Individual Fibers." Yin discussed how resizing recycled carbon fibers (rCF) can improve the shear strength of composites. Although resizing did not significantly affect the mechanical properties of individual fibers, it enhanced the adhesion between fibers and epoxy resin, offering a viable approach for reusing rCF in new composite materials.

The final presentation, "European Recycling and Circularity in Large Composite Components (EureComp): Sizing Effect on Reclaimed Continuous Carbon Fibres' Properties Extracted from Recycled Automotive Composite Parts," was delivered by Dionisis Semitekolos, Chemical Engineer PhD candidate at the National Technical University of Athens. Semitekolos shared insights from the EureComp project, exploring the impact of sizing on the properties of recycled carbon fibers from automotive composite parts. The study analyzed the fibers' characteristics and mechanical performance, comparing reclaimed fibers with original materials.

The workshop attracted 45 page views on the registration platform, with 36 participants registered and 40 attending the event. Participants hailed from a variety of prestigious institutions and companies, including **Efacec**, **Comet Group**, **CENTEXBEL**, **Fraunhofer IFAM**, **National Technical University of Athens (NTUA)**, **University of Patras**, **Arts et Métiers Institute of Technology**, **Liverpool University**, **Gaiker**, **ISQ**, **AELS**, and **IMDEA Materials Institute**. Key aerospace companies such as **Safran**, **Com&Sens**, and **Delta Air Lines** were also represented, alongside research centers like the **National Composites Centre** (NCC) and **INVENT GmbH**. The event was attended by professionals working in recycling, sustainability, and the composites industry, underscoring the broad and interdisciplinary nature of the workshop.

The full recording of the session is available on the MORPHO project's YouTube channel, where it has already garnered 72 views.

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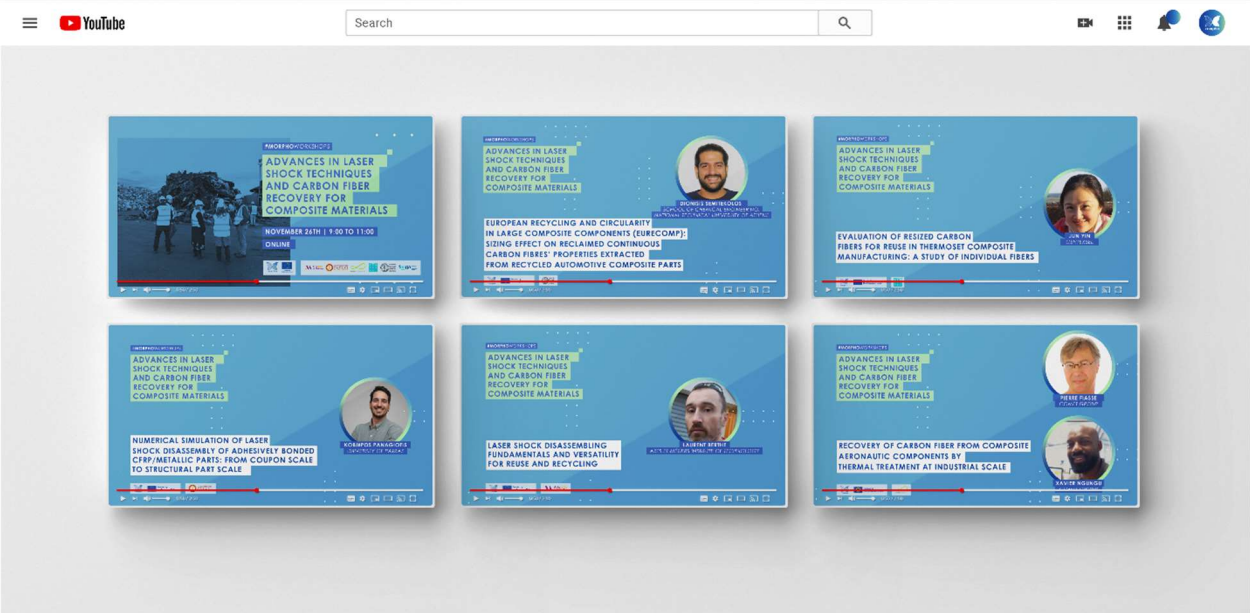

