Werktuigbouwkunde 3TU OW 2012

Maritime Technology Programmes,
Delft University of Technology

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This report was finalized on 30 November 2012.

Report on the bachelor's programme Marine Technology and the master's programme Marine Technology of Delft University of Technology

This report takes the NVAO's Assessment framework for limited programme assessments as a starting point.

Administrative data regarding the programmes

Bachelor's programme Marine Technology

Name of the programme:	Marine Technology
CROHO number:	56957
Level of the programme:	bachelor's
Orientation of the programme:	academic
Number of credits:	180 EC
Specializations or tracks:	
Location(s):	Delft
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2013

Master's programme Marine Technology

Name of the programme:	Marine Technology
CROHO number:	66957
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	Science, MT-Sc, Design Production and Operations
Location(s):	Delft
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2013

The visit of the assessment committee Werktuigbouwkunde 3TU OW 2012 to the Faculty of Mechanical, Maritime and Materials Engineering of Delft University of Technology took place on 20-21 September 2012.

Administrative data regarding the institution

Name of the institution:	Delft University of Technology
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	positive

Quantitative data regarding the programmes

The required quantitative data regarding the programmes are included in Appendix 5.

Composition of the assessment committee

The committee that assessed the bachelor's programme Marine Technology and the master's programme Marine Technology consisted of:

- Prof. dr. J.K.M. de Schutter, professor in Mechanical Engineering, KU Leuven, Belgium;
- Prof. dr. ir. M. Vantorre, professor in Maritime Technology, Ghent University, Belgium;
- Prof. dr. ir. P. Van Houtte, professor in Material Sciences, KU Leuven, Belgium;
- Ir. G. Calis, Chairman Division of Mechanical Engineers of the Royal Institute of Engineers in the Netherlands, former manager of Stork group of companies;
- Ir. H. Grunefeld, Department of Training and Consultancy, Centre for Education and Learning, University Utrecht;
- E.M. Porte, master student Mechanical Engineering, Twente University.

The committee was supported by dr. B.M. van Balen, who acted as secretary.

Appendix 1 contains the curricula vitae of the members of the committee.

Working method of the assessment committee

Preparation
The assessment of the bachelor's programme Marine Technology and the master's programme Marine Technology of Delft University of Technology is part of a cluster assessment of ten Mechanical engineering degree programmes offered by three universities. The bachelor's and master's programmes Mechanical Engineering and the master's programmes Offshore and Dredging Engineering and Materials Science and Engineering of TU Delft are also part of this cluster evaluation. The assessment of these programmes will be described in separate reports.

The kick off meeting for the cluster assessment was scheduled on 4 September 2012. During this meeting the committee members received an introduction into the assessment framework and evaluation procedures and the committee agreed upon its general working method. The entire committee consists of nine members. For each visit a subcommittee was composed that ensures the necessary expertise to evaluate the programme. Furthermore the domain specific requirements and the most recent developments concerning the Mechanical Engineering domain were discussed. These domain-specific requirements and the actual context form the starting point for the evaluation of the quality of the degree programmes.

The programme management prepared a self-assessment report. This report was sent to QANU and, after a check by the secretary of the committee to ensure that the information provided was complete, forwarded to the committee members. The committee prepared the site visit by studying the self-assessment report and a number of Bachelor's and Master's theses (bachelor mini-paper and master graduation report, respectively). The secretary of the committee selected for the Delft bachelor programmes 17 bachelor and 22 master theses randomly and stratified, out of a list of all graduates of the last two years per programme. The following stratification is used: one third of the theses for each degree programme with low grades (6-6.5), one third of the theses with middle ranged grades (7-8) and one third of the theses with high grades. QANU asked the programmes to send the theses including the assessment by the supervisor and examiner and divided them among the sub committee members.

When a thesis was assessed as questionable or unsatisfactory by a committee member, a reassessment was done by another committee member. In the case that more than ten percent of the theses were assessed as questionable or unsatisfactory by two committee members the selection of theses for the programme was extended, but this was not the case.

Site visit
The committee members formulated questions raised by studying the self-assessment report in advance. These questions were circulated in the committee.

The committee visited the programme on the days of 20-21 September 2012. The programme of the site visit was developed by the committee's secretary in consultation with the programme management and the chair of the committee. The committee interviewed, next to students, teachers and alumni, the programme management and representatives of the Faculty Board, the Examination Board and the student and teacher members of the Education Committee. An open office hour was scheduled and announced (but not used).

During the site visit the committee studied additional material made available by the programme management. Appendix 7 gives an overview of all documents available during the site visit. The last hours of the site visit have been used by the Committee to establish the assessments of the programme and to prepare the oral presentation of the preliminary findings of the committee to the representatives of the programme.

Report
The secretary wrote a draft report based on the findings of the committee. The draft report was amended and detailed by the committee members. After approval of the draft report by the committee it was sent to the department for a check on facts. The comments by the department were discussed in the committee. This discussion resulted in some changes in the report and subsequently the committee established the final report.

The assessment was performed according to the NVAO (Accreditation Organization of the Netherlands and Flanders) framework for limited programme assessment (as of 22 November 2011). In this framework a four-point scale is prescribed for both the general assessment and assessment of each of the three standards. The committee used the following definitions for the assessment of both the standards and the programme as a whole.

Decision rules
In accordance with the NVAO's Assessment Framework for Limited Programme Assessments (as of 22 November 2011), the committee used the following definitions for the assessment of both the standards and the programme as a whole.

Generic quality
The quality that can reasonably be expected in an international perspective from a higher education bachelor's or master's programme.

Unsatisfactory
The programme does not meet the current generic quality standards and shows serious shortcomings in several areas.

Satisfactory
The programme meets the current generic quality standards and shows an acceptable level across its entire spectrum.

Good
The programme systematically surpasses the current generic quality standards across its entire spectrum.

Excellent
The programme systematically well surpasses the current generic quality standards across its entire spectrum and is regarded as an (inter)national example.

General Assessment

- When standard 1 or standard 3 is assessed as 'unsatisfactory', the general assessment of a programme is 'unsatisfactory'.

- The general assessment of the programme can be good when at least two standards, including standard 3, are assessed as 'good',

The general assessment of the programme can be excellent when at least two standards, including standard 3, are assessed as 'excellent'.

Summary judgement

Bachelor's programme Marine Technology

Standard 1
The goal of the *Bachelor's programme Marine Technology* (Maritieme Techniek) at 3mE is to educate students to the level of BSc in Marine Technology, enabling them to exercise the profession of engineer at a professional academic level. This means that they are able to:

- Identify, define and analyse problems, for the solution of which Marine Technology principles and techniques can contribute;
- Systematically design and work out a sound and safe solution;
- Effectively present this solution.

The Bachelor's programme guarantees admission to relevant Master's programmes.

The international standards for the bachelor level are reflected in the intended learning outcomes, both in general terms and for the domain of Marine Technology (ABET, OECD). The intended learning outcomes are transparent and specific and in line with the ambitions of the programmes. The Bachelor's programme, therefore, meets the criteria for standard 1 of the assessment framework.

Standard 2
The programme consists of a major in Marine Technology (150 EC), which is equal and compulsory for all students, and a minor (30 EC) as an elective part scheduled at the beginning of the third year. The study programme has two principal forms:

- Course-based education, i.e. lectures/workshops ('colleges/instructies') with associated examinations.
- Projects in which students work together in project groups. Projects are primarily used to apply the earlier taught knowledge in a realistic setting.

In September 2013, the courses will be clustered into larger courses, resulting in less examinations and more cohesion in the programme. The courses have been grouped into 5 clusters: Mathematics, Physics, Marine Technology, Projects cluster and an Economics, Society & Social Skills cluster. The committee finds the curriculum coherent and the teaching forms used adequate.

The programme has shown an increase in the number of VWO freshmen entering the programme of approx. 50% since 2006 (per December 1st 2009: 63 VWO freshmen). Of these students, on average about 20% drop out during their first year up to 2009. Up to 2009 the total drop-out in the Bachelor's programme appears to be in the order of magnitude of 30-40%. It is expected that due to the introduction of the Binding Recommendation on Continuation of Study (Bindend Studie Advies (BSA) in 2009 the drop-out in the Bachelor's programme will shift largely to the first year.
In recent years actions have been taken to improve the success rate of students. The committee is convinced - supported by comments of the alumni - that the programme is feasible.

The quantity and the quality of the teaching staff are adequate. The experimental facilities for Marine Technology are excellent. The committee appreciates that these facilities are used for teaching purposes. Quality assurance on programme level is functioning adequately.

Standard 3
The committee has looked into the assessment system and the Bachelor's theses in order to answer the question whether the intended learning outcomes are achieved. The committee is convinced that the assessment system is sufficiently valid and reliable. The committee has seen that the Board of Examiners is in control and has made a start with the implementation of an updated, adapted to renewed legislation, test policy. The theses are at the required level of an academic Bachelor's programme. Bachelor's graduates are well prepared to continue their studies in an academic Master's programme

The committee assesses the standards from the Assessment framework for limited programme assessments in the following way:

Bachelor's programme Marine Technology:

Standard 1: Intended learning outcomes	good
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment and achieved learning outcomes	satisfactory
General conclusion	satisfactory

Master's programme Marine Technology

Standard 1
The Master's programme MT has the ambition to provide students with a profound educational basis, allowing them to find excellent job positions after their graduation, either in business or in academia. Integration is a key word in the daily life of a Maritime Engineer. Designers are trained to understand not only the design aspects, but also the economics of shipping such as for instance the fuel efficiency which is of great importance regarding the running costs of a ship.
The programme has two master tracks: Design, Production and Operation (DPO) and Science (Sc).
The international standards for the master level are reflected in the intended learning outcomes, both in general terms and for the domain of Marine Technology (ABET, OECD). The intended learning outcomes are transparent and specific and in line with the ambitions of the programme.

Standard 2
The first year the programme entails a core part, a specialisation part and an elective part, which together amount to at least 60 EC. In the second year the programme consists of an internship and the Master's graduation project. The students chose their course programme in consultation with the Master's programme coordinator of the track and/or the graduation supervisor.

The MT Science track contains an introduction project to familiarise the new Master students with the curriculum, the staff and with each other. The students following the DPO programme spend the first semester at the NTNU (Norges Teknisk-Naturvitenskapelige Universitet, Trondheim) in Norway. Cohesion of the programme is ensured by maintaining a core programme that is identical for all specialisations within a track, extended with courses specific to each specialisation. The teaching forms used in the Master's programme are adequate; the students are content with the guidance and supervision they receive.

The quantity and the quality of the teaching staff are adequate. Quality assurance on programme level is functioning adequately. The experimental facilities, like the model basins and the cavitation tunnel, are excellent. The committee appreciates that these facilities are used in teaching and that they are available for students. The facilities contribute to the quality of the Marine Technology programmes.

Standard 3
The committee has looked into the assessment system and the Master's theses in order to answer the question if the intended learning outcomes are achieved. The committee is convinced that the assessment system is sufficiently valid and reliable. The committee has seen that the Board of Examiners is in control and has made a start with the implementation of an updated, adapted to renewed legislation, test policy and plans to implement uniform Master's theses assessment forms.

The theses are at the required level of an academic Master's programme. Master's graduates have an excellent foundation for a career in industry as well as in research.

The committee assesses the standards from the Assessment framework for limited programme assessments in the following way:

Master's programme Marine Technology:

Standard 1: Intended learning outcomes	good
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment and achieved learning outcomes	good

General conclusion	good

The chair and the secretary of the committee hereby declare that all members of the committee have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 30 november 2012

Prof. dr. J.K. De Schutter

Dr. B.M. van Balen

Description of the standards from the Assessment framework for limited programme assessments

The Bachelor's and Master's programmes Marine Technology are offered by the Faculty 3mE of Delft University of Technology. Next to these programmes the Faculty 3mE also offers a Bachelor's and a Master's programme Mechanical Engineering as well as five specific Master's programmes. The Mechanical Engineering and the Master's programmes Materials Science and Engineering and Offshore and Dredging Engineering are also assessed in this cluster evaluation. The assessments of these programmes are reported separately.

Throughout the report, the findings have been extracted from the self evaluation report, the interviews during the site visit and additional documentation provided by the programme management, unless mentioned otherwise.

