Project acronym: **RAMSSES**
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Deliverable D06.6
Final Report on PUDF and Business Plan

November 2021

Dissemination level: **Public**

Abstract

Main authors of the chapter: Arnold de Bruijn, NMTF

In order to streamline the communication flow from and to external parties a communication strategy has been developed. The goals pursued are manifold (general dissemination, general exploitation measures and preparation of technology market uptake, identification of concepts for future innovation in the maritime industry and development of rules and regulations…), and the corresponding measures have to be customised to the suitable target groups.

This deliverable consists of mainly two parts, one part describing the communication strategy, including dissemination activities. The other part builds on the initial exploitation plan, providing guidance for the demonstrator cases to create their own exploitation- and business plan and prepare for technology market uptake.

Deliverable 6.6 is based upon Deliverable 6.4 and presents the results up to PM54:

- A more detailed description of the Communication Management Group (CMG)
- For each goal a communication plan in tabular format, providing an overview of the communication to WHOM (target group), WHY and WHAT (the message), HOW and by WHO (responsible Work Package and Partners)
- An overview of anticipated dissemination activities including status update and a list of disseminations activities in Annex B
- An overview of cooperation with other projects
- A list of exploitable results and an overview of the usage of IPR instruments

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Involved partners

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Contents

List of symbols and abbreviations

CKB	Common Knowledge Repository
CMG	Communication management Group
DoA	Description of Action
DC	Demo case
HSLA	High Strength Low Alloy Steel
IPR	Intellectual Property Rights
LCPA	Life Cycle Performance Anaylsis
MAG	Maritime Advisory Group
PUDF	Plan of Use and Dissemination of Foreground knowledge
QCG	Quality Control Group
SG	Steering Group
TTG	Technology Transfer Group
WP	Work package

1 Executive summary

Main authors of the chapter: Arnold de Bruijn, NMTF

1.1 Problem definition

In order to streamline the communication flow from and to external parties a communication strategy has been developed. The goals pursued are manifold (general dissemination, general exploitation measures and preparation of technology market uptake, identification of concepts for future innovation in the maritime industry, development of rules and regulations). The corresponding measures have to be customised to the suitable target groups.

1.2 Technical approach

This deliverable consists of mainly two parts, one part describing the communication strategy, including dissemination activities, and one part builds on the initial exploitation plan, providing guidance for the demonstrator cases to create their own exploitation- and business plan and prepare for technology market uptake.

1.3 Results and achievements

Deliverable 6.6 presents:

- A more detailed description of the Communication Management Group (CMG)
- For each goal a communication plan in tabular format, providing an overview of the communication to WHOM (target group), WHY and WHAT (the message), HOW and by WHO (responsible Work Package and Partners)
- An overview of anticipated and performed dissemination activities since the beginning of the project and a list of dissemination activities in Annex B
- An overview of cooperation with other projects
- A list of key exploitable results
- An overview regarding the use of IPR instruments amongst partners

Highlights Innovation Management:

- The Common Knowledge Repository will be transformed into an Innovation Platform (D04.5)

Highlights Implementation and Dissemination plan:

- The ISSC Committee V.3 agreed to include a chapter dedicated to the qualification of Composite materials in the 2021 report.
- Plans on the involvement of students within the RAMSSSES project have been elaborated and implemented. The lead responsible partner for dissemination towards this target group, is NTUA, the National Technical University of Athens.
- Several events have been held to strengthen cooperation and knowledge transfer with other industries.
- Multipliers (associations of ship operators) were successfully invited to the MAritime Advisory Group (MAG). The first workshop of the MAG took place in June 2018 in St. Nazaire, France of the third RAMSSES General Assembly. The second workshop of the Maritime Advisory Group took place in Vigo, Spain in June 2019 and was included in the public E-LASS seminar on lightweight innovations.
- The RAMSSES project's suggested approach ('Smart track to approval – STtA') has been introduced to the International Maritime Organization's Sub-Committee on Ship Design and

Construction (SDC) in a lunch break presentation during the SDC7 session in London on February 3rd, 2020.

- CMT, NMTF and other RAMSSES project partners are members of the Partnership 'Zero Emission Waterborne Transport' which provides suitable channels to communicate any observed technology gaps, research needs or other barriers which impede further and wider use of material innovation in the maritime industry.

Highlights Dissemination Activities:

- RAMSSES Project Website: Upcoming public events with the E-LASS network are regularly announced on the project website, as well as the reports on the meeting, as the general intention is to create a sustainable network.
- In January 2020 E-LASS joined forces with the German maritime lightweight network MariLight.Net. As result, a joint event bringing together the RAMSSES consortium with the German and the European lightweight networks was organised. The public event, which took place in Bremen, Germany was attended by more than 120 persons. In the following to this event, E-LASS memberships, and hence the size of the network, was further increased.
- Project video: During the 7th RAMSSES General Assembly, which took place in Germany, interviews were conducted with all WP leaders which will be used for the production of the demo case videos.
- New cooperation with projects E-ferry and HOLISHIP.

Highlights Exploitation & Business Plan:

- A full list of key exploitable results is illustrated.
- An overview is given regarding the preliminary choices/preferences of IPR tools amongst partners.
- Multiple forms of exploitation have been identified.

1.4 Contribution to RAMSSES objectives

According to the DoA, the strategic objective of RAMSSES is to obtain recognition and an established role for advanced materials in the European maritime industry.

To achieve this, the RAMSSES project follows a two-way strategy, aiming to

- strengthen European leaders (represented in the project consortium, see ch.3.3) by demonstrating full feasibility and by validating the technical and economic properties of innovative material solutions in close to-reality applications.
- add value to a wider European maritime community, by improving the exchange of information, technology transfer, extending the knowledge base and developing procedures to a faster approval.

Deliverables 6.1 and 6.4 have contributed to this objective by organizing the inbound and outbound communication and dissemination activities towards a large number of target groups. In Deliverable 6.6. the current status of all activities is added. The strategy has been updated and elaborated upon. In addition, the exploitation plans and business plans developed by the demonstrator cases will help extending our knowledge base and focus on improving the market uptake of innovative materials. Furthermore a key list of exploitable results and IPR preferences have been identified in this deliverable.

1.5 Exploitation and implementation

Regarding exploitation this deliverable contains the guidance for the project partners to write their own business and exploitation plans. Deliverable 6.6 provides an overview of the identified key exploitable results and the usage of IPR instruments by the project partners.

2 Introduction

Main author of the chapter: Arnold de Bruijn, NMTF

Dissemination and exploitation of RAMSSES's results is a major part of the project's communication strategy. Chapter 3 addresses the Communication Strategy that was outlined in the DoA, and reports the steps undertaken so far in terms of putting it into practice and monitoring that process.
In RAMSSES, dissemination is not only understood as all activities related to outbound information flow in order to spread results of the project to the desired targets, but also to organise an inbound information flow to the RAMSSES consortium, with the aim to improve the work of the project, to create future ideas for material innovation and to enhance the related knowledge base with external data and information. An overview on dissemination activities and further plans is given in chapter 4.
Chapter 5 refers to the exploitation plan that was outlined in the DoA (2.2.4) and provides guidance for the demonstrator cases to write an exploitation plan and business plan for their particular application, encouraging the demonstrator work packages to share their expected results and how they envisage the results to be used in commercial and non-commercial manner. A list of key exploitable results are presented which are to be generated throughout the project. Moreover, different forms of exploitation have been identified. In addition, an overview is given regarding the preliminary choices/preferences of IPR amongst de partners. The exploitation plans will be updated during the project to monitor progress and to determine the impact of the RAMSSES project as a whole.

3 Communication Strategy

Main author of the chapter: Matthias Krause, CMT

3.1 Relation to the project's strategic objectives

The internal information flow in the RAMSSES consortium is organised in order to ensure successful financial and administrative project management and achievement of the technical objectives of the project in an efficient manner. This part of the communication strategy is discussed in relevant Deliverables by WP01 and WP02.

The Deliverable at hand discusses those parts of the communication strategy which are aiming at the third strategic objective of the project:

> *"Objective 3: RAMSSES will contribute to support the innovation capabilities of the consortium members and the maritime sector" Annex 1, Part B, p. 7*

As indicated in Figure 1, this strategy mainly addresses information flow from and to external parties and interaction with these. The goals pursued are manifold; general dissemination, general exploitation measures and preparation of technology market uptake, identification of concepts for future innovation in the maritime industry and development of rules and regulations. The corresponding measures have to be customised to the suitable target groups.

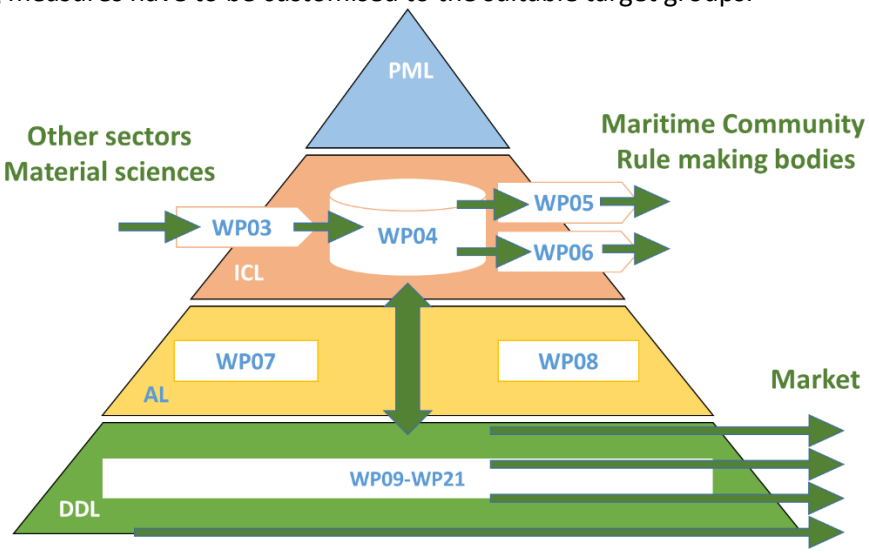


Figure 1: External information flow (Annex I, Part B, p. 30)

3.2 Structures and Bodies for Dissemination and Exploitation Activities

3.2.1 Communication Management Group

> *‚All external communication will be facilitated and monitored by the CMG...'*
> *(Annex I, Part B, ch. 2.2.3)*

The RAMSSES Management structure as described in the DoA foresees a Communication Management Group (CMG) which convenes every six months. The CMG kick-off meeting, organised as a Webex conference, took place on November 22nd, 2017 to agree on the terms of the CMG's work, its composition and next steps. The most important decisions were as follows:

- The CMG consists of all members of the WPs 03…06, not only the WP leaders.
- CMG will monitor the implementation of the project's dissemination plan.

- Particular dissemination activities can be implemented by any RAMSSES partner. All members of the Consortium are encouraged to disseminate activities and results in the project. They are obliged to support the CMG in performing dissemination measures.
- CMG will report to the SG on a regular basis.

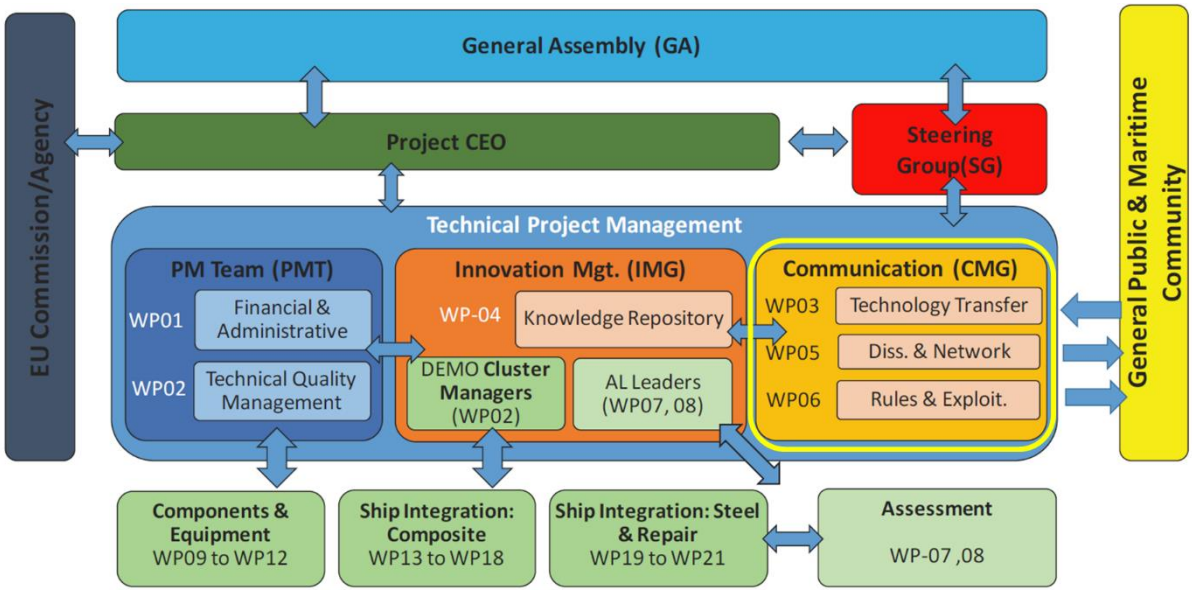


Figure 2: The CMG (highlighted yellow) in the RAMSSES Management structure

The CMG continues to convene every six months via web-based meetings discussing latest developments and further actions with a small deviation between CMG meeting number 04 and CMG meeting number 05, where between both events not six but eight months were spent.

3.2.2 Innovation Management

The core strategic element for the innovation management is the Common Knowledge Repository (CKB). The CKB will not only provide a means to store information that needs to be shared between the RAMSSES partners, but also data and information that stems from inbound communication (e.g. Technology Transfer Group) and which is intended for outbound information flow (e.g. input to rule making bodies). Thus, the CKB is clearly a strategic tool for the project's dissemination and exploitation measures.

The repository has been developed in WP04. The Deliverable D04.1, which was due project month 8 provided a first overview of the development of the CKB, including a list of requirements for the RAMSSES repository and its envisaged functionalities. It furthermore listed potential databases which might be suitable candidates for interfaces with the CKB as well as an overview of the planned software structure. Since then three more deliverables (D042 (PM12); D04.3 (PM18); D04.4 (PM24) have been published on the development of the steadily growing repository. In the following the CKB will be transformed into an Innovation Platform. In deliverable D04.4 the terms of reference for this Innovation Platform are defined, the deliverable D04.5 which was due in PM36, is dedicated to this transformation from the CKB into an Innovation platform.

3.3 Implementation of the Dissemination plan

The tactical approach to handle the external communication was outlined in the table 'initial dissemination plan' in the DoA, Part B. Four main goals of dissemination were identified, and to each goal one or more target groups were allocated. The following sub chapters 3.3.1 till 3.3.4 contain the dissemination plans, including updates and brief summaries on further plans and activities already

initiated. More information about the most significant activities which have been initiated or completed are documented in the forthfollowing chapters.

3.3.1 Improving Public Perception and Societal Image

3.3.1.1 Plan

Table 1: Dissemination Plan summary – goal 'Improving Public Perception and Societal Image'

To **WHOM**	**WHY** and **WHAT**	**HOW**	**WHO***
General public (European citizens), Science community	Make wider community aware of impact of EU research, improve public image of maritime, enable contact to project	Project website; press releases; innovative media (e.g. LinkedIn); project dissemination material; interviews in local media and science magazines; project videos	**WP05:** CMT,-RISE

3.3.1.2 Comments on status

Status month 24 – website launched, LinkedIn group established, two press releases were issued (project kick-off, first RAMSSES/E-LASS conference). Interviews will be given in a later stage. First of a series of RAMSSES demo case videos was produced; a concept for a general project video was prepared.

Status month 36 – website regularly updated, including a major update at the end of period 2; various video material compiled by CMT and partners – publication of videos planned in the final period; various articles including two further press releases (MAG workshop, presentation at IMO final conference), continuous maintenance of LinkedIn channel.

Status month 54 – final update of the website; several videos completed and put on the RAMSSES Youtube channel, continuous maintenance of LinkedIn channel.

3.3.2 Developing a Maritime Materials Innovation Platform

3.3.2.1 Plan

Table 2: Dissemination Plan summary – goal 'Developing a Maritime Materials Innovation Platform'

To **WHOM**	**WHY** and **WHAT**	**HOW**	**WHO***
Maritime RDI Community	Inform on work and results, receive feedback on technical developments, foster knowledge and result uptake	Publication in specific newsletters, research and professional magazines; annual joint events with other initiatives, SMARTYards network, WATERBORNE platform exchange and discussion in the ISSC expert group V3 *Material and Fabrication*	**WP05:** CMT, RISE, NTUA, AIMEN
Other RDI project consortia	Use synergies, e.g. joint resources, uptake of suitable external developments, exchange of results, cooperative work	WATERBORNE and EFFRA** networks and websites, participation in CSAs, joint workshops, TTG with confirmed partners from other	**WP03, 05:** CMT, NETCOMP, FHG, TNO, NMTF, RISE (E-LASS), AIMEN, BV

To **WHOM**	**WHY** and **WHAT**	**HOW**	**WHO***
		sectors; cross-project partner networks, joint conferences, cooperation agreements using SMARTYard templates	
School graduates, Students & Young professional	Attract young people to RDI and maritime, inform about job opportunities, improve technical skills for under- and post graduate students	Training material, presentations at universities, network of WEGEMT, twinning projects, support to EM-Ships actions, internal placements for students	**WP05:** NTUA, CMT, AIMEN, RISE
Other sectors, material sciences	Get information on latest development and available new solutions, initiate cooperation	Dedicated Technology Transfer Group with confirmed partners from rail, road, aero and materials, annual reports to GA, analysis of solutions for maritime	**WP03:** CMT, BV, NETCOMP, FHG et al

3.3.2.2 Comments on status

Target group 'Maritime RDI community'

Status month 24 – Several project partners' newsletters introduced RAMSSES; a couple of general articles about the project were issued in trade magazines; CMT and others gave presentations to some of the technical working groups or associations they are represented in. Direct contact to the members of the SMARTYards network is sought. Together with the ISSC Committee V.3 and the FIBRESHIP project, RAMSSES organised a workshop on qualification of composites. A set of measures towards new approaches for approval of new materials was agreed and published in the 3-annual ISSC report in 2018.