Figure 29 Videos from Workshop 3 on the MORPHO YouTube channel

Additionally, a blog post summarizing the workshop and providing links to the presentation materials is available on the project's website, which has contributed an additional 30 views to the workshop materials. It can be consulted here: https://morpho-h2020.eu/advances-in-laser-shock-techniques-and-carbon-fiber-recovery-for-composite-materials/

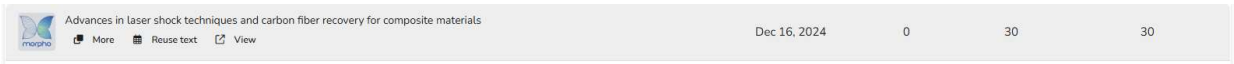

Figure 30 Visits to the Workshop 3 blog page

3.4 MORPHO Final Conference

The MORPHO Final Conference took place on January 30, 2025, in Vigo, Spain, marking the culmination of the MORPHO Project's efforts. The event featured a series of insightful sessions, providing participants with a comprehensive overview of the project's results and innovations in the areas of structural health monitoring, smart manufacturing, and the recycling of composite materials. Alongside the conference sessions, attendees had the opportunity to explore an engaging poster exhibition and participate in networking activities, which fostered collaboration and the exchange of knowledge.

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Figure 31 MORPHO Final Conference agenda

The conference opened with a welcome from **Javier Pereiro**, General Manager of FEUGA, setting the stage for a day filled with insightful presentations and discussions. The first plenary talk was delivered by **Nazih Mechbal** from Arts et Métiers Institute of Technology and **Oscar D'Almeida** from Safran, who presented **"A Cognitive Paradigm to Life Cycle Management of Aeronautical Composite Structures: Challenges and Key Issues."** This session discussed the integration of cognitive technologies into the management of composite structures throughout their lifecycle, a key topic within the MORPHO Project.

Following this, **Nikos Panteletis** from Synthesites and **Eric Monteiro** from Arts et Métiers Institute of Technology took the stage to present their work on the **"Smart Injection RTM Process Based on Innovative Sensors and Hybrid Twin."** Their presentation provided an in-depth look at how smart manufacturing processes are transforming the aerospace industry, particularly through the use of sensors and hybrid twins for real-time process optimization. **Ingo Wirth** of Fraunhofer IFAM and **Marc Rebillat** from Arts et Métiers Institute of Technology also took the opportunity to explore new avenues for **structural health monitoring** with their talk on **"Printed Sensors: Exploring New Opportunities for Structural Health Monitoring."**

Another highlight of the plenary sessions was **Theodoros Loutas** from the University of Patras, who presented on **"AI-based Structural Health Monitoring of Composite Structures."** His talk demonstrated how artificial intelligence can be applied to monitor and assess the health of composite materials used in aerospace structures, promising to enhance safety and reduce maintenance costs in the long run. **Quentin Van Haute** from Comet Group and **Konstantinos Tserpes** from the University of Patras also presented a session on **"De-assembling & Recycling Aeronautics Composites Parts by Laser Shock Techniques and Thermal Treatment."** Their research focused on the novel use of laser shock technology and thermal treatment for the disassembly and recycling of aeronautical composite parts, which is essential for advancing sustainability within the sector.

In addition to the plenary sessions, the conference featured a series of introductions to sister projects. These included **INFINITE** by **Peio Olaskoaga** from IDEKO, which focuses on digitally sensorized aerospace composites, **CAELESTIS** by **Cristian Builes Cárdenas** from AIMEN Centro

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Tecnológico, presenting a hyperconnected simulation ecosystem, and **GENEX** by **José Luis Núñez** from Instituto Tecnológico de Aragón, which offers a digital framework for optimized manufacturing and maintenance of composite structures. Other sister projects like **DIDEAROT**, **DREAM-ON**, **TURBO**, and **THUMB-SI** also presented their innovative approaches to composite materials in aerospace applications, including predictive manufacturing, real-time damage monitoring, and waste reduction in turbine blade production.

