CoPropel

Composite material technology for next-generation Marine Vessel **Propel**lers

www. Copropel.com

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Contents

Glossary

Abbreviation / acronym	Description
CA	Consortium Agreement
DMP	Data Management Plan
DOA	Description of action
DOI	Digital Object Identifier
EC	European Commission
FAIR	Fair Accessible Interoperable and Reusable
GA	Grant Agreement
LCA	Life Cycle Analysis
OA	Open Access
OS	Open Science
PDC	Project Data Contact
SHM	Structural Health Monitoring
WP	Work Package
OEM	Original Equipment Manufacturers

1. Executive Summary

This deliverable is a mid-term report on the progress of dissemination, communication and exploitation activities as part of CoPropel project. The main strategy is to disseminate project related information in networks of people who are connected closely through shared objectives and activities to the scientific field of CoPropel, either as affected and/or interested stakeholders, or as end users. The different foreseen dissemination measures involve a major analysis of market segmentation and a detailed evaluation of marketplace potential. The deliverable is providing updates in:

- Communication strategy
- Dissemination and exploitation strategy

The communication section includes information about the communication activities which have been performed up to now and the ones which are planned for the next months as part of CoPropel project. These activities include events, press releases, attendance in conferences and exhibitions, maintenance of the website and updates to the video that describes the project activities. Next, information about the dissemination and exploitation strategy is included and how the consortium has been working on the development of the Advisory Board in order to connect with the marine and composites' community. The market outlook is regularly being monitored to ensure the quick uptake of the CoPropel technology after the finalization of the project.

1. Introduction

CoPropel puts forth a holistic approach towards the realisation of marine propellers made of advanced composite materials. Compared to their traditional counterparts, marine composite propellers offer gains in propulsion efficiency, noise reduction and weight savings.

The CoPropel project sees an interdisciplinary team of experts drawn both from research and industry, from theoretical considerations and numerical modelling to precision manufacturing - assembly and experimental verification testing. The CoPropel action brings together 9 organisations from 5 countries: 4 Research Institutes – TWI, University of Ioannina, Brunel University London and The Bulgarian Ship Hydrodynamics Centre; 4 Industrial partners – Loiretech, MECA, Danaos and Glafcos Marine with one certification body Bureau Veritas Marine & Offshore. Together, we will develop and bring to market a marine composite propeller with an embedded structural health monitoring system. The proposed activities will mature our Technology Readiness Level to 5-6 and drastically de-risk the integration of the investigated solutions on future products, effectively resulting in reducing the direct operating costs for the operators while minimizing the environmental impact.

Existing work by the partners has shown an approximate 12% reduction in energy consumption and subsequent fuel consumption, with the potential savings exceeding 15% at full-scale marine vessel propellers, which will be investigated and confirmed during our real-time sea trials as part of the CoPropel project.

The main objectives of the project are summarized in Table 1

Table 1 List of Objectives for the CoPropel

No	Objectives	Objective description and means of verification
1	Design a large scale composite marine propeller utilising methodologies and composite materials	The key characteristic of composite materials is the capability to exploit their inherent anisotropy in order to tailor the stiffness and strength of the final product. This will enable the propeller blades to exhibit outstanding hydrodynamic efficiency as well as controlled deformations pertaining to shape-adaptive structures capable of adapting their shape according to the specific regime of the operational envelope. The design activities of the composite propeller are planned for the first 24 months of the project, with a Critical Design Review (CDR) performed at the end of the second year of the project. More precisely, three different CDRs will be performed which will focus on the following items: 1. CDR for the blades in M21 (6 months before the final CDR in order to start full scale manufacturing) 2. CDR for root and fixing in M24 3. CDR for SHM system together with final assessment of full propeller in M27
2	Optimise the manufacturing process for the fabrication of the composite propeller based on closed mould resin infusion techniques.	Resin infusion/injection techniques are particularly suitable for such structures. Together with the unique process monitoring and online quality control technologies available at the consortium level, they guarantee repeatability and quality assurance at every step of the manufacturing process. Automation processes will be built into the manufacturing system in order to allow increased productivity and error elimination. The novel manufacturing process will be approved through a CDR in M21 which will

		focus on the blades of the propeller. In that way, the outside surface will be fixed and the RTM tools can start getting prepared 6 months before the final CDR which will be done in M27.
3	Develop a condition and structural health monitoring system that will be embedded within the propeller	A network of suitable sensors will be embedded within the propeller structure and transmit information about the "structural health" of the composite structure. This Structural Health Monitoring (SHM) system, apart from the embedded sensors, will be comprised of signal transmission lines, interrogators, and analysis modules that will enable the detection of events such as impacts with objects as well as the identification of inspection and repair intervals. The SHM system will be fully developed and assessed at the CDR on M24 of the project.
4	Validation of the composite propeller	Precursor testing of smaller-scale (1:5) propeller demonstrator will be carried out in the relevant environment, e.g. water tank, in order to de-risk the full-scale testing (WP4). Then, validation testing of a full-scale propeller with a 1.1 m diameter (to be defined based on the available vessel) in a real environment (sea trials) will be conducted. The composite propeller along with the SHM system will be installed in a marine vessel and tested in real operational conditions (WP5). With the sea trials, TRL 7 of the technology will be achieved. Sea trials will take place at the end of the project (M30 to M35), and the experimental data will be compared with predictions.
5	Assist in the formulation of new guidelines regarding the use of composite materials at the propeller	Our consortium partner BV is developing a guidance note NI663 concerning the design assessment of propeller in composites materials. In order to complete and improve this document, BV will use results obtained in the project with regards to 1. the design assessment methods and fatigue investigation, 2. the manufacturing survey, 3. the propeller monitoring 4. the testing procedure including the quality control.
6	Communication and Dissemination of the project outcomes – open science-related objective	CoPropel will be widely promoted across different academic and industrial stakeholders by providing at least 6 open access scientific publications. Within the scope of the project, we will identify and attend at least 4 major Marine and Composite Conferences and Events that will serve as communication channels to promote CoPropel.
7	Define roll out strategy and develop a business plan	Future technical and business development roadmaps will be defined and be available at the consortium level towards the end of the project. Certification issues are the focus of specific activities, and the foreground knowledge during the project's tenure will simplify future applications.