Status month 36 – The ISSC Committee V.3 agreed to foresee a chapter dedicated to the qualification of Composite materials in the upcoming 2021 report. The chapter will include a review of the 'set of measures' that were suggested in the 2018 report, and the actual progress which has taken place since. Despite Covid-19 effects, CMT is planning to organise a dedicated meeting in which the state of play should be discussed. Members of the ISSC Committee, several class societies and key partners of RAMSSES and other relevant projects should take part in this meeting.

Status month 54 – The ISSC Committee meeting with external experts took place as planned (digital meeting). The draft Committee report, including conclusions and recommendations e.g. for further improvement of innovation capabilities and regulatory frameworks, was submitted to the ISSC Standing Committee in November 2021.

Target group 'Other RDI project consortia'

Status month 24 – Various contacts have been made, cooperations with several consortia have been initiated and will be intensified in the future; RAMSSES uses the E-LASS conferences to organise presentations of other projects and to meet other consortia.

Status month 36 – Specific collaboration activities, either technical or communication related, took place. The most relevant cases are discussed in chapter 4.7.

Status month 54 – Continued collaboration with other projects is discussed in chapter 4.7. Dedicated discussion with the new projects FIBREGY and FIBRE4YARDS on joint use of the material database.

Target group 'School graduates, Students & Young professional'

Status month 24 -Plans being elaborated – The lead responsible partner for dissemination towards this target group, NTUA, has identified the following plans:

- Dissemination activities to the academic community
  1) NTUA can create an initial mail list of contact persons in various university naval architecture departments worldwide (not including those participating in RAMSSES).
  2) The above list will be circulated to all RAMSSES partners in order to be populated with more entries.
  3) Once the list is finalized, RAMSSES informative material (info about the project and possible forthcoming project related events) can be mailed to all persons of the list (this can be done either centrally – e.g. from CETENA or CMT – or from a WP5 partner).
  4) Establish a contact with WEGEMT (European Association of Universities in Maritime Technology and Related Sciences) and its secretary general George Smyrnakis, providing him periodically with RAMSSES informative material and asking him to disseminate within the WEGEMT members.
- Dissemination activities to the scientific community
  1) Collect contact information from all RAMSSES partners about their naval architects national professional organizations or about other similar organizations (like for example the Hellenic Institute of Marine Technology).
  2) Contact both the above organizations and other similar ones like the Society of Naval Architects and Marine Engineers (SNAME), the Royal Institution of Naval Architects (RINA), the Institute of Marine Engineering, Science and Technology (IMarEST), the Chinese Society of Naval Architects and Marine Engineers (CSNAME), the Confederation of European Maritime Technology Societies (CEMT), periodically sending them RAMSSES informative material.

Status month 36 - Plans on the involvement of students within the RAMSSES project have been elaborated and implemented– The lead responsible partner for dissemination towards this target group, is NTUA, the National Technical University of Athens.

- The following dissemination activities to the academic community were taken:
  1) An initial mail list of contact persons in various university naval architecture departments worldwide (not including those participating in RAMSSES) has been created
  2) The list has been circulated to all RAMSSES partners in order to be populated with further entries.
  3) In addition, RAMSSES partners were asked, if they are interested in involving students or young graduates in the RAMSSES project providing them with certain projects (eg. diploma/ master thesis, internship,..)
  4) Once all partners provided their input, a RAMSSES presentation was prepared informing academia on the objective of the project, the methodologies used as well as the opportunities provided and the relevant contact points
  5) The presentation was distributed amongst the partners networks, also sent to networks like SEA Europe and the WEGEMT network to share it within their networks.
  6) Contact with WEGEMT (European Association of Universities in Maritime Technology and Related Sciences) and its secretary general George Smyrnakis has been established, providing him with RAMSSES informative material and asking him to disseminate it within the WEGEMT members.

- Furthermore the dissemination activities to the scientific community, as described in the status report for Month 24 will be pursued.

Target group 'Other sectors, material sciences'

Status month 36 - Several events have been held to strengthen cooperation and knowledge transfer with other industries. Every year during the project, RAMSSES invites experts from different sectors to share the knowledge through Technology Transfer Group (TTG) workshops. Detail information about the TTG workshops can be seen in chapter 4.1. Besides TTG workshops, CMT was also actively involved in organizing other knowledge transfer and future concepts discussion events such as future concepts workshop, CMT day, and ZAL workshop. The future concepts workshop and CMT day were held to discuss the current innovative solutions that should be used and adapted in the shipbuilding process to improve the production and maintenance process in the shipyard. ZAL workshop is the event where the shipbuilding industry meet the aviation industry to discuss common problems, requirements, priority for innovative solutions, and future collaboration in research and development project. Report and observation from the workshop are written in the WP03 deliverables.

Status month 54 – A final TTG workshop was held in February 2020; from that point on, the most promising ideas for technology transfer were identified, and opportunities and recommendations for their use in maritime were elaborated in the design studies on future concepts. Good practise results on technology transfer which took place in RAMSSES were presented in a public TT workshop of the German maritime lightweight network MariLight (October 2021).

3.3.3 Improving Competitiveness and Market Uptake

3.3.3.1 Plan

Table 3: Dissemination Plan summary – goal 'Improving Competitiveness and Market Uptake'

To **WHOM**	**WHY** and **WHAT**	**HOW**	**WHO***
Ship owners and Operators	Inform potential customers about the benefits and potentials, receive feedback to the work	Direct contact with end-users (consortium), Maritime Advisory Group with confirmed ship owners, dedicated information on leaflets, website, presentations, network of ECSA and national associations	**WP03, 06:** DSNS, BV,-RISE, CMT
European Shipbuilding & Equipment Community	Increase critical mass on the market, foster wider commercialisation of results, receive information on latest technical developments, establish cooperation	Dedicated workshops, conferences, flyer and video using the E-LASS, SMARTYards, and WATERBORNE network, SEA Europe, national associations, SME network of CMT, Cooperation agreements using available templates	**WP05:** CMT, DSNS, BV, AIMEN, NTUA,-RISE et al
Investors, Banks, Insurance	Provide awareness for sustainable financing and life cycle cost efficiency	Direct contacts as established in previous projects (e.g. JOULES, LeanShips), focused	**WP05, 06:** NMTF,-RISE, TNO, BV

To **WHOM**	**WHY** and **WHAT**	**HOW**	**WHO***
		articles and presentations	

3.3.3.2 Comments on status

Target group 'Ship owners and Operators'

Ongoing – Please refer to chapter 4.2 about the Maritime Advisory Group.

Target group 'European Shipbuilding & Equipment Community'

Status month 24 – Multipliers (associations of ship operators) were successfully invited to the Maritime Advisory Group (MAG). The first workshop of the MAG took place in June 2018 in St. Nazaire, France in the course of the third RAMSSES General Assembly, and was attended by operators (DANAOS, Royal Caribbean, Carnival Maritime) and maritime associations (eg. ECSA) ; CMT presented the RAMSSES project to some of the technical working groups for members in the German shipbuilders and offshore association (*VSM-Arbeitskreise*).

Status month 36 – The second workshop of the Maritime Advisory Group took place in Vigo, Spain in June 2019 and was included in the public E-LASS seminar on lightweight innovations. The attendance of this MAG meeting was limited, only two partners attended, and the envisaged open discussions within the public frame was hindered. As lessons learnt it was decided that MAG #3 will take place again behind closed doors with designated partners to attend the discussion. Due to the current COVID-19 pandemic, the MAG #3 needed to be postponed from June 2020 into September 2020. A fourth MAG meeting at the very end of the project, as initially foreseen, taking place during the RAMSSES final conference is still to be discussed.

Status month 54 – The MAG #3 took place as planned. It was a digital meeting in conjunction with the General Assembly/E-LASS seminar which was co-organised by Damen Naval in Vlissingen. Most of the MAG members attended the workshop. The MAG members were provided with a dedicated MAG newsletter that showed detailed intermediate project results. Due to the pandemic situation and the related economic difficulties, the collaboration with the *VSM-Arbeitskreise* slowed down noticeably.

Target group 'Investors, Banks, Insurance'

NMTF has spoken with representatives of the Dutch association of insurance companies to establish first connections (located near NMTF). However, they did not see a need to join the conversation with the RAMSSES project since we use risk based design methods and have a class society involved in assessing the safety of the design.

3.3.4 Remove external Barriers towards Application

3.3.4.1 Plan

Table 4: Dissemination Plan summary – goal 'Remove external Barriers towards Application'

To **WHOM**	**WHY** and **WHAT**	**HOW**	**WHO***
Maritime rule maker (class, flag states, IMO)	Feed results and approach of RAMSSES (Fast Track to Approval) into upcoming rules and regulations, receive feedback	Direct contact through consortium partners; common position papers, project guidelines, project data base, participation to IMO meetings, communication to flag	**WP06:** NMTF, BV,-RISE, CMT

To **WHOM**	**WHY** and **WHAT**	**HOW**	**WHO***
		states, IACS, SEAEurope (NGO in IMO)	
Cross-industry standards (ISO)	Transmit findings and needs to standards to increase critical mass across sectors	Technology Transfer Group, dedicated partners working in standard committees on EU and national level, common positions, regular information	**WP06:**-RISE, FHG, NETCOMP, TNO, BV
Research Admin. and funding authorities	Ensure consideration of achievements and RDI needs for future research programmes	Reports to COM, WATERBORNE ETP, EFFRA**, EU associations, contact with national governments	**WP05:** CMT, RISE, TNO, NTUA, AIMEN et al

3.3.4.2 Comments on status

Target group 'Maritime rule maker (class, flag states, IMO)'

Status month 24 – Partners of WP06 have strong connections and close relationship with class societies, flag states and IMO. WP06 has been continuously interacting with them to discuss the development of rules and regulations and feed the results of RAMSSES into the rule making process.

Status month 36 – The RAMSSES project's suggested approach ('Smart track to approval – STtA') has been introduced to the International Maritime Organization's Sub-Committee on Ship Design and Construction (SDC) in a lunch break presentation during the SDC7 session in London on February 03rd, 2020. From RAMSSES's perspective, chances are good that the suggestions will be addressed in the upcoming SDC sessions on further rule development.

Status month 54 – RAMSSES project invited the representative of flag states and class societies to participate and exchange opinions and information about the RAMSSES STtA and FRP Guidelines. The flag states are expected to give a referral to IMO-SDC7 to submit proposals for the evaluation of MSC.1/Circ.1574 and proposal to use RAMSSES FRP Guidelines as a basis for a submission to IMO-SDC8 (2022). However, due to COVID-19 the IMO has focussed on a limited number of topics and IMO members have too little experience with MSC.1/Circ.1574 to submit proposals to IMO yet. It is expected that the RAMSSES partners can continue to support flagstates when a submission will be prepared for IMO-SDC9 (2023).

More details are given in the following deliverables:

- D06.2 (Confidential) Report on Rules and Policy Interaction; IPR issues (PM12)
- D06.3 (Confidential) Updated Report on Rules and Policy Interaction; IPR issues (PM24)
- D06.5 (Confidential) Final Report on Rules and Policy Interaction; IPR issues (PM45)
- D06.7 (Public) Final recommendations to rules and policy makers (PM48)

Target group 'Cross-industry standards (ISO)'

RAMSSES will monitor/follow the activities at the TTG to identify if there are any ISO/non-IMO standards that can be beneficial for the maritime area to adopt or refer to for maritime applications. Plans for further activities aiming at developing cross-industry standards will be developed during the project. When developing the suggested Smart Track to Approval (see above), RAMSSES made use of an existing standardised risk scenario approach which is in place for the approval procedure for new materials in the construction industry.

Target group 'Research Admin. and funding authorities'

Status month 24 – Not commenced yet – detailed plan and first activities will be reported in a later stage of the project

Status month 36 – CMT, NMTF and other RAMSSES project partners are prospective members of the proposed Partnership 'Zero Emission Waterborne Transport' which provides suitable channels to communicate any observed technology gaps, research needs or other barriers which impede further and wider use of material innovation in the maritime industry. Use of this opportunity will be made in the last period of the project.

Status month 54 – CMT representatives contributed to several Waterborne consultations and became member of 'Team D', a group combining several German members to Waterborne.

4 Dissemination Activities (CMT,BAL)

Main author of the chapter: Matthias Krause, CMT

4.1 Technology Transfer Group (TTG)

This chapter provides a summary about the TTG and first related activities. More details will be given in the Deliverables:

- D03.2 *First report on Technology Transfer & Future concepts* (PM12)
  The first TTG workshop has been held on 30th January 2018 in Borås, Sweden. The main topic of the first TTG presentation focusing on quick assembly strategies. Experts from the rail (NewRail), aviation (ZAL), and infrastructure (Infracore) industry shared their expertise on the methodologies, innovations, and solutions for quick assembly that could be applied and bring advantages to the shipbuilding industry. The complete presentation and the observation of the first TTG workshop can be found in D03.2 [1].
- D03.3 *Updated report on Technology Transfer & Future concepts* (PM24)
  The second TTG workshop was focusing on the innovative lightweight materials and the development of rules and regulatory frameworks to approve the application of the new materials. The speakers were coming from the experts on the material qualification in the aeronautic sector (GMA-Werkstoffprüfung GmbH), infrastructure sector (Infracore), and university (Southampton University). The qualification process for innovative material can be started from the definition of the structure and materials before the analytical analysis can be performed. Subsequently, the analytical analysis should be supported by experimental testing on the material and the structure. The complete presentation and the observation of the second TTG workshop can be found in D03.3 [2].
- D03.4 *Final report on Technology Transfer & Future concepts* (PM 48)
  The third TTG workshop was focusing on the application of Strucural Health Monitoring (SHM) system in the marine and renewable energy. The speakers were experts in the infrastracture (ICC), aviation (ZAL), and rail (V2C2). In principle, the aviation, infrastructure, rail and maritime industries use SHM systems for a non-destructive test (NDT), monitoring the load, structure conditions, and also for predicting the maintenance period. It means the SHM application in one industry may be applied to other industries as well. However, each sector has its requirement that might impact the choice of the sensors, installation, and data processing for the SHM system. The complete presentation and the observation of the third TTG workshop can be found in D03.4 [3].

All deliverables contain sensible and confidential information, therefore access to deliverable can be requested to the project coordinator.

4.1.1 Approach

In aviation and automotive industry, the application of advanced material like composites or HSLA had been used long time before the maritime industry started to use it. Hence, it is important to learn from other industries to minimize the trial and error time during the exploration of the new materials. The objective of this dissemination activity is to facilitate the technology transfer between maritime industries with material research in other industries (automotive, rail, aeronautics, etc).
In order to meet the dissemination objective, the Technology Transfer Group (TTG) which consists of experts from other industries needs to be formed. The TTG has the responsibility to provide the information on possible technologies that could be applied in the maritime industry. Moreover, it will also advise RAMSSES partners on the advanced materials or production processes which had been researched by them, and enlighten the audiences of the advantages/disadvantages from technical, economical, and sustainable point of views.

The dissemination process will be applied by organizing public event, workshop, and providing reports from the RAMSSES TTG members, and the works are related with WP 03. A minimum of 4 reports which are related and adaptable in maritime industry need to be provided. TTG members also need to send their experts to attend the workshops which are arranged by the consortium, and to present their reports to public audiences or to RAMSSES partners.

4.1.2 Status and outlook

During the first eight months of the RAMSSES project, CMT created the invitation of potential members and successfully recruited them to join the TTG. They are mostly from research organizations with background from aviation, automotive, rail, and material science. The list of TTG members can be seen in Table 5. The involvement of TTG members on internal dissemination activities started at the 3rd RAMSSES General Assembly meeting in Sweden. Depending on the particular focus of the member and/or the industry they represent, the members will either present the topic of 'quick assembly technology' or 'innovative production technology'. It is expected that during the workshop the presenter and the audience will discuss the possibility, the advantages/disadvantages of the process in maritime application.

The next step of this dissemination activities is planning another 3 workshops to discuss further topics. Till now, the consortium identified a list of favourite topics that could be concentrated on in future workshops:

- innovative materials
- rules & regulation
- Structural health monitoring

Table 5 Technology Transfer Group members

Company	Industry	Topic of Knowledge transfer
ZAL Zentrum für Angewandte Luftfahrtforschung GmbH	Aviation	Composite material, fuel cell, Factory of the future, maintenance, repair, and overhaul
Das virtuelle Fahrzeug, Forschungsgesellschaft mbH (Virtual Vehicle Competence Center, V_2C_2)	Automotive & Rail	Advanced materials for safe and environmentally friendly vehicles in the road and rail
NewRail	Rail	Application of new and lightweight material
InfraCore (RAMSSES partner)	various	Advanced material in multi industries application, e.g. construction industry

4.2 Maritime Advisory Group

This chapter provides a summary of the MAG and the first related activities. More details are given in the Deliverable D03.1 *Installation of Advisory Group and Collaboration Plan* (PM06).