The conference included three interactive world coffee sessions, which provided an opportunity for attendees to engage in discussions on key industry topics. The first, **"Smart Manufacturing in Aviation: What's Next?"** was moderated by **Asmaa Messaoudi** from ENSAM, with contributions from **Jan Koch** (Fisens), **Nikos Panteletis** (Synthesites), and **Oscar D'Almeida** (Safran). The second session, **"Structural Health Monitoring Systems: Is This the End of Traditional Inspections?"** was moderated by **Theodoros Loutas** (University of Patras), with speakers **Elena García Sánchez** from the European Union Aviation Safety Agency, **Thang Hung Le** from Vestas, **Santiago Parente de Castro** from Navantia, and **Morteza Moradi** from TU Delft. The final session, **"Recycling in Composites Materials: Challenges and Opportunities"**, was moderated by **Cristian Lira** from the National Composites Center, with contributions from **Quentin Van Haute** (Comet Group), **Konstantinos Tserpes** (University of Patras), **Felix Quintero** (University of Vigo), and **Jun Yin** (Centexbel).

A total of 54 participants attended the MORPHO Final Conference in person, representing a diverse range of organizations and institutions from across the aerospace and technology sectors. Notable attendees included representatives from AIMEN Technology Center, Comet Treatments, ENSAM, ESI Group, FEUGA, FISENS GmbH, Fraunhofer IFAM, Safran SA, Synthesites, TU Delft, University of Patras, EASA, National Composites Center (UK), Universidade de Vigo, Cintecx - Universidade de Vigo, CENAERO, Centexbel, École Normale Supérieure Paris-Saclay, IDEKO, Instituto Tecnológico de Aragón, ITAEREA Business School, MMWeb, Navantia S.A., TechBrained, The Grass Producciones, Vestas Wind Systems AS, and CATEC.

The event was livestreaming by Youtube, connection problems made not possible to broadcast word café sessions, but the event was recorded and is available on the Youtube channel together with a recap video of the event. Just one day after the event, the videos had already garnered 217 views.

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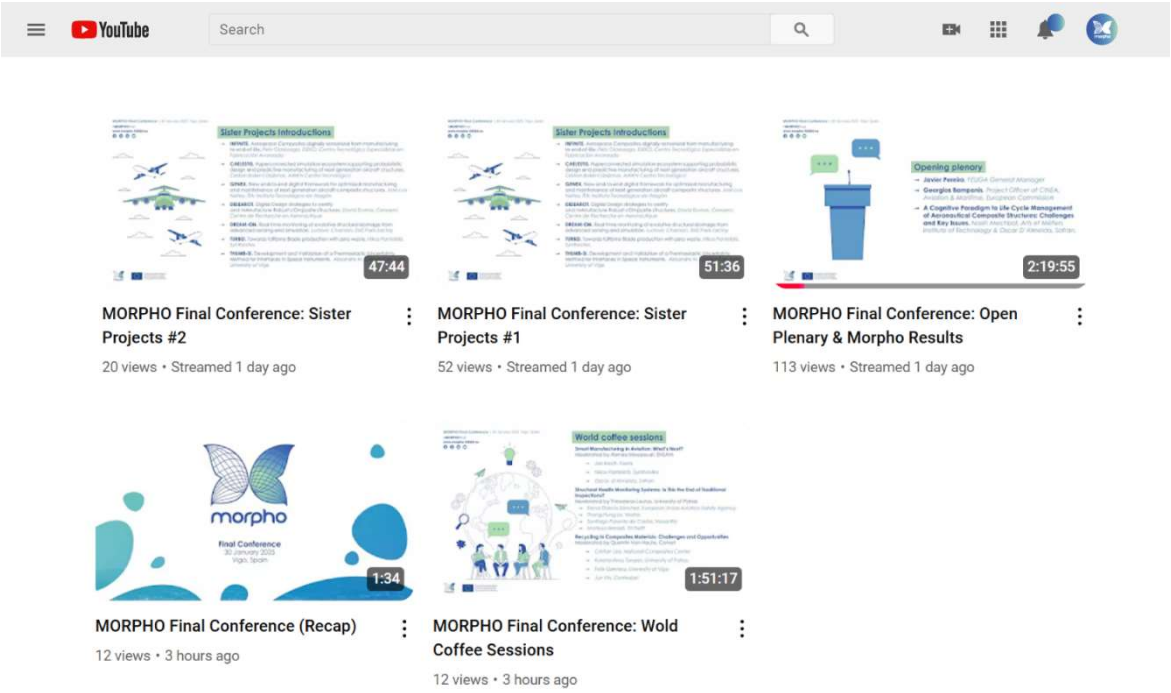