1.1. Deliverable Objectives

This deliverable provides an update to the initial report on dissemination and exploitation including communication activities of the CoPropel project up to month 18.

2. Communication strategy

2.1. Communication activities

The strategy that is being followed for the communication and promotion of the CoPropel project and its results is presented in **Table *2***.

Table 2 Communication strategy

Communication activity	Short name[1]	Target audience
Attendance at exhibitions and seminars, one-to-one communication, e-mailing stakeholders, periodic newsletters as direct communication means.	CoPropel-Com1.X (seminars and exhibitions) CoPropel-Com2.X (periodic newsletters)	Expert audience in composite engineering and technology and relative manufacturing technologies
Contacting parallel related projects, cross-field events.	CoPropel-Com3.X	Expert audience in the marine composites and structural sensors community that includes academic, engineering and business developing personnel as well as EC personnel.
General communication through the Project website, press releases, posters and leaflets.	CoPropel-Com3.X	General public and experts.
Conveyance of the new knowledge into University curriculums, publications of MSc and PhD theses.	CoPropel-Com4.X	Academic personnel and engineering students as well as industrial experts.

The communication of the project outcomes is carried out in the following ways:

- **Conferences and Exhibitions**: The project will utilise the CoPropel grant to have exhibition stands and/or oral and poster presentations at a number of major European and international seminars, workshops, conferences and trade fairs for the presentation of project results and a prototype demonstration to potential partners and end users and development of a potential sales pipeline.
- **Project website and social media**: The website will be used for the dissemination of information about the project and the individual collaborators to all stakeholders and the general public. A project website will facilitate for general dissemination. In addition, we shall promote the technology using social media tools, such as LinkedIn, Twitter and Facebook for project updates.
- **Electronic and printed material**: Results and reports will be communicated by mail, email, a dedicated protected project workspace on SharePoint and via the planned project meetings. Suitable dissemination materials in a range of standard formats (electronic and printed) for distribution through targeted campaigns of mail, email and web will be produced. Activities will include:
    - Press releases on the project website, which will also be distributed to trade journals in the aeronautics and composite manufacturing sectors.

[1] The communication activities mentioned in Table 1 are broad categories of the activities performed in CoPropel. Therefore a serial number has been included in the short name to take into account the different activities within each category when reporting on the EU portal.

- Preparation of brochures with a generic outline of the project, its benefits and the format of use for potential collaborators and end-users.

- **Publication of articles**: The Project Dissemination Manager will prepare a range of project texts that may be freely disseminated by the beneficiaries throughout Europe and beyond. These texts will summarise the objectives, activities and expected exploitable results; the practical applications; how the results might be exploited or used for future research; the need for further development work or collaborations; and project contact details. It is the projects' aim to author some papers in high-impact peer-reviewed journals and industry-specific magazines, promoting the developments in composite materials, manufacturing and automation and processing simulation and modelling. Articles will be prepared as the project results are identified and validated and sufficient evidence is developed to satisfy the peer review process.
- **Dissemination among CoPropel member organisations**, TWI is a member-based organisation with more than 150 industry members from the marine sector including major European companies from the marine sector. Using the project's case studies and field demonstrations and the validation of the results, the project will disseminate project achievements to the marine and composite manufacturing community through TWI's regular updates to the membership including publications such as the TWI Journal, and TWI industry updates. Dissemination through TWI membership also provides access to professionals in other industries that may benefit from the project outputs such as the energy, aerospace and automotive sectors.
- **Scheduled short training courses**: These will train the technical staff from within partner organisations, focusing on how to use the developed training tools and modules to enhance the industrial and commercial application of the project's results.
- **CoPropel workshop**: 3 workshops are plannedto disseminate results to other organisations who have expressed an interest in the project. The workshop will target researchers on composite manufacturing technologies as well as industrial end users (e.g. marine, automotive manufacturers, aerospace OEMs and maintenance industries) interested in novel composite manufacturing with high throughput.
- **Coordination with other EU and national projects**, identified as relevant to CoPropel, especially those in the Horizon Europe programs.
- **Coordination with European, national and regional trade associations and technology networks** to make their members aware of the development of the project, gather interest and aid use of the CoPropel technologies down the supply chain.

Consortium partners have already attended several events and a list of events/exhibitions has been created in order to ensure that events of high importance to CoPropel project will not be missed and relevant partners will attend them. In particular, the partners have already attended the following events:

1. JEC 2023 (25 – 27 April) -- > CoPropel-Com1.1

Partners Loiretech and TWI attended JEC in Paris and promoted the activities of CoPropel (Figure 1).