4.2.1 Approach

In order to improve the research result in RAMSSES, the requirements on new material and technologies should involve the knowledge on market innovation and opinions of the end user. Hence, the RAMSSES consortium decided to create a Maritime Advisory Group (MAG) which involves ship owners/operators and their associations. Besides inbound information flow (i.e. gaining input for RDI purposes), the MAG will also be a means to organise outbound flow (i.e. informing potential customers about the project's benefits and their potential). Thus, the MAG is a contribution to implement the dissemination strategy towards the corresponding target group.

For the purpose of keeping the detailed work in RAMSESS confidential and meeting the objectives of MAG, separate workshop for MAG members will be conducted annually. Moreover, the works are connected with dissemination and network activities in WP 05 where appropriate. However, the MAG members will not be able to attend the General Assembly meeting or other meetings which can show them the detailed process in the RAMSSES project. If MAG members have interest in the results within

the RAMSSES project to be applied in their product or process production, they can do direct communication with RAMSSES work package partners. Hence, it is necessary for work package partners to introduce the RAMSSES project to their customers or suppliers and suggest them to join the MAG. Moreover, there will be 4 MAG workshops during the RAMSSES project. MAG members are required to attend at least 3 workshops and send their expert in the topic selected for each workshop.

4.2.2 Status and outlook

After eight months of RAMSSES project, the WP leaders had given suggestions on the potential members of the MAG. Subsequently, CMT, with help from WP leaders, created and circulated an invitation letter to join the MAG, along with some basic information about RAMSSES. There are 9 companies which have confirmed their participation as a member of the MAG. They are mostly coming from ship owners/operators and related associations. The RAMSSES CMG considers this a sufficient amount to start a useful cooperation. However, latecomers can still be accepted to join the MAG. The list of RAMSSES MAG can be seen in Table 6.

The first MAG workshop was conducted June 2018 in St. Nazaire, France. Prior to that, a Memorandum of Understanding was distributed to formally agree on the terms of cooperation including a questionnaire to investigate the MAG members' expectations. Questionnaire answers were analysed to support the preparations of the first MAG workshop in line with MAG members' expectations. Also, a RAMSSES dossier was given to MAG members prior to the workshop (including confidential information, after it has been agreed by the consortium). , and a questionnaire to investigate the MAG members' expectations. Questionnaire answers will be analysed to prepare the first MAG workshop as expected by MAG members. 7 MAG members (ECSA, RCCL, CMAL, Pro Danube, DANAOS, Stena, Aero Kommune (E-Ferry project)) attended the workshop. During the workshop, CMT introduced the RAMSSES project followed by DSNS who presented the development of a custom-made hull in their work package. To give understanding about the benefit of the application of innovative materials during the life cycle of the ship to MAG members, RAMSSES partner Balance presented how RAMSSES project involves LCPA analysis in each component and demo case work package. Moreover, NMTF also presented the smart track to approval approach to assure the standardisation, simplification, and evolving of the regulatory regime of innovative materials in the RAMSSES project.

The second MAG workshop was conducted on June 2019 in Vigo, Spain. A newsletter about the development of RAMSSES project was given to MAG members couple weeks before the event. The MAG workshop was combined with E-LASS event. Two MAG members attended the event (Danaos and Royal Dutch Navy). During the event, the MAG members were presented with the development of the RAMSSES project. Due to the combined event, a constructive discussion, and feedback between RAMSSES and MAG members was hard to achieve. Therefore, RAMSSES consortium agreed that the next MAG workshop should be separated from E-LASS event.

The third MAG workshop was conducted virtually in September 2020. The third MAG newsletter about the development of RAMSSES project was given to MAG members a week before the event. 9 MAG members (CMAL, Danaos, DMO, Carnival, ECSA, French MoD, Pro Danube, Stena, CERTH) and one IMO representative attended the event. In the beginning, each participant introduced themselves and stated the importance to use new and lightweight materials and structures and the variety of reasons and requirements to do so. The MAG members acknowledge the achievements of the RAMSSES project so far. RAMSSES partner, Balance and Damen presented the development on their demonstrators and possible market uptake opportunities based on the LCPA study. Furthermore, NMTF presented the progress of interaction with IMO and flag states about RAMSSES STtA and RAMSSES FRP Guidelines for the evaluation of MSC.Circ.1574 and proposal to use RAMSSES FRP Guidelines as a basis for a submission to IMO-SDC8 (2022). The process of implementing the modified regulation could be speeded up if significant interest is articulated by IMO members. The RAMSSES partners in the MAG meeting agree that a discussion about suitable dissemination activities should take place (e.g. continued dissemination to flag states, lobbying for funding opportunities).

Table 6 Maritime Advisory Group (MAG) members

Company	Ship types/industries represented
DANAOS Shipping	Container vessels
European Community Shipowners' Associations (ECSA)	Various (association)
Pro Danube	Various inland water vessels and infrastructures (Danube river)
Royal Netherlands Navy	Patrol vessels
STENA	Ferries (Baltic sea)
Styrsöbolaget	Ferries (municipal/coastal areas)
Royal Caribbean Cruises LTD (RCCL)	Cruise vessels
Carnival Maritime	Cruise vessels
Caledonian Maritime Assets Ltd (CMAL)	Ferries and infrastructures (Scotland)

4.3 RAMSSES Sustanaible network

4.3.1 E-LASS & SARGASSO

As agreed at an early stage of the project, RAMSSES will establish a sustainable network that will maintain a platform for information exchange and cooperation after the end of the project. E-LASS, the network for lightweight applications at sea, is the strategic partner for achieving this goal. E-LASS is a joint initiative by the RAMSSES partners RISE and CMT as an outcome of the two projects LASS (Swedish national funding) and DE-Light Transport (EU-FP5). E-LASS (e-lass.eu) was established in 2013 and gathers stakeholders interested in lightweight design for the maritime industry. The aim is to create an organization where exchange of information and knowledge becomes easy and natural. RAMSSES's main aspect in creating a sustainable network is to strengthen E-LASS. E-LASS is bringing experts (ship owners, shipyards, OEM, material suppliers, etc.) from the maritime materials sector together by organising technical visits and seminars in which success stories, challenges (e.g. rule-making) and lessons learnt are presented and discussed. Today, the network comprises approx. 310 member organisations, all being experts with a focus on lightweight applications in the maritime area.

Together with RAMSSES, E-LASS organised workshops on a semiannually basis, including technical visits of relevant industry sites. As RAMSSES and E-LASS share the same aims, it was decided, that RAMSSES and the E-LASS network will join forces by organising the E-LASS workshops together. To create synergies and to save resources, E-LASS workshops have been combined with RAMSSES General Assemblies. The first workshop organised in that way took place in Pula on October 11th, 2017 (pictures: **Error! Reference source not found.**, **Error! Reference source not found.**; conference agenda: **Error! Reference source not found.**).

Figure 3: Tommy Hertzberg, coordinator of the E-LASS network, opens the workshop in Pula

Figure 4: E-LASS members inspecting Composite car decks during the industry tour at Uljanik shipyard, Pula

Table 7: Agenda of the RAMSSES/E-LASS conference in Pula

E-Lass Conference
11.10.2017, Hotel Histria, Pula

Lightweight Applications				
08:15	08:30	Welcome to Uljanik	Aleksandar Kajtez	Uljanik
08:30	09:10	Uljanik composite RoRo-deck project	Vito Radolovic, Michael Rahm	Uljanik / RISE
09:10	10:00	Composite Tween Deck for Bulk Carrier – Testing of a Full-scale Prototype	Philippe Noury, Ragnar Hansen, Lars Espen Holm	DNVGL/ HEAC/ CompOcean
10:00	10:20	FAUSST - novel solutions for composite-steel joints	Rafael Luterbacher	Center of Maritime Technologies e.V.
10:20	10:45	Coffee break		
10:45	11:05	Lightweight structures	Lars Molter	Center of Maritime Technologies e.V.
11:05	11:25	Composite hatches and doors	Arnold Vaandrager	Vabocomposites
11:25	11:45	PET-based core material	Stefan Reuterlöv	Armacell
11:45	12:05	Basalt fibres for composites	Wouter Verbouwe	Basaltex NV
12:05	13:00	Lunch		
Innovation Actions				
13:00	13:30	The RAMSSES project	Carlo Cau, Matthias Krause	Cetena, Center of Maritime Technologies e.V.
13:30	14:00	Project cooperation opportunities in RAMSSES	Frank Roland	Center of Maritime Technologies e.V.
14:00	14:30	GasVessel - technologies and its application in the maritme and civil sector	Pierluigi Busetto	Navalprogetti
14:30	15:00	Coffee break		
Rules and Regulations				
15:00	15:20	New materials attached to offshore practice	Agnes-M. Horn, Ramin Moslemian, Philippe Noury	DNVGL
15:20	15:40	IMO FRP regulation status	Franz Evegren	RISE
15:40	16:00	Modernising composite materials regulations	Simon Quinn	University of Southampton
16:00	17:00	Discussion: approaches to improve innovation capabilities	Arnold de Bruijn (moderator)	Netherlands Maritime Technology Foundation

sponsored by:

Since then, nine further joint workshops took place. In January 2020 E-LASS joined forces with the German maritime lightweight network MariLight.Net. As result, a joint event bringing together the RAMSSES consortium with the German and the European lightweight networks was organised. The public event, which took place in Bremen, Germany, was attended by more than 120 persons. In the following to this event, E-LASS memberships and hence the size of the network was further increased.

During the Covid-19 pandemic, two E-LASS events were held virtually in November 2020 and June 2021. A good interactive webinar format supported by a well-prepared moderator created a successful knowledge exchange and discussion among the stakeholders interested in lightweight design for the maritime industry.

Another important aspect to ensure the sustainability of the network is the strong cooperation with research projects, also beyond the RAMSSES network. E-LASS will continue to contribute, also in the long run, to research projects as a channel for result dissemination and collaboration, to rule-making as a strong alliance towards legislation, and to innovation, not least through an open maritime innovation platform called SARGASSO. SARGASSO connects companies and organizations looking for solution providers to technical challenges or services or new partners to project consortia.

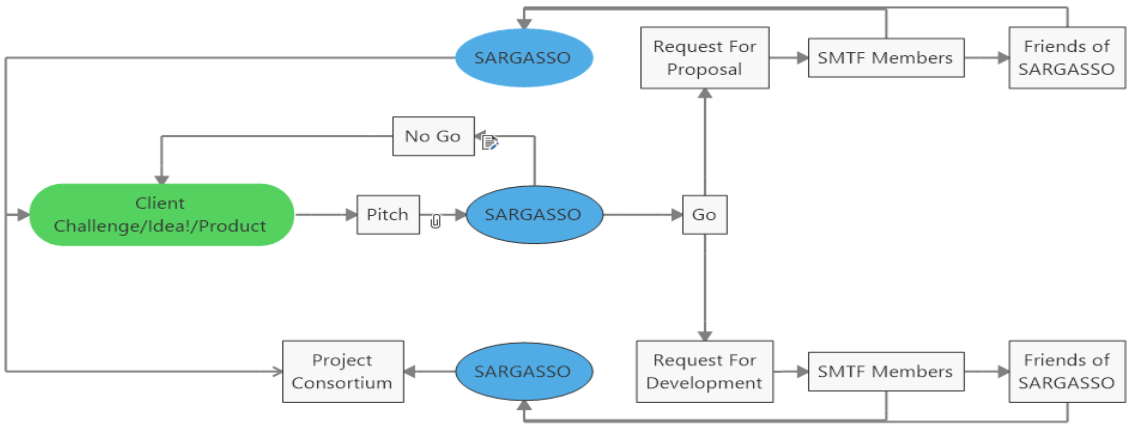


Figure 5: SARGASSO work process

4.4 RAMSSES Project website (CMT)

The RAMSSES project website was launched in November 2017. It provides an overview of the project and its single demo cases and will be updated on a continuous base. For more in-depth information the deliverable D5.1 provides a detailed report on the website.
Upcoming public events with the E-LASS network are regularly announced on the project website, as well as the reports on the meeting. As the general intention is to create a sustainable network beyond the time frame of the RAMSSES project, it was jointly decided that the main platform for communicating the events as well as the place for accessing the presentations held during this events will be the E-LASS website.

4.5 Project Flyer and Final Brochure (CMT)

During the proposal stage of the RAMSSES project as one of the dissemination measures it was decided to create a project flyer. Within the first internal meetings with the dissemination team it was decided to create a project poster instead of a flyer. One major decision driver was the participation of RAMSSES on the Waterborne booth at the Transport and Research Arena 2018 which took place in Vienna, Austria from 16th to 19th of April 2018. At this booth, RAMSSES was one of five H2020-projects to be presented with a poster in square format. From this initial design a poster in DIN-format and a file for printing roll-up has been derived. All dissemination material and presentation during final conference will be available for download on the RAMSSES website as well as the PM tool BAL.PM.
A final brochure has been prepared and published to disseminate the results and achievements of the demo cases, assessment, integration and communication layers. The online version of the final brochures will be available for download on the RAMSSES website. The printed version of the final brochure was handed to the participants during RAMSSES final conference. In addition, CMT will also use the printed version of the final brochure to disseminate the RAMSSES project results during the Buy Blue event, a b2b even where buyers and suppliers have opportunities to get to know each other and present their offers, needs and services.

4.5.1 Social Media

In order to raise additional awareness for the RAMSSES project, a profile on the social network platform LinkedIn was created. With the support of some selected RAMSSES partners, steady posts on project developments lead to a growing community that follows the RAMSSES project.

Currently, there are 599 followers who have subscribed to the RAMSSES channel on LinkedIn. In the last 12 month 18 announcements have been posted, on average 2 times per month. The most popular post was the review of the joint pubic event of both the maritime lightweight networks, the German MairLight.Net and the European E-LASS, generating 2.754 Impressions, 475 Klicks and 56 reactions. Posted on January 30th, 2020. More announcements will be posted just before and after the final conference to disseminate the final results of RAMSSES project.

4.6 Project videos

The initial plan was to produce one short RAMSSES film (3…4 minutes) that will explain the motivation for and developments achieved in RAMSSES. Besides that, there will also be a video on each of the thirteen demo cases with a length of approx. 2 minutes per video. As far as possible, the videos will be produced at an early stage of the project, so they can be used during the time of the project in various dissemination activities.
The WP05 budget (personnel and other costs) allocated to production of videos were used to cover efforts for postproduction costs whereas the DC leaders, especially large companies, covered the costs for the production at site (CMG decision, approved by SG). Where required and if budget permits, WP05 resources should also be used to support the video production activities at site of smaller companies (BaltiCo, MEC, PodComp, Baltic Workboats).
In short, the actual results are as follows:
Several short videos (approx. 2…6 minutes length) were produced during the RAMSSES project. They can be distinguished in two groups:

- The first group is a series of five videos which were directed by CMT. They explain the motivations for the work done, and developments achieved in the project. Although some of the videos have a closer look at the activities of some selected partners, the aim was always to create an understanding of the entire project.
- The second group comprises four more videos which were directed by other partners, in collaboration with CMT. Those films dive deeper into the activities of some the Work Packages, and they give impressive examples of the immense efforts and excellence of work behind all the achievements.

All the videos are shared on YouTube on a dedicated RAMSSES channel, on the RAMSSES website, on the LinkedIn RAMSSES channel and through the partners networks.

- Link to the YouTube playlist: https://youtube.com/playlist?list=PLc-BlKa-K-b5jLjhnL1ACcVFYW2K0jw80
- Link to the videos section on the project website: https://www.ramsses-project.eu/videos/

The detail report on the results of video productions can be read in D05.5 [4].

4.7 Cooperation with projects

In order to improve the quality of the research, besides the already formed TTG and MAG, the RAMSSES consortium is also interested to collect information from other projects (ongoing and previous) to enhance the RAMSSES knowledge repository and create cooperation with other consortia. The objective for this action is to collect the test results, design solution, and lesson learnt from other projects by getting the permission to access their public summaries or confidential report which might be helpful for research in RAMSSES.
The other objective of this action is to exchange ideas and results of the RAMSSES project with other project consortia and to look for synergies and fields for collaboration. From the subchapters below, some short descriptions about the identified projects can be derived that might be very beneficial for

RAMSSES to exchange project information. The consortia of each project have been contacted and they agreed to exchange information with RAMSSES.
Several new projects on maritime lightweight applications started in the late phase of RAMSSES, particularly FIBREGY (focus on composite structures in the maritime renewable energy sector) and FIBRE4YARDS (focus on efficient shipyard processes). Interaction with RAMSSES comprised presentations of the new projects at E-LASS seminars and a discussion about possibilities to share knowledge using the RAMSSES material database.
Collaboration between RAMSSES and organsiations in particular countries were mainly handled through the three national maritime lightweight networks S-LASS, D-LASS and MariLight. The latter receives additional support through a funded project, MariLight.Cluster (similar to Cooridnation and Support Actions on European level). RAMSSES partners already appeared on three MariLightCluster workshops to present and discuss various project results (Smart Track to Approval, and results from WP 10, WP 12, WP 13, WP 14, WP 15).