Standard 1: Intended learning outcomes

The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

Explanation:
As for level and orientation (bachelor's or master's; professional or academic), the intended learning outcomes fit into the Dutch qualifications framework. In addition, they tie in with the international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme.

Findings

This section contains the committee's assessment on the profile and orientation of the bachelor's and the master's programmes (1.1), the domain-specific framework of reference (1.2) and the intended learning outcomes (1.3).

1.1. Profile and orientation of the programmes

The goal of the *Bachelor's programme Marine Technology* (MT) is to educate students to the level of BSc in Marine Technology, enabling them to exercise the profession of engineer at a professional academic level. This means that they are able to:

- Identify, define and analyse problems, for the solution of which Marine Technology principles and techniques can contribute;
- Systematically design and work out a sound and safe solution;
- Effectively present this solution.

The Bachelor's programme guarantees admission to relevant Master's programmes.

The *Master's programme Marine Technology* (MT) has the ambition to provide students with a profound educational basis, allowing them to find excellent job positions after their graduation, either in business or in academia. The programme aims to train designers who are able to understand not only the design aspects, but also the economics of shipping, such as for instance the fuel efficiency which is of great importance on the running costs of a ship. The programme has two tracks: the 'MT Science Track' (Sc), with the specialisations Ship Hydromechanics and Ship and Offshore Structures, and the 'Ship Design, Production and Operations Track' (DPO), specialisations: Marine Engineering, Ship Production, Ship Design and Shipping Management.

The committee has studied the information provided in the self-evaluation report about the ambition and the profile of the Marine Technology programmes. During the site visit the vision on Marine Technology education has been discussed with the management representatives, who explained that a new curriculum for the MT Bachelor's has been developed recently, aiming to improve study progress and enhancing the enthusiasm and involvement of teachers and students for this programme. The committee finds the vision clear and to the point. It noted that the profile and orientation of the Bachelor's and Master's programme Marine Technology describe engineering programmes at an academic level.

1.2. Domain specific framework of reference

The three collaborating programmes in Mechanical Engineering at the University of Twente (UT), the Eindhoven University of Technology (TU/e) and Delft University of Technology (TUD) have decided to use the ABET (Accreditation Board for Engineering and Technology) criteria as the basis for their domain-specific framework of reference, and to add the definition documents of the OECD (Organisation for Economic Co-operation and Development) and ASME (American Society of Mechanical Engineers). Naval Architecture and/or Marine Engineering is one of the disciplines defined by ABET.

The ABET criteria define the necessary elements of the curriculum: 'The curriculum must require students to apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations); to model, analyse, design, and realize physical systems, components or processes; and prepare students to work professionally in both thermal and mechanical systems areas.' The Tuning-AHELO Conceptual Framework (OECD in 2011), adds an emphasis on engineering skills in practice (theory and application), analysis (products, processes and methods) and design (apply knowledge to develop designs). For a full description of the domain-specific framework of reference, see Appendix 2.

A comparison between the Master's programmes Marine Technology offered at Delft university and the other maritime universities in Europe (organised through WEGEMT) shows that not all of the WEGEMT universities offer full Master's degree programmes. Generally there is limited interest in Production and Shipping Management and most MSc programmes maintain the old division of Naval Architect and Marine Engineer. The committee is aware of the fact that the number of degree programmes Marine Technology offered in Europe is limited, which makes benchmarking difficult. However, the committee is of the opinion that the domain-specific framework of reference clearly describes what is expected of students graduating in Marine Technology on an academic level. The committee finds the frameworks of the Marine Technology programmes adequate.

The committee appreciates the Professional Review Committee, which meets twice a year, but recommends to make better use of this platform to collect feedback on the intended learning outcomes of the programme and the quality of the graduates in a more structured way.

1.3. Intended learning outcomes

The following final qualifications have been defined for the Bachelor's programme Marine Technology:

1. A broad and profound knowledge of the fundamental engineering sciences, which form the basis of Marine Technology (solid and fluid mechanics, materials science and mathematics), as well as some basic knowledge of related fields (thermodynamics, control engineering, electricity, magnetism, information technology), to such a level that entrance

can be obtained to internationally accredited Master of Science programmes Marine Technology and Naval Architecture. The ability to apply this knowledge to design marine systems.
2. Basic technical scientific knowledge of the most important Marine Technology disciplines: shipping management, ship design, ship hydromechanics, ship structures, marine engineering and production. The ability to apply this knowledge to design such systems.
3. Basic knowledge of methods and tools for modelling, simulating, designing and executing experiments and research on marine systems. The ability to apply this knowledge.
4. The capability to contribute to the solution of technological problems by a systematic scientific approach. This includes the analysis, the definition of innovative solutions, the evaluation of the feasibility, the recognition and acquisition of lacking knowledge, as well as the recognition of the relativity and limitations of knowledge and the working out of the solution.
5. The capability of working individually as well as in (multidisciplinary) teams, taking initiatives where necessary.
6. The capability to effectively communicate (including presenting and reporting) about one's work with regard to information, problems, ideas and solutions to both professionals and non-specialist public.
7. The capability to evaluate and assess the technological, societal and ethical impact of one's work and to take responsibility with regard to sustainability, economy and social well-being. The ability to gather and interpret relevant information.
8. The ability to maintain and extend one's competences by permanent self-study, with a high degree of autonomy.

The elaborated intended learning outcomes for the Bachelor's programme are included in Appendix 3.

The final qualifications of the Master's programme comply with the domain specific reference framework. The academic, scientific and professional levels are such that a Delft Marine Engineering graduate has:

1. Competence in one or more scientific disciplines;
2. Competence in conducting research;
3. Competence in designing;
4. A scientific approach (including life-long learning);
5. Basic intellectual skills;
6. Competence in cooperating and communicating;
7. Consideration of the temporal and social context including sustainability.

The committee has studied the intended learning outcomes of the Bachelor's and the Master's programme as provided in Appendix 3 and established that these are very well defined. Intended learning outcomes have been specified for the competences of the graduated Bachelor's student in detail and for each track in the Master's programme. The intended learning outcomes show the academic level required for Bachelor's and Master's programmes as described in the Dublin descriptors and in the 3 TU Criteria for Academic Bachelor's and Master's Programmes. The committee finds the learning outcomes clear and specific. They indicate in a transparent way the intended level and orientation of the programmes and the requirements the students have to meet for graduation.

Considerations
The committee concludes that the Bachelor's and the Master's programme Marine Technology of the TU Delft are unique programmes for the Netherlands. The profiles of the programmes are strongly related to the Delft engineering profiles and of academic level. The committee has verified and established that the profile and orientation of the Bachelor's and Master's programmes are at an academic level.

The domain-specific framework of reference describes adequately what is expected of students graduating in Marine Technology at an academic level. The international standards for the Bachelor's and Master's level are reflected in the intended learning outcomes, both in general terms and for the domain of Marine Technology. The intended learning outcomes are transparent and specific and in line with the ambitions of the programmes. The Bachelor's and the Master's programme, therefore, meet the criteria for standard 1 of the assessment framework.

Conclusion
Bachelor's programme Marine Technology: the committee assesses Standard 1 as **good.**
Master's programme Marine Technology: the committee assesses Standard 1 as **good.**

Standard 2: Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Explanation:
The contents and structure of the curriculum enable the students admitted to achieve the intended learning outcomes. The quality of the staff and of the programme-specific services and facilities is essential to that end. Curriculum, staff, services and facilities constitute a coherent teaching-learning environment for the students.

2. Findings
The following aspects will be described in this section: the structure of the curriculum (2.1), didactic principles (2.2), feasibility (2.3), staff (2.4), programme-specific facilities (2.5) and programme-specific quality assurance including the improvement measures that have been taken in response to the previous evaluation (2.6).

2.1. Structure of the curriculum
The different courses in the Bachelor's curriculum have been grouped into five different clusters:

- **Mathematics** cluster – This cluster contains the courses Analysis, Linear Algebra, Differential Equations and Probability & Statistics and the courses on simulation and Programming (Delphi, Matlab and Ansys), and Electrical Networks.
- **Physics** cluster – This cluster contains the courses Statics, Strength, Materials Science, Thermodynamics, Dynamics, Fluid Mechanics and Non-linear Mechanics.
- **Marine Technology** cluster – This cluster contains the courses Hydromechanics, Ship structures, Marine engineering, Ship design, Maritime operations, Ship production and Ship vibrations.
- **Projects cluster** – This cluster contains the projects on Marine industry, Production methods, Marine systems, hydromechanics, Ship structures, Ship production, Ship Design and a research/design topic.

- **Economics, Society & Social Skills cluster** – This cluster contains courses on presentation, reporting and project management skills, research methodology, business economics as well as on the societal subjects, safety, ethics and sustainability.

The first year contains large mathematics and physics parts, as a foundation for the following courses and as a selection tool for the following years of the Bachelor's programme. It also consists to a large extent of projects. In these projects the earlier taught knowledge is applied, which turns out to be very stimulating since this is where the students get acquainted with the marine technology practice. The last project in the first year is completed with a competition in which a floating crane construction is tested. The construction is designed and made by the students themselves. This competition is combined with the parent's day organised by the Study Association and is considered as a festive finale of the first year.

The second year goes deeper into the mathematical and physical foundations and into the diverse parts of marine technology, such as marine engineering, hydromechanics, ship design, and ship production. The first semester of the third year contains the minor. The second semester mainly contains marine technology courses and a course on economy alongside with the final Bachelor's project, which consists of a group-research or -design assignment with a report and a public defence. An overview of the Bachelor's curriculum is included in Appendix 4.

In principle, students can take minors at any university, both at home and abroad. However, most students take a minor offered by TU Delft. TU Delft offers approximately 50 thematic minors each year. The quality of the minors offered by TU Delft is guaranteed by a TU-wide central-review committee.

Since 2010 the TU Delft has a so called Challent (Challenge the Talent) Programme for Bachelor's students who perform very well, to challenge them by doing an additional programme. Already in 2008 the Faculty 3mE took the initiative to start with a similar programme called TopTrack. TopTrack is accessible to the top best 5-10 percent of the second and third year Mechanical Engineering and Marine Technology students. Since 2012 these programmes are transferred into the Honours Programme Delft. The goal of these programmes is to offer excellent students the opportunity to learn more than just their curriculum. Extra classes, assignments and projects with industry are options, while they can also tailor their own minor (with help of the staff), going much further and deeper into the topic than the commonly offered minors can do.

The programme has been defined along learning lines. The major learning lines are:

- mathematics
- programming/simulation/control
- mechanics/materials/ship vibrations
- fluid mechanics/thermodynamics
- hydromechanics
- construction/production
- ship design/maritime operations/marine engineering
- projects

The learning lines cover all three course years ensuring a logical increment of study contents and a build-up of knowledge and competences during the consecutive course years. The structure of these learning lines in combination with the two educational forms, course based education and projects, aims at increasing knowledge and application skills during the course of the programme. The students confirmed that the structure of the curriculum is logical and coherent and supports them to develop their knowledge and skills.

The committee has studied the information provided on the content of the curriculum and is of the opinion that the Bachelor's curriculum contains the courses, subjects and training students need to achieve the intended learning outcomes. The committee also studied several course descriptions in detail to check whether the literature used is adequate and up-to-date. The handbooks used in the programme are adequate and up-to-date. The projects cluster is appreciated by the committee. These projects help the student to integrate and apply the acquired knowledge and to develop design and research skills.

Although the learning lines give a clear structure to the programme, the students experience the programme as fragmented. This observation was confirmed by the students the committee interviewed during the site visit. The students reported that the renewal of the curriculum in 2011 already is an improvement for the cohesion in the programme. A second restructuring of the programme will be implemented in 2013, resulting in less examinations and more cohesion in the programme. The committee appreciates this restructuring.

The *Master's programme Marine Technology* contains two tracks with several specialisations:

MT Science Track (Sc)
- Ship Hydromechanics (SH)
- Ship and Offshore Construction (SOC)

Ship Design, Production and Operations Track (DPO)
- Marine Engineering (ME)
- Ship Production (SP)
- Ship Design (SD)
- Shipping Management (SM)

The first year the programme entails a core part, a specialisation part and an elective part, which together amount to at least 60 EC. In the second year the programme consists of an internship and the Master's graduation project. The students choose their course programme in consultation with the Master's programme coordinator of the track and/or with the graduation supervisor.

