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IMarEST BeNeLux Branch

Committee
Arthur Vrijdag (Chairman), Erik-Jan Boonen (Secretary), Joris Rusman (Treasurer), Lode Huijgens (Web-coordinator), Roely Ruissen, Rinze Geertsma, Arie de Groot, Tjeerd Heeringa, Douwe Stapersma, Menno van Leeuwen, Chris de Man (Student, Early-career representative)

Mini-symposium: Submarines and Annual General Meeting (AGM)

Speakers: Günther Dorst (Airbus Defence and Space), Anders Brage (Saab Kockums), Johan Jenson (Saab Kockums), Jack Reijmers (Nevesbu), Sven Los (Nevesbu)
Date: Friday 15th of November 2019
Time: 13:00 - late
Venue: Royal Netherlands Naval College
Het Nieuwe Diep 8
1781 AC Den Helder
Contact: imarestbenelux@gmail.com

Dear member or friend,

You are hereby cordially invited to the coming Mini-Symposium (open to all) and Annual General Meeting (members only) of the IMarEST BeNeLux Branch. We have organised an optional morning programme and an optional dinner as well. Please inform me which of these events you will attend by filling in the **online form**; advance registration is required. Your attendance would be much appreciated.

Details of the programme and additional information can be found below.

Dinner at the “Marineclub” will be subsidised by means of a small financial contribution of the BeNeLux branch, however a personal contribution to the dinner costs will be required from each participant. The exact amount per participant that the branch will pay will be announced on the day. Please let me know whether you will join the dinner in the online form as well, so we can make an accurate reservation at the restaurant.

You are required to bring an official ID.

Please register **online** before the 12th of November. Thank you in advance.

Yours sincerely,
E.J. Boonen – Honorary Secretary Benelux Branch.

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Programme

Optional morning programme **(please reserve sufficient time for registration at main gate of the Naval base)**

10:30 - 11:00 Arrival at 'traditiekamer onderzeedienst', Nieuwe Haven, Den Helder.
11.00 - 12.00 Submarine visit for selected group of visitors
12.00 - 12.15 Drive to Royal Netherlands Naval College
12.15 - 13:00 Lunch at own cost in Royal Netherlands Naval College restaurant (Enys house)

Afternoon programme

13.00 - 13.20 Arrival and coffee at Royal Netherlands Naval College (Enys house)
13.20 - 13.30 Welcome, by chairman
13.30 - 13.45 Welcome, by Royal Netherlands Navy
13.45 - 14.25 Presentation by Airbus Defence and Space
14.25 - 14.40 Coffee break
14.40 - 15.20 Presentation by Saab Kockums
15.20 - 15.35 Coffee break
15.35 - 16.15 Presentation by Nevesbu
16.15 - 16.30 Discussion and closure of Mini-symposium
16.30 - 17.00 Coffee Break

17.00 - 18.00 Annual General Meeting (AGM) IMarEST Benelux branch (members only) - Agenda given below
18:15 Leave for home/ restaurant

Optional dinner

18.30 Annual Dinner at the Marineclub (https://marine-officiersclub.nl/) in representative clothing (no jeans, t-shirts, sweaters or sport-shoes).

Agenda for AGM (for members only)

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1. Opening
2. Announcements
3. Minutes of Last AGM
4. Annual Report of this year's activities
5. The Financial Account for the year up to 1 October 2019
6. Auditors Statement
7. Appointment of Auditors for the year up to 1 October 2020
8. Announcement of winner of Branch Certificate for the best presentation made to our branch over the past year
9. Election of committee members
    a. Retirements
    b. Election new committee members/ officers
10. Technical Programme 2020 – Programme will be announced
11. Any other business
12. Closure

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Morning program

Submarine visit at the naval base in Den Helder

The Walrus class submarines are an internationally renowned class of submarines that operate worldwide at the edge of operations of the Royal Netherlands Navy, In order to maintain her operational relevance, the Walrus class submarine are undergoing their life extension plan, which is engineered and delivered by a consortium of the Maintenance Establishment of the Navy, the Defence Materiel Organisation and Netherlands industry and technology partners, such as Thales, RH Marine, Nevesbu, Damen Schelde Naval Shipbuilding and TNO. A presentation on this Life Extension Plan features on IMarEST TV. The Royal Netherlands Navy now invites the members of IMarEST for a unique opportunity to visit one of the submarines, that has undergone the life extension programme, and is currently operationally available in the port of Den Helder. The visit will consist of a guided tour for approximately one hour. Only a limited number of places will be available.

Abstracts

"Life support systems aboard submarines" by mr. Dorst of Airbus Defence and Space

Airbus Defence and Space GmbH - former Dornier System GmbH - started to develop Environmental Control and Life Support Systems ECLSS by the end of the 1970ies. Dornier was responsible for the design and manufacturing of the ECLSS of Spacelab, the European contribution in the US Space Shuttle program. The first Spacelab mission was conducted end 1983 on STS-9 flight with the space shuttle Columbia. One of the main systems of an ECLSS is the air purification system, developed to purify the air in a closed environment. In particular the metabolically produced carbon dioxide, but also a variety of VOC's, as well as hydrogen and carbon monoxide have to be removed from the air. Based on the Spacelab experience Airbus Defence and Space GmbH developed carbon dioxide scrubber systems on LiOH basis for the German submarine fleet and for different other Navies.

However, permanently manned space habitats (like the ISS), as well as modern AIP submarines and other long diving submarines need regenerative air purification systems. The Columbus module of the ISS will be equipped with the ACLS (Advanced Closed Loop System) developed by Airbus Defence and Space GmbH. ACLS was launched in September 2018.

Airbus Defence and Space GmbH also developed regenerative air purification systems for submarines. CO2 is removed with ASTRINE™, a functionalized specific ion exchange resin on solid amine basis. The regeneration of ASTRINE™ is done with steam. A Zeolithe system is used to remove all kinds of VOC's including freons and controls these VOC's on very low concentrations in the range of only several ppm. The Zeolithe is also regenerated by means of steam. H2 and CO are removed catalytically.

Currently there are two European Navies using the regenerative air purification systems from Airbus Defence and Space GmbH on their submarines. The system is scalable for boats with conventional propulsion and a screw size of about 30 people up to huge nuclear submarines.

"Stirling AIP system for submarines" by mr. Anders Brage and mr. Johan Jensen and of Saab Kockums

The most essential capability of a submarine is to covertly stay submerged during long time without revealing its presence above the sea surface. A conventional diesel-electric submarine submerged endurance is entirely dependent on their batteries. An air-independent propulsion system is therefore of essence to increase the submerged endurance and meeting the endurance of a nuclear submarine.

During the early 80´s Saab Kockums started to develop the Stirling AIP system which now has successfully been operational since 1988. This presentation will take a look at the Saab Kockums Stirling AIP System and the operational benefits of using AIP on a submarine.

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“Tomorrow’s pressure hull“ by mr. Reijmers

Submarine design is teamwork, and the main drivers are the staff requirements. This will result in a general arrangement with input from all the disciplines involved. The volume of this lay-out must be contained in an envelope providing a safe environment for the crew. This means that the pressure hull, offering this envelope, is not a stand-alone structure. It must follow the design changes that are inherent to the process.

However, it is a complex structure with a significant contribution to the displacement. Therefore the preliminary design must be accurate enough to give a sound input to the weight balance, but not too time consuming. This was common practice in the past, it is nowadays and it will be in the future.

Computer power has been increasing over the years, and it will continue to grow. However, whether numerical simulation capabilities will alter the design process is disputable. Nonlinear Finite Element Analysis is within reach, but different analysts will produce different models, with different results. Obtaining consensus on the outcome is not an overnight issue. And this means that there is no room for pervasive analysis in the preliminary design phase.