Figure 32 Videos of the Final Conference on the MORPHO YouTube channel

The poster exhibition attracted 15 contributions from both the consortium and sister projects, presenting a diverse array of research topics. Among the projects featured were DREAM-ON, which focuses on robust, real-time, and data-driven modeling for online control of structural damage, and NEXTAIR, which explores designing, manufacturing, and quantifying uncertainties to enhance aviation safety. Another key contribution was DEMOQUAS, which also delves into quantifying uncertainties to improve aviation safety.

The exhibition also highlighted CoPropel, a project aimed at next-generation propulsion technology for structural health monitoring (SHM) of composite marine propellers. GENEX presented their work on verifying surface preparation for scarf repairs using laser-based cleaning and spectroscopy technologies. Additionally, TURBO showcased their efforts towards zero-waste turbine blade production, and CENTEXBEL explored the potential for recycling and reusing recycled carbon fiber and post-production carbon fiber prepreg. These contributions provided valuable insights into the cutting-edge research being conducted across various sectors of the aerospace and composite materials industries.

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Figure 33 Poster exhibition during the Final Conference

A dedicated website for the final conference was created, offering direct access to key resources such as the event agenda, video recordings, a photo gallery, and the posters presented during the event. This webpage was actively used for event promotion, and it successfully garnered until today 949 views, demonstrating strong interest and engagement with the event. This page can be consulted here: https://morpho-h2020.eu/final-conference/

/final-conference/	949	7.48%

Figure 34 Views of the Final Conference website

3.5 Participation in external events

The midterm report on Communication and Dissemination activities provided an overview of the initiatives undertaken by MORPHO partners from April 1, 2021, to December 31, 2022, with both qualitative and quantitative perspectives. During this period, MORPHO participated in several significant events, including the EU Green Week 2021, where circular aviation was discussed, and the 11th EASN International Conference, focusing on advanced airframe and engine parts. MORPHO was also showcased at high-profile events such as the ECOMONDO trade fair, JEC World 2022 in Paris, and ILA Berlin, highlighting its contributions to sustainability and innovation. The project featured prominently in academic and industry gatherings, such as the ECCM20 conference in Lausanne and the 10th European Workshop on Structural Health Monitoring, reaching a wide audience of industry experts, academics, and policymakers. Additionally, MORPHO participated in specialized forums like the SuCoHS Final Public Workshop and the AISC-SHM Committee meeting, fostering collaboration and emphasizing its advancements in structural health monitoring. This detailed overview sets the stage for an in-depth exploration of events from 2023, 2024, and January 2025, which will be explained in the subsequent section.

3.5.1 10th SMART2023 ECCOMAS Thematic Conference

The 10th SMART2023 ECCOMAS Thematic Conference, held on July 3-6, 2023, at the University of Patras, provided a dynamic forum for discussing advancements in smart structures and materials. Special Session (SS19), dedicated to the MORPHO project, focused on "Embedded Life Cycle Management of Smart-Multifunctional Structures," covering topics such as process

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monitoring, structural health monitoring (SHM) with embedded sensors, and smart-dismantling strategies.

The conference featured renowned plenary speakers and facilitated the submission of selected papers to leading journals. MORPHO contributed significantly with five presentations addressing topics like digital twin-based damage quantification, FBG sensor integration for RTM process monitoring, hybrid twin applications for SHM, printed sensor integration for composite functionalization, and laser-shock disassembly for bonded materials. These contributions highlighted MORPHO's role in advancing innovation and sustainability in smart materials research.