Since 2011, the core curriculum for the first year of the MT Science track contains an introduction project. It is scheduled in the first week of the Master's programme and intended to familiarise the new Master's students with the curriculum, the staff and with each other. It is introduced to enhance the social coherence between the Delft MT Bachelors and new Master students and the staff.

The MT DPO programme does not have such a track, mainly due to the fact that the students spend the first semester at the Norges Teknisk-Naturvitenskapelige Universitet in Trondheim, Norway. The MT programme cooperates with the NTNU, which has resulted in an agreement of exchange of students. The expertise in NTNU is supplementary to the TU Delft. The possibility to follow courses in Trondheim increases the diversity and depth of the DPO track. The quality of the education in Trondheim is monitored and guaranteed by the Board of Examiners of the TU Delft. The committee agrees with the programme's management that the semester in Trondheim has an added value to the DPO track, all students are positive about this part of their studies.

The electives are chosen by the student in close consultation with the professor responsible for the particular specialisation. The students are provided with a list of suggested courses, but they are free to defer from this and come up with their own suggestions. The responsible professor makes sure that any personal preferences fit in the learning goals of the specialisation.

The internship in the second Master's year should cover a project or assignment at the level expected from a future graduate. The internship is awarded by 15 EC. The chosen subject and company either have to be deepening or broadening the knowledge of the student. This is of course restricted to the maritime field. Students are encouraged to seek an internship with a company abroad to fulfil this part of their education. The maritime industry is an international one, and spending three months in a foreign culture is regarded as an advantage. In case the graduation project is performed in cooperation with and at the offices of an external party, the internship and Master's thesis may be combined in one project.

The graduation project is a large (45 EC) individual research project and is performed either within an external company or internally within the MT research group. Graduation projects that are carried out within the research group are usually linked to PhD research performed in the group. The day-to-day supervision will then be performed by a PhD student, while a member of the scientific staff will supervise the thesis. Graduation projects performed at external companies are supervised by a member of the academic staff and by an employee at the facilitating company. Subjects for the graduation project are chosen in such way that the scientific level is guaranteed or that the project is sufficiently innovative. Many companies participate in graduation projects.

Cohesion of the programme is ensured by maintaining a core programme that is identical for all specialisations within a track, extended with courses specific to each specialisation. One factor negatively affecting the cohesion of the Science track is the fact that DPO students spend their first semester at NTNU in Norway. This means that the more basic courses of the Science track, that are also followed by students from the DPO track, should be taught in the second semester. The actual situation is that for the Science track students follow more advanced courses in the first semester, followed by more basic courses in the second semester and consequently leading to incoherence in their study programme.

Management reported that it is the intention to address these issues in the Master's programme update in 2012. To improve the coherence in the Science track, one option that is being considered is to offer the education in modules, instead of as a large number of small subjects. Students doing the Science track reported that they also found possibilities to do part of their study abroad, but they would appreciate more flexibility to accommodate this choice.

The committee has noted that the Master's programme is adequate. There is a clear distinction between the Science and the DPO track. The DPO track is well structured and thought through. The structure of the Science track needs some attention, but the committee has noted that the programme's management is working on that. The committee appreciates that the staff is actively working on improving the cohesion in the programme. The committee was however not convinced of the added value of defining six specialisations within the two tracks, and suggests reconsidering this structure.

2.2. Didactic principles

The *Bachelor's programme* has two principal forms:

- Course-based education, i.e. lectures/workshops with associated examinations. The lectures are primarily used to teach the basic fundamental knowledge and some applications.
- Projects in which students work together in project groups. Projects are primarily used to apply the earlier taught knowledge in a realistic setting. Moreover, projects include design and non-technical subjects (e.g. project skills, communication, sustainability, safety and ethics). Most projects are multi-disciplinary and are defined by a group of teachers. Each project has one teacher who has the final responsibility and acts as teacher-principal. During projects lectures are given by the teachers to elucidate the goals of the project. Regular project-group meetings are scheduled, during which a student-coach (first course year) or teacher (second and third course year) gives guidance to the project group with regard to the planning, team work and approach of the project. Projects very much contribute to the motivation of students, which is confirmed by evaluations and by the students the committee has interviewed.

The committee appreciates the emphasis which has been put on project work in the bachelor's programme. It noticed that the students are satisfied with the guidance and supervision during the projects. Students can apply the acquired knowledge in these projects and learn to co-operate.

The first year of the *Master's programme* focuses on the acquisition of knowledge, in terms of academic knowledge, domain specific knowledge, and specialisation specific knowledge. The approach differs per track: the Science track builds on the fundaments of the Bachelor's programme, and continues this education in the Master's programme, the result is a more lab and lecture oriented education. Within DPO the focus is more on experience with the application of the elements of the Bachelor. This has resulted in projects combined with lectures in many of the courses. The second year focuses on educating students to become independent specialised designers.

The first educational format, course based education, consists of lectures and workshops with an examination for each course. This format is used for the engineering sciences, for domain-specific knowledge, as well as for elective courses. It may include exercises and project work designed to train students in practical applications. In addition, a series of colloquia may be part of this educational format. Depending on the variant of a student's individual study programme, course based education involves 50 percent of the study load of the curriculum. The number of hours spent on lectures and workshops is limited to approximately one third of the study load.

The second educational format consists of assignments. This format is used for the graduation project, the internship either in industry or at a research institute and for other assignments. The internship is intended to give students first-hand experience with and confront them with the level of work that will be expected of them after graduation. The graduation project is the final part of the Master's programme. It is intended to act as proof that students are able to conduct academic research independently and that they have obtained all of the final qualifications. The project also prepares students for exploring unknown territories, and it helps them to understand that abstraction and simplification are their primary tools for success.

The third educational format consists of laboratory work. The purpose of this format is to apply knowledge of theory to laboratory settings, in which students gain hands-on experience through the application of theory, and by developing empirical academic skills.

The committee has established that the teaching formats used are adequate. In the DPO track the semester in Trondheim is valuable. The DPO students are satisfied with their Master's programme. The Science track students are somewhat more critical. As mentioned the management of the programme is aware of this and is taking action to improve the cohesion and guidance in the Science track. The students are content with the guidance and supervision they receive in both tracks.

2.3. Feasibility

The bachelor's curriculum is designed for students, who have obtained a VWO (pre-university education) diploma either of the track 'nature and technology' or 'nature and health' (including Mathematics B and Physics). The contents of the mathematics and physics courses are in line with VWO final qualifications. A problem with the VWO freshmen is that they do not always have the knowledge and skills that they should have according to the VWO final qualifications. To make incoming students aware of this problem, they have to take a mathematics test in their second university week. They have to succeed for this test in order to be allowed to take the Analysis 1 examination. The result of the test can be used by students to refresh their knowledge.

During information meetings the marketing staff, student counsellors, lecturers and students inform the potential students about the formal requirements to enrol. It is also mentioned that for a successful study, it is required to have a real interest in the subject of the study, to be prepared to invest a sufficient amount of time in the study and that reasonable good marks for mathematics and physics at VWO graduation are important. The programme has seen an increase in the number of students. While on average about 20% drop out during their first year up to 2009, the total drop out rate is between 30 and 40%. Up to 2009 the total drop-out in the Bachelor's programme appears to be in the order of magnitude of 30-40%.
In 2009 the BSA (Binding Recommendation on Continuation of Studies) has been introduced. It is expected that due to the introduction of the BSA the drop-out in the Bachelor's programme is shifted largely to the first year. In recent years actions have been taken to improve the success rate of students. This includes emphasising that more effort is required of the students than in their pre-university education and that change is required of the old 'if I don't pass this year, there will be another chance next year' culture among students. For this purpose the management considers the BSA to be a powerful tool. Students report that the Bachelor's programme is do-able as long as they work 35 hours or more per week. Sometimes project work leads to study delay, when students are trying too hard to get a good result. Average study progress is slow. The Bachelor success rate within three and four years varies between 0 and 6%, and 10 and 20%, respectively.

The Master's curriculum is designed for students, who have obtained a TU Delft BSc degree Marine Technology. Students who obtained their BSc degree in Marine Technology from TU Delft or from one of the WEGEMT universities (Newcastle, Southampton, Hamburg, Berlin and Trondheim) may enter the programme without any restraints. Due to intensive contacts with these universities, their Bachelor's programmes are well known and have been established to comply with the required entrance knowledge and skills for the Master MT programme. Students with a Dutch academic BSc degree in Aerospace Engineering, Applied Physics, Civil Engineering, Industrial Design Engineering and Mechanical Engineering also have access to the MT programme without prior selection, but they will have to follow a number of additional courses from the Marine Technology Bachelor's programme. Their total study load will increase to a maximum of 150 EC (120 + maximum 30 EC).

Students holding academic BSc degrees from a technical university other than those mentioned above, may be accepted to the study programme after an evaluation of the curriculum of their Bachelor's programme and their study results. The intake coordinator of the Board of Examiners is responsible for this selection and for the determination of the required additional programme. The selection procedure can result in: admission to the programme, admission to the programme with or without additional requirements of maximum 45 EC (see for procedure above) or no admission. For students coming from universities abroad additional university-wide requirements and procedures apply. Students with a Bachelor's degree from a Dutch polytechnic college (so-called HBO) in ship building, or a degree from a nautical college may be admitted (national BEng degrees), if the student has completed the Bachelor's programme within four years with good results. These students have to follow a pre-Master's programme.

Besides the planning problems for the Science track students, as reported in the self-evaluation report, students did not report any obstacles in the Master's programme. They confirmed that the programme is do-able in two years. In practice, the duration of study is difficult to determine accurately, but management estimates the duration to be 27 months. Implementation of the "harde knip" will allow a better follow-up on this.

2.4. Staff

3mE lecturers teach in both Bachelor's programmes (Mechanical Engineering and Marine Technology) and the six Master's programmes offered by the Faculty. The majority of the teaching staff has completed a PhD, although the committee is of the opinion that some improvement can be made here. All teaching staff is actively involved in research. The committee appreciates that a number of staff members has been working in industry and/or at a research institute. Some of them combine their job in industry with their position at the university.

The teaching qualities of new employees are the starting point in the appointment process. Teaching qualities form part of the annual review in the R&D staff cycle. The Basic Teaching Qualification programme (BTQ) has to be taken as a whole or as a set of tailor-made course by present teaching staff with no teaching experience. Lecturers who need to improve in certain areas, as a result of evaluations, or because of specific wishes or agreements with their manager, are given targeted training. Newly appointed lecturers must have obtained their BTQ within two years.

Due to the increased student inflow in the maritime technology programmes there is a high teaching load for the staff involved. The committee however thinks that the academic staff of the Faculty is at an appropriate level, quantitatively and qualitatively. The committee appreciates that the Faculty 3mE is actively encouraging teachers to improve their teachings skills. The committee is also positive about the number of teachers that has experience in industry.

2.5. Programme-specific facilities

The programme has a number of experimental facilities at its disposal, which are worth mentioning. The facilities are both used for research and education purposes. The facilities play an important role throughout the Bachelor and Master's programme of Marine Technology. The committee inspected some of the facilities and was impressed by the possibilities these have for education. Some of the experimental facilities are mentioned below:

- Model basins - The Ship Hydromechanics Laboratory contains two model basins fitted with wave makers and towing carriages. Both can be used for resistance and propulsion tests and sea-keeping tests with models with or without forward speed. Typically, the smaller towing tank is used for laboratory practices in both the Bachelor and the Master programme Marine Technology as part of the core curriculum. The smaller towing tank is also used for research assignments for Bachelor students. Master students who perform model tests as part of their graduation project typically perform their experiments in the more accurate larger model basin.
- Cavitation tunnel - A closed circuit cavitation tunnel is available. Besides research, the tunnel is used for practical work linked to courses in ship resistance and propulsion and occasionally during Master's thesis projects. The cavitation tunnel is used in the second year course Hydromechanics 3 (mt527).
- Flume Tank - Specially intended for Dynamic Positioning tests a flume tank is available This facility is in regular use for the BSc research project (wbtp303) and is used for the MSc course Mechatronics in MT (mt218).
- Robots - A number of robots are available for a practical assignment. Robots are part of the first-year course Introduction to Ship Production (mt1406).
- Laboratory facilities - The laboratory facilities of the Materials Science department are used for the materials science module.