4.7.1 E-ferry

4.7.1.1 Basic information

- Current status: completed
- Funding: EU H2020 MG-4.1-2014
- Area: completely electrically powered ferry for passengers and vehicles

4.7.1.2 Abstract

"E-ferry addresses the urgent need for reducing European CO2 emissions and air pollution from waterborne transportation by demonstrating the feasibility of a 100% electrically powered, emission free, medium sized ferry for passengers and cars, trucks and cargo relevant to island communities, coastal zones and inland waterways. The vessel will be based on a newly developed, energy efficient design concept and demonstrated in full-scale operation on longer distances than previously seen for electric drive train ferries (> 5 Nm), i.e. the medium range connections Soeby-Fynshav (10.7 Nm) and Soeby-Faaborg (9.6 Nm) in the Danish part of the Baltic Sea, connecting the island of Aeroe (Ærø) to the mainland.E-ferry builds on the Danish ERDF funded project Green Ferry Vision proving feasibility of the concept to be demonstrated and indicating significant potential impacts compared to conventionally fuelled ferries operating on the same medium range routes; energy savings of up to 50%, annual emission reductions of approx. 2,000 tonnes CO2, 41,500 kg NOx, 1,350 kg SO2 and 2,500 kg particulates. E-ferry is likely to be the one with the largest battery-pack ever installed in a ferry with a record breaking high charging power capacity of up to 4 MW allowing for short port stays. On top of being 100% powered by electricity, the innovative novelties of the E-ferry design concept and its expected impacts addresses flaws in current state-of-the-art by demonstrating a concept based on optimised hull-shape, lightweight equipment and carbon composite materials, ensuring reduced weight by up to 60% on parts replaced by composite elements. Approval of the use of carbon fibre-reinforced composite modules in E-ferry's superstructure according regulation through material and fire testing also is key to the project."

4.7.1.3 State of collaboration

- Trine Heinemann, project coordinator of the E-ferry project has been an active member in the RAMSSES MAG, also beyond the E-ferry project lifetime.
- Steady presentations on the developments of the project during the E_LASS events, a continuous exchange between the two projects was provided.
- E-ferry invited RAMSSES to present on their final conference, which unfortunately must have been cancelled due to COVID-19.

4.7.2 FibreShip

4.7.2.1 Basic information

- Current status: ongoing

- Funding: EU H2020 MG-2.2.2016 (funded under the same call topic as RAMSSES)
- Area: Ship hull entirely made of FRP

4.7.2.2 Abstract

"The main objective of the FIBRESHIP project is to enable the building of the complete hull and superstructure of large length sea going and inland ships in FRP materials by overcoming the above-mentioned challenges. In order to achieve this objective, the project will develop, qualify and audit innovative FRP materials for marine applications, elaborate new design and production guidelines and procedures, generate efficient production and inspection methodologies, and develop new validated software analysis tools. Clear performance indicators will be designed and applied in the evaluation of the different solutions developed for three targeted vessels categories (Light commercial Vessels, Passengers transportation & leisure Vessel, Special Services Vessel). Finally, the different technologies generated in FIBRESHIP will be first validated and then demonstrated by using advanced simulation techniques and experimental testing on real-scale structures." [5]

4.7.2.3 State of collaboration

Status month 24:

- Mutual participation in the projects' kick-off events, exchange of information and ideas
- Deeper collaboration with FibreShip is sought especially by RAMSSES WP17 (*Demo Case Custom made hull for offshore vessel*) and WP06 *Rules and Regulations, Exploitation*.

Status month 36 – The collaboration with FIBRESHIP is very lively and fruitful. CMT was present at a public FIBRESHIP workshop, and the FIBRESHIP Coordinator attended RAMSSES/E-LASS events (Vigo 2019, Bremen 2020). The most important and successful part of the collaboration is the development of a joint presentation at IMO's SDC7 session about the Smart Track to Approval (see chapter 3.3.4).

4.7.3 GasVessel

4.7.3.1 Basic information

- Current status: ongoing
- Funding: EU H2020 MG
- Area: Compressed Natural Gas Transport System (here, *vessel* means *tank*, not *ship*)

4.7.3.2 Abstract

"The GASVESSEL aims to prove the techno-economic feasibility of a new CNG transport concept enabled by a novel patented Pressure Vessel manufacturing technology and a new conceptual ship design including safe on- and offloading solution. It carries out research and innovates different steps in the value chain from a decision support model to simulate and benchmark scenarios until the process of ship design, new Pressure Vessel designs and manufacturing as well as novel high pressure on- and offloading. The project will make it possible to supply natural gas to places where natural gas is not yet a part of the energy supply e.g. where large investment in regassifiers are not feasible or done (yet) such as the Mediterranean Islands.

The concept offers novel cost-effective gas transportation and hence promising prospects to start using and monetizing the huge amount of currently wasted (flared), stranded and associated gas which is currently wasted or not used, while contributing to reducing an important environmental side effect of global oil exploitation. The validation and proof of concept of the GASVESSEL project is performed by a cost-benefit analyses (financial viability), safety assessment, environmental impact analyses and value chain business cases development in relation to real-life geo-logistic scenarios." [6]

4.7.3.3 State of collaboration

- The Coordinator of GASVESSEL gave a detailed overview presentation at the E-LASS event in Pula
- RAMSSES and GASVESSEL have various requirements and interests in common. Exchange will be continued, further collaboration is sought.

4.7.4 ADAM4EVE (finished project)

4.7.4.1 Basic information

- Current status: finished
- Funding: EU FP7
- Area: Adaptive and smart materials and structures for more efficient vessels

4.7.4.2 Abstract

"ADAM4EVE – is an EU FP7 project that focuses on the development and assessment of applications of adaptive and smart materials and structures in the shipbuilding industry.
Materials and structures are called adaptive if they can change certain properties in a predictable manner due to the forces acting on them (passive) or by means of built in actuators (active). Those materials and structures are referred to as smart if they provide best performance when operation circumstances change.
The main idea of ADAM4EVE is to explore the potentials of adaptive materials and structures in ships and pave the way for industrial application. This will allow ships to react more flexible to changing operational and environmental conditions and thus to operate more efficiently and environmentally friendly, while at least maintaining the safety level. Moreover, the use of smart and intelligent materials will allow offering new functionalities, making ships more attractive to operators and passengers." [7]

4.7.4.3 State of collaboration

The ADAM4EVE consortium has been requested for approval to share project results with RAMSSES knowledge base. The partners who have answered so far (the period for answering is still ongoing) do not object, and they support the idea of collecting project results in a common knowledge base.

4.7.5 QUALIFY

4.7.5.1 Basic information

- Current status: ongoing
- Funding: EU Interreg
- Area: Ship hull entirely made of FRP

4.7.5.2 Abstract

"The Interreg project Qualify aims to remove the technological and regulatory barriers that currently prevent the widespread application of hybrid structures (metal/composite) in the industry. It will deliver the knowledge and the guidelines that the industry needs to pursue certification of adhesively bonded hybrid joints for primary structures in marine applications.
The approach proposed requires a combination of capabilities and experiences not available within the national borders of individual participants The innovative approach is the combination of state-of-the-art knowledge with the experience of the classification societies and that of end-users: physically-based models, developed in previous and parallel projects that describe the adhesive bond performance, will be further expanded to include the relation to environmental conditions; they will be extensively tested and validated, giving reliable prediction of performance in real operating conditions. To shorten the testing time, unique accelerated test methodologies and equipment will be developed, to reflect the lifetime of the bonded structure with one month of testing. For the first time in the industry, an inspection and monitoring protocol will be developed, using advanced sensing technologies, as well as an innovative in-situ repair technology. These innovative advances will enable certification of composite superstructures using steel/composite adhesive bonds for their use in primary structures in marine applications." [8]

4.7.5.3 State of collaboration

- Status month 24 – For QUALIFY project, Center of Maritime Technologies e.V (CMT) is responsible as a project's observer. CMT will provide information and connecting the QUALIFY

project with other projects. Hence, CMT will connect the QUALIFY and RAMSSES projects, create synergies and exchange information.

- Status month 36 – CMT attended two of the QUALIFY events:
- General QUALIFY Assembly in Portsmouth on November 30, 2018, including a meeting with the observers group
- Public workshop in Rotterdam on June 18, 2019 – including an overview presentation about RAMSSES, given by CMT
- Answering a questionnaire by QUALIFY on expected market volume for adhesive bonding in the maritime industry
- participation in a public QUALIFY workshop in 2020 and in the final event in 2021

4.7.6 DE-LIGHT Transport (finished project)

4.7.6.1 Basic information

- Current status: finished
- Funding: EU FP6
- Title: Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design

4.7.6.2 Abstract

"DE-LIGHT Transport (Developing Lightweight Modules for Transport Systems Featuring Efficient Production and Lifecycle benefits at Structural and Functional Integrity using Risk Based Design). Complex lightweight modules for ships and railway will be developed using risk based design methods. The modules will contain structural and outfitting components. The modules can be efficiently pre-assembled under favourable working conditions using economy of scale. Modules can be adapted to customer needs thus featuring structural and functional integrity, improved safety and environmentally friendliness as well as efficient operation and reduced life cycle cost. The development of lightweight modules will thus contribute to increase the competitiveness of European producers and operators of transport systems. The application of risk based design methods will allow to develop highly innovative solutions exceeding the range of existing classification rules by exploring new material combinations, innovative joining, assembly and pre-outfitting techniques. The scope of applications followed by DE-LIGHT reaches from passenger and RoRo ships, through cargo and short sea ships, to inter-modal transport". [9]

4.7.6.3 State of collaboration

The DE-LIGHT Transport consortium has been requested for approval to share project results (test reports) with the RAMSSES knowledge base. The partners have agreed.

4.7.7 HOLISHIP

4.7.7.1 Basic Information

- Current status: ongoing
- Funding: EU H2020
- Title: HOLIstic optimisation of SHIP design and operation for life cycle

4.7.7.2 Abstract

"Most maritime products are typically associated with large investments and are seldom built in large series. Where other modes of transport benefit from the economy of series production, this is not the case for maritime products which are typically designed to refined customer requirements increasingly determined by the need for high efficiency, flexibility and low environmental impact at a competitive price. Product design is thus subject to global trade-offs among traditional constraints (customer needs, technical requirements, cost) and new requirements (life-cycle,environmental impact, rules). One of the most important design objectives is to minimise total cost over the economic life cycle of the product,

taking into account maintenance, refitting, renewal, manning, recycling, environmental footprint, etc. The trade-off among all these requirements must be assessed and evaluated in the first steps of the design process on the basis of customer / owner specifications. Advanced product design needs to adapt to profound, sometimes contradicting requirements and assure a flexible and optimised performance over the entire life-cycle for varying operational conditions. This calls for greatly improved design tools including multi-objective optimisation and finally virtual testing of the overall design and its components. HOLISHIP (HOLIstic optimisation of SHIP design and operation for life-cycle) addresses these urgent industry needs by the development of innovative design methodologies, integrating design requirements (technical constraints, performance indicators, life-cycle cost, environmental impact) at an early design stage and for the entire life-cycle in an integrated design environment. Design integration will be implemented in practice by the development of integrated design s/w platforms and demonstrated by digital mock-ups and industry led application studies on the design and performance of ships, marine equipment and maritime assets in general."

4.7.7.3 State of Collaboration

The collaboration is related to the work in WP13. The work package leader and member, Meyer Werft and CMT involve both of the projects. The know-how and lesson learned during process engineering work to use lightweight material have been shared to create a better plan during the design and assembly process in the shipyard.

5 Exploitation Plan

Main author of the chapter: Arnold de Bruijn, NMTF

Exploitation of results is an important aspect of the RAMSSES project, since it relates directly to Objective 1 of the RAMSSES project:

> "The RAMSSES Demonstrator Cases (Demos) will foster the use of new materials in real applications with high market potential"

To prove this potential each demonstrator case is required to make an exploitation plan and a business plan in which both the commercial and non-commercial use of the demonstrator cases are outlined and made measurable as far as reasonable and practicable. This enables the monitoring of results of all demonstrator cases and their combined impact.

An initial exploitation plan was included in the DoA (2.2.4) and has been used as basis for this document, it is repeated in subchapter 5.1. Then subchapter 5.2 outlines the process and timeline of monitoring the results of all demonstrator cases and the combined impact. Subchapter 5.3 provides templates for the demonstrator cases to develop their exploitation and business plan. A full list of exploitable results is presented in subchapter 5.4. Subchapter 5.5 covers IPR within the RAMSSES consortium, in which an overview is given regarding the preliminary choices/preferences of IPR tools amongst partners. Subchapter 5.6 covers multiple forms of exploitation and the proceeding of the exploitation plan. Finally, subchapter 5.7 describes the final achieved results compared to the expected results.

It is expected that in future updates of this deliverable subchapters are added with guidance on the monitoring of exploitation.

This document (D06.4) has been updated and developed regarding exploitation, the final version was consolidated at the end of the project (D06.6).

Part of the contents of this report and its updates might also be used to contribute to the development of new rules and standards, therefore we will include references to other deliverables covering this subject (D06.4)

5.1 Exploitation plan from proposal phase

Exploitation/Business Plans to exploit project results and achieve the impact described in this chapter are:

- The Exploitation Plan is meant for the usage and exploitation of project results by the partners who have access to these results. Results listed in the exploitation plan can be tangible outputs, e.g. prototypes, drawings or intangible outputs e.g. know-how, data or solution catalogues. Those results can be used for commercial purposes, but also as training material, for future research etc. The Exploitation Plan includes:
  - a list of project results for each Work Package and from the entire project;
  - a description of those results, including the possibilities to use and IPR rights related to them;
  - a description of the exploitation plans for each partner.

- A Business Plan refers to the commercial use of results. It is therefore covering a sub-group of results presented in the Exploitation Plan and their use primarily by industry partners. The Business Plan is meant to ensure market uptake and contains business goals and the assessment of their achievability (e.g. supported by a SWOT analysis, market analysis, customer review), and a plan on how the business goals shall be reached.

Both Plans will be stepwise developed during the project

5.1.1 Commercial use of results

The RAMSSES partners will use the project results according to their specific fields of activity:

Commercial Use of Results

- Shipyards and ship equipment suppliers will use the results to improve their products, hereby strengthening their market position, explore new market segments and gain new customers;
- Engineering service providers, classification societies and research centres will improve their services and adapt them to the latest technological developments, hereby ensuring market leadership in advanced technologies and engineering methods
- Knowledge and data generated in RAMSSES will also be used in the discussion with banks and insurance companies to improve the financing conditions for innovative technologies.

5.1.2 Non-commercial use of results

Non-Commercial Use of Results will be implemented as following:

- All those groups jointly will use the results and knowledge gained from the RAMSSES project to contribute to the development of new rules, regulations and legislation and to provide feedback to policy making;
- Associations and research centres will use the knowledge and results to improve services towards their members to develop the European RDI network and to inform them on latest technical developments;
- All partners will use results for further developments, the definition of future research needs and use the knowledge to increase their competences in research, development and innovation;
- Academic partners, associations, research centres and industry will use the knowledge gained through the project to develop training material both for graduate and post-graduate academic and vocational training.

Table 8 presents draft intentions of selected partners for non-commercial exploitation of RAMSSES results.

Table 8: Plans for non-commercial exploitation

Partner	Exploitation Plan
Academia / Research Institutes	
CMT	Will use the results to improve their services to the European and German shipbuilding industry in developing and coordinating complex projects in the area of maritime materials and constructions.
SICOMP	Will improve their advisory services and testing capabilities for companies in the area of determining properties of complex composite materials
RISE	Will apply the extended knowledge on testing of fire properties and acoustic performance of composite materials for improving their services and testing capabilities
FHG	Will improve their knowledge on mechanical testing of small scale composite structures in order to better advice and support the maritime industry
TNO	Will be able to provide better advice to designers of large scale composite structures and will utilise the experience gained in mechanical testing of these structures for services to yards and engineering companies
ENSTA	Will utilise the experience gained in testing of complex 3D component to increase their competences in research and education, and will offer their improved testing capabilities to industry
ECN	Will expand their knowledge of additive manufacturing of complex 3D structures to improve their scientific and technical skills and competences for future research and services.

AALTO	Will improve their capability to provide scientific advice on application of high tensile steel in cruise ship structures
NTUA	Will use the knowledge on High Tensile Steel gained in the project to increase the competences in research and education, to increase their scientific reputation by publications in scientific journals and conferences
NMTF	Will utilise the strategy and long term plan for evolving the maritime regulatory regime in their advisory role to the national flag state, and will initiate and support innovation projects for the Netherlands maritime sector in the area of new materials
AIMEN	Will apply the gained knowledge on properties of High Tensile Steel to improve their advisory and testing services to the industry
Classification Societies	
BV	Expects to increase knowledge and competence to support shipyards and ship-operators in selecting technologies for application of lightweight materials that better address reduction of ships weight and production costs and meet stringent IMO and SOLAS regulations

While commercial and non-commercial exploitation potentials have been described above, the following tables describe the expected business potentials from the perspective of the consortium and in view of an external market uptake. The overview presented is the result of interviews with consortium key partners. It contains indicative figures that partners were able to provide at this stage.

Expected business potentials and market uptake by RAMSSES partners

The partners of RAMSSES will be the first to apply the innovative solutions demonstrated in the project in their businesses. The consortium represents about 50% of Europe's total shipbuilding production value. The strength of project with regard to the commercial uptake of results can be illustrated by some statements of key partners on their intended exploitation and market uptake. These statements will serve as starting point for the exploitation and business plans, which will be developed during the project by each demo in compliance with Obj.1.