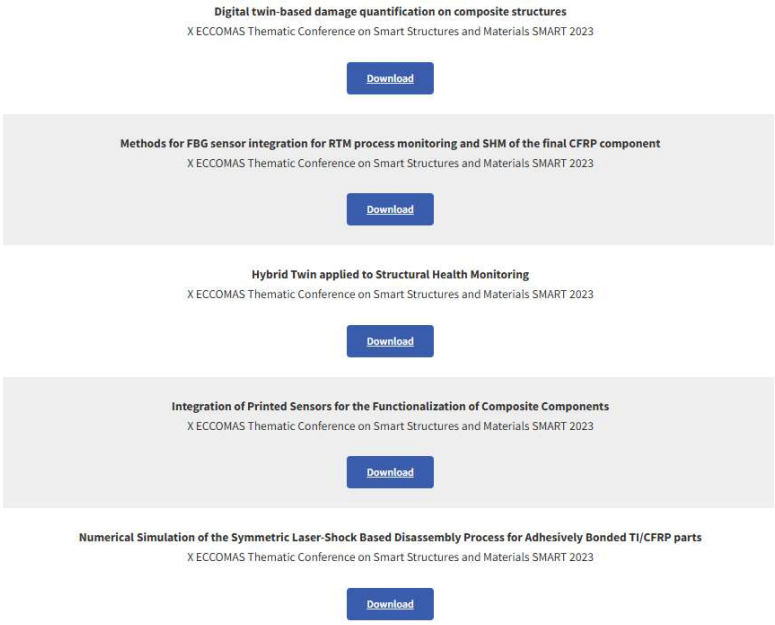

Figure 35 Scientific publications on Morpho website

3.5.2 Paris Air Show 2023

On June 12, 2023, MORPHO showcased its innovations at the prestigious Paris Air Show, a premier event for aerospace technology, at the European Commission's stand. Partners ENSAM, Comet, and FEUGA represented the project, highlighting MORPHO's cutting-edge real-time embedded sensors, including FBG, piezo, and thermocouple technologies, designed to enable aircraft components to "sense" and offer early warnings of potential issues. With an impressive 210,000 professional visitors and 170,000 general public attendees, totaling 400,000 entries, the event provided an invaluable platform to enhance the visibility of the project and its groundbreaking contributions to the aerospace sector. The participation in this event was extensively promoted through social media channels and the project's website, reaching a wide audience and generating significant interest. The strategic use of these platforms helped amplify the visibility of MORPHO's participation, attracting attention from both industry professionals and the general public.

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Figure 36 Photographs of the Paris Air Show

For the Paris Air Show, FEUGA designed two types of paper planes as part of its interactive engagement with younger attendees. The first type was a basic, easy-to-fold design, which allowed children to quickly participate and enjoy the experience of creating and flying their own plane. The second type was a more advanced design, offering a slightly more challenging fold, allowing older or more engaged participants to experiment with aerodynamics and see the effects of design changes on flight performance.

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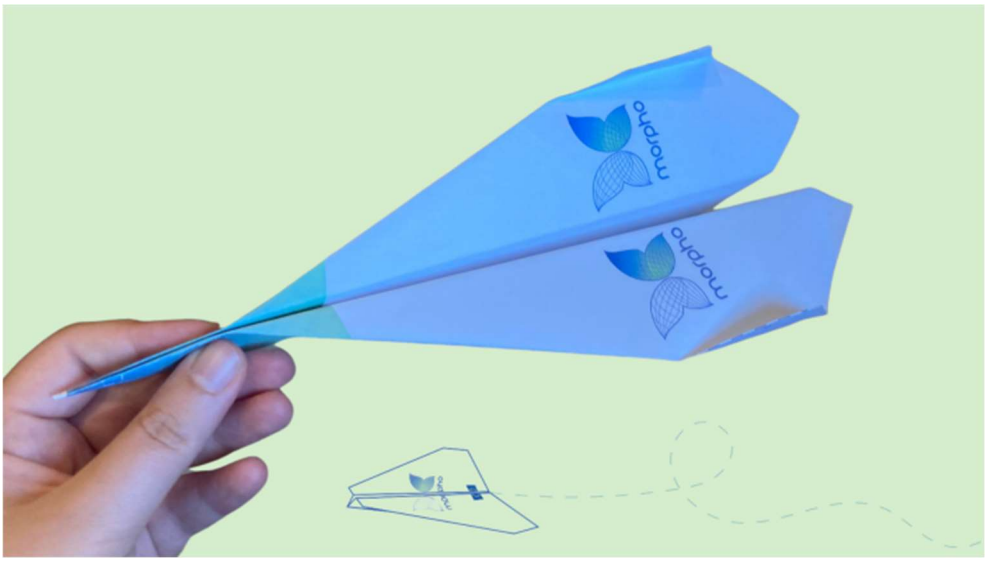