The committee concludes that the Marine Technology programmes are very well equipped and appreciates that the excellent research facilities are used for teaching. Marine Technology students furthermore can make use of the study facilities in the Faculty 3mE. This Faculty has to cope with a large inflow of students. The committee was impressed by the creativity of the management to find solutions for the large numbers of students it has to accommodate. All physical spaces are used in a most efficient way to create room for the students for self study and to cooperate in the projects.

2.6. Programme-specific quality assurance

Feedback from students, as part of the regular quality-assurance process, on both the programme and the individual courses, is obtained each educational period by means of on-line surveys and evaluation sessions. The results are discussed in the Education Committee (OCMT) and improvements are implemented. The committee met representatives of the Education Committee and could establish that it is working adequately. The students reported to the committee that evaluation results are in fact discussed in the Education Committee and that several of the reported issues resulted in changes and improvements in the programme. They also mentioned that many teachers have a personal response group and are continuously trying to improve themselves. Teachers can easily be approached by email to make an appointment.

Since the last assessment of the Marine Technology programmes in 2006 several improvements are made following the recommendations of the previous assessment committee. The bachelor programme of Marine Technology has been restructured in 2011 and will be restructured again, to improve the do-ability of the programme and the study duration of the students. It is as yet not possible to see the results for the cumulative bachelor yield of this restructuring.

Several actions are already successfully implemented e.g. making the mathematics test and remedial measures compulsory for first year students. Reporting skills are now trained from the start of the Bachelor programme, which is very positively evaluated by the students. The committee also noticed that the programme maintains an auditable record of the assessment of master theses. The committee appreciates that quality assurance and continuous improvement is on the to-do list of the programme management.

Considerations

The committee has investigated the different aspects of the teaching-learning environment to assess whether the intended learning objectives can be achieved. The meetings with students, staff and the educational committee gave clear information about the level and orientation of the programmes.

The Bachelor's programme provides the necessary foundation in theory and skills. The contents and structure of the curriculum enable the students admitted to achieve the intended learning outcomes. The committee appreciates the efforts of the programme management to improve the cohesion in the curriculum. The emphasis on projects in the curriculum is very positive.

The Master's programme is well structured and enables the students to do an internship as well as a considerable research project. The cooperation with the NTNU in Trondheim is valuable for the DPO track of the Master's programme. The Science track should have some more attention in regard to cohesion of the programme and flexibility for the students to do part of their programme abroad. Management assured the committee that they are working on that aspect. The described modes of instruction and teaching in the programmes are appropriate.

The committee thinks that the academic staff of the Faculty is at an appropriate level, quantitatively and qualitatively. The committee appreciates that the Faculty 3mE is actively encouraging teachers to improve their teachings skills. The committee is also positive about the number of teachers that has experience in industry.

The experimental facilities, like model basins and cavitation tunnels are excellent. The committee appreciates that these facilities are used in teaching and available for students. The facilities contribute to the quality of the Marine Technology programmes. The committee furthermore appreciates the creative way in which the Faculty management - faced with the limited means it has and the increasing student numbers - improves the study facilities.

The average length of study remains a major concern. The feasibility of the programme is in order, even though only a very small minority of the students finishes on time. The students indicate that they often give priority to other activities, such as the student association, sports, study trips or jobs. The committee expects that new measures such as BSA and 'harde knip' will lead to different study behaviour. In addition, the committee advises to emphasise to staff and students that 'good' is 'good enough' and that finishing a project on time is also an important learning objective.

Conclusion

Bachelor's programme Marine Technology: the committee assesses Standard 2 as **satisfactory.**
Master's programme Marine Technology: the committee assesses Standard 2 as **satisfactory.**

Standard 3: Assessment and achieved learning outcomes

The programme has an adequate assessment system in place and demonstrates that the intended learning outcomes are achieved.

Explanation:
The level achieved is demonstrated by interim and final tests, final projects and the performance of graduates in actual practice or in post-graduate programmes. The tests and assessments are valid, reliable and transparent to the students.

3. Findings

This section consists of two parts. First, it deals with the committee's findings with regard to the system of assessment (3.1). Secondly, it answers the question of whether students achieve the intended learning outcomes (3.2).

3.1. Assessment system

For each course in the curriculum the study results of the students are evaluated by one or more tests. Regular courses are tested by a written examination directly at the end of the teaching period. In case students fail a test, a re-sit is possible at the end of the next teaching period or in the August resit period. For each course two test possibilities are given per study year. For some courses voluntary exercises can be worked out during the teaching period that may give a bonus to the formal test. For some courses participation in exercises during the teaching period is an entry requirement for the first-following examination. The formula to determine the final mark based on the marks for examination, exercises and voluntary tests, is published on the Blackboard site of that course.

Projects are evaluated based on a project report and/or a presentation. In the Bachelor's programme the report and presentation are the responsibility of the complete project group. Each student in the group receives the same mark. On top of this, each student's contribution to the project is evaluated. This evaluation is done by the coach of the project group (propaedeutic year) or the teachers responsible for the project. The Bachelor's Research Project is the final project of the Bachelor's programme. Students carry out small-scale-scientific-research projects in groups of four students. The project is finalised with a mini paper and a one-day symposium. The projects are assessed on basis of the mini-paper, the presentation at the symposium and the defence. Furthermore the supervisor of the project provides an assessment of the research file and the learning process of the students. The final grade for the project-work is therefore an average of five assessments.

An element of course-based education during the first Master's year is that the students complete each of their courses by an exam, whether they are core courses, specialisation courses or elective courses. This may include exercises and project work designed to train students in practical application, or include homework assignments and individual or group project work as well.

The Faculty 3mE has one *Board of Examiners* which is responsible for all degree programmes offered. It is responsible for the pass/fail rules for the Bachelor's examinations, as well as the criteria for a degree with distinction (cum laude). This board also sets the rules and guidelines for tests. The pass/fail rules for each type of courses/subjects of the different programmes are published in the study guide.
The Board determines ten times per study year which students have passed and failed for the Bachelor and the Master examinations. The pass/fail rules are then applied. In special cases

the Board may deviate from these rules but always in favour of the student. For each course the testing method is determined by the responsible teacher of that course in consultation with the Director of Education and/or the Education Advisor.

The Board of Examiners delegates certain clearly defined duties. The most important of them is the assessment of the Master's graduation project, which is delegated to a professor as chairman, at least one member from the scientific staff of the research group responsible for the specialisation and at least one member from the scientific staff of a different research group of Delft University of Technology. There is a special form for the final examination that has to be used to assess all aspects of the examination. As this form is quite extensive, some groups use shorter forms. A form should evaluate at least four aspects: the graduation process and the attitude towards the work during the MSc project, the quality of the Master thesis, the quality of the presentation, and the quality of the defence. Usually, the presentation takes thirty minutes and the defence one hour. The evaluation forms of the MSc examinations are collected and archived by the secretariats of the departments.

The committee had a meeting with the Board of Examiners and established that the Board is in control of the rules and the procedures for exams. The committee has noted that the board is aware of the recent extension of its responsibilities and that it is in the process of developing and implementing policies and plans with regard to testing and exams 'the New Delft Test Methodology'. The committee noticed that a variety of forms were still used for the assessment of master's graduation projects. The board of Examiners assured the committee that it has taken action to achieve uniformity of the forms and the way the forms are used.

3.2. Achievement of intended learning outcomes

During the site visit all bachelor examinations including the students' answers were available for inspection by the committee. They were found to be at an adequate level and well-marked.

The committee has studied a selection of five Bachelor's graduation projects and seven Master's theses to assess whether the intended learning outcomes are achieved.

The committee concludes that all Bachelor's papers meet the requirements. Some of the papers were of a very high level. The committee appreciates the way the 'mini-paper' is structured as a scientific paper.

The Master's theses the committee has studied were also adequately assessed. The Master's theses indicate that the graduates have achieved the level that can be expected in a master's degree programme. Graduates of the Marine Technology programme of the TU Delft easily find employment at an academic level in the maritime sector, and they are satisfied with their formation which prepares them to function in this environment. Graduates are sought after on the labour market.

Considerations

The committee has looked into the assessment system and the Bachelor's and Master's theses in order to answer the question if the intended learning outcomes are achieved. The committee is convinced that the assessment system is sufficiently valid and reliable. The committee has seen that the Board of Examiners is in control and has made a start with the implementation of an updated, adapted to renewed legislation, test policy and achieving uniformity of the Master's theses assessment forms.

The theses are at the required level of an academic Bachelor's and Master's programme. Bachelor's graduates are well-prepared to continue their studies in an academic Master's programme and Master's graduates have an excellent foundation for a career in industry as well as in research.

Conclusion
Bachelor's programme Marine Technology: the committee assesses Standard 3 as **satisfactory.**
Master's programme Marine Technology: the committee assesses Standard 3 as **good.**

General conclusion

The committee concludes that Bachelor's and Master's programmes Marine Technology Engineering meet the requirements for accreditation. The intended learning outcomes of the Bachelor's and the Master's programme Marine Technology are formulated in line with the Domain Specific Framework and the requirements for an academic Bachelor's respectively Master's programme in a specific, clear and transparent way. The curricula enable the students to achieve the intended learning outcomes. The Bachelor's graduates are well prepared to continue their studies in a Master's programme. The Master's graduates have an excellent foundation for a career in industry or research.

Conclusion
The committee assesses the *bachelor's programme Marine Technology* as **satisfactory.**
The committee assesses the *master's programme Marine Technology* as **good.**

Appendices

Appendix 1: Curricula vitae of the members of the assessment committee

Joris De Schutter (chair) received the M.Sc. degree in mechanical engineering from the Katholieke Universiteit Leuven, Belgium, in 1980, the M.Sc. degree from the Massachusetts Institute of Technology, in 1981, and the Ph.D. degree in mechanical engineering, also from KU Leuven, in 1986. Following work as a control systems engineer in industry, in 1986, he became a lecturer in the Department of Mechanical Engineering, KU Leuven, where he has been a full professor since 1995. He teaches courses in kinematics and dynamics of machinery, control, robotics and optimization. His research interests include sensor-based robot control and programming, optimal motion control of mechatronic systems, and modeling and simulation of human motion. In 2000-2001 he spent a sabbatical year in industry (environmental technology). From 2001 to 2003 he was president of K VIV, the Flemish association of university-graduated engineers.

Gijs Calis received his master's degree in Mechanical Engineering (Production Automation) from Eindhoven University of Technology in 1974. He held various management positions within the Stork group of companies as of 1974. His latest position was Corporate Director Risk Management, Stork B.V.; Corporate Head Office (2002 – 2010).
He retired in April 2010. His current other positions include being the chairman of the Division of Mechanical Engineers of the Royal Institute of Engineers in The Netherlands; vice-chairman and arbitrator of the Council of Arbitration for the Metal Trade and Industry; and chairman of the Policy Committee 'Machinebouw' of NEN, the standardisation institute of the Netherlands. Formerly he was a member of the Advisory Board of the Graduate School of Engineering Mechanics in the Netherlands (1996 -2011) and a member of the Advisory Committee to the Faculty of Mechanical Engineering of Delft University of Technology (1996 - 2000) and the UHD committee of this Faculty (2000 – 2005).

Hetty Grunefeld has a master's degree in Computer Science from the University of Twente (1988). Since then she worked as a teacher and as educational consultant within the Faculty of Computer Science on several curriculum development and quality enhancement projects. In 1995 she started working within the Educational Centre on similar projects in e.g. Mechanical Engineering. Since 2001 she has been working as an educational development consultant at Utrecht University. She is involved in curriculum development projects and quality enhancement. She is programme leader of the prestigious course Educational Leadership that was developed by Utrecht University. She was a member of the assessment committee that evaluated the quality of the Electrical Engineering programmes (HBO, 1995) and of the committee for Economics (WO, 2009).

Elze Porte is master student Mechanical Engineering uit the University Twente. She did her bachelor programme Mechanical Engineering in Twente and a minor at the Technical University in Vienna. She has been a member of the educational committee since 2010 and a member of the committee for the restructuring of the mechanical engineering programmes since 2011. In 2011 and 2012 she has been a student assistant for the Calculus 3 course.