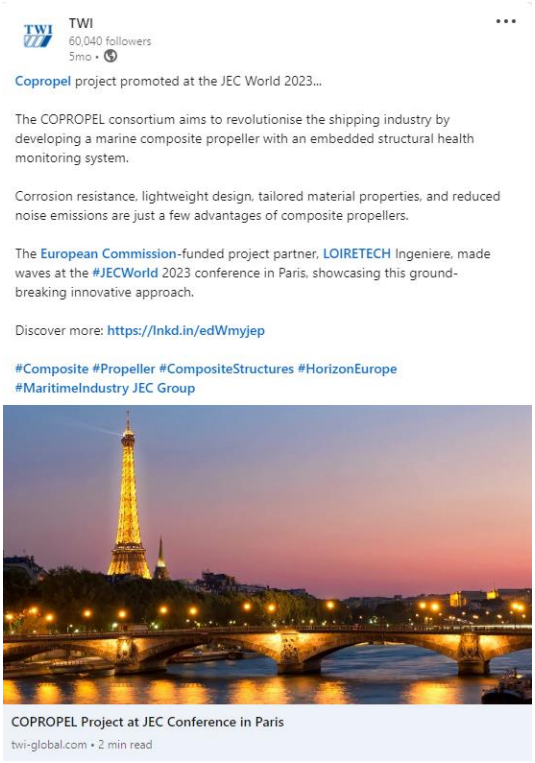


Figure 1 LinkedIn post for CoPropel's attendance at JEC 2023 (LRT and TWI partners represented CoPropel)

2. E-lass seminar day --> CoPropel-Com1.2

Partners Bureau Veritas and MECA presented about CoPropel during the E-lass seminar day (Figure 2).

Figure 2 LinkedIn post for CoPropel's attendance at E-lass seminar day (MECA and BV partners represented CoPropel)

3. DSEI (Defense and Security Equipment International) event (12-15 September) --> CoPropel-Com1.3

TWI partner promoted CoPropel project at DSEI (Figure 3).

Figure 3 The TWI team at DSEI

4. Naval Architecture Symposium (11th – 13th October) --> CoPropel-Com1.4
   CoPropel partner BSHC attended the International Naval Architecture and Maritime Symposium and the Expomaritt Exposhipping Istanbul maritime expo on 11th - 13th October. BSHC had the opportunity to discuss with key players from the maritime industry and to introduce the activities performed in CoPropel project.
   https://www.linkedin.com/feed/update/urn:li:activity:7120744530294755330

5. Advanced Engineering Show (1st – 2nd November) --> CoPropel-Com1.5

Partner TWI exhibited at Advanced Engineering Show in UK in order to promote the activities and progress of CoPropel (Figure 4)

Figure 4 TWI's booth showcasing the CoPropel video

Table 3 shows the list of events which are planned from the CoPropel partners along the course of the project until 2025.

Table 3 CoPropel project – List of events 2023-2025

Event	Location	Date
SAMPE Europe	Paris (France)	2024
PRADS – International Symposium on Practical Design of Ships and Other Floating Structures	USA	October 2025
Composites Europe	Essen (Germany)	2024-2025
ICCM	Baltimore USA	4th-8th August 2025
ECCM	Nantes, France	2nd – 5th July 2024
Posidonia Expo	Greece	3-7 June 2024/2025
METSTRADE	Amsterdam	2024-2025
JEC 2024	Paris	5–7 March 2024
JEC 2025	Paris	To be defined
International Symposium on Marine Propulsions (SMP) Home - smp (marinepropulsors.com)	Egypt	17-21 March 2024
DSEI (Defence & Security Equipment International)	ExCeL London	9–12 September 2025
OMAE (Ocean, Offshore, & Arctic Engineering) 2024	Singapore	9th – 14th June
International Congress of International Maritime Association of the Mediterranean	To be announced	To be announced
International Conference on Maritime Technology and Engineering	To be announced	To be announced
Society of Naval Architects and Marine Engineers (SNAME)	To be announced	To be announced
Naval Architecture Symposium	Istanbul	To be announced

Apart from the aforementioned events, the consortium is currently preparing a dedicated workshop which is going to be held in the first quarter of 2024. The objective of the workshop is to inform the marine and composites community about the progress of the project towards the enhanced efficiency of composite propellers in terms of fuel consumption, underwater radiated noise and structural health monitoring.

2.2. Multimedia promotional package

2.6.1 Public website and social media

A project website has been created and is being maintained by TWI (https://www.copropel.com/). This website provides public information to potential stakeholders on project aims and successes. Figure 5 shows an example of the "News" section of the website which includes information about relevant activities that have been performed as part of CoPropel project.

Figure 5 News page for the CoPropel Project

2.6.2 LinkedIn and Twitter accounts

The LinkedIn account which was created during the beginning of the project is kept up to date and mirrors information shared on the website to increase visibility and reach a larger audience. The LinkedIn URL along with the relevant updates about the project is: https://www.linkedin.com/showcase/copropel. Screenshots from the LinkedIn account are provided in Figure 6.