Figure 37 Example of one of MORPHO's paper airplanes

MORPHO's participation in the Paris Air Show, including the design of paper planes for younger attendees, can be considered an RRI action for several reasons:

1. **Engagement of Diverse Audiences**: RRI focuses on involving society at large in research. By offering a fun, hands-on activity like paper planes, MORPHO made aerospace innovation accessible to children, sparking their curiosity about science and technology.
2. **Inspiring Future Innovators**: Engaging children in interactive activities fosters early interest in STEM fields, helping to inspire the next generation of scientists and engineers, aligning with RRI's goal of shaping future innovation.
3. **Inclusive Science Communication**: The paper plane activity simplified complex concepts, making aerospace research understandable and engaging for younger audiences, in line with RRI's emphasis on clear communication.
4. **Encouraging Creativity**: The activity encouraged creativity and problem-solving, allowing children to experiment with aerodynamics, which ties into RRI's focus on promoting innovative thinking.
5. **Ethical Outreach**: RRI promotes ethical, inclusive outreach, and by involving children, MORPHO demonstrated its commitment to making science enjoyable and accessible for all ages.

This initiative helped make aerospace research more approachable, aligning with RRI's principles of public engagement and responsible innovation.

3.5.3 Certbond COST Action Final Conference

On July 5, 2023, MORPHO joined an online workshop dedicated to composite recycling and disassembling, organized by CertBond (COST Action CA18120). The event featured key presentations on sustainable practices and cutting-edge projects. Pr K. Tserpes from the University of Patras (UPAT) represented MORPHO, showcasing the project's innovative

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approaches to composite recycling, aimed at enhancing efficiency and sustainability in handling composite waste.

The workshop also included talks by M. Blanco from Airbus on recycling perspectives and Pr G. Griffini from POLIMI on disassembling techniques under the Recreate Project. The event concluded with interactive discussions on the future of composite disassembling. MORPHO's participation reinforced its commitment to advancing sustainable practices in aerospace and composite materials.

The recording of Professor Kostas's intervention is available on the project's YouTube channel, where it has already garnered 77 views. Additionally, a detailed news article covering the event was published on the project's website and can be accessed here: MORPHO joins an online workshop on composite recycling and disassembling.

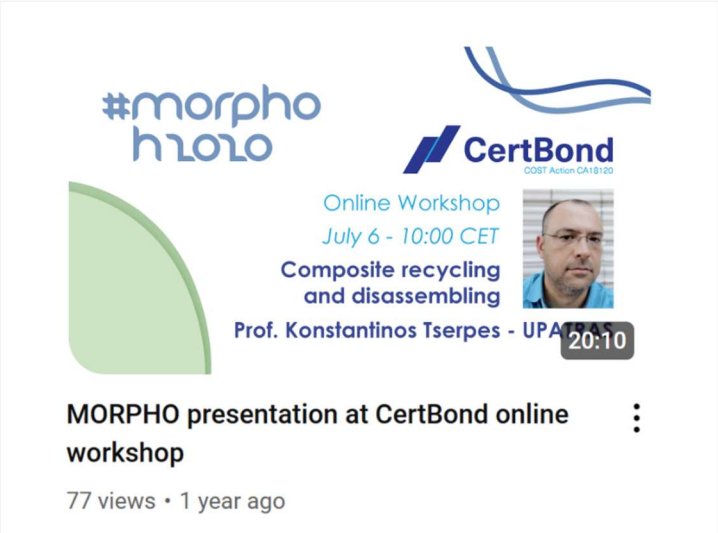

Figure 38 Professor Kostas's video

3.5.4 13th EASN International Conference on "Innovation in Aviation & Space for Opening New Horizons"