The middle of the twentieth century offered a lot of analytical formulations that are still implemented in the guidance of classification societies. This means that the presentation may look up to date, but the basis is more than 60 years old.

Production and material choice, however, is a different issue. The yield strength of steel has been growing over the decades in combination with production problems. Nowadays High Yield steels can be welded without problems. Different materials are also under consideration, but the application cannot be assessed without looking at the extraordinary nature of the loading. Compression of a ring-stiffened cylinder requires a closer look at the interaction of buckling and yielding. The first phenomenon is highly driven by the Young’s modulus and this raises a problem with materials that combine a low density with a low Young’s modulus, such as aluminium and titanium.

Furthermore, the application of fibre reinforced plastics is worthwhile to mention. However, it requires a lot of research, and has a large impact on the lay-out. For the time being this concept may be regarded as a bridge too far.

“Total battery powered submarine design“ by mr Sven Los

Conventional submarines use a diesel-electric power plant. However, this might change in the nearby future. The ongoing research of civil industries into alternative power plant solutions, such as high capacity batteries and fuel cells, leads to technical improvements. This might make alternative power plants in submarines feasible in the nearby future.

On last year’s UDT, a totally battery powered concept the E-MORAY was presented. This year’s paper presents a full electric battery/fuel cell powered submarine design; the H_2MORAY. This design has a power plant consisting out of high capacity lithium batteries and polymer electrolyte membrane fuel cells. Hydrogen storage will be achieved by means of high pressure bottles outside the pressure hull containing pure hydrogen. The H_2MORAY will be able to reach ranges up to 2920 nautical miles and an endurance of 42 days, without needing to surface. This enables the design to perform local to medium range missions with a high level of covertness.

The H_2MORAY has improved operational capabilities compared to the E-MORAY, which is able to reach a range of 1950 nautical miles and an endurance of 24 days. However, this is at the cost of higher design complexity. Compared to conventional diesel-electric submarines, the range and endurance of designs with an alternative power plant is still significantly less. However, with the expected improvements in technology the potential of totally battery powered and fuel/battery powered
submarines is expected to increase in the nearby future. This will make such designs realistic alternatives for the conventional diesel-electric submarine.

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About the speakers

Günther Dorst

Günther Dorst finished his study in electronics in 1988 at the University of Stuttgart. In the same year he joined Airbus Defence and Space in Ulm, former AEG Telefunken. Most of the time in his business life he worked in the fields of signal reconnaissance.

Since 2016 he is responsible for the Submarine Life Support Business in Friedrichshafen, Germany where based on the technology for the human space flight, life support systems for submarines are developed as a spin-off from the space technology.

Anders Brage

Anders Brage is a Project Manager at Saab Kockums in Malmö, Sweden. He started his career at Saab Kockums in 2004 as System Engineer at the Mechanical Engineering Department and has been involved in several submarine projects both as a System Engineer and Project Manager. His current position is Project Manager for Ship Systems within the C71 Program.

Johan Jensen

Johan Jensen is a Naval Architect at Saab Kockums in Malmö Sweden since 2002 and has been involved in submarine and system development. Johan is a former naval officer and has served on Swedish submarines during the early 1990, starting his career on the first AIP submarine Näcken of RSwN. His current position is Chief Designer within C71 Program.

Jack Reijmers

Jack Reijmers is an experienced engineer in submarine design. After receiving his degree as a marine engineer at the Delft University of Technology, Jack started working at Nevesbu, where he remains active after his retirement. Despite reaching retirement age, Jack promotes his passion by working on his PhD at the Technical University in Delft. The complex and innovative topic of his research is 'Pressure Hull Analysis on a Reliability Base' (PHAReB).

Sven Los

Sven Los is a Naval Architect with a Master’s Degree in Marine Technology. He specialized himself in submarine design during his graduation research, which he performed at Nevesbu B.V.. As a Naval Architect at Nevesbu B.V., he has worked on several submarine studies and concept designs. The focus of his latest studies was on alternative power plant solutions