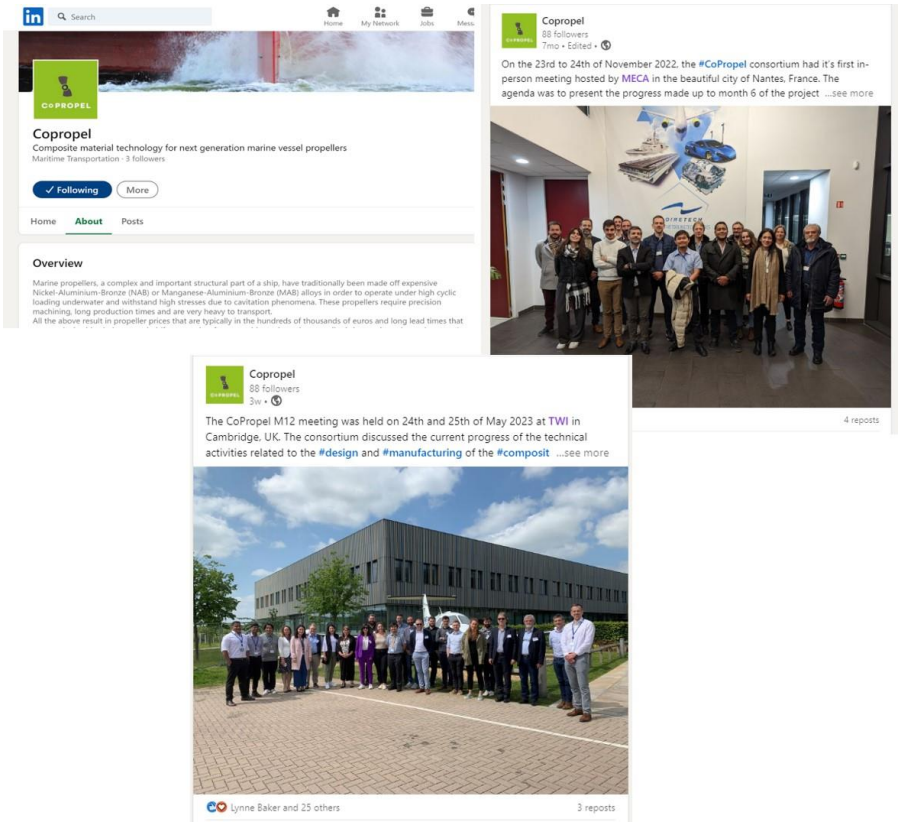


Figure 6 LinkedIn Screenshots

LinkedIn posts which focus on "Hear from our Experts" are also being developed. The aim of these posts is to promote the activities of each partner in the project and their associated interest. A post for LRT is shown in Figure 7.

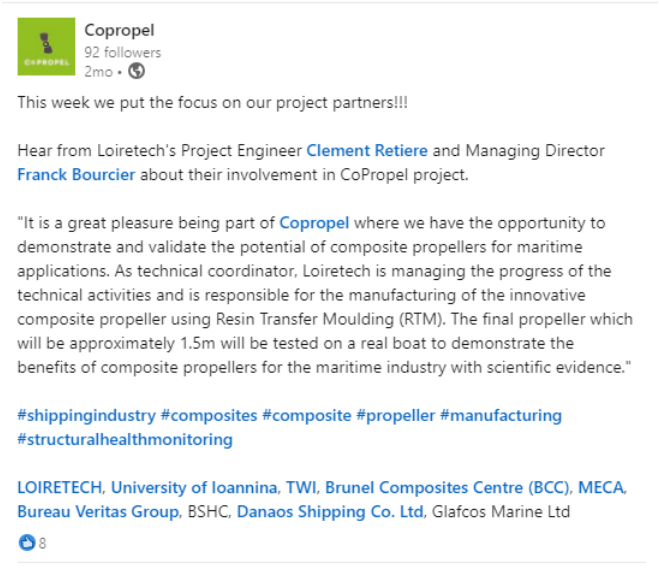


Figure 7 LinkedIn post for LRT's activities in CoPropel

2.6.3 Project video

A dedicated video which is going to be used to promote the project activities has also been developed. Figure *8* shows screenshots from CoPropel video. The video will be updated in order to follow the progress of the project activities.

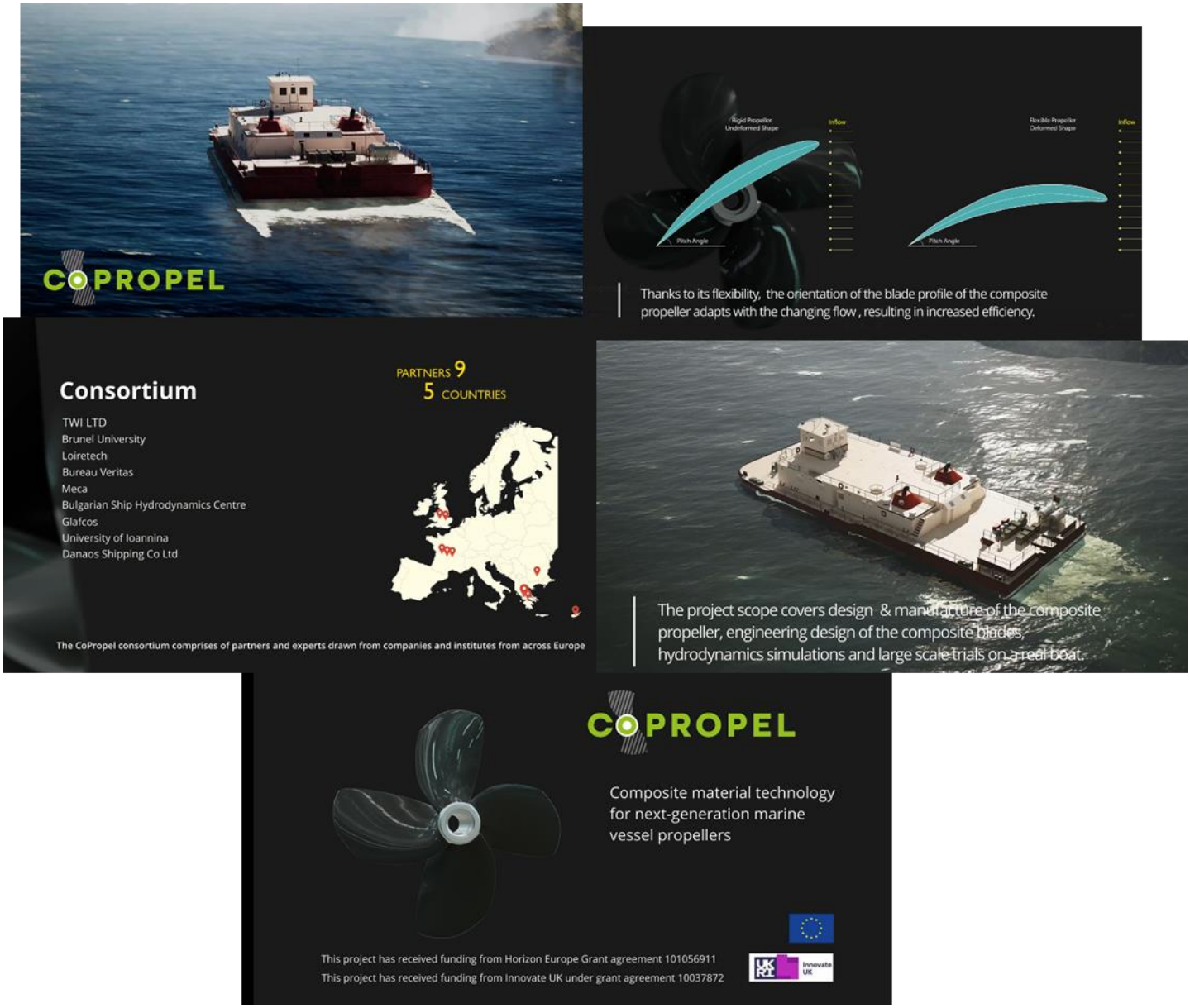


Figure 8 Screenshots from CoPropel video

2.6.4 Other promotional material

Apart from the logo, website, LinkedIn account and video, there is more promotional material which is currently under preparation. A brochure for the project has already been created and is shown in Figure 9. Finally, a poster, a roll up banner, an infographic and a newsletter are under development. The rest of the promotional material will be presented in the next deliverable associated with the communication activities.

Figure 9 CoPropel brochure

3. Dissemination and exploitation strategy

Dissemination is a significant tool that will be used to inform people (i.e. consortium members, the general public and specific target groups of stakeholders in the related scientific fields) of the achievements and activities performed within this project. Exploitation activities involve all actions related to the use of the knowledge generated within the project. Consequently, by effectively and strategically disseminating and exploiting the project's results, greater public awareness is created, as well as knowledge sharing, transparency and education being promoted.

A tailored, dedicated plan for the dissemination and exploitation of CoPropel results has been prepared and is detailed below. A policy of wider dissemination of the project results will be pursued. Loiretech (LRT) will champion dissemination of information, particularly for the purpose of ensuring future exploitation. Moreover, general dissemination activities will include:

- The inclusion of project results in the Partners web sites.
- The publication of project results in technical papers, trade journals and conferences.
- Disclosure of information through a project brochure to relevant associations and organizations.

This draft plan summarizes the consortium's strategy and concrete foreseen actions (to be performed during and beyond the end of the project) to disseminate, exploit and protect the new knowledge produced within CoPropel. The dissemination champion is expected to play an essential role both in the definition and implementation of this dissemination plan using his own network towards factory partners in fabrication and OEMs. The scientific knowledge developed will be disseminated to the target end-users through established links fostered by large beneficiary partners within the consortium. The target audiences and dissemination activities are listed in ***Table 4***.

Table 4 CoPropel Dissemination Strategy- Target audience and means of engagement

Target audience	Format	Activity	Distribution	Deliverable	Short name[2]
Scientific community	Research publication, Conferences, workshops, emails, website	Technical information review	Six monthly to Project participants, scientific community	Technical design package	CoPropel-Dis1.X
Educators	Training documents, workshops	Training reviews	As required to Project Team and Stakeholders	Training material and report	CoPropel-Dis2.X
Marine and manufacturers Professionals	Emails, website, interactive forums, workshops, implementation of the methods and the tools into commercially available software	Project results reviews, updates	Quarterly to Professionals	Project outcomes: Website, interactive forums, workshops	CoPropel-Dis3.X

3.1. Dissemination and exploitation objectives

The primary objective of the CoPropel Dissemination and Exploitation Plan is to prudently identify and organize the activities to be performed in a timely manner, in order to maximize its influence. At the same time, it will also take into account the dissemination needs of the project at each stage of its lifecycle, as well as the specific technical, market, organizational issues and interests of each of the various pre-defined CoPropel target groups/end users. Consequently, the main aims of the planned dissemination and exploitation approach can be summarized as follows:

- **Inform** about the CoPropel activities to stimulate the participation of SMEs, Academia, Industry, Research Establishments, civil society and their networks. Organise (participate in) events, workshops and seminars;
- **Raise Awareness**: Present the project, its main objectives and expected impact (e.g. CoPropel public website, social media pages, project leaflet, poster and newsletter, etc.);
- **Networking**: Exchange experiences with other projects relevant to CoPropel in order to combine efforts, minimize duplication and maximize its exploitation potential;

[2] The dissemination activities mentioned in Table 4 are broad categories of the activities performed in CoPropel. Therefore a serial number has been included in the short name to take into account the different activities within each category when reporting on the EU portal.

- **Disseminate Knowledge and make the toolset commercially available to industry**: Regularly provide information about CoPropel results through several channels (e.g. Horizon Europe, the EU Research and Innovation Magazine);
- **Support CoPropel Exploitation**: Pave the way for a successful exploitation of the project's results by addressing the full range of potential users and uses, including research, commercial, investment, social, environmental, policy making, setting standards, skills and educational training.

3.1.2 Exploitation content

Exploitation activities involve all actions related to the use of the knowledge generated within the project. Through the effective and strategic dissemination and exploitation of the project results, greater public awareness is created, as well as knowledge sharing, transparency and education. The exploitation of results achieved during the CoPropel project, will enhance the relationship between the consortium partners and increase business opportunities for future applications with Tier 1 end users. Results achieved during the project will lead innovation in marine propeller product design and marine composite manufacturing processes and enhance the development of the competences and capabilities of the European marine industry.

3.1.3 Advisory board

As part of the increase of awareness around the activities of CoPropel project, the consortium has been working in forming the advisory board for the project. The advisory board will enable the consortium partners to exchange views with industrial players in order to pool their expectations and needs with regards to the final product that is planned to be developed which is an optimised composite propeller. This activity will enable CoPropel's partners to develop technologies to meet specific goals or verify the consistency of technologies integrated into the composite propeller. Finally, this support will also allow the consortium to gain visibility in the targeted sector, maritime in order to improve the dissemination of results.

The data presented within the advisory board will be protected by dedicated Non-Disclosure Agreements (NDAs). The partners of CoPropel project have the right to review the information that will be shared with the advisory board to confirm that they are happy with their distribution. A first potential list of advisory board members is presented in Table 5.

Table 5 CoPropel potential advisory board members

Name	Type of entity	Location
CMA CGM	Maritime chartering company	France
AML	Shipyard	France

RNLI	Shipyard	United Kingdom
VICUSdt	Ship propulsion engineering company	Spain
SIREHNA	Navigation and maritime environment engineering	France
Chantier de l'Atlantique	Naval construction	France
Chantier Dalmau	Naval construction fish	Spain
ARESA Shipyard	Naval construction fish	Spain
Karstensens Shipyard Ltd	Naval construction fish	Denmark
Nidri Marine Service	Naval construction fish	Greece
ASTILLEROS CAROU	Naval construction fish	Spain
OCEA	Naval construction	France
MARTINEZ CONSTRUCTIONS NAVALES	Naval construction/reparation	France
Jeanneau	Naval construction	France
Beneteau	Naval construction	France
Dufour	Naval construction yacht	France

3.1.4 Workshop

A dedicated workshop to promote the activities of CoPropel project will be arranged during the first quarter of 2024. The objective of the workshop would be to let the rest of the marine and composite materials community know that this project is working on proving the efficiency of a composite propeller which will lead to lower fuel consumption, reduced underwater radiated noise and that will have an appropriate structural health monitoring (SHM) system. The workshop will be a one day event where the CoPropel partners will have dedicated time slots to present their progress and activities as part of the project.

4. Market outlook

The CoPropel consortium is constantly updating the post-project exploitation plan that has been created with regards to the technology developed in the project. This high-level analysis of the state of the target market is intended to support the ongoing development of the plan.

The scope of this report is to assess the characteristics and growth forecasts for the project's target market, namely marine propeller manufacturing. It also examines the influence of policy and regulation, and the competitive landscape of the target market.

4.1. Status of target markets:

Marine freight shipping

The state of the marine freight markets is a fair indicator of the state of the overall economy. Since 2020 and the advent of the Covid-19 pandemic, the global economy has faced unprecedented headwinds. Currently, these include the risk of escalation of the conflict in Ukraine, rocketing energy and food prices, political instability and double-digit inflation. All this is causing a negative effect on consumer spending, either retail or B2B.

Amid fears of a global recession especially since 2020, consumer confidence is low and fewer goods are being bought, therefore less marine freight space is needed. DHL reports that though the shipping companies' order books remain strong the cost of freight has been falling for several months. Furthermore, since freight shipping remains a profitable enterprise, the drop in freight prices is attributable to factors outside the sector, namely the sluggishness of consumer spending due to rising interest rates and the advent of recession.

Status of target markets: Shipbuilding

It takes up to three years to build a container ship, so matching building new capacity with anticipated demand is challenging, particularly in the current era of unforeseen global shocks like the Covid-19 pandemic. This trend is exacerbated by shipbuilders' historic tendency to use profits to build new shipping capacity, thereby leading to over supply. This is undoubtedly a contributory factor to the current drop in freight costs. In 2023, 2.34 million Twenty feet Equivalent Units (TEUs) will be brought to market, 2.83 million TEUs in 2024, comfortably the largest amount of capacity ever to be built.