MORPHO participated in the 13th EASN International Conference, "Innovation in Aviation & Space for Opening New Horizons," held in Salerno, Italy, from September 5–8, 2023. During the event, MORPHO joined a workshop organized by the European Climate, Infrastructure, and Environment Executive Agency (CINEA) on Digitalization of Manufacturing, Sustainable Manufacturing, and MRO. Collaborating with projects such as CAELESTIS, GENEX, INFINITE, DOMMINIO, and SUSTAINair, the workshop aimed to drive advancements in these critical areas.

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Figure 39 EASN International Conference

3.5.5 European Research Showcase

MORPHO participated in the European Research Showcase, part of the European Researchers' Night, held on September 29–30, 2023. This event, spanning from 9 AM to 9 PM each day, provided a platform to showcase groundbreaking research and foster collaboration across Europe. MORPHO was represented by Shweta Paunikar, a Postdoctoral Researcher at Arts et Métiers ParisTech – École Nationale Supérieure d'Arts et Métiers.

Specializing in wave propagation, composites, structural health monitoring, and finite element methods, Shweta embodies MORPHO's commitment to innovation in aerospace technology. Her participation highlighted MORPHO's advancements and reinforced its dedication to connecting with the broader research community.

The European Research Showcase featured engaging interviews, profiles, and videos across platforms like Twitter, Instagram, and TikTok, ensuring broad public access. The European Researchers' Night itself provided an invaluable opportunity for the public to engage directly with scientists and learn about the vital role of research in shaping our world.

MORPHO's participation in the European Research Showcase, part of the European Researchers' Night, is considered a Responsible Research and Innovation (RRI) action because it actively promotes public engagement with research, transparency in scientific work, and addresses societal needs through innovation.

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Figure 40 Post on MORPHO's X account about European Research Showcase

3.5.6 JEC Innovation Awards 2024

MORPHO was selected as one of the top three finalists in the "Equipment, Machinery & Heavy Industries" category for the 2024 JEC Innovation Awards, which recognize outstanding collaborative projects in the field of composites. The entry, the **Automatic Composites Moulding System**, was developed by Synthesites in partnership with Safran as part of the MORPHO project. This event brought together over 1,300 exhibitors, and attracted 43,000 visitors. To capture the essence of MORPHO's participation, a short video was created and showcased as part of the awards ceremony, giving great visibility. The video is available for viewing here: MORPHO Video. Additionally, a web entry highlighting MORPHO's success as a top 3 finalist in the JEC Innovation Awards can be found here: MORPHO at JEC Innovation Awards.

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Figure 41 Post on MORPHO's X account about JEC Innovation Awards 2024

Figure 42 top 3 finalist in the JEC Innovation Awards

3.5.7 SustainAir's Final Conference: Circular Aviation in the EU

On June 11–12, 2024, MORPHO participated in the Circular Aviation in the EU 2024 conference, held at the Arcotel Kaiserwasser in Vienna, Austria. Organized as the final conference of the SustainAir project, this event brought together industry leaders, policymakers, and innovators to discuss sustainable practices and the transition to a circular economy in aviation.

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MORPHO played a key role in the **"EU Sister Projects Unite"** session, collaborating with CAELISTIS, DOMMINIO, and INFINITE to showcase advancements in sustainability. The conference provided a platform for presenting MORPHO's contributions to sustainable aviation through innovative technologies, such as real-time monitoring and end-of-life solutions for composite materials.