Paul van Houtte is professor at the Department of Metallurgy and Materials Engineering of the Katholieke Universiteit Leuven, Belgium. He did his Master of Science in Mechanical Engineering in 1970 at the Faculty of Engineering of the "Katholieke Universiteit Leuven", Belgium and his Ph. D in 1975, directed by Prof. Etienne Aernoudt, of the Department of Metallurgy of the Katholieke Universiteit Leuven were Van Houtte remained during his career. From 1975 -1977: research associate (temporary position), 1977-1988: permanent position as assistant (several ranks), 1988-present: permanent position as professor (several ranks); from 1995: Full Professor. He has been member and chair of several committees amogn which member of the evaluation commission of the Faculty of Engineering.

Marc Vantorre obtained his degree of naval architect (MSc) in 1981 and PhD titles in 1986 and 1990, all at Ghent University. Presently he holds the position of senior full professor at Ghent University (Faculty of Engineering and Architecture), where he is head of the Maritime Technology Division. He is responsible for the courses in maritime hydrostatics and hydrodynamics for students Master of Electromechanical Engineering (main subject Maritime Engineering). He also teaches courses Ship Technology and Water & Shipping on behalf of the interuniversity (UGent - UA) programmes Master of Maritime Science and Advanced Master Technology for Integrated Water Management, respectively. He is member of the Programme Committees of the mentioned master programmes. His research activities concern ship behaviour in shallow and restricted waters, including manoeuvring and vertical motions induced by waves and squat, as well as wave energy conversion. The research on the first topic is mainly performed in close co-operation with Flanders Hydraulics Research (Antwerp, Flemish Government). He is and has been member of several international working groups (PIANC, ITTC).

Appendix 2: Domain-specific framework of reference

This appendix gives a brief summary of the ABET definitions of Naval Architecture added by a summary of the OECD definitions.

1. ABET

Engineering
The American Engineers' Council for Professional Development has defined engineering as: The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behaviour under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property. We used the accreditation criteria of the Accreditation Board for Engineering and Technology (ABET) as a domain-specific qualifications framework to formulate the objectives and outcomes of the programme.

Marine Technology
Marine Technology is defined by WEGEMT (a European association of 40 universities in 17 countries) as 'technologies for the safe use, exploitation, protection of, and intervention in, the marine environment'. In this regard, according to WEGEMT, the technologies involved in marine technology are the following: naval architecture, marine engineering, ship design, ship building and ship operations; oil and gas exploration, exploitation, and production; hydrodynamics, navigation, sea surface and sub-surface support, underwater technology and engineering; marine resources (including both renewable and non-renewable marine resources); transport logistics and economics; inland, coastal, short sea and deep sea shipping; protection of the marine environment; leisure and safety.

The principal elements of naval architecture are:

• Hydrostatics
Hydrostatics concerns the conditions to which the vessel is subjected to while at rest in water and its ability to remain afloat. This involves computing buoyancy, (displacement) and other hydrostatic properties.
Trim – The measure of the longitudinal inclination of the vessel.
Stability – The ability of a vessel to restore itself to an upright position after being inclined by wind, sea, or loading conditions.
• Hydrodynamics
Hydrodynamics concerns the flow of water around the ship's hull, bow, stern and over bodies such as propeller blades or rudder, or through thruster tunnels.
Resistance – resistance towards motion in water primarily caused due to flow of water around the hull. Powering calculation is done based on this.
Propulsion – to move the vessel through water using propellers, thrusters, water jets, sails etc. Engine types are mainly internal combustion. Some vessels are electrically powered using nuclear or solar energy.
Ship motions – involves motions of the vessel in seaway and its responses in waves and wind.
Controllability (manoeuvring) – involves controlling and maintaining position and direction of the vessel.
• Structures

Involves selection of material of construction, structural analysis of global and local strength of the vessel, vibration of the structural components and structural responses of the vessel during motions in seaway.

• Arrangements

This involves concept design, layout and access, fire protection, allocation of spaces, ergonomics and capacity.

• Construction

Construction depends on the material used. When steel or aluminium is used this involves welding of the plates and profiles after rolling, marking, cutting and bending as per the structural design drawings or models, followed by erection and launching. Other joining techniques are used for other materials like fibre reinforced plastic and glass-reinforced plastic.

Incoming students

We request that all incoming students have a Bachelor's degree. The ABET document 'Criteria for Accrediting Engineering Programmes'4 describes the following student outcomes for baccalaureate level engineering and engineering technology programmes:

a. An ability to apply knowledge of mathematics, science, and engineering.
b. An ability to design and conduct experiments, as well as to analyse and interpret data.
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d. An ability to function on multidisciplinary teams.
e. An ability to identify, formulate, and solve engineering problems.
f. An understanding of professional and ethical responsibility.
g. An ability to communicate effectively.
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i. A recognition of the need for, and an ability to engage in life-long learning.
j. A knowledge of contemporary issues.
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

General criteria for Master's level Engineering programmes

The ABET document 'Criteria for Accrediting Engineering Programmes' gives the following two general criteria for Master's level programmes:

1. Master's level programmes must develop, publish, and periodically review, educational objectives and student outcomes. The criteria for Master's level programmes are fulfilment of the baccalaureate level general criteria, fulfilment of programme criteria appropriate to the Master's level specialisation area, and one academic year of study beyond the baccalaureate level. The programme must demonstrate that graduates have an ability to apply Master's level knowledge in a specialized area of engineering related to the programme area.
2. Each programme must satisfy applicable Programme Criteria (if any). Programme Criteria provide the specificity needed for interpretation of the baccalaureate level criteria as applicable to a given discipline. Requirements stipulated in the Programme Criteria are limited to the areas of curricular topics and faculty qualifications. If a programme, by virtue of its title, becomes subject to two or more sets of Programme Criteria, then that programme must satisfy each set of Programme Criteria; however, overlapping requirements need to be satisfied only once.

General criteria for Naval Architecture and Marine Engineering programmes
The ABET document also gives the following two programme criteria for Master's level Naval Architecture and Marine Engineering:

1. Curriculum
The programme must prepare graduates to apply probability and statistical methods to naval architecture and marine engineering problems; to have basic knowledge of fluid mechanics, dynamics, structural mechanics, materials properties, hydrostatics, and energy/propulsion systems in the context of marine vehicles and; to have familiarity with instrumentation appropriate to naval architecture and/or marine engineering.
2. Faculty
Programme faculty must have sufficient curricular and administrative control to accomplish the programme objectives. Programme faculty must have responsibility and sufficient authority to define, revise, implement and achieve the programme objectives.

2. OECD

The OECD offers a test, Assessment of Higher Education Learning Outcomes (AHELO), to assess Learning Outcomes on an international scale by creating measures that would be valid for all cultures and languages. It can be compared with the PISA-test for undergraduate education. AHELO gives several definitions of engineering, the following two describe the vision of the faculty 3mE very well:

• Professional engineering is not just a job – it is a mindset and sometimes a way of life. Engineers use their judgment and experience to solve problems when the limits of scientific knowledge or mathematics are evident. Their constant intent is to limit or eliminate risk. Their most successful creations recognize human fallibility. Complexity is a constant companion.
and
• Engineering is a profoundly creative process. A most elegant description is that engineering is about design under constraints. The engineer designs devices, components, subsystems, and systems and to create a successful design, in the sense that it leads directly or indirectly to an improvement in our quality of life, must work within constraints provided by technical, economic, business, political, social, and ethical issues.

Furthermore, AHELO stresses that 'The members of the engineering profession are expected to exhibit the highest standards of honesty and integrity' and also the importance of good ethical behaviour which is strongly endorsed by the Delft University of Technology.

Appendix 3: Intended learning outcomes

Final Qualifications of the Bachelor's programme Marine Technology

The goal of the Bachelor's programme Maritieme Techniek (Marine Technology) is to educate Bachelors Marine Technology (BSc) to exercise the profession of engineer at a professional academic level, who are able to:

• Identify, define and analyse problems, for the solution of which Marine Technology principles and techniques can contribute;
• Systematically design and work out a sound and safe solution;
• Effectively present this solution.

The programme shall ensure admittance to connecting Master's programmes.

In line with the TU Delft Profile for an Academic Engineer and the DSRK the following final qualifications have been defined, which serve to achieve the goal of the Bachelor's programme 'Maritieme Techniek':

The graduated Bachelor of Science Marine Technology has, to a sufficient extent, the following qualities:

1. A broad and profound knowledge of the fundamental engineering sciences, which form the basis of Marine Technology (solid and fluid mechanics, materials science and mathematics), as well as some basic knowledge of related fields (thermodynamics, control engineering, electricity, magnetism, information technology), to such a level that entrance can be obtained to internationally accredited Master of science programmes Marine Technology and Naval Architecture. The ability to apply this knowledge to design marine systems.
2. Basic technical scientific knowledge of the most important Marine Technology disciplines: maritime operations, design of ships and offshore systems, ship hydromechanics, ship structures, marine engineering and production. The ability to apply this knowledge to design such systems.
3. Basic knowledge of methods and tools for modelling, simulating, designing and executing experiments and research on marine systems. The ability to apply this knowledge.
4. The capability to contribute to the solution of technological problems by a systematic scientific approach. This includes the analysis, the definition of innovative solutions, the evaluation of the feasibility, the recognition and acquisition of missing knowledge, as well as recognition of the relativity and limitations of knowledge and the working out of the solution.
5. The capability of working individually as well as in (multidisciplinary) teams, taking initiatives where necessary.
6. The capability to effectively communicate (including presenting and reporting) about one's work with regard to information, problems, ideas and solutions to both professionals and non-specialised public.
7. The capability to evaluate and assess the technological, societal and ethical impact of one's work and to take responsibility with regard to sustainability, economy and social well-being. The ability to gather and interpret relevant information.
8. The ability to maintain and extend one's competences by permanent self study, with a high degree of autonomy.

Below an elaboration of the abovementioned final qualifications is given in its original Dutch form. This specifies the competences of the graduated Bachelor 'Maritieme Techniek' for each final qualification in more detail. The elaboration has been the basis for the courses within the major Marine Technology (150 EC) and the learning goals for each course.

Uitgewerkte eindtermen voor de major Maritieme Techniek (150 EC)
De bovengenoemde eindtermen zijn hieronder uitgewerkt. Deze uitwerking vormt de basis voor het vaststellen van de leerdoelen per curriculumonderdeel.

1. Brede en grondige kennis van de fundamentele ingenieurswetenschappen, die de basis van de Maritieme Techniek vormen (mechanica, stromingsleer, materiaalkunde en wiskunde), evenals enige basiskennis van aangrenzende gebieden (thermodynamica, regeltechniek, elektriciteit, magnetisme, informatica), op een zodanig niveau dat toegang verkregen kan worden tot internationaal geaccrediteerde masteropleidingen 'Marine Technology' en 'Naval Architecture'. Deze kennis actief kunnen toepassen op maritieme systemen.
1.1. mechanica: krachten, spanningen en vervormingen bepalen en beoordelen in zowel statisch bepaalde als statisch onbepaalde 2D en 3D constructies (bestaande uit staven, balken, platen, volume-elementen) voor lineair-elastische isotrope en anisotrope materialen, voor geometrisch lineair en niet-lineair gedrag (instabiliteit van balk en plaatconstructies) en plastisch materiaalgedrag; het dynamische gedrag van massapunten en starre lichamen in 2D en 3D bepalen en de daarbij behorende krachten; het trillingsgedrag van discrete mechanische systemen met één en meerdere vrijheidsgraden modelleren en oplossen; het trillingsgedrag voor continue mechanische systemen, zoals staaf, as, snaar en balk modelleren en oplossen; principes en structuur van eindige elementen programmatuur.
1.2. stromingsleer: integrale en differentiale behoudswetten voor massa impuls en energie toepassen; verschillende soorten stroming (laminair, turbulent, compressibel, niet-compressibel stationair, niet-stationair rond en langs lichamen, openwater) beschrijven; dimensieanalyse toepassen; stromingsberekeningen uitvoeren; eigenschappen en prestaties van roterende stromingsmachines (compressoren, pompen, turbines) afleiden en toepassen;
1.3. materiaalkunde: inzicht in (micro)structuren, mechanische en fysische eigenschappen, corrosie en degradatie, productie en verwerking (vervormbaarheid, bewerkbaarheid) van materialen, zowel voor metalen als composieten; inzicht in de invloed van bewerkingsprocessen (lassen, branden, vervormen) op materiaaleigenschappen; op basis van die kennis een verantwoorde materiaalkeuze doen
1.4. wiskunde: calculus, lineaire algebra, gewone en partiële differentiaalvergelijkingen en statistiek tot een zodanig niveau dat voldoende wiskundekennis en vaardigheden aanwezig zijn om de eindtermen in de fundamentele vakgebieden te realiseren. Dit betreft o.a.: stelsels lineaire vergelijkingen oplossen, kleinste kwadraten methode toepassen, numerieke methoden toepassen om stelsels op te lossen; eigenwaarden en eigenvectoren bepalen; kwadratische vergelijkingen oplossen; lineariseren; differentiëren, partieel differentiëren; enkelvoudig en meervoudig integreren; complexe rekenwijze toepassen; vector operaties uitvoeren; analytisch limieten bepalen o.a. d.mv. reeksontwikkeling; functies benaderen met Taylor reeksen; minima en maxima van functies bepalen; lineaire, niet-lineaire en partiële differentiaal oplossen; stelsels van 1e orde lineaire differentiaal vergelijkingen oplossen; impliciete en expliciete partiële differentiaalvergelijkingen oplossen; op basis van kansdefinitie en kansverdeling , verzamelen, analyseren en conclusies (inclusief betrouwbaarheidsintervallen) trekken uit gegevens
1.5. thermodynamica: de verschillende vormen van energie (inwendige, warmte, arbeid, elektrische, potentiële, kinetische) beschrijven; thermodynamische grootheden en begrippen beschrijven, bepalen en toepassen; ideaal en niet-ideaal gedrag van gassen beschrijven en toepassen; 1e en 2e hoofdwet van thermodynamica beschrijven en toepassen;