Table 8.1: Statements on intended exploitation and market uptake

D. Büchler, CEO (BALTICO-WP09): *"we are an innovative SME and expect to achieve a flexible industrial serial production of composite components within RAMSSES. The modular approach will allow up to 25% cost savings in the production, making custom-made lightweight solutions "affordable". This will both improve the competitiveness of BALTICO and expand the market for advanced material solutions in maritime and other sectors in which we are active. The modular system including dedicated joining elements will allow to use mechanical joining (screws and bolts) to connect the elements on board, thus avoiding both welding and bonding to a large extent."*
P. Lundmark, CEO (PODCOMP-WP10): *"PODCOMP aims to deliver 7.000m² in the first year after the project with a turnover of 1.4 Mill. €. This would be an additional product for our production line and would require an additional workforce of 3 employees. It is expected that the maritime market will request in the medium term 70.000m² per year. The wall system which will be developed in RAMSSES can be applied in cabins with a production volume of more than 60.000m² per cruise liner. We are prepared to produce about 30.000 m² per year, expecting the market for this product to triple within the next 5 years."*
M. Morel, R&D manager (NAVAL GROUP-WP11): *"The ship propeller market is projected to grow $6 Billion by 2020 at a CAGR of 10 % according to a recent study of MarketandMarket US firm which is the No 2 world sources in terms of annually published premium market research reports. In this competitive market, 3D additive process in producing serial blades in innovative material, will provide differentiation to propeller manufacturers for important market take up."*

J. Mehldau, Head of R&D (BMS-WP12): *"RAMSSES allows to continue innovate and show the feasibility of larger composite rudder components. This provides the option to reduce costs in our value and supply chain. Using composites more complex geometries can be manufactured, leading to load and hydro dynamical optimised rudder flaps. In addition, the using composites will make it possible to reduce weight, material consumption, maintenance costs, installation efforts, transport costs and lead times. The expected results will enable European equipment manufacturer to keep up competitiveness especially for the shipbuilding market in Asia."*
H. Josef Mammes, Head of Research (MW-WP13): *"We intend to use RAMSSES results in coming cruise ship orders, in particular the 11 ships we have in our order book for the next five years. Interior walls system and modular lightweight superstructure are excellent applications for new material solutions. Discussions with our customers, Norwegian Cruise Lines, Carnival Cruise Lines and others to present the ideas of RAMSSES showed a positive attitude and high expectations. A key challenge for us is to reduce the cost of innovative material solutions and to integrate it into our highly mechanised process chain. We see the modular lightweight system as an important means to solve this challenge."*
V. Buic, Head of ship design (ULJ-WP14): *"The ongoing production of Car Carriers with lightweight solution implemented, totally 60.000m² of composite structure on five vessels, showed a positive impact on the yard process as well as vessel performance. The full order book up to year 2018 and positive feedback from shipowners regarding innovative solutions gives the possibility for development and implementation of RAMSSES lightweight solution for different types of vessels."*
Imre Kuusk, project engineer (BWB – WP15) *"Baltic Workboats produces 15-20 workboats or ferries each year. With novel approach to deckhouse structures based on Aluminium sandwich panels, the shipyard could use 50-75 tons of aluminum panels per year resulting in considerable saving in insulation time and usable onboard space"*
M. Morel, R&D manager (NAVAL GROUP-WP16*): "NAVAL GROUP group delivers worldwide high value ships. Step by step, the preoccupation with optimisation of superstructure has led to work on incorporating new functions into composites by choosing the components no longer on the sole criterion of their mechanical performance and weight, but also on the basis of multi-functionality. Furthermore, use has been made of the ability of composites to incorporate into their structure foreign components (e.g. fine metal grids, sensors, antennas, etc.) providing a new function while minimising the impact on the mechanical performance."*
L. Morel, Composite Specialist (DSNS-WP17): *"The Damen Group delivers 150-200 ships per year. The potential market expectation for composite materials in ships is enormous, exceeding 1 billion euro. Damen already has a composite shipyard with 120 employees, and business plans are already developed to expand the composite production capacity by more than 100 employees."*
L Rouxel-Duval, R&D Ship Manager (STX Fr – WP18): *"The novel passenger cabin and associated superstructure solution to be developed within RAMSSES offers great saving potentials in terms of weight, ship CAPEX and OPEX due to associated energy saving and improved compactness. Such saving potentials correspond well to our customer expectations. If RAMSSES Project confirms such potential, this break-through solution may represent one key-element of the next cruise ship generation in 10 years' time, keeping and reinforcing Europe leadership in the cruise vessel market."*
FINCANTIERI and CETENA (FC&CET-WP19): *"A cruise vessel structure contains ca. 30.000 tons of steel. Considering a market of 10 to 15 Cruise vessel per year built in Europe in the next decade, and adoption of HSLA (high strength low alloy steel) up to 20 -25% of total structural weight, more than 70.000 tons of HSLA could be used in European shipyards in the next years."*
A. Niemelä, Head of Hull Basic Design (MT-WP20*):"High Tensile Steel (HTS) weight saving potential in a cruise ship hull structure level is about 20%. Benefits are more efficient production and material utilization, better ship stability and hydrodynamic properties, smaller ship fuel consumption, more efficient ship projects... After a successful demonstration in RAMSSES, MT*

targets to gradually introduce HTS in the hull structures in the 7 large cruise ships currently in the order book"
B. Cardama, R&D Department (CARDA-WP21): *"Steel and composite repairs will open new services offered by Cardama Shipyard to its customers, and an increased 10% of repairing orders are expected as long as these innovative materials are being introduced more and more in the next 5 years. This will help the effort of the Shipyard to convince new-building customers to introduce composites into their vessels every time it is worthy to do that."*

Figure 5 shows the expected schedule for the exploitation of the RAMSSES results by the different partners, starting from the prototype test and the pilot installation, which will both happen in RAMSSES, up to the market entry. This last phase is scheduled for the project follow-up phase, but will start already during the project for selected innovations. 90% of the technologies demonstrated in the project can be implemented within 2 years after finalisation of the project.

Extended market exploitation

The shipyards and technology providers are market leaders in their segments, but do not cover the full production capability of European shipbuilding companies. In Table 9, the extended market potential of all European shipbuilding companies has been estimated, including their production capability outside Europe. The statistics are based on the Sea Europe Market studies.

Table 9 Potential weight saving per year and CO2 reduction perc. of the extended market for all European shipyards

	Light Ship weight [t]	Weight Savings [t]	Estimated new-builds/year	Weight Saving Fleet (max) [t]	Realistic weight saving potential [t]
Cruise large	80.000	4%	6	19.200	8.000
Cruise medium	50.000	4%	6	12.000	7.000
Cruise small	35.000	4%	5	7.000	3.150
Small Craft	150	5%	250	1.875	806
Offshore vessels	500	5%	110	2.750	1.188
Car carriers	15.000	5%	10	7.500	4.688
Total				50.325	24.831

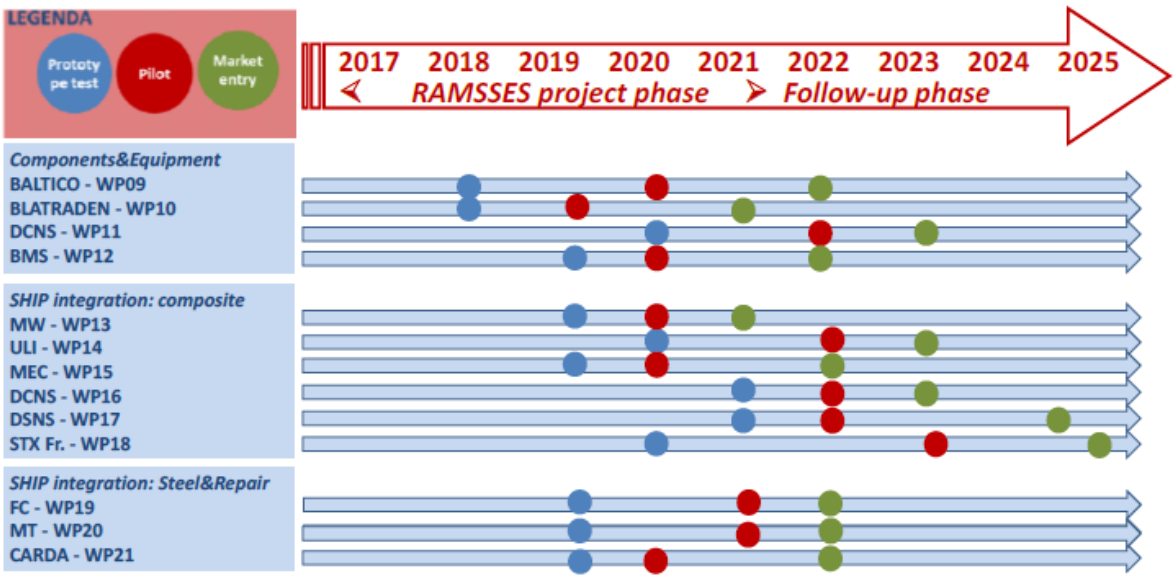


Figure 6 Overview of exploitation phases 1

The realistic weight savings potential is estimated based on an ”implementation” percentage that differs per ship type. The weight saving will lead to CO2 reduction by decreasing the energy consumption per passenger or per ton transported goods, partly due to a smaller ship displacement. E.g. for the 6 estimated newbuilds of medium cruise ships the CO2 saving potential as assumed in ch. 2.1.2 of the project proposal would sum up to a maximum of 30.000t per year, with a more conservative assumption of 20.000t per year. The number of new build cruise ships will grow slightly in the next few years. The share of weight and CO2 reduction by non-consortium companies cannot be directly influenced by the consortium, but are included in the basis for market monitoring, business plans and measures for market uptake. Technology providers within the consortium may stimulate a wider introduction of weight saving solutions. The estimate only accounts for market potentials in the ship types covered within the demonstrators (first order extrapolation). In view of possible applications within ship types not included in the table and a world market share of European ship equipment suppliers of 43% according to latest EU studies, the figures contained in this table appear to be conservative.

5.2 Process and timeline of monitoring RAMSSES impact

The initial Exploitation Plan illustrates how the RAMSSES results will be used by the individual partners as well as jointly within the consortium. Most of the results will be generated by the demonstrator cases, therefore it is important that they keep focus on achieving the expected results, share information on progress and enable the use of results by the consortium.
Monitoring progress and deviations in the expected results will help the demonstrators to take timely actions or modify their approach if needed, additionally it will also enable the consortium to determine the joint impact of RAMSSES demonstrators.
As follow-up on the initial Exploitation plan, a draft Exploitation Plan and Business Plan is expected from every demonstrator work package, using the templates in chapter 5.2.1 and 5.2.2. These draft plans was returned in PM11, and was be updated in PM34 and PM46, such that these plans could be incorporated in D6.2 (for the non-commercial use in the rule making process), D6.4 and D6.6. Most probably updated templates will be provided to guide the reporting process.

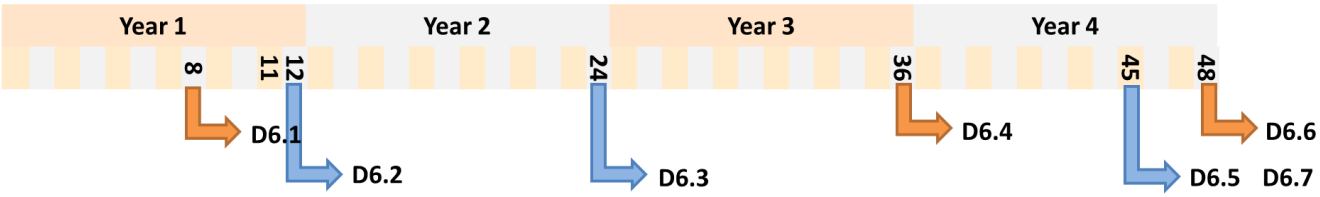


Figure 7: Timeline for reporting progress on expected results

Annual cycles are in place regarding exploitation. In year 1, two questionnaires were set up (a business questionnaire and an exploitation questionnaire). Both questionnaires were used to determine support for further improvement. More information on the questionnaires can be found in section 5.3. In year 2, the questionnaires were combined into one document: the current exploitation plan in which parts of the business plan are integrated. At this moment the exploitation plan template is more extensive, including more elaborate tables and a description per section. Through the updated plan it is expected that partners are able to generate clear(er) answers, expectations and results of the DC’s. In year 2 all partners have created a list of exploitable results. Throughout this period WP6 has guided partners, by (for example) inspiring other DC’s to consider similar use of their results. A full list of exploitable results is presented in section 5.4. The focus in year 3 is on IPR and business opportunities, including an update of previous elements. Section 5.5 covers IPR within the RAMSSES consortium, a preliminary overview/preferences of chosen IPR protection tools is given. In year 4 the Exploitation Plan will be finalized and the overall impact of the

RAMSSES will be evaluated. WP 6 expects that all Demonstrator Cases will regularly update their exploitation plan. Every 3 months there is communication on feasible progress.

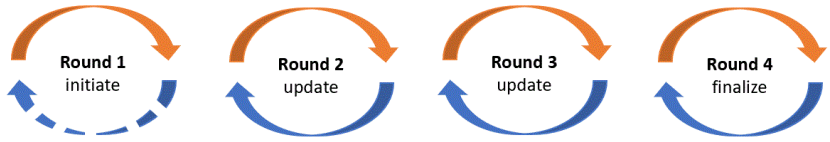


Figure 7: Workflow exploitation plans

5.3 Templates for developing Exploitation plan and Business plan

5.3.1 Template for Exploitation Plan

Each demonstrator work package is required to submit a draft exploitation plan using the following document structure.

5.3.1.1 Description of demonstrator case

An general description which may be used for public presentation of the demonstrator.

5.3.1.2 Expected impact and results

A description of expected impact and a list of results supporting this impact.

- The expected impact could be an estimated weight reduction, or saving in production time or CO2 footprint.
- The results can be tangible outputs, e.g. prototypes, drawings, calculations, or intangible outputs e.g. know-how, data or solution catalogues.

Please use the initial exploitation plan from the proposal phase as a basis, but only use the items applicable to the demonstrator case. Be as specific as possible.

5.3.1.3 Potential use of results

Describe the possibilities for (non-)commercial use of these results and IPR rights related to them, also indicate which partner within the consortium is expected to use these results.
Please use the initial exploitation plan from the proposal phase as a basis, but only use the items applicable to the demonstrator case. Be as specific as possible.

5.3.1.4 Work plan

Provide a plan on how the expected results will be achieved, possible Interdependencies with other work packages and a simple timeline indicating important milestones for achieving these results.

5.3.2 Template for Business Plan

Each demonstrator work package is required to submit a draft business plan using the following document structure.

5.3.2.1 Description of demonstrator case

Refer to the draft exploitation plan and add how the demonstrator will offer new business opportunities.

5.3.2.2 Market review

In addition to describing the size and structure of the sector, the review should address the dynamics of the market. In particular, it should note the technologies and economics that are driving the market and the anticipated trends that could influence the market entry of the offering.

5.3.2.3 Assessment of competition

Assessment should be limited to those players offering products or services that the proposed offering seeks to supplant, either through superior technology or functionality. While the offering may be novel to the market, it will still be necessary to 'persuade potential customers that it is superior to existing offerings.

5.3.2.4 Business opportunities related to the demonstrator solution

Describe the innovation of the proposed offering in the context of the competition and the sector's needs. This subsection should include a SWOT analysis and focus on the strengths of the offering and show how those strengths play to the opportunities that the competition survey has highlighted. Indicate the weight, price and lead time improvements compared to current technology. Summarise potential business model(s).

5.3.2.5 Work plan

Provide a plan on how and when the business opportunities will be achieved. Outline, graphically, the roll-out of the offering: timescale; sales growth; market share

5.4 List of exploitable results

Table 10 summarizes the key exploitable results which have been generated during the project. Please note that the numbers (quantifications) which are given by the partners are estimates. In total there are 47 key exploitable results which can be subdivided in different forms of exploitation. Five forms of exploitation have been identified: commercial, environmental, policy, scientific and educational.

Table 10 List of exploitable results RAMSSES

No	Exploitable Results	Description of the result	Partners involved	Exploitable form
Work Package 9: Development of a catamaran powered by solar energy – *Lead Partner BALTICO*				
Due to the lightweight structure of the boat the reassembly can be done with a minimum amount of support devices.				
1	Modular standard system allowing an easy assembly and transportation	A modular system combines flexibility with the advantages of serial production.	BALTICO	**Commercial** • Reduction of mounting time due to modularisation of the vessel; improvement of noise damping and reduction of raw material consumption
2	Rod placing technology for vessels	Use of rovings in an automated process to build the structure.	BALTICO	**Commercial, Environmental** • Weight reduction (e.g. 50 kg/m2 state of art to 10 kg/m2)
3	Use of CFRP in boatbuilding	Use of high standard material in maritime applications (plates made of carbon fibres) which gives advantages with respect to weight and corrosion.	BALTICO	**Commercial, Environmental** • Weight reduction • Nearly no maintenance costs
4	A simulation of a factory/shipyard and the production line for a serial production for the vessel (50 in the first years)	A simulation of an automated production of composite vessels for maritime applications is a new and great achievement, due to the fact that this is mostly done for steel applications. The simulation study also increase the efficiency by reducing bottle neck in the production process.	CMT, BALTICO	**Commercial** • Production & factory planning, planning, identifying of bottlenecks, optimizing the work, material flow
Work Package 10: Lightweight Components for High Loads and Fire Class – *Lead Partner PODCOMP*				

Development of a sandwich that fulfils the requirements for fire demands on a ship according to IMO. Sandwich panels that can be used in different applications like cabin walls, sun deck floor, balconies or similar.				
5	Experience from the Uljanik shipyard shows that one by reducing the weight on top deck gives the ship better stability. Research at KTH in Stockholm shows that a normal Cruiseliner saves about the same amount of fuel per year as the weight reduction of the structure gives.	Development of an integrated fire, thermal, acoustic and lightweight panel system for a competitive price.	PODCOMP, SWEREA-RISE, COMPEVO, BAL, CETENA	**Commercial, Environmental** • Weight reduction with 20% and reduction of cost for maintenance because no corrosion
Work Package 11: Propeller blades made by additive manufacturing – *Lead Partner NAVAL GROUP* ***Development of a representative blade propeller demonstrator and identify fabrication risks to mitigate be-fore introducing this solution on the market. Choosing Additive Manufacturing (AM) for production provides great benefits for the entire production value chain.***				
6	Demonstration of the possibility to design propeller with enhanced performance (higher efficiency & noise emission reduction) together with reduction of propeller weigh, thanks to hollow blade concept	Efficient fabrication strategies in Wire and Arc Additive Manufacturing (WAAM) are implemented for hollow blades propellers ensuring proper geometry, rapid fabrication and absence of defects.	ECN, NAVAL GROUP	**Commercial, Environmental, Operational** • Weight reduction by 30-40% • Propulsive efficiency increased by 3-5% • Cavitation reduced by 60%
7	Development of efficient fabrication strategies in WAAM process for hollow blades propellers ensuring proper geometry, rapid fabrication and absence of defects.	Demonstration of the possibility to design propeller with enhanced performance (higher efficiency & noise emission reduction) together with reduction of propeller weight, thanks to hollow blade concept.	SIREHNA/ NAVAL GROUP	**Commercial, Industrial** • Costs equivalent to foundry can be reached based on current technology • Important room for improvement is identified which would allow to reduce the production cost by up to 30% once the process will be industrially mature
8	Demonstration of fitness for purpose of the obtained material (mechanical strength, resistance to corrosion and to fatigue)	Reduced cost of poor quality in relation with foundry defects repairs.	ECN, NAVAL GROUP, ENSTA BRETAGNE	**Industrial, Operational** • Reduced cost of poor quality in relation with foundry defects repairs
Work Package 12: Lightweight Rudder Flap – *Lead Partner BMS* ***Design, production and optimization of a market ready flap rudder for a container ship using lightweight and high performance materials (i.e. composites).***				
9	Application lightweight rudder flap	First time application large composite component on rudders for merchant vessels.	BMS, CMT, CET	**Commercial, Environmental** • Compared to a conventional steel rudder flap a weight saving of more than 50% is expected • Market share of composite rudder flaps will increase • Expected emission reduction due to lightweight and high performance materials

10	Optimized hydrodynamic design of rudder flap	Higher efficiency by hydrodynamic optimized geometry	BMS	**Commercial, Environmental** • Improvement of side force generation of about 5% • Benefits for costumers with higher requirements on maneuvering performance • Expected emission reduction due to improved efficiency
11	Material reduction by load adapted design	Compensation of higher material and manufacturing cost by less consumption.	BMS, CMT	**Commercial, Environmental** • Usage of less material; reduced manufacturing costs • Expected emission reduction due to lightweight and high performance materials
12	Reduced maintenance effort of rudderflap	Wear and tear reduction by adaption of bending lines of steel and composite component.	BMS, CMT	**Commercial, Educational** • Lower maintenance costs • Training of steel experienced staff on properties of new material
13	Elimination of the rudderflap's corrosion problem	Elimination of anodes used for steel design.	BMS, CMT	**Commercial, Environmental** • Less operational costs • Increase lifecycle rudderflap
14	Reduced costs and effort in the rudder flap's transport and handling	Cost reduction from weight saving	BMS	**Commercial, Environmental** • Expected cost reduction regarding transport and handling • Expected emission reduction due to the fact that the rudder is estimated to be 3 times lighter compared to steel
Work Package 13: Integration of System for Internal Walls and Superstructure of Cruise Ships into shipyard processes – *Lead Partner: MEYERWERFT* ***Introduce fiber reinforced polymers into the yard production process for the usage in cruise ships, passenger ferries and gas carriers with the aim to reduce weight of up to 30 % compared to the steel structure.***				
15	A composite design of non-load bearing walls which are easy to connect and disconnect	Rooms where composite panels are used can be refurbished easily and panels can be reused (outcomes: design schedule is more flexible, more cabins can be integrated, with an estimation of 64).	MW, InfraCore Company	**Commercial, Environmental** • Saving of production time, refurbishment/repair time • Reduction of maintenance cost • Weight reduction of at least 30% • Reduction of CO2 footprint
16	Composite panel with high fire resistance	More panels can be fitted were steel was used previously resulting in overall lower ship weight	MW, InfraCore Company	**Policy** • Expected approval of the application
Work Package 14: Modular Decks for RoRo Vessels – *Lead Partner FLOWSHIP* ***Construction of internal strength decks on RoRo vessels introducing FRP pultruded profiles and FRP sandwich technology.***				

17	Prototype of the pultruded composite deck	The pultruded composite deck can be used in all new ships like car carrier and RO-RO vessels for car decks being beneficial both for ship production costs and lightweight. Compared to conventional steel deck gives weight reduction.	FLOW, OCS	**Commercial, Environmental** • Reduced deck production cost for 20 % compared to the base design with GRP sandwich modules • Weight reduction of 10 % compared to the conventional steel deck • Shorter lead time (13.3% shorter compared to conventional design and 42.6% shorter compared to the base design)
18	Drawings and calculation results, structural and fire test results and assessments	Fire and structural test results and assessment could be used for design approval according SOLAS II-2/17 and Guidelines MSC/Circ.1002 [1] "Guidelines on Alternative Design and Arrangements for Fire Safety". Methodology used in RAMSSES can be applied on a commercial application and reduce cost and time for Alternative design and arrangement procedure.	FLOW, OCS, FHG, RISE	**Commercial, Scientific, Policy** • Technology ready to be implemented on a newbuilding project
19	Production cost and lead time analysis results	The analysis can be used to optimize the production process of composite materials in a newbuilding project depending on the shipyard where the ship will be built and thus reducing production costs by 18,5 percent and lead timeby 11-12 percent.	CMT, FLOW	**Commercial, Scientific** • Optimized production models for commercial project (reducing production costs and lead time to minimum) • Similar scientific studies
20	Know-how for the RAMSSES composite deck, using the technology of pultrusion, and connection details which give 'ready to install' knowledge	Design and know how ready to be implemented on a newbuilding project from contract to detail design.	FLOW, OCS	**Commercial** • New lightweight, energy efficient ship designs • The knowledge gained in RAMSSES and built demonstrator give confidence to potential clients to invest in new solutions
Work Package 15: Lightweight Panels for Work Boats – *Lead Partner MEC* ***Implementation of lightweight panels for the deckhouses on small and medium size workboats.***				
21	Sandwich panel concept with improved fire resistance	Improved fire resistance, panel design can be approved by the classification societies.	MEC, BWB, BAL, PODCOMP	**Commercial, Environmental, Policy** • Reduction of weight (10-20%), finer surface finish; shorter assembly time for small and medium size workboats. Potential market size for BWB would be up to 10 vessels per year • Expected approval of the application

22	Proof of concept via demonstrators if they satisfy the requirements and expectations of the shipyard (incl. design and production aspects and guidelines)	Production of actual real scale structure using novel panel design.	MEC, BWB, BAL, PODCOMP	**Commercial, Environmental** • Weight reduction (15-25%), shorter assembly time (less insulation required), less deformations, higher quality of final product • Introduction of new production and assembly procedure in the shipyard
Work Package 16: Composite superstructure module on a steel deck for multi-purpose vessels – *Lead Partner NAVAL GROUP* ***Developing a streamlined approach to introduce innovative materials in the maritime sector and, more precisely, in composite superstructure made up of modules on a metallic deck.***				
23	New composite panels	Compared to existing panels, it offers superior fire retardant properties. Higher usability of panel with good fire retardant behavior.	NAVAL GROUP, RISE, BV	**Policy** • Expected approval of the application
24	Structural optimization of a composite superstructure	Iterative finite element modelling to optimize de structure in terms of mechanical behavior.	NAVAL GROUP, BV	**Commercial, Environmental, Educational** • More panels can be fitted were steel was used previously • Weight saving up to 40% compared to a metallic design • CO2 saving, through reducing the required propulsion power • Skills and educational training
25	New junction designs	New multi-material junctions.	NAVAL GROUP, BV, ENSTA	**Commercial, Scientific, Policy** • Ability to produce optimized hybrid structures • Improved production and assembly at the shipyard • Collaboration scientists • Expected approval of the application
26	Sensors integration to perform Structural Health Monitoring in composite materials	Integration of non-intrusive strain sensors in junctions.	NAVAL GROUP	**Commercial, Scientific** • Reduce the maintenance activities (Reduce life cycle cost) • Collaboration scientists
27	Quick & easy (dis)assembly junctions	Ability to disbond adhesive bonded joints by thermal activation to get modularity of composite superstructure.	NAVAL GROUP, BV	**Commercial, Scientific** • Maintain market share in a growing market through more efficient design • Reduce the maintenance activities (Reduce life cycle cost) • Production costs reduction • Collaboration scientists
Work Package 17: Custom Made Hull for Offshore Vessel – *Lead Partner DAMEN*				

The objectives are to scale up the composite technology and capability to design, produce and market complete composite vessels up to 85 m length that comply with SOLAS and class regulations. Besides designing and approving composite structures complying with class rules, challenges in scaling up the composites technology include pioneering the capability to infuse thick laminates up to 6 meters in height that represent full ship hull structures.				
28	Design report of hull section	The structural analysis report contains the analysis approach and results of the hull structure.	DSNS,DSGO, BV	**Commercial, Environmental** • Roughly 40% weight reduction on structure that is to be replaced. (Note: this is not overall ship weight reduction) • Large scale composites produced at steel shipyard conditions • Develop new product-market-composite technology combinations
29	Validated 6 meter high infusion strategy	Realizing the infusion of a hull structure vertically up to 6 meters in height.	ICC,AEL	**Policy** • Expected validation of large composite structures
30	Validated large scale box specimen	A representative box will be built, having the same scantlings and full scale joints as the actual ship. This box is subjected to a bending load, resulting in the stress in the panels being the same as in the actual vessel, and will demonstrate the ability to successfully model large composite structures.	TNO, ICC, DSNS	**Policy** • Extreme large scale validation testing • Expected validation of large composite structures
31	Robustness of large scale composite demonstrator	Understanding of robustness of large scale composite structures.	TNO, DSNS	**Commercial** • Acceptance and building up trust of composites in commercial shipbuilding
32	Validated large scale joints and connections	Validation and understanding of full scale behaviour		
33	Validated fire resistance of InfraCore helideck after artificial damadge representing a fire after helicopter crash landing	Validation and understanding of full scale behaviour		
34	Trade-off study InfraCore technology vs sandwich technology	Validation and understanding of pro's and con's of different structural concepts, enabling proper decision making by designers and end-users		
Work Package 18: Multi material lightweight cabin area for passenger ships – *Lead Partner CdA* ***Designing innovative cabins and ship structure interfaces to generate a novel ship structure architecture, reducing weight, size, costs, production times, maintenance and refurbishment effort.***				
35	Development of a novel ship architecture	Novel ship architecture allows integration of the cabins from the outside (without rolling them from the center of the ship).	CdA	**Commercial, Policy** • Weight reduction, time saving, recognized product differing on the market, facilitate the retrofit • Expected verification of the structure

36	Development of a 6 faces cabin which allows a control by the customer post integration on board	Developing a six face cabin would allow checking the cabin right after its fabrication phase. Then, the cabin will be sealed and integrated on board.	CdA	**Commercial, Policy** • Time saving, limit the damages of post integration on board (save money) • Expected verification of the structure • Expected verification of the materials and the cabin design
Work Package 19: Highly Loaded structural details from high tensile steel in passenger and research vessels – *Lead Partner FC* ***Demonstrating through the test campaign supported by appropriate design activities (Design of Experiments, FEM analysis, etc.) that the HSLA can be used also in complex welded marine structures guaranteeing better performances than the conventional steels.***				
37	HSLA characterization	At the end of the project a list of HSLA steel applicable to marine industry will be identified. This will enable the adoption of HSLA steel in ship structural design.	CET, AIMEM, NTUA, FC	**Commercial, Scientific** • Weight reduction: 5 – 10% • Energy Saving: 5% • Ship capacity payload improving: 0 -10% • Experience gained during the project will be used as a starting point for future studies
38	Welding process optimization and improvement	Higher applicability of HSLA on-board. Welding of HSLA steel.	CET, AIMEM, NTUA, FC	**Commercial, Scientific** • No extra time respect to conventional steel • Structural weight and fatigue effect reduction • Experience gained during the project will be used as a starting point for future studies
39	Fast qualification and approval	Inclusion of HSLA in regulatory framework, essential for HSLA applicability on-board. This will be done according to the "Fast track to approval" methodology in strict relation with WP06-WP07, in particular cooperating with BV.	CET, FC	**Commercial, Policy** • The fast qualification and approval process will enable the on-board application of HSLA. This have repercussions both on the policy and commercial side
40	Testing methodology	Facilitate testing campaign through Design of Experiment methodology. Numerical parameter for numerical simulations (FEM).	CET, AIMEM, NTUA, FC	**Commercial, Scientific** • Optimisation of testing activities due to experiences gained during the test campaign • Reduction of testing costs (To be defined at the end of the project) • Experience gained during the project will be used as a starting point for future studies
Work Package 20: Lightweight Decks using High Tensile Steel in cruise ships – *Lead Partner MEC*				

Implementation of high strength steel materials and advanced manufacturing technology together so that high quality production and resulted higher strength can be used in a final product.				
41	Reliable production methods	Reliable production methods for thin deck panels and high strength steels allows to lower cruise ship's weight.	MT	**Commercial, scientific, environmental** • Reliable production methods can reduce repair costs
42	Requirements for quality	Updated limits for weld quality when producing thin deck panels (laser-hybrid welding) and high strength steel structures.	MT, Aalto	**Commercial, scientific** • Link between production quality and resulting fatigue strength will be found
43	Quality control procedure	New quality control procedures to ensure consistent quality for thin panels and high strength structures.	MT	**Commercial, scientific** • Ensuring consistent quality and fatigue strength
44	Experimental results for class approval	New fatigue test results for thin decks and high strength structures.	MT, Aalto	**Scientific, policy** • Weight reduction of 15-25%, which can be utilized as: more cabins and passengers on board, more advanced structural solutions, better ship stability as the centre of gravity could be lower, better energy efficiency • Fatigue tests will be published • Test results will impact classification societies
Work Package 21: Composite Overlay to repair and improve metallic and non-metallic structures – *Lead Partner AIMEN* ***Demonstrate that composite overlaminating is suitable both as a repair technology for damaged structures in a marine environment as to improve the pristine properties of welded joints***				
45	Know-how about the application of composites over metals, surface treatments and adhesion procedures	Nowadays, repair and reinforcement strategies are based on thick steel plates inserts that need to be welded. These conventional strategies are time-consuming, inaccurate and difficult to apply, requiring long-term experience. Furthermore, they need to be carried out on land resulting in a great cost for the ship owners. Faced with this, RAMSSES project delivers: • New materials with improved performance (lightweight, easy application and flexibility) for ship repair/reinforcement. • Tailorable and easy-to-apply repair strategies for different type of cracks (linear and irregular). • More accurate	AIMEN, CARDA, GALVENT (all but virtual modelling), CET (virtual modelling)	**Scientific, industrial, commercial, environmental, policy** • Increase knowledge on composites and new materials in the marine sector. Boost acceptance. • Longer lifespan of vessels (by 100%), increasing profitability per vessel for ship owners (increased reparability, improved performance, lower repair time & cost (estimated savings could reach up to € 1M/day (excluding repair cost) by not having to repair at the shipyard). • Weight reduction (up to 20%). • Less fuel consumption (initial estimations on containers show that fuel

		• Patch composite overlamination suitable for welded areas. • Faster and cheaper repair/reinforcement operations • Application on board		
46	Steel and composite repair strategies			•
47	Composite overlamination techniques for welding reinforcement			•

At present five forms of exploitation have been identified, which are illustrated in figure 8: commercial (46%), environmental (21%), policy (16%), scientific (13%) and educational exploitation (4%). Commercial exploitation has the largest share.

Prominent examples of exploitation are illustrated below:

Table 11 Prominent examples of exploitation

Commercial	Environmental	Policy	Scientific	Educational
• Usage of lightweight and high performance materials • Weight reduction • Reduced maintenance costs • Reduced production and/or manufacturing costs • Reduced operational costs • Expectation of increased market share • Increase of lifecycle product • Acceptance and building up trust of composites in commercial shipbuilding • Technological ready • Know-how • Ship capacity payload improving • Ability to improve optimized structures • Structural weight and fatigue effect reduction	• Expected emission reduction due to lightweight and high performance materials (weight reduction/ CO2 reduction) • Increase lifecycle, longer lifespan vessels • CO2 saving, through reducing the required propulsion power • Large scale composites produced at steel shipyard conditions	• Expected approval of the application • Technology ready to be implemented on a newbuilding project • Expected validation of large composite structures • Expected verification of the structure • Results will impact classification societies	• Scientific studies • Collaboration scientists • Experience gained during the project will be used as a starting point for future studies • Publications	• Training of steel experienced staff on properties of new material • Skills and educational training

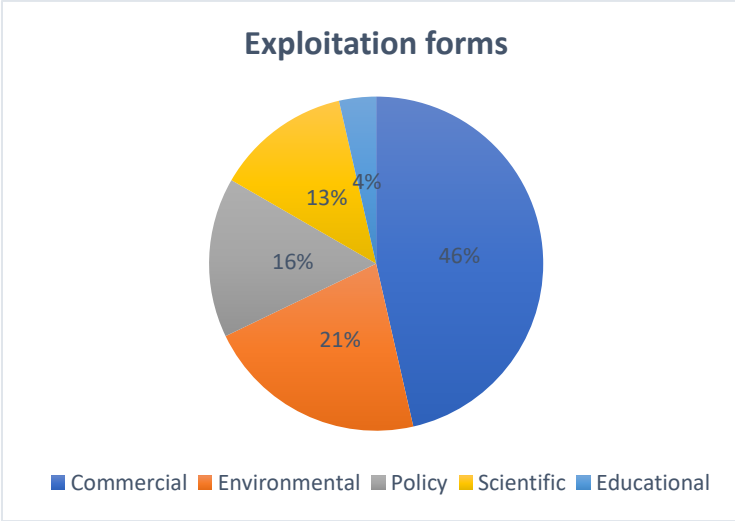
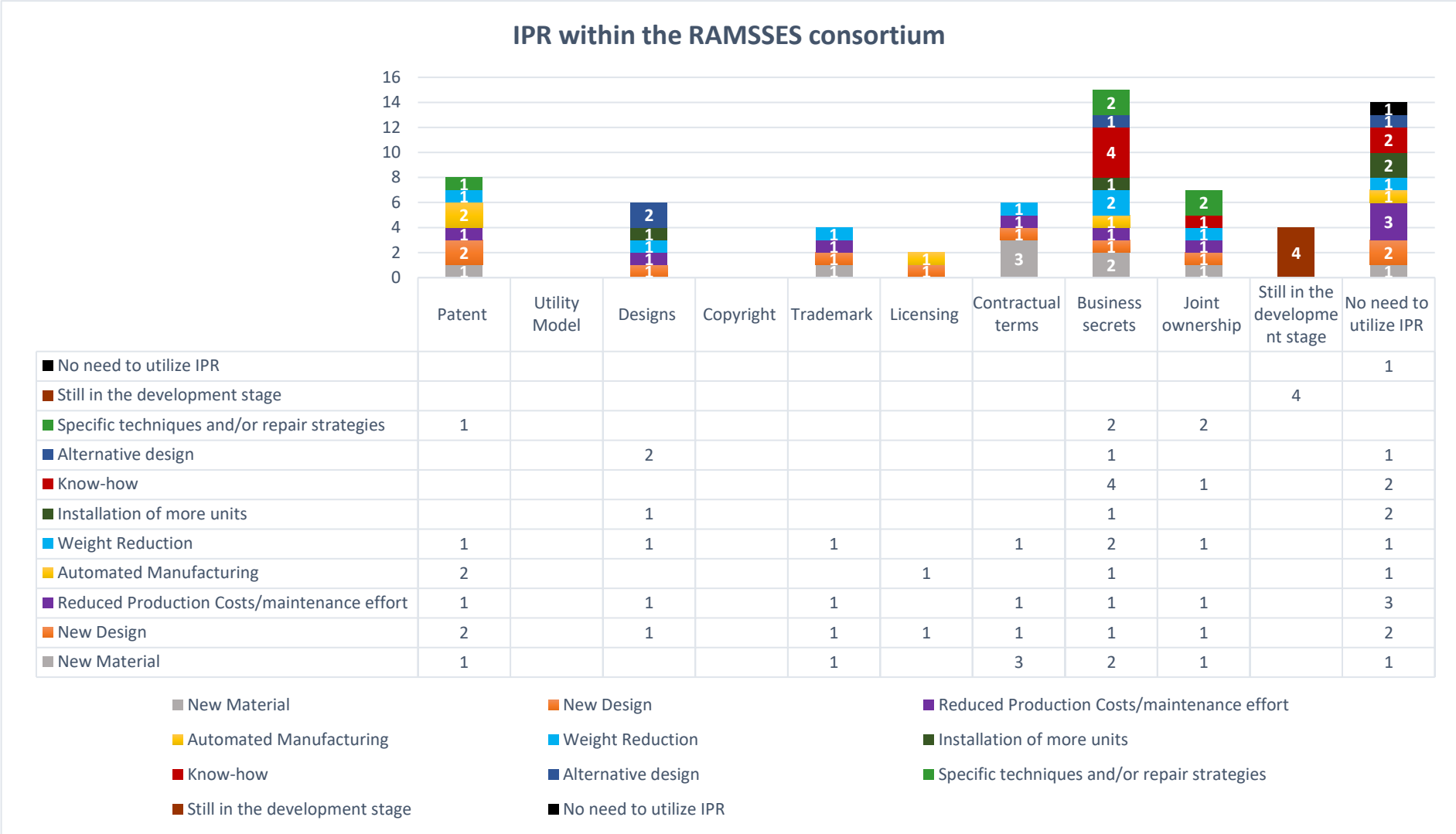


Figure 8: Exploitation forms within the RAMSSES project

5.5 IPR within the RAMSSES consortium

Figure 9 on the next page gives an overview of the preliminary choices/preferences of IPR tools amongst partners. Almost all of the partners within the RAMSSES project have defined the IPR protection tools which they will apply. Business secrets, joint ownership, contractual terms, designs, patents and licensing agreements are also amongst the most chosen protection tools. Moreover, for many exploitable results it also not necessary to apply IPR because they represent general outcomes (which, of course, remain highly relevant to the demonstrator cases).

The partners that have chosen business secrets recognize the advantage to withhold know-how which gives a significant advantage towards competitors. Subsequently, various partners have registered their designs. Patents prove to be the most common way to protect property rights. It should be mentioned that costs for filing patents are relatively high. Many partners have indicated that licensing would be a good option as it allows for commercial exploitation while protecting own rights.



	Patent	Utility Model	Designs	Copyright	Trademark	Licensing	Contractual terms	Business secrets	Joint ownership	Still in the development stage	No need to utilize IPR
No need to utilize IPR											1
Still in the development stage										4	
Specific techniques and/or repair strategies	1							2	2		
Alternative design			2					1			1
Know-how								4	1		2
Installation of more units			1					1			2
Weight Reduction	1		1		1		1	2	1		1
Automated Manufacturing	2					1		1			1
Reduced Production Costs/maintenance effort	1		1		1		1	1	1		3
New Design	2		1		1	1	1	1	1		2
New Material	1				1		3	2	1		1

Figure 9: IPR within the RAMSSES consortium

5.6 Proceeding of exploitation plan

In subject to the list of exploitable results, exploitation can be subdivided into multiple forms:

1. **Commercial exploitation**: "The RAMSSES Demonstrator Cases will foster the use of new materials in real applications with high market potential"
2. **Environmental exploitation**: This includes expected emission reduction due to lightweight and high performance materials, focus on renewable materials and increase of lifespan.
3. **Scientific exploitation**: this involves (further) research, publishing of certain results of the project, etc.
4. **Educational exploitation**: results will be used for training and/or educational purposes.
5. **Policy exploitation**: this involves standardization of class societies, reform of rules and regulations.
6. **Community exploitation**: through the open RAMSSES repository (database) relevant information from the DC's can be publicly shared. In PM 48 it is expected that D6.4 of WP04 will be accomplished, hence the storing of data in the Innovation Platform (Knowledge Repository). In the next update of the exploitation plan more emphasis will be given on this form of exploitation.
7. **Research & Development (R&D) exploitation**: by engaging in new projects (EU-funded or sponsored by other sources), based on the experiences gained in the project.

In the next update of the exploitation plan attention will be given to community and R&D exploitation as well. In project month 45 an overall impact can be estimated in the RAMSSES project considering the exploitable results and multiple forms of exploitation covered above. The exploitation plan together with the calculations completed by WP8 in regard to KPI used in LCPA will be consulted in order to evaluate the overall impact from RAMSSES as a whole.

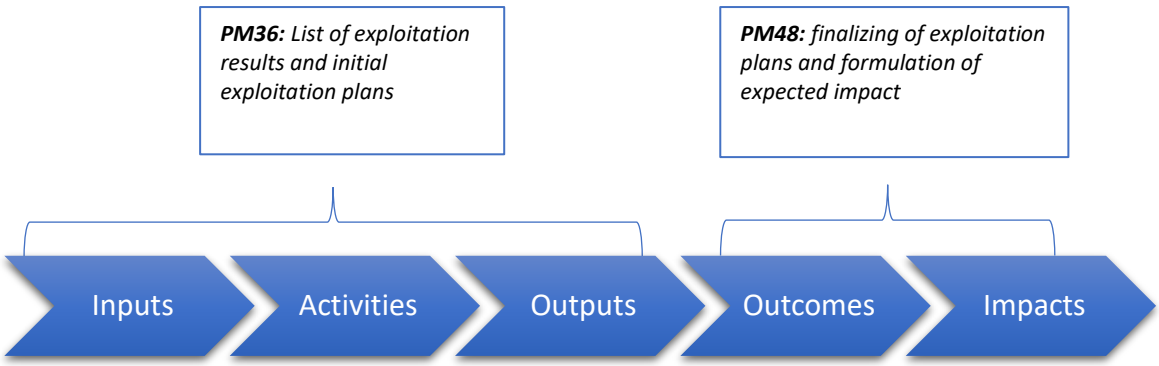


Figure 10: Proceeding of exploitationplan

5.7 Estimated impact from RAMSSES demonstrators

Now that all demonstrator cases have been performed, the final list of exploitable results with their expected impact after full exploitatoin could be defined. In table 10 of paragraph 5.4 the latest updates can be found. During the project some slight changes have been made on the expected weight savings, but in general the results meet the expectations. That makes the estimate of the total impact of RAMSSES the same as the predicted impact during the proposal phase. Table 9 in the paragraph 'extended market eploitation' with the weight saving potential per ship type is therefore still valid.

It should be mentioned that the indicated weight savings are the direct result of usage of the lightweight material. When the ship becomes lighter it is expected that the engine power could be reduced and thus also result in weight reductions. Those secondary benefits are not taken into account in this impact estimation.

Complementary to the weight savings, many workpackage leaders have indicated that the project has contributed to a knowledge level which exceeds the expectations and which will contribute to even more impact in the future.

Impact for each workpackage

As described above, WP8 made LCPA calculations to evaluate the impact of each demo-case.
The LCPA-results of the demo-cases varied for each demo-case, but demonstrates the high potential of lightweight applications in the maritime industry. Each demo-case shows an environmental benefit throughout the life cycle while remaining economically viable due to operating costs savings, like lower fuel consumption and -costs. Some lightweight applications even have lower investment costs, since the assembly process is easier and faster compared to state of the art applications. An LCPA-result-overview is provided in the following table:

WP	NPV	Payback time	Production costs	Investment costs	Maintenance costs	Fuel cost	GWP	CED
09	●	●	-	-	-	●	●	●
12	○	-	-	●	-	-	○	○
13	●	○	-	-	-	○	○	○
14	○	●	-	-	-	○	○	○
15	○	●	-	-	-	●	●	●
16	●	●	○	○	○	○	○	○
17	●	●	◐	◐	●	●	●	●
18	●	-	-	-	-	○	○	○
19	○	-	-	-	-	○	○	○
20	○	-	-	-	-	○	○	○

○ Noticeable impact: 0-5% ● Significant impact: > 5% savings ◐ No savings yet

Figure 11: Impact per workpackage

Impact to the fleet

The total impact of RAMSSES is also very much depending on the utilization of the weight savings and the market uptake. Many workpackage leaders would describe the exploitation and market uptake just as they or their predecessor did at the start of RAMSSES. The first statements can be found in Table 8.1. Some WP leaders have made some changes which can be found in Table 12.

Table 12: New statements on intended exploitation and market uptake

J. Andrisic, CEO at Flow Ship Design (FLOW-WP14): *"Shipping and shipbuilding industry is in a transition to new, greener, more efficient powering and transportation solutions with the aim to reduce greenhouse gasses emissions. International stakeholders, IMO and cargo owners are setting goals for future shipping and to achieve these goals new energy sources and powering systems will be required, but also lightweight solutions that will contribute to lower power demand.*

The technology of pultruded composite panels developed in RAMSSES certainly matches those requirements as a lightweight solution with more benefits in terms of capital investment, production flexibility and lead time. *Flow Ship Design aims to incorporate and promote this technology on future projects to give their clients a solution that will contribute to global goals of greenhouse gasses reduction, but also competitiveness and safety to exploiters of such solutions."*
M. Elenbaas, (DSNS-WP17): *"The project has been a great success for all partners involved in Work Package 17. Each of us has achieved results challenging its own expertise within its high ambition levels. Together the results surpass the targets set in the beginning of the project. As joint effort the complete development cycle for large composite ships structures was challenged. Clear advances were made from setting requirements, development of resin, design methodologies, risk based design, assembly at steel yard conditions, validation of composite design, production and assembly; all under supervision of classification society. Each of us can disseminate results towards large composite marine assemblies. For the work package leader, Damen, results will be used for extending the use of composite in for larger composite ships that currently ranging up to 25 meters, and results can be used for larger composite modules larger, 140-meter offshore patrol vessels."*
P. Delaunay, (WP18): "We confirmed technical feasibility of 6 faces cabins with self-supported floor and saving potential in terms of weight. Ship behaviour has been validated when removing cabin decks without structural impact. Main current difficulty is to find suitable material with good fire retardant performance that both candidate materials do not offer. To pass test, we must add insulation and savings are consumed by this additional wool + reinforcements… RAMSSES architecture could not work with current performances of lightweight material, and only possibility we have is to monitor new material in the future with high fire retardant performances."

6 References

[1] M. Krause, F. Roland and S. L. Maharani, RAMSSES project. D03.2 – First Report on Technology Transfer & Future Concepts, May: 31, 2018.

[2] M. Krause and S. L. Maharani, RAMSSES project, D03.3 – Updated Report on Technology Transfer & Future Concepts, May: 31, 2019.

[3] M. Krause, S. L. Maharani and B. Wodecki, "D03.4 - Final report on Technology Transfer & Future concepts".

[4] S. Schilling, "D05.5 - Project Video," 2021.

[5] R. S. Mullor, "Engineering, production and life-cycle management for the complete construction of large-length FIBRE-based SHIPs," in *Kick-Off Meeting*, Madrid, June 2017.

[6] L. Aerts, "GASVESSEL, Compressed Natural Gas Transport System," in *PNO Innovation N.V*.

[7] "ADAM4EVE," [Online]. Available: http://www.adam4eve-project.eu. [Accessed 10 January 2108].

[8] Stitching Materials Innovation Institute (M2i), "Qualify," *Enabling Qualification of Hybrid Structures for Lightweight and Safe Maritime Transport,* 2017.

[9] "DE-Light Transport," [Online]. Available: http://cordis.europa.eu/project/rcn/81519_en.html. [Accessed 11 January 2018].

7 Indexes

7.1 Index of tables

7.2 Index of figures

8 Annex A: Public summary

Since the report at hand is a public RAMSSES Deliverable, there is no need to provide a public summary.

9 Annex B: list of dissemination activities

Brokerage event - total number: 1 R&D – Experience in practice from the point of view of an R&D&I network organization // Using the lightweight subject and the RAMSSES project as an example, CMT gave insights about the benefits of teaming up for R&D&I in networks and collaborative projects. Communication campaign (eg. Radio/Tv) - total number: 3 Contribution to WELT online News paper interview // Dissemination in reporting period: - Online article on assembly posted by Damen - News paper article on WP 17 in local printed newspaper, and national, digital newspaper - footage made for WP 17 video, including time laps, drone, interviews (ICC, NMTF DSNS), etc. Video regarding WP 17 // Video regarding RAMSSES on website (direct link: https://corporate.evonik.com/de/schiffbau-leicht-gemacht-117657.html)
Exhibition - total number: 9 Advanced Engineering show // Cancelled due to Covid Advanced Engineering Show // Gathered new contacts and developed some existing contacts for fire retardant PFA composites Display of demonstrator at SMM Hamburg ECN open day // Presentation of RAMSSES project and live demonstration of RAMSSES demo blade fabrication by WAAM process JEC World 2021 // Cancelled due to Covid and replaced with online event Key note composites development at Damen // Presentation on composites development at Damen; similar to presentation at E-lass on waterbus development, and few slides on Ramsses general en WP 17 Project materials presented at SMM2018 // Project materials presented at SMM2018 SMM // BALance will present on it's booth project brochures and display prototype material, in addition an annnouncement /advertising will be organmised in a digital magazin of SHIP Technology/ OFFSHORE Technology /Future Cruise Southampton International Boat Show // Gathered contacts and opportunities for fire retardant PFA composites in marine sector
Flyers training - total number: 7 Final brochure First, second and final MAG newsletter // The newsletter was distributed to the members of the maritime advisory group of shipowners and ship operators RAMSSES Flyer // first version of the flyer RAMSSES poster/Roll-up RAMSSES Flyer // updated version
Organisation of a conference - total number: 7 4th RAMSSES General Assembly // Technical visits to Chantiers de l'Atlantique and IRT JV 4th RAMSSES General Assembly // E-LASS Seminar; https://e-lass.eu/event-in-pornichet/

E-LASS/RAMSSES event // This combined E-LASS and RAMSSES public day event is planned for the 30 Jan in Borås, Sweden. It is kind of inter-sessional and will only cover one seminar day, i.e. no industry tour. This particular event is planned together with CMT.

Final conference // Hybrid conference

First Joint E-Lass RAMSSES conference // Pula

Organisation of GA09 meeting and ELASS // Naval Group

S-LÄSS // Including general presentation of the RAMSSES Project.