This engagement highlights MORPHO's commitment to fostering collaboration and driving progress in sustainability across the aviation sector, aligning with its mission to promote environmental stewardship and technological innovation. Further information on the event is available at:

https://www.sustainair.eu/2024/02/20/circular-aviation-in-the-eu-sustainair-final-conference-takes-flight-in-vienna/

Figure 43 Promotional banner and X post for the SustainAir's Final Conference: Circular Aviation in the EU

3.5.8 SAMPE 2023 & 2024

MORPHO participated in the **SAMPE 2024 Conference and Exhibition**, which took place from **May 20–23, 2024** at the **Long Beach Convention Center** in California. SAMPE is recognized as North America's premier event for advanced materials and process engineering, attracting industry leaders, engineers, scientists, and professionals to discuss the latest innovations and advancements in the field.

As part of the **Factory of the Future** session, MORPHO presented on **"Advanced Process Monitoring and Control for CFRP RTM in Aerospace without Compromises,"** a topic delivered by **Dr. Nikos Pantelelis**, Director of **Synthesites**. The presentation took place on **May 22, 2024**, from **3:30 pm to 3:55 pm (Room 103 B)**, where Dr. Pantelelis discussed MORPHO's advancements in real-time process monitoring and control for composite manufacturing, focusing on the aerospace sector. In 2023, Synthesites also presented the MORPHO project at this conference.

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Figure 44 Post on MORPHO's X account about SAMPE 2024

3.5.9 11th European Workshop on Structural Health Monitoring (EWSHM 2024)

MORPHO participated in the **11th European Workshop on Structural Health Monitoring (EWSHM 2024)**, held in **Braunschweig, Germany**. Represented by **ENSAM**, MORPHO contributed to **Session Mo.1.B: Aerospace – Data Acquisition 1**, chaired by **Peter Wierach** from the **German Aerospace Center (DLR)** and **Claudio Sbarufatti** from **Politecnico di Milano**. The session took place in **Room D1+D2** and focused on advancements in SHM technology for aerospace applications.

The MORPHO team's presentation, titled **"Printed PZT Transducers Network for the Structural Health Monitoring of Foreign Object Damage Composite Panel"**, was delivered by **Shweta Paunikar**, a postdoctoral researcher at **ENSAM/CNRS/CNAM**. The presentation was scheduled for **12:10 pm** on **Monday, June 10, 2024**.

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Figure 45 Post on MORPHO's X account about EWSHM 2024

Table 11. Events progress on the quantitative objectives by the end of the project

Channel or activity	KPIs	Current state	Percentage achieved
Participation in events (presentations and posters)	20	20	100%
IPR workshops to create awareness on IPR & Exploitation	3	3	100%
Channel or activity	**KPIs**	**Current state**	**Percentage achieved**
Dissemination events	-1 mid-term dissemination events with at least 40 stakeholders attending. -Final conference with at least 1000 stakeholders attending.	Completed Completed	1 300 participants

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Channel or activity	KPIs	Current state	Percentage achieved
	-At least 3 workshops at partners' level.	3	100%
	-At least 3 activities releated with RRI.	3	100%
Joint actions with other European projects	5	7	140% over the target

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4 Conclusions

The MORPHO project has successfully implemented a robust communication and dissemination strategy, fostering awareness, engagement, and knowledge sharing across diverse audiences. Through strategic use of multiple channels—including the project website, social media platforms, printed materials, scientific publications, and participation in conferences—the project effectively showcased its objectives, advancements, and outcomes.

While the number of journal publications fell short of the initial target, strong engagement in conference proceedings and the commitment of partners to future publications ensure the continued dissemination of MORPHO's findings. The final campaigns, workshops, and conference exemplified the project's ability to generate impactful dialogue and collaboration within and beyond the scientific community.

As the deliverable is submitted just one day after the final conference, the full impact achieved through the press release, or the conference itself cannot be properly measured at this time. This will be updated as part of the final reporting.

As the project concludes, its outputs and materials remain accessible on public platforms like Zenodo, YouTube and the project website, ensuring ongoing visibility and impact. MORPHO's communication efforts not only met the project's goals but laid a solid foundation for continued exploitation and application of its results in future research and industrial context