Researchandmarkets.com's latest analysis of the marine propellers market growth prospects predicts that the segment will grow at a rate of 4.5% per year out to 2027. Report by generic market research firms such as this one should be treated with some caution. They tend to predict a straight line upward growth trajectory, underplay the influence that external economic conditions have on a given market segment, and often disregard its particular characteristics, such as those discussed above. In this case however, given the huge increase in shipping capacity coming online in 2023-24, the growth prediction of 4.5% may be reasonably accurate.

4.2. The influence of policy and regulation

CO_2 reduction

Like other heavy CO_2 emitting industries, there is now considerable pressure being applied to ship makers, owners and operators to clean up the shipping industry. Although international shipping was not included in the 2015 Paris Agreement, the International Maritime Organisation (IMO) has taken a leading role in setting out the path to zero CO_2 emissions from global shipping within this century. The Energy Efficiency Design Index (EEDI) for new ships, and Ship Energy Efficiency and Management Plan (SEEMP) for the existing fleet are the main policy instruments. The EEDI regulations include the need for reducing vessel weight which will inevitably involve the introduction of components made from lighter materials, such as carbon fibre composite propellers.

Noise reduction

Into 2014 the IMO introduced its first policy on reducing underwater noise and its negative impact on marine life. The policy does not refer to composite propellers, but the American Bureau of Shipping, in its white paper on this topic, does, stating that

"These types of propellers may be significantly lighter, and the propeller blades can be elastically tailored to improve performance. Compared with metallic propellers, composite propellers may offer acoustic and efficiency advantages."

Qualification and certification of composite propellers

In 2015, ClassNK, the Japanese ship classification organisation released guidelines titled Guidelines for Composite Propellers (Part on Manufacturing/Product Inspection). The guidelines arose from R&D with Nakashima Propeller and specify

"…the requirements for the approval of the manufacturing process for composite propellers and the testing/inspection of the product in the form of guidelines to assist in the effective use of composite material propellers on ships."

In 2020, Bureau Veritas issued Guidance Note NI 663 Propeller in Composite Materials which

"…defines the procedures and requirements for certification, design, construction, installation, test, trials and surveys of composite propellers to be fitted on board ships classed with the Society."

Both sets of guidelines indicate the growing acceptance and maturity of composite propellers in the industry. As demand for these components grows and new companies, hitherto unknown in the industry, such as composite designers, enter the market, these guidelines will provide critical quality assurance throughout the supply chain.

5. Competitive landscape

5.1. Supply chain and market entry points

In order to understand where the CoPropel technology will be targeted, a theoretical supply chain model is presented below in Figure 10. This model helps understanding of the value-adding stages, activities and actors involved in taking a major component from functional design (TRL 4-6) through to at-scale manufacture (TRL 9).

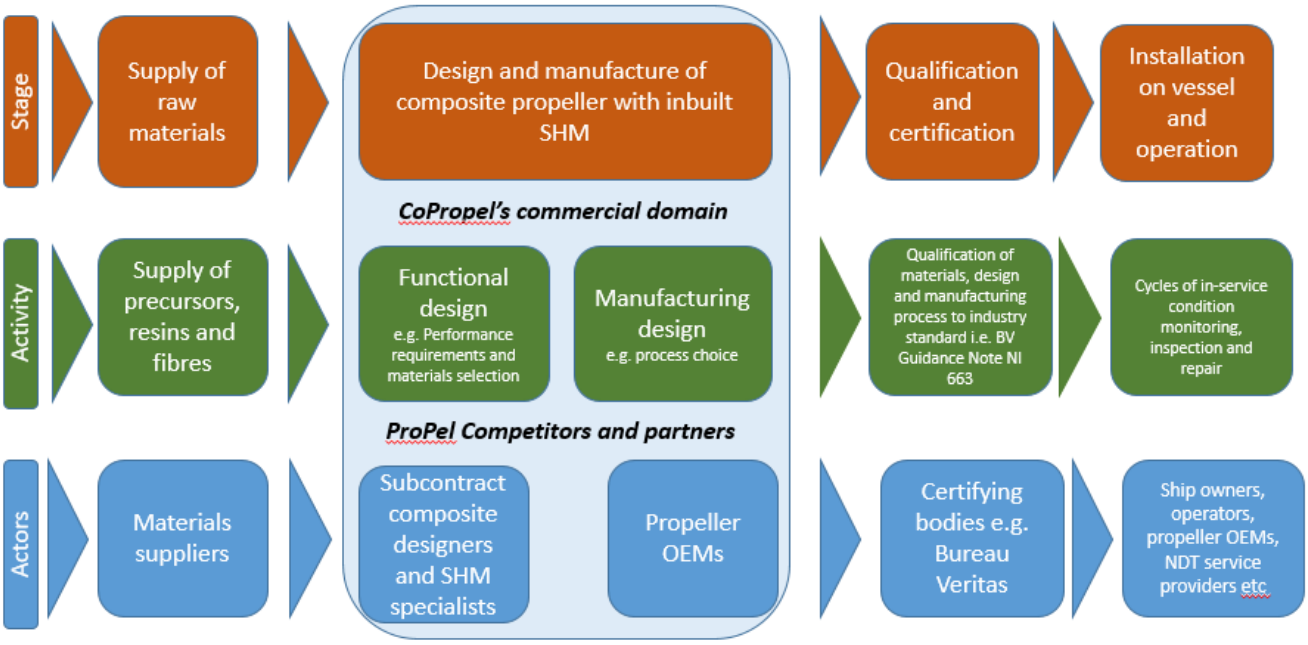


Figure 10: CoPropel therotical supply chain model

At the conclusion of the project CoPropel technology is expected to have advanced to TRL 7 (system prototype in an operational environment, via sea trials), but is not fully market ready. When it is, it will address the central design and manufacture stage of the supply chain. To get to that point in a live commercial/industrial context may need further investment and industrial partnership.

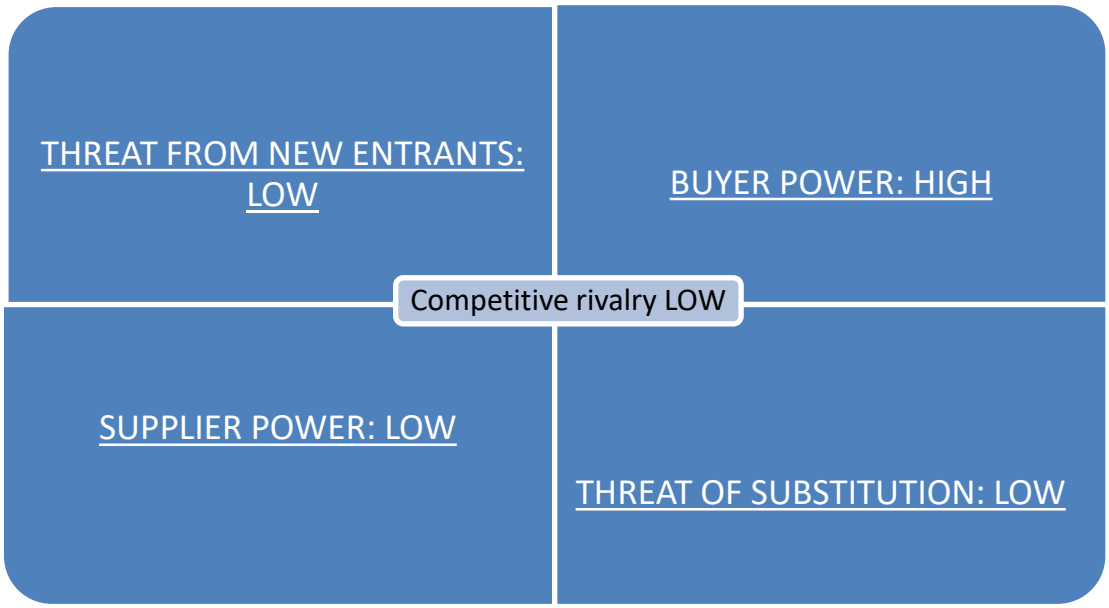
6. Competitive landscape

The principal incumbents in the market for marine propellers are listed in **Table *6***. Those that use composite materials are highlighted with an asterisk and hyperlinks.

Table 6 Principal propeller manufacturers

AB Volvo
Balti Composite Technology (formerly AIR Fertigung-Technologie GmbH)*
Brunswick Corporation
Hyundai Heavy Industries
Kawasaki Heavy Industries Ltd.
LoireTech*
MAN Energy Solutions SE
Méca*
Mecklenburger Metallguss GmbH
Mercury Marine
Metstrade*
Mitsubishi Heavy Industries Ltd.
MOTH
Nakashima Propeller Co. Ltd.*
Naval Group*
Pirhana*
ProPulse AB* (no website available)
Rolls-Royce Holdings
Schaffran Propeller + Service GmbH
Schottel GmbH
Teignbridge Propellers International Limited
Veem Ltd.
Wartsila

7. Porter – five forces analysis



Supplier power – low

- Competitive due to numerous materials suppliers.
- CoPropel's materials requirements are standard.
- Switching suppliers to get better deals easy.

Threat from new entrants – low

- Few new entrants join market due to high capex costs of metal casting.
- However, threat could escalate rapidly due to the introduction of a disruptive technology e.g. CoPropel

Buyer power - High

- Large ship builders add capacity at the top of the market, creating 'boom and bust' cycles out of step with wider economic cycle.

Threat of substitution – low

- No direct competitor that combines composite propeller with integral SHM capability

Overall degree of competitive rivalry – low

- CoPropel has ‘first mover’ advantage

8. Conclusion

In this deliverable, the strategy that is being followed for the communication, dissemination and exploitation activities within the CoPropel project has been described. The communication tasks and dissemination activities that have already been carried out to promote the work performed in CoPropel are also included in this report and the tools that have been created to monitor the aforementioned activities are highlighted.
A dedicated website and LinkedIn account have been created and a logo that is a visual identity of the project is used in all the marketing material. A video has also been developed which has been used in several events to provide an overview about CoPropel's activities. The target markets and a plan for the exploitation of the results from the CoPropel project is also presented with the relevant key activities and the routes that will be followed for that purpose. A description of the multimedia promotional package has also been provided along with an update regarding the events/conferences that the partners have successfully attended up to date and the ones that they are planning to attend by the end of the project.

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