Organisation of a workshop - total number: 13

CCeV-Thementag: Braucht man noch ein Werkzeug?

Industry Tour // http://www.jeccomposites.com/knowledge/french-composites-news/ramsses-un-projet-européen-dédié-aux-nouvelles-technologies-pour-le

ISSC (International Ship and Offshore Structures Congress) 2022 - Committee V 3 – Materials and Fabrication - Interim Committee Meeting with External Experts // A similar workshop withinvited experts took place at the beginning of the RAMSSES project (see https://ramsses.bal-pm.com/BALPM4/dissemination_report/activity/edit/encbMk6r1wtWDE-3D-/), and the findings had been described in the ISSC 2018 report of Committee V3, including a list of identified knowledge gaps, research needs related to the topic 'Qualification and approval of New Materials and Processes'. Plenty of the elements in the list are being addressed in RAMSSES, and the current Committee V3 welcomed the idea to organise a follow-up workshop in 2020, to review the progress in the field. The 2022 report will again include a dedicated chapter on Qualification of Composite materials and related processes.

The event did not only help not make RAMSSES activities and outcomes known in the maritime world, but also to underline the importance of suggested (exploitation) measures such as the Smart Track to Approval.

ISSC Committee V3 - Materials and Fabrication workshop // For organisational reason, the meeting took place before the RAMSSES kick-off, but the follow-up activities (CMT contribution to the ISSC report) took place during the RAMSSES project (Background: Presentation and discussion of RAMSSES and other new projects (GASVESSEL) and their relevance for the ISSC initiative to include a chapter on 'Qualification and Approval of New Materials and Processes' in the next report). RISE and BV participated in the workshop as well.

Presentation on a.o. RAMSSES at composites workshop COMPOSITES NL at Damen Shipyards 10 September

several workshops on RAMSSES related topics during E-lass conference

(Co-)organisation of seven more E-LASS seminars during the RAMSSES project (total: 10 seminars)

Other - total number: 5

Galventus new company brochure

Interview with a journalist working for the TradeWinds Journal // The interview took place in order to prepare an article in a planned special TWJ issue for SMM 2018. CMT asked for such an article in order to rectify some misleading statements about RAMSSES in an earlier TWJ which had not been authorised by RAMSSES.

Project presentation to industry (Composite Plus) // Presentation of project results to a composite product producer.

RAMSSES mentioned in Dutch National Cooperation Agenda for Composites // NMTF participated in the creation of a Dutch National Cooperation Agenda for Composites by providing input for the maritime sector. The creation of this agenda is coordinated by CompositesNL, the Dutch association for composite technology and was handed over to Maarten Camps, the Dutch Secretary-General of the Ministry of Economic Affairs and Climate at the end of the Country on Stage Program of the JEC World 2019 in Paris.
Support for RAMSSES website and brochure preparation and updating

Participation in activities organised jointly with other H2020 project(s) - total number: 4

Exchange of operating profile of 2 of the types of vessels studied within FIBRESHIP // Data for the following vessels were provided:
- Dynamic positioning offshore supply vessel (approx. 50 m long), with four Diesel-Electric propulsion units,
- Approx. 110 m long ROPAX, with four diesel engines
The data shared inform about the percentage usage of each unit w.r.t. the MCR
Poster on Waterborne Booth at TRA 2018 // Poster for download on the RAMSSES project website
Presentation of RAMSSES & FIBRESHIP at IMO-SDC7 // size of audience is estimated

Co-organised with H2020 project FIBRESHIPS and MAG member Danaos

Title of activity will change

The dissemination activity was reported by CMT-MK (NMTF is the main responsible partner)
Presentation of the scope and aims of RAMSSES in the final SHIPLYS project workshop

Participation of a conference - total number: 29

"2nd Workshop of EU Research & Innovation Maritime Projects, The Hellenic contribution" // The attendance number was above 100 with attendees from Hellenic maritime, academic, technology and research community.
BT2i conference TWatch Greener Plastics // Gave presentation about fire retardant PFA biocomposites
Business to Sea 2018 // Oporto, Portugal
Conference paper: Influence of weld-induced distortions on the stress magnification factor of a thin laser-hybrid welded ship deck panel

FRP in ship structures // Fire performance of FRP composites was an event held at Fire Service College, in Moreton-in-Marsh, Gloucestershire. Kujtim Ukaj from RISE attended the event and held a presentation on the purpose and goal of RAMSSES with focus on relevant fire test procedures for FRP composite.
https://compositesuk.co.uk/events/fire-performance-frp-composites
ICCM 23 - INTERNATIONAL CONFERENCE ON COMPOSITE MATERIALS // ICCM23 | Abstract Submitted in November 2020, pending to be accepted in February 2021. ICCM23 postponed, will be celebrated in 2023. Postponed due to Covid-19
ICCM 23rd conference // Postponed in 2023 due to covid19...
ICPSCM-2021 INTERNATIONAL CONFERENCE ON POLYMER SCIENCE AND COMPOSITE MATERIALS

Industry 4.0 Summit and Expo // Presentation of a joint research paper ECN - Naval Group :

Manufacturing of a hollow propeller blade with WAAM process - From the material characterisation to the achievement
Keynote: introduction of RISE and it's involvement in projects // Keynote held by T. Hertzberg Ship technology Consortium organized by Ulstein Naeringsforum introducing RISe participation in projects

Audience: The Norwegian “Blue Maritime cluster”

PI Marine 2019 // AIMEN presented in a conference talk its finished and ongoing projects related to shipbuilding. A slide summarizing AIMEN's role in RAMSSES project was included.

Prensentation of WP16 developments during ECCM 2020 // Did not occur due to COVID-19

presentation about the use of composites in shipbuilding, for CompositesNL; the Dutch association for composite technology // The goals of the presentation were to present the status quo of the usage of composite technology in Dutch Shipbuilding, to show our ambitions and participation in RAMSSES, and look for cooperation between NMTF and Composites NL We used the slides from GA02 about general RAMSSES objectives and structure to introduce the audience to the project.

Presentation at Composites NL public event // Mentioned 'DSNS WP 17 RAMSSES' during presentation on composites development within Damen at Composites NL workshop

Presentation composiet vessels approval composite vessels

Presentation of RAMSSES project on SORTA2018 (Simposium on theory and practice of shipbuilding) // General presentation on ongoing EU founded projects at Uljanik (RAMSSES and HOLISHIP). Summary of the paper has been accepted.

Presentation of the WP16 developpements during ELASS #13

Presentation ofWP16 during the french conference "ATMA" + Scientific paper

Presentation on the application of composites to large, thick marine structures // Presentation on some work AEL Airborne have done regarding thick composite structures. Part of the presentation will introduce and briefly explain the RAMSSES project

presentation: Bondship - refreshing course and brief outlook

Presentation: Building and mounting demonstrators in RAMSSES

Presentation of WP10 results // internal RAMSSES workshop at GA in Bremen, Germany

RAMSSES General presentation // General Presentation of RAMSSES at ECMAR scientific community and several invited people from shipbuilding and Maritime sectors

RAMSSES presentation at Waterborne Confernce

SORTA 2020 - Symposium on the Theory and Practice of Shipbuilding // Publication: "Modular Deck System for RoRo Vessels - RAMSSES H2020 R&D Project"

Transport Research Arena 2018 // A paper about RAMSSES was included in the proceedings and presented by CMT during the conference

Ultra Low Heat Release Prepregs for Mass Transport Applications // Advanced Engineering Show: Birmingham; 30th October 2019

Ultra Low Heat Release Prepregs for Mass Transport Applications // Composites UK : Fire Performance of FRP Composites; 29th January 2019 - Gloucestershire (UK)

WP 12 Presentation at E-lass Conference at Vigo

Participation of a workshop - total number: 32

1st workshop of the FIBRESHIP project // CMT, DSNS, BV and BALance discuss with members of the FIBRESHIP and QUALIFY consortia and with the FIBRESHIP Advisory Group about first results of FIBRESHIP and collaboration opportunities between the projects

'A study on Dual Use Materials – Addressing dual-use issues in enabling technologies research. Knowledge exchange and policy action workshop' // The RAMSSES project was presented as an example of projects that handles research on topics with a dual use potential.

Attending the VSM Arbeitskreis 'Fertigungstechnik Schiffbau' (Working group in the German Association of shipbuilders) // CMT informed about the progress of the RAMSSES project, highlighting the public E-LASS seminars and the discussions about Future Concepts

Composites Manufacturing Masterclass // General Introduction to the RAMSSES project and WP17

Composites product development; a multidiciplinairy aproach // March 15th: Refereed to RAMSSES WP17 in presentation on integral design approach of composite products at KNVTS (Royal Netherlands association for technicians in the maritime sector.)

Development of a Lightweight Composite Flap for High-Lift Rudder Applications

joint RAMSSES / Fibreship presentation

MariLight Cluster Technology Transfer Workshop // Presented PFA composites technology transfer from other sectors and further development for maritime within RAMSSES WP10

Material Improvements for Increased Fire Performance with Fibre Polymer Composites // Gathered useful information about fire retardant materials, suppliers and applications

Présentation of the WP16 // During the 2nd Fibership workshop, Naval Group had the opportunity to present the overall RAMSSES project and the technial work conducted in the WP16 demonstrator case which is a composite superstructure block on a metallic deck.

Project presentation at VSM Arbeitskreis "Fertigungstechnik Schiffbau" (Working group in the German Association of shipbuilders) // Audience was consisting of manufacturing experts from several German shipyards, and staff of VSM

Project presentation at VSM Arbeitskreis "Industrial Engineering" (Working group in the German Association of shipbuilders) // The agenda of the workshop needed to be updated on short notice, and the RAMSSES presentation had to be postponed.

Project presentation at VSM Arbeitskreis 'Industrial Engineering' (Working group in the German Association of shipbuilders) // Originally, this presentation was scheduled earlier (meeting in Lahr), but it had to be postponed.

RAMSSES - WP 10 Lightweight Components for High Loads and Fire Class - Progress presentation

Schiffbau meets Aviation – Multi-material in water and air // RAMSSES was not directly involved in the organisation of the workshop, but the initiative came from RAMSSES and the collaboration with ZAL in the TTG.

WP13 presentation at E-LASS seminar // Presentation on developments in WP13

16 more presentations on ongoing activities and achievements during several E-LASS seminars (total: 21 presentations)

Participation of another event - total number: 3

ISSC Specialist Committee V.3 Materials and Fabrication Technology - RAMSSES presentation // The General RAMSSES presentation was shown and sent to the members of the Committee. Discussion concentrated on the Demo Cases, namely those on Composite materials.

ISSC Specialist Committee V.3 Materials and Fabrication Technology - second meeting // The work of RAMSSES was touched during the discussions several times. As a follow-up of the ISSC-2018 report, it was agreed that an update of the catalogue of suggested measures for approval of new materials (success stories, lessons learnt, suggested next steps...) should be included in the 2021 report.
Visit of Manufacturing Facilities of IRT Jules Verne - 4th GA Ramsses in France // 27th June 2018, 41 people from RAMASSES consortium:
Visited the Technocampus Océan (TCO), Industry tour to IRT-JV facilities: Additive manufacturing (metallic and composites) and Robotics (mobility in industrial environment and manufacturing flexibility)
Visited the Technocampus Composite TCC, Industry tour to IRT-JV facilities at Composites workshop (forming and preforming processes; assembly and joining technologies)

Pitch event - total number: 1
Forum Europa Seminar // The event is meant to promote participating in H2020 projects by highlighting the successes and (expected) benefits of several past and ongoing projects. Target audience mainly consists of Dutch SME's. I was asked to present about RAMSSES and intend to present the goal, objectives and approach how we will reach our goals. Furthermore I would show a short summary of the demonstrator cases and the composition of the consortium to illustrate the power of cooperation.

Popularised publications (non-scientific and non-peer reviewed) - total number: 21
"TRAVELLING LIGHT" in UK magazine Eureka! // Article "TRAVELLING LIGHT"
AIMEN 2017 annual report
Ein effizienter Zulassungsprozess für den Einsatz innovativer Werkstoffe // Schiffbau Industrie is a magazine issued by VSM, the German Shipbuilding and Ocean Industries Association
Einsatz von innovativen Leichtbaumaterialien im Schiffbau
Gemeinsames Netzwerktreffen E-LASS und MariLight // S. 25 (CMT-Forum)
Global Compact COP report 2018
Global Compact COP report 2019
How to be light? // http://www.motorship.com/news101/industry-news/how-to-be-light
Interview at radio show. Ramsses project briefly discussed. // http://www.ettevotlusraadio.ee/?s=tabri
'Leichter geht noch' - Newspaper article
Lightweighting ships with composites // Comprehensive overview article about the use of composite materials in the maritime area; the article was written by CW based on interviews with CMT and many contributors (RAMSSES partners and others)
MATERIAL ADVANTAGE: SEEKING ALTERNATIVES TO RELIANCE ON STEEL - RAMSSES project turns spotlight on using composites to increase competitiveness of European-built ships // 2nd responsible partner: BV
New materials to make ships more sustainable and less noisy for marine life.
Publication of press release in Swedish magazine // Swedish translation/summary of the RAMSSES press release, announcing the RAMSSES project and that RISE is involved in the project.
RAMSSES - Lightweighting ships for a cleaner environment
RAMSSES article in SWZ Maritime, the leading Dutch magazine for technical professionals in maritime industry and appears once a month. // in consultation with CMT, article was based upon draft article for TRA2018.

RAMSSES introduction in INEA brochure

RAMSSES project investigating use of lightweight materials in shipbuilding; 70m fiber-reinforced composite hull // CMT did not publish itself but rather stumbled upon this article on RAMSSES

RAMSSES project presentation // In collaboration with NMTF

Time for Plastic rethink // https://www.motorship.com/news101/industry-news/time-for-a-plastics-rethink
"TRAVELLING LIGHT" in UK magazine Eureka!

Press release - total number: 9

Another project under way complementary to the Fibreship project

Article - "Low weight on high seas" // Composite world magazine - June 2018, Article "Low weight on high seas" on composite cargo decks installed on the Car carrier "SIEM Cicero", mentionig RAMSSES project

Composites in shipbuilding event by E-LASS and RAMSSES in Vigo

E-LASS Seminar - Update // CMT newsletter

innovative Spirit - the EI's contribution to DAMEN's RDI

Input WP 12for article "Removing barriers to lightweighting ships with composites" about Ramsses and Fibreship progress
JEC Composites Magazine // Presentation of BV activities in Research, innovation and development for

composite marine and offshore applications

link to LinkedIn video teaser WP 17

Press release (and website news article) - to be written around successful output of WP10 e.g. demonstrator part, test results etc.

Social media - total number: 24

Post on General Asembly

RAMSSES in AIMEN's social media report (until April/2019) // A report is available with the stadistics of the RAMSSES citations and followers interactions. There is no place in this type of dissemination to upload a document.

RAMSSES profile at LinkedIn created

RAMSSES WP 17 Hull section demonstrator

20 posts on the RAMSSES profile at LinkedIn

Trade fair - total number: 13

Husum Wind 2017

JEC World 2019 // AIMEN has a booth at the fair to show its capabilities regarding advanced materials products and technologies. A flyer from RAMSSES project was available in the booth and explained to visitors.

JEC World 2020 // AIMEN will have a stand in the JEC World Fair in which dissemination material from RAMSSES will be available for visitors, as well as specimens mainly from WP21.

MetsTrade 2019

2 appearances at Neva // St. Petersburg, Russia

RAMSSES dissemination at JEC 2019 // reportted by CMT

Salon Halieutis 2019

Several appearances at SMM (physical, digital)

Wind Europe Conference & ExhiBition 2019 WindEnergy Hamburg 2018
Video/film - total number: 10 3D metal manufacturing of ship propellers – Analysis of the mechanical properties of a hollow metal blade Collaboration between Naval Group and Centrale Nantes on the production of the second hollow blade using additive manufacturing. Interview with Patrice Vinot, Head of the RAMSSES project propulsion package at Naval Group, and Jean-Yves Hascoët, University Professor, Head of the Rapid Manufacturing Platform at Centrale Nantes and international expert in additive manufacturing. General RAMSSES video Project video - RoRo Demo Case (Uljanik Shipyard) Smart track to approval Spezialharz macht Schiffe leichter // Evonik Study of composite material assembly for ship superstructures Video on collaboration between WP10 et al Video on WP17 activities and achievements WP17 teaser - develoment of a one shot vertical infusion of a 6m high composite hull // WP17 raw material provided by Airborne and with the assistance of all WP17 partners finalized
Website - total number: 8 announcement RAMSSES start and NMTF participation // at the start of RAMSSES, we have updated the NMTF website with an echo of the RAMSSES press release and some added lines why NMTF is participating. This message is also shared using a newsletter sent to our members / subscribers. Appearance on an internet portal on innovation activities conducted in the Hamburg metropol region // An interview with CMT to prepare the publication was done on October 16, 2019 Galventus website Jules Verne induytrs tour - RAMSSES // http://www.jeccomposites.com/knowledge/french-composites-news/ramsses-un-projet-europ%C3%A9en-d%C3%A9di%C3%A9-aux-nouvelles-technologies-pour-le?utm_source=SalesForceMarketingCloud&utm_medium=email&utm_campaign=JEC+Composites+Informations+N.+312 Presentation of RAMSSES in the R&D activties of IRT Jules Verne // Diffusion of Ramsses project at IRT Jules Verne's Website Public Project website, and updates RAMSSES project op het European Inland Barging Innovation Platform (EIBIP) // https://eibip.eu/publication/ramsses/