thermodynamische systemen (inclusief kringprocessen) op basis van de controle volume methode, van behoud van massa en energie beschrijven, analyseren en optimaliseren
1.6. regeltechniek: dynamisch gedrag van systemen beschrijven met behulp van overdrachtsfuncties en het beïnvloeden van het systeemgedrag door middel van regelen; stabiliteit van systemen bepalen; klassieke P-, PI-, PD- en PID-regelaars beschrijven en instellen.
1.7. elektrotechniek, magnetisme: kennis van elektriciteitsleer en magnetisme, zodanig dat de werking en eigenschappen van elektrische machines en sensoren kan worden begrepen.
1.8. informatica: kennis van computerarchitectuur o.a.: hardware, software, compileren, executeren, broncode, objectcode; voor programmeren zie 3.6.

2. Basis technisch-wetenschappelijke kennis van de belangrijkste maritieme disciplines: maritieme operaties, ontwerpen van schepen en offshore systemen, scheepshydromechanica, constructieleer, maritieme werktuigkunde en productie. Deze kennis actief kunnen toepassen voor het ontwerpen van dergelijke systemen.
2.1. maritieme operaties: de rol en de betekenis van de verschillende soorten bedrijven en spelers uit de maritieme sector en hun onderlinge relaties; marktwerking, scheepvaarteconomie en juridische aspecten; opzet en analyse van eenvoudige maritieme vervoersconcepten; kostenberekeningen.
2.2. ontwerpen van schepen en offshore systemen: ontwerpen en conceptontwikkeling van schepen, offshore systemen en/of delen daarvan, inclusief analyse van markt en rederseisen; keuze van rompvorm en hoofdafmetingen; beoordeling van stabiliteit, belasting en sterkte, veiligheid; schatting van gewichten, volumes en oppervlakken; weerstand en voortstuwing; lay-out; beladingcondities; zeegang en manoeuvreereigenschappen; anatomie van veel voorkomende scheepstypen hun eigenschappen en toepassingen; offshore exploratie en exploitatie, typen en eigenschappen van mobiele platforms; ontwerpmethodieken en ontwerpgereedschappen; systematische rompvormen, transformatie van rompvormen; vastleggen van conceptueel ontwerp in algemeen plan en bestek (specificaties); toepassen van klassevoorschriften; bekendheid met juridische aspecten, milieu eisen; visualisering van concepten; esthetische vormgeving.
2.3. scheepshydromechanica: ontwerp van rompvorm, rompindeling en voortstuwers rekening houdend met: stabiliteit, weerstand en voortstuwingsgedrag, manoeuvreergedrag en scheepsbewegingen; nationale en internationale (IMO) regelgeving op gebied van scheepshydromechanica en veiligheid; ontwerp van lijnenplan; berekening van hydrostatische gegevens, intacte stabiliteit en lekstabiliteit, zowel statisch als dynamisch, invloed van scheepssnelheid, golven, wind en vrije vloeistofoppervlakken; waterdichte indeling; 3D-potentiaaltheorie; viskeuze stroming; berekenen en meten (modelschaal) van weerstand van schepen, onderscheid tussen wrijving, vorm en golfweerstand; schaalregels, dimensieanalyse, Reynolds en Froude getal; schroefgeometrie, actuator disk theorie, schroefontwerp met behulp van systematische diagrammen, interactie tussen voortstuwer en romp; cavitatie; berekenen van dynamisch gedrag van schepen in regelmatige en onregelmatige golven; bewegingsvergelijkingen voor 6 graden van vrijheid; golfkarakteristieken; bewegingsvergelijkingen voor manoeuvreergedrag van schepen, koersstabiliteit.
2.4. constructieleer: (conceptuele) constructieve ontwerp van een schip of platform maken; functies van constructieve elementen onderkennen, waaronder verbindingstechnieken; constructie modelleren tbv berekening; toepassen van klassevoorschriften; uitwerken van de langsscheepse sterkte; berekenen van het langsscheepse bezwijkmoment; toepassen van de theorie voor (orthotrope) platen die in of loodrecht op hun vlak belast zijn, inclusief permanente vervorming tgv grote laterale belasting; kniksterkte van verstijfde plaatvelden berekenen en naknikgedrag beschrijven; torsiesterkte van dunwandige doorsneden berekenen;

lange termijn verdeling van belastingen vaststellen en de evaluatie ervan; faalmechanismen (vermoeiing, scheurgroei en brosse breuk) onderkennen en in ontwerp betrekken; toepassen van de betrouwbaarheidsbenadering op de sterkte; berekenen van de eigenfrequenties en trilvormen van de scheepsromp in water.

2.5. maritieme werktuigkunde: voortstuwingsystemen en elektriciteitsopwekkinginstallaties ontwerpen; schatten van voortstuwing en elektrische vermogens (elektrische balans); karakteristieken van aandrijvende machines (inclusief elektrische machines) en voortstuwers; thermodynamische grondslagen van aandrijvende machines; transmissie-installaties beschrijven; afstemming van aandrijvende machine met voortstuwer; regelbare elektrische aandrijvingen; off design condities van voortstuwingsinstallaties berekenen; lay out hulpsystemen ontwerpen; werken met karakteristieken van hulpwerktuigen (pomp versus systeem); zuighoogte (NPSH) en systeemberekeningen maken; afvalwarmtebenuttings-systemen conceptueel ontwerpen; koelinstallaties en luchtbehandelingssystemen conceptueel ontwerpen.

2.6. productie: plaats, rol en omvang van de scheepsbouw in de economie; bewerkings-, fabricage- en assemblageprocessen op een scheepswerf; toepassing van planningstechnieken; werkvoorbereiding, logistiek, besturing en integratie van de productieprocessen; kenmerken van massa-, serie- en enkelproductie; toegepaste materialen en consequenties voor de productieprocessen; materiaalbeheer; lasprocessen; te water laten van schepen; kenmerken van scheepsreparatie; lay-out, inrichting en uitrusting van een scheepswerf.

3. Basiskennis van methodes en gereedschappen voor het modelleren, simuleren, ontwerpen en uitvoeren van experimenten en onderzoek van/aan maritieme systemen. Het actief kunnen toepassen van deze kennis.

3.1. kennis van en vaardigheid met de toepassing van methodes en gereedschappen voor rapportage, presentatie, uitvoeren van berekeningen, dataopslag en verwerking, zoeken van informatie op het www, in databases en in bibliotheken.

3.2. visualiseren van maritieme systemen en onderdelen in 2D en 3D met behulp van handschetsen en CAD software, het genereren van productie informatie hiermee.

3.3. methodes om het ontwerp en engineeringproces op een systematische wijze vorm te geven en uit te voeren, waaronder fasering en te gebruiken methodes en technieken.

3.4. onderzoeksmethodologie om onderzoek op systematische wijze vorm te geven en uit te voeren, waaronder uitwerking van de vraagstelling, formulering van hypotheses, opzet en uitvoering van het onderzoek, interpretatie van de resultaten.

3.5. opzetten en uitvoeren van experimenten, het gebruik van moderne data acquisitie en verwerkingssystemen, interpretatie van de resultaten.

3.6. de oplossing voor een probleem vertalen in een algoritme en uitwerken in een computerprogramma met behulp van een moderne object georiënteerde programmeertaal.

3.7. rekenproblemen en simulaties (numeriek) uitvoeren met een modern software pakket.

3.8. statisch en dynamisch lineair elastische analyses aan constructies uitvoeren, inhoudende het plannen, modelleren, uitvoeren en interpreteren van de resultaten met behulp van een modern eindig elementen pakket; zich de beperkingen realiseren van de gekozen modellering.

4. Een bijdrage kunnen leveren aan het oplossen van technologische problemen door een systematische wetenschappelijke aanpak. Dit betreft de analyse, het definiëren van innovatieve oplossingen, het onderkennen van de haalbaarheid, het onderkennen en verwerven van ontbrekende kennis, evenals de betrekkelijkheid en de beperkingen van de kennis onderkennen en de uitwerking van de oplossing.

4.1. systematisch analyseren van problemen, waaronder ontwerpopdrachten en onderzoekvragen; het interpreteren van de analyseresultaten.

4.2. concipiëren van alternatieve en innovatieve oplossingen voor de vraagstelling.

4.3. onderzoeken van de technische, economische en maatschappelijke haalbaarheid van de oplossingen en het beargumenteerd maken van een keuze.
4.4. uitwerken van de gekozen oplossing tot een zodanig niveau dat implementatie kan plaatsvinden.

5. Vermogen zowel individueel als in (multidisciplinaire) teams te werken, waar nodig het nemen van initiatief.
5.1. zowel individuele opdrachten als opdrachten in teamverband uitvoeren.
5.2. projectvaardigheden verwerven waaronder planningen opstellen en bewaken, vergaderen, taken verdelen en coördineren, onderhandelen, omgaan met conflicten, eigen en andermans sterke en zwakke punten onderkennen.
5.3. uitvoeren van opdrachten met aanvankelijk goed gedefinieerde probleemstelling maar in latere fasen ook met een vage beperkt gedefinieerde probleemstelling, waarvoor de kennis en nodige informatie nog verworven moet worden.

6. Effectief kunnen communiceren (waaronder presenteren en rapporteren) over hun werk, t.a.v. informatie, problemen, ideeën en oplossingen aan zowel de professionele collegae als aan een niet-specialistisch publiek.
6.1. goed gestructureerde Nederlandstalige presentaties voor verschillende doelgroepen verzorgen met gebruik van state of the art presentatietechnieken.
6.2. schrijven van goed gestructureerde en heldere Nederlandstalige rapporten.
6.3. verworven kennis en resultaten van eigen werk helder en overtuigend overdragen aan anderen.

7. Kunnen evalueren van de technologische, maatschappelijke en ethische gevolgen van hun werk en de verantwoordelijkheid nemen met betrekking tot duurzaamheid, economie en sociale welzijn. In staat zijn om relevante informatie te verzamelen en interpreteren.
7.1. duurzame ontwikkeling beschrijven en operationaliseren waaronder schaarste, milieuproblematiek, duurzaam energie- en grondstoffengebruik, rol van de techniek daarin.
7.2. morele problemen onderkennen; beargumenteren welke actoren daarbij een rol spelen en de rol van een ingenieur; normatieve en feitelijke beweringen; wettelijke, technische en morele eisen; zuiver argumenteren.
7.3. veiligheidsrisico's kwalitatief en kwantitatief bepalen; methoden om veiligheidsrisico's in te perken.
7.4. economische haalbaarheid van technische oplossingen beoordelen.
7.5. Nederlandse en Engelse literatuur lezen, interpreteren en samenvatten; idem bij mondelinge communicatie.

8. Het op peil houden en uitbreiden van de eigen competenties door permanente zelfstudie, met een hoog niveau van autonomie.
8.1. zich realiseren dat ontwikkelingen op gebied van wetenschap, techniek, methoden en gereedschappen in hoog tempo gaan.
8.2. noodzaak voor eigen verdere ontwikkeling onderkennen.

Final Qualifications of the Master's programme Marine Technology

The goal of the Master's programme Marine Technology is to educate graduates Marine Technology (MSc) to exercise the profession of engineer at a professional academic level. The level corresponds to the technological borders of a specific discipline.

The graduates are capable:

• To identify, define and analyse problems, for the solution of which principles and techniques of Marine Technology can contribute;
• To design and produce a sound solution to the problem;
• To present these solutions effectively.

In line with the TU Delft Profile for an Academic Engineer and the DSRK, the following final qualifications have been defined, which serve to achieve the goal of the Master's programme Marine Technology:

The graduated Master of Science Marine Technology meets, to a sufficient level, the following qualifications:
1. A broad and profound knowledge of engineering sciences (applied physics and mathematics), relevant to a specific marine technology discipline and the capability to apply this knowledge at an advanced level in that discipline.
2. Broad and profound scientific and technical knowledge of the discipline and the capability to use this knowledge effectively. The discipline is Mastered at different levels of abstraction, including a reflective understanding of its structure and relations to other fields, and reaching in part the forefront of scientific or industrial research and development. The knowledge is the basis for innovative contributions to the discipline in the form of new designs or development of new knowledge.
3. Thorough knowledge of paradigms, methods and tools as well as the skills to actively apply this knowledge for analysing, modelling, simulating, designing and performing research with respect to innovative discipline related systems, with an appreciation of different application areas.
4. The capability to independently solve technological problems in a systematic way involving problem analysis, formulating sub problems, providing innovative technical solutions, in known as well as in new and unfamiliar situations. This includes a professional attitude towards identifying and acquiring lacking expertise, monitoring and critically evaluating existing knowledge, planning and executing research, adapting to changing circumstances, and integrating new knowledge with an appreciation of its ambiguity, incompleteness and limitations.
5. The capability of working both independently and in (multidisciplinary) teams, taking initiatives where necessary.
6. The capability to effectively communicate (including presenting and reporting) to both professionals and a non-specialised public in the English language about one's work, such as solutions to problems, conclusions, knowledge and considerations.
7. The capability to evaluate and assess the technological, ethical and societal and impact of one's work, taking responsibility with regard to sustainability, economy and social well-being. The capability to come to conclusions with incomplete and limited information.
8. The attitude to independently maintain professional competence through life-long learning.
These final qualifications have the same structure as those for the Bachelor's programme, but are differing both with respect to domain specific and general qualifications.

The Master's programme is offered in two different tracks:

• Design Production and Operation (DPO)
• Science (Sc)

A track covers a cluster of specialisations within the study programme. For each track a coherent curriculum has been defined. Within a track it is possible to carry out the Master's thesis project under the guidance of one of the professors that have their speciality within the field of the track. This leads to a large number of different specialisations. These tracks with specialisations are described in the study guide. For each track the final qualifications have been elaborated in more detail. The elaborated final qualifications are given next. They show the competences of the graduated Master of Science in Marine Technology. The elaborated final qualifications are the basis for the compulsory courses within each track and the learning goals of each course.

Final Qualifications of the track Science within the Master's programme 'Marine Technology'
The goal of the Master's programme Marine Technology is to educate graduates in Marine Technology to an academic engineering level. The level corresponds to the technological borders of a specific discipline. The graduates are capable:

- To identify, define and analyse problems, for the solution to which marine-technology principles and techniques can contribute;
- To develop and to produce a sound solution to the problem;
- To present these solutions effectively.

The track Science comprises following Specialisations:

- Ship Hydromechanics, including Offshore Units

This specialisation covers the hydromechanics of vessels and other floating objects as a synthesis of ship form, the marine environment, economics, technical restrictions from strength, stability and production, etc.

- Ship Resistance and Propulsion

This specialisation covers all subjects related to determining the resistance and propulsion of new building, modification, repair, of ships and other floating marine objects.

- Ship and Offshore Structures, Strength and Vibration

This specialisation concentrates on construction, strength and vibrations of the ships and other floating objects in relation to global and local response of the structure in the marine environment.

The graduated Master of Marine Technology in the track Science meets, to a sufficient level, the following qualifications:

1. Broad and profound knowledge of engineering sciences (applied physics and mathematics) and the capability to apply this knowledge at an advanced level in the disciplines of the track Science.
2. Broad and profound scientific and technical knowledge of the disciplines in the track Science and the skills to use this knowledge effectively. The disciplines are Mastered at different levels of abstraction, including a reflective understanding of its structures and relations to other fields, and reaching in part the forefront of scientific or industrial research and development. The knowledge is the basis for innovative contributions to the discipline in the form of new designs or development of new knowledge.
3. Thorough knowledge of paradigms, methods and tools as well as the skills to actively apply this knowledge for analysing, modelling, simulating, designing and performing research with respect to innovative systems in Science. with an appreciation of different application areas.
4. Capability to independently solve technological problems in a systematic way involving problem analysis, formulating sub-problems and providing innovative technical solutions,

also in new and unfamiliar situations. This includes a professional attitude towards identifying and acquiring lacking expertise, monitoring and critically evaluating existing knowledge, planning and executing research, adapting to changing circumstances, and integrating new knowledge with an appreciation of its ambiguity, incompleteness and limitations.
5. Capability to work both independently and in multidisciplinary teams, interacting effectively with specialists and taking initiatives where necessary. 6. Capability to effectively communicate (including presenting and reporting) about one's work such as solutions to problems, conclusions, knowledge and considerations, to both professionals and non-specialised public in the English language.
7. Capability to evaluate and assess the technological, ethical and societal impact of one's work, and to take responsibility with regard to sustainability, economy and social wellbeing.
8. Attitude to independently maintain professional competence through life-long learning.

Elaborated final qualifications of the track Science within the Master's programme Marine Technology
For defining the specific goals per subject within this Master's track, the above-mentioned final qualifications have been worked out as follows:

1. Broad and profound knowledge of engineering sciences (applied physics, mathematics, etc.) and the capability to apply this knowledge at an advanced level in the discipline Science,
-- The required knowledge has been obtained in a Bachelor or pre-Master's programme.

2. Broad and profound scientific and technical knowledge of the discipline of Science and the skills to use this knowledge effectively. The discipline is Mastered at different levels of abstraction, including a reflective understanding of its structure and relations to other fields, and reaching in part the forefront of scientific or industrial research and development. The knowledge is the basis for innovative contributions to the discipline in the form of new designs or development of new knowledge.
2.1 For all specifications:
-- Knowledge of different hydrodynamic and structural calculation techniques, knowledge types, knowledge representation and knowledge engineering. Ability to apply knowledge engineering in marine technology.
-- Knowledge of hydrodynamic and structural model testing for marine applications and the ability to apply the basics of computer based measuring and control. Ability to analyse and interpret the performance of a model system.
-- Knowledge of existing technology and recent advances in Science related to hydrodynamics, ship resistance and propulsion, ship and offshore structures, strength, fatigue life and ship vibrations.
2.2 Specific for specialisation Hydromechanics of Ships and floating structures.
-- Further knowledge and in depth understanding of ship motions, ship manoeuvring, hydrodynamic theory, numerical methods and physical aspects thereof.
-- Knowledge of model facilities (model scale laws, lay-out, measuring equipment etc.) and model testing procedures in a sustainable way.
-- Understanding the complexity of Ship Hydromechanics and the ability to apply the latest developments in the field.
-- Knowledge of advanced engineering methods, i.e. CFD etc., and simulation methods.
-- Ability to develop appropriate vessel forms i.e. by simulation techniques in innovative designs.
2.3 Specific for specialisation Ship Resistance and Propulsion
-- Further knowledge and in depth understanding of ship resistance and propulsion, related theory, numerical methods and physical aspects thereof.

-- Knowledge of model facilities (model scale laws, lay-out, measuring equipment etc.) and model testing procedures in a sustainable way.
-- Understanding the complexity of Ship Resistance and Propulsion and the ability to apply the latest developments in the field.
-- Knowledge of advanced engineering methods, i.e. CFD etc., and simulation methods.
-- Ability to develop appropriate vessel forms and propulsors, i.e. by simulation techniques in innovative designs.
2.4 Specific for Ship and Floating Structures, Construction, Strength, fatigue and Vibration
-- Knowledge of existing methods and procedures to determine a ship's construction, her strength, fatigue life and vibration levels. Ability to develop appropriate calculation methods and strategies, taking into account global and local loading, the maritime environment, materials etc.
-- Knowledge of basic concepts of ship and offshore structures systems, ship strength, fatigue life evaluation and vibration levels and the ability to design and apply these concepts in innovative designs.

3. Thorough knowledge of paradigms, methods and tools as well as the skills to actively apply this knowledge for analysing, modelling, simulating, designing and performing research with respect to innovative systems for Science with an appreciation of different application areas.
3.1 Ability to apply methods, tools and techniques based on existing knowledge from the BSc programme in an advanced and more profound way to obtain engineering solutions or in research in the discipline Science.

4. Capability to independently solve technological problems in a systematic way involving problem analysis, formulating sub-problems and providing innovative technical solutions, also in new and unfamiliar situations. This includes a professional attitude towards identifying and acquiring lacking expertise, monitoring and critically evaluating existing or developing new knowledge, planning and executing research, adapting to changing circumstances, and integrating new knowledge with an appreciation of its ambiguity, incompleteness and limitations.
4.1. Capability to decompose complex problems into sub-problems, to analyse these subproblems and formulate innovative solutions, and to interpret the results in terms of the overall problem formulation. This includes the ability to detect and reformulate ill-posed research and design problems and to suggest remedies.
4.2. Capability to independently formulate and execute a research or design plan, and to steer adaptations if required by technological developments within the discipline or by changing external circumstances.
4.3. Capability to conceive knowledge gaps and to independently acquire expertise through studying the scientific literature on the discipline and/or to acquire this knowledge through other experts. Skill to contribute to the development of scientific knowledge or to design techniques in the area of specialisation.
4.4. Capability to conceive alternative and innovative solutions to discipline-related problems, including the ability to work out the chosen solution up to the level of real-life implementation.

5. Capability to work both independently and in multidisciplinary teams, interacting effectively with specialists and taking initiatives where necessary.
5.1. Capability to work independently and in teams on problems of high technological and/or scientific complexity.
5.2. Capability to set up and maintain a plan, to delegate and to coordinate tasks, to negotiate and handle conflicts, to recognise strong and weak points of themselves and of others

5.3. Capability to handle tasks which initially seem straightforward, but at a later stage require additional knowledge.
6. Capability to effectively communicate (including presenting and reporting) about one's work such as solutions to problems, conclusions, knowledge and considerations, to both professionals and non-specialised public in the English language.
6.1. Give well-structured presentations for different audiences using state-of-the-art presentation techniques.
6.2. Write well-structured and clear reports and contributions to scientific papers.
6.3. Convey acquired knowledge and results to others in a clear and convincing way.
6.4. Read, interpret and summarise literature; idem for verbal communication.

7. Capability to evaluate and assess the technological, ethical and societal impact of one's work, and to take responsibility with regard to sustainability, economy and social well-being.
7.1. Describe and implement sustainable development.
7.2. Recognise moral issues, argue who play a role in these and be aware of his / her own position.
7.3. Assess safety risks both qualitatively and quantitatively; methods for reducing safety risks.
7.4. Analyse and assess the technical, economic and social feasibility of engineering solutions.

8. Attitude to independently maintain professional competence through life-long learning.
8.1. Awareness of the (historic) development of the discipline, of its technological and scientific boundaries, and consequently of the necessity of life-long learning to maintain the desired level.

Final Qualifications of the track Design, Production and Operation within the Master's programme Marine Technology
The goal of the Master's programme Marine Technology is to educate graduates in Marine Technology to an academic engineering level. The level corresponds to the technological borders of a specific discipline. The graduates are capable:

- To identify, define and analyse problems, for the solution to which marine-technology principles and techniques can contribute;
- To develop and to produce a sound solution to the problem;
- To present these solutions effectively.

The track Design, Production and Operation comprises following Specialisations:

- Ship Design, including Offshore Units Design

Covers the design of vessels and other floating objects as a synthesis of requirements from the owner, the marine environment, economics, technical restrictions from strength, stability and production, application of mechanical and electrical engineering, etc.

- Marine Engineering

Covers the design, installation and operational use of all mechanical and electrical systems on board of a ship.

- Ship Production

Covers all subjects related to new-building, modification, repair, maintenance and scrapping of ships and other floating marine objects.

- Shipping Management, in co-operation with Antwerp University

This specialisation concentrates on the use of the ship in relation to global trade developments, supply and demand of cargo, marketing, fleet management, economic feasibility and innovation in shipping.

The graduated Master of Marine Technology in the track Design, Production and Operation meets, to a sufficient level, the following qualifications:

1. Broad and profound knowledge of engineering sciences (applied physics and mathematics) and the capability to apply this knowledge at an advanced level in the disciplines of the track Design, Production and Operation.
2. Broad and profound scientific and technical knowledge of the disciplines in the track Design, Production and Operation and the skills to use this knowledge effectively. The disciplines are mastered at different levels of abstraction, including a reflective understanding of its structures and relations to other fields, and reaching in part the forefront of scientific or industrial research and development. The knowledge is the basis for innovative contributions to the discipline in the form of new designs or development of new knowledge.
3. Thorough knowledge of paradigms, methods and tools as well as the skills to actively apply this knowledge for analysing, modelling, simulating, designing and performing research with respect to innovative systems in Design, Production and Operation, with an appreciation of different application areas.
4. Capability to independently solve technological problems in a systematic way involving problem analysis, formulating sub-problems and providing innovative technical solutions, also in new and unfamiliar situations. This includes a professional attitude towards identifying and acquiring lacking expertise, monitoring and critically evaluating existing knowledge, planning and executing research, adapting to changing circumstances, and integrating new knowledge with an appreciation of its ambiguity, incompleteness and limitations.
5. Capability to work both independently and in multidisciplinary teams, interacting effectively with specialists and taking initiatives where necessary.
6. Capability to effectively communicate (including presenting and reporting) about one's work such as solutions to problems, conclusions, knowledge and considerations, to both professionals and non-specialised public in the English language.
7. Capability to evaluate and assess the technological, ethical and societal impact of one's work, and to take responsibility with regard to sustainability, economy and social well-being.
8. Attitude to independently maintain professional competence through life-long learning.

Elaborated final qualifications of the track Design, Production and Operation within the Master's programme Marine Technology
For defining the specific goals per subject within this Master's track, the above-mentioned final qualifications have been worked out as follows:

1. Broad and profound knowledge of engineering sciences (applied physics, mathematics, etc.) and the capability to apply this knowledge at an advanced level in the discipline Design, Production and Operation.
-- The required knowledge has been obtained in a Bachelor or pre-Master's programme.

2. Broad and profound scientific and technical knowledge of the discipline of Design, Production and Operation and the skills to use this knowledge effectively. The discipline is Mastered at different levels of abstraction, including a reflective understanding of its structure and relations to other fields, and reaching in part the forefront of scientific or industrial research and development. The knowledge is the basis for innovative contributions to the discipline in the form of new designs or development of new knowledge.
2.1 For all specifications:
-- Knowledge of different design techniques, knowledge types, knowledge representation and knowledge engineering. Ability to apply knowledge engineering in marine technology.

-- Knowledge of mechatronics for marine applications and the ability to apply the basics of computer based measuring and control. Ability to analyse and interpret the performance of a simple mechatronic system.
-- Knowledge of modern project management techniques and the ability to apply these techniques for complex projects in Design, Production and Operation of floating vehicles.
-- Ability to develop a sound strategy for a maritime company and to analyse and interpret financial results, also under influence of changes in the maritime business dynamics.
-- Knowledge of common legal procedures and regulations applicable in engineering and in maritime oriented business and the ability to apply this knowledge on a level to understand professional lawyers.
2.2 Specific for specialisation Design of Ships, Offshore Units Design and Marine Engineering.
-- Knowledge of existing and recent advances in hydromechanics, loads and strength of structures, propulsion and auxiliary systems, safety and protection of the environment, economic analysis, etc.
-- Understanding the complexity of designing marine vehicles and the ability to apply contemporary design methods to obtain a suitable design taking into account the owners requirements and technical, environmental and other restrictions.
-- Knowledge of advanced design- and optimisation methods.
-- Knowledge of (international) rules and regulations, its backgrounds, use of FSA in rulemaking as well as design methods based on "first principles" and goal based standards.
2.3 Specific for specialisation Ship Production
-- Knowledge of existing technology and recent advances in engineering and production to order.
-- Knowledge of production facilities (lay-out, equipment) and production processes (materials management, -handling and- preparation, cutting and joining techniques, planning and control, job preparation, purchase, logistics, etc.)
-- Understanding the complexity of engineering for production to order and the ability to apply the latest developments in adequate and effective working methods and organisation.
-- Knowledge of advanced engineering and production processes, e.g. concurrent and collaborative engineering, co-makership, product data management, virtual manufacturing (simulation) and robotization.
-- Knowledge of existing methods and procedures to structure and to manage a shipyard in a sustainable way, including economic and financial management. Ability to develop appropriate business strategies, i.e. by simulation techniques.
2.4 Specific for specialisation Shipping Management
-- Knowledge of existing methods and procedures to structure and to manage a shipping company in a sustainable way, including economic and financial management. Ability to develop appropriate business strategies, taking into account global trade developments, supply and demand of cargo, marketing and (required) fleet constellation.
-- Knowledge of basic concepts of transport systems and logistics of integrated systems and chains and the ability to design and apply these concepts.

3. Thorough knowledge of paradigms, methods and tools as well as the skills to actively apply this knowledge for analysing, modelling, simulating, designing and performing research with respect to innovative systems for Design, Production and Operation, with an appreciation of different application areas.
3.1 Ability to apply methods, tools and techniques based on existing knowledge from the Bachelor's programme in an advanced and more profound way to obtain optimum designs, efficient production processes, economic operations or in research in the discipline Design, Production and Operation.

4. Capability to independently solve technological problems in a systematic way involving problem analysis, formulating sub-problems and providing innovative technical solutions, also in new and unfamiliar situations. This includes a professional attitude towards identifying and acquiring lacking expertise, monitoring and critically evaluating existing or developing new knowledge, planning and executing research, adapting to changing circumstances, and integrating new knowledge with an appreciation of its ambiguity, incompleteness and limitations.
4.1. Capability to decompose complex problems into sub-problems, to analyse these subproblems and formulate innovative solutions, and to interpret the results in terms of the overall problem formulation. This includes the ability to detect and reformulate ill-posed research and design problems and to suggest remedies.
4.2. Capability to independently formulate and execute a research or design plan, and to steer adaptations if required by technological developments within the discipline or by changing external circumstances.
4.3. Capability to conceive knowledge gaps and to independently acquire expertise through studying the scientific literature on the discipline and/or to acquire this knowledge through other experts. Skill to contribute to the development of scientific knowledge or to design techniques in the area of specialisation.
4.4. Capability to conceive alternative and innovative solutions to discipline-related problems, including the ability to work out the chosen solution up to the level of real-life implementation.

5. Capability to work both independently and in multidisciplinary teams, interacting effectively with specialists and taking initiatives where necessary.
5.1. Capability to work independently and in teams on problems of high technological and/or scientific complexity.
5.2. Capability to set up and maintain a plan, to delegate and to coordinate tasks, to negotiate and handle conflicts, to recognise strong and weak points of themselves and of others.
5.3. Capability to handle tasks which initially seem straightforward, but at a later stage require additional knowledge.

6. Capability to effectively communicate (including presenting and reporting) about one's work such as solutions to problems, conclusions, knowledge and considerations, to both professionals and non-specialised public in the English language.
6.1. Give well-structured presentations for different audiences using state-of-the-art presentation techniques.
6.2. Write well-structured and clear reports and contributions to scientific papers.
6.3. Convey acquired knowledge and results to others in a clear and convincing way.
6.4. Read, interpret and summarise literature; idem for verbal communication.

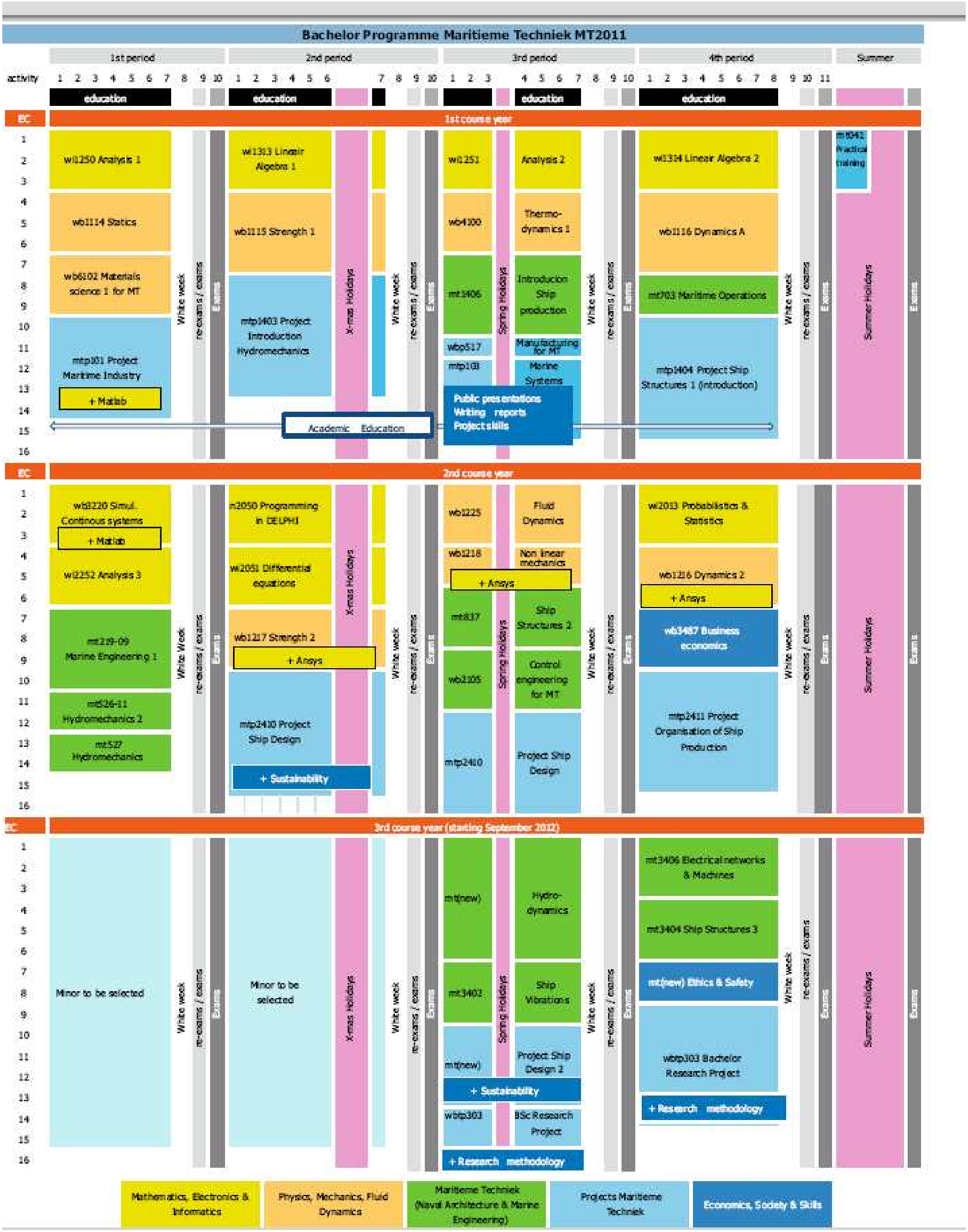
7. Capability to evaluate and assess the technological, ethical and societal impact of one's work, and to take responsibility with regard to sustainability, economy and social wellