

# Electron beam treatment of marine diesel exhaust gases

## Consortium meeting

Genova, Italy, 1 March 2018

Agenda of the meeting along with the relevant presentations and supporting documentation is available here: <https://indico.cern.ch/event/704222/>

Previous meeting in Geneva: <https://indico.cern.ch/event/659434/>

List of participants:

[https://indico.cern.ch/event/704222/contributions/2889132/attachments/1609123/2555992/List\\_of\\_participants.pdf](https://indico.cern.ch/event/704222/contributions/2889132/attachments/1609123/2555992/List_of_participants.pdf)

### **Informal summary**

After introduction and presentations (available as indicated above) relevant to the project, the following points were outlined during discussions:

**MSC<sup>1</sup>:** project has good potential. MSC is interested in on-board application of said technology and noted that there are technical challenges to overcome in order to bring it on-board of the ship. There is no doubt that technology is working – this is engineering project to solve. Company is following rules and regulations. Sulphur Cap is coming up and will have to comply with it by using existing means and possibilities. However, if there is other solution (like this technology) – is happy to go for that. Final aspects can be fully evaluated only after proof-of-concept.

**DNV/GL<sup>2</sup>:** very much interested, is participation at this stage only in observer capacity. However, have to evaluate internally how and if ~~when~~ to contribute to the project. Is taking information and will report to management. Expressed personal point of view – very promising technology and solutions. Timeframe is an issue. Another point is potentially high power demand of this hybrid technology (to which answer was provided that it is estimated about 2% of the main engine power). Question is how to move from land to ship.

**DNV/GL (Hamburg):** in case of NOx certification procedure is stipulating that engine manufacturers are involved – since the certification shall be done for the whole engine as such. Potentially can support project by its expertise in type approvals, certification and validation of the systems. However, this has to be discussed in detail and has to be approved by the management of the company. Could help in contacting engine manufacturers. Regarding its participation in the Consortium – it has to be checked whether there is no conflict of interest between “setting the rules” and later certification of the technology

**RINA<sup>3</sup>:** is interested. Question is how and if can contribute to the project. At this stage cannot commit. However, expressed personal point of view – potentially good solution and was already tested in other (power plant) installations. “marinisation” could be an issue here

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<sup>1</sup> <https://www.msc.com/che>

<sup>2</sup> <https://www.dnvgl.com/maritime/index.html>

<sup>3</sup> <https://www.rina.org/en/business/marine>

– e.g. type approval and environmental protection rules. Time is short – all this have to be done by 2020.

**ARPAL**<sup>4</sup>: is interested in environmental issues; is interested in the development and testing of the control devices and pollution control. Looking forward to improve its instrumentation by external funding. Can contribute to the project with its experience of on-board measurements of the ship exhaust gases. Is interested in “marinisation” of its tools.

**ABS**<sup>5</sup>: is participation at this stage only in observer capacity, yet looking with interest towards this new technology. Its expertise could be in implementation and building of regulatory framework. The best expert of ABS here is Mr. Mark Penfold. If ABS is engaging in this project, then type of cooperation has to be considered. Typical role is to certify and not to “build” technology.

**Fraunhofer FEP**<sup>6</sup>: is full partner of Consortium with particular expertise in the feasibility studies of the accelerators.

**IT CG**<sup>7</sup>: is having flag state point of view and understands that project is still in its experimental phase. Common goal is to improve environmental situation, especially in reducing ship emissions and improving environmental situation in the ports. This could be done by developing this technology and new solutions. Everybody can put into the project its experience. The first step would be feasibility and costs and then to develop relevant rules. Furthermore, this technology provides potential solution not only to NOx and SOx but also other pollutants and smaller particles. Certification procedure afterwards IMO rules can be developed. Can have a role in case if new regulations will have to be put towards IMO.

**EC DG MOVE**<sup>8</sup>: is very much interested in this this project – full support and encouragement. Will liaise with relevant Policy Unit and “Scrubbers Group”. Would like to invite to present this project to DG MOVE management and other relevant stakeholders.

Institute of Nuclear Chemistry: is full partner of the Consortium and has significant expertise in the accelerators integration projects. There is Polish national scientific project evolving and could contribute to this project.

**CERN**<sup>9</sup>: is full partner of Consortium. This technology and project has great potential. Momentum is there.

**ebeam Technology**<sup>10</sup>: producing industrial electron beam accelerators. Are seeing potential in this technology. Question was raised regarding cost of the relevant electron accelerator – which is of magnitude of 150K EUR. Without supporting equipment.

### **Field of expertise and potential contributions (responsibilities) within the project**

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<sup>4</sup> <https://www.arpal.gov.it/>

<sup>5</sup> <https://ww2.eagle.org/en.html>

<sup>6</sup> <https://www.fep.fraunhofer.de/en.html>

<sup>7</sup> <http://www.guardiacostiera.gov.it/genova>

<sup>8</sup> [https://ec.europa.eu/transport/home\\_en](https://ec.europa.eu/transport/home_en)

<sup>9</sup> <https://home.cern/>

<sup>10</sup> <https://ebeamtechnologies.com/>

At the end of the meeting participants were asked to shape their potential field of expertise relevant to this project and Consortium – at this moment without any commitment or obligations.

#### **Confirmed participants of the Consortium:**

1. **Riga Technical University<sup>11</sup>**: confirmed its participation in Consortium - will provide letter of support. Contribution: overall project coordination + technical design, manufacturing engineering, design and technical integration. Finances: ready to contribute with 10K in cash or in kind.
2. **Institute of Nuclear Chemistry and Technology<sup>12</sup>**: confirmed its participation in Consortium - will provide letter of support. Contribution: critical knowledge and major expertise in the field + mechanical engineering, analytics, calculations and chemical engineering – can provide know-how and hardware to the project. Finances: ready to contribute with 10K in cash or in kind.
3. **Fraunhofer FEP**: confirmed its participation in Consortium - will provide letter of support. Contribution: expertise in electron beam sources – can provide know-how and hardware to the project. Finances: ready to contribute with 10K in cash or in kind.
4. **CERN**: confirmed its participation in Consortium - will provide letter of support. Contribution: expertise - leading world's lab in the accelerator technologies + testing, resources + fire safety expertise. Finances: ready to contribute with 10K in cash or in kind.
5. **Riga Ship Yard<sup>13</sup> (represented by RTU)**: confirmed its participation in Consortium - will provide letter of support. Contribution: is ready to provide at its premises marine diesel engine for the tests + marine engineering expertise, workshops and relevant specialists. Finances: ready to contribute with 10K in cash or in kind.
6. **ebeam Technologies**: confirmed its participation in Consortium - could provide letter of support. Contribution: for the project can offer to perform test using its accelerator at companies premises in Switzerland and/or lending accelerator to the project. The last has to be discussed in detail. Company has expertise in accelerator windows in corrosive environment – which is very relevant to this technology and project. Finances: ready to contribute with 10K in kind.

Previously expressed their interest to be part of the project, however not represented at this meeting:

7. **Accelerator Science Group, Particle Physics Department, STFC Rutherford Appleton Laboratory<sup>14</sup> (UK)**: confirmed its participation in Consortium - will provide letter of support. Contribution: expertise in the industrial applications of the accelerators. Finances: to be confirmed.

**Potential partners of the Consortium, however engagement type and scale has to be decided:**

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<sup>11</sup> <https://www.rtu.lv/en/hep>

<sup>12</sup> [http://www.ichtj.waw.pl/drupal\\_eng/](http://www.ichtj.waw.pl/drupal_eng/)

<sup>13</sup> <http://www.riga-shipyard.com/>

<sup>14</sup> <https://www.stfc.ac.uk/research/particle-physics-and-particle-physics/particle-physics/particle-physics-department/>

1. **Italian Coast Guard:** could be interested to be part of Consortium - will provide letter of support. Yet, this has to be confirmed by the HQ. Contribution: flag state perspective – could help in setting and writing relevant rules. Finances: cannot be confirmed at this point.
2. **ARPAL:** engagement into the Consortium has to be discussed internally and within the Consortium. Contribution: environmental control, field experience in the measurements *inter alia* of NOx and SOx on board Ro-Ro ships + instrumentation and measuring technique. Finances: cannot be confirmed at this point.
3. **DNV/GL:** is interested in the project. Need to clarify with legal department if there are any obstacles for participation in this project considering that later on we could be one of the RO who will certify the equipment. Yet, role in the project and participation in the Consortium - has to be decided by the management. Potentially could provide letter of support (I actually didn't say that but if there are no legal obstacles I think we can provide the letter). Contribution: support to draft the rules and requirements to certify equipment. R&D department could provide support regarding rules for machinery. Could seek support of IACS<sup>15</sup>. Finances: cannot be confirmed at this point.
4. **RINA:** is interested in the project. Yet, role in the project and participation in the Consortium - has to be decided by the management. Potentially could provide letter of support. Contribution: support to draft the rules and requirements to certify equipment. R&D department could provide support regarding rules for machinery. Finances: cannot be confirmed at this point.
5. **ABS:** aligns with other two Class Societies - role in the project and participation in the Consortium - has to be decided by the management. Potentially could provide letter of support. This project eventually could be Joint Industry programme. Contribution: Has significant expertise in the field and relevant technologies for the exhaust gas treatment. Finances: cannot be confirmed at this point.
6. **Mediterranean Shipping Company:** is generally interested in the project - could provide letter of support. However, at this stage is not ready to engage in this project as full Partner and member of Consortium. Potential contribution: ship owner

Previously expressed their interest to be part of the project, however not represented at this meeting:

7. **Remontowa Marine Design & Consulting<sup>16</sup> (Gdansk, Poland):** could be interested to be part of Consortium - will provide letter of support. Yet, this has to be confirmed by the management. Potential contribution: marine design, on-board system integration, expertise in the scrubbers installation, mechanical and electrical engineering. Participation – to be confirmed

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<sup>15</sup> <http://www.iacs.org.uk/>

<sup>16</sup> <http://rmdc.rh.pl/>

8. **Grimaldi lines**<sup>17</sup>: was represented at the first meeting on 1<sup>st</sup> December 2017 at CERN in Geneva, expressed its interest and support. However, no information afterwards. Potential contribution: ship owner. Participation – to be confirmed

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<sup>17</sup> <https://www.grimaldi-lines.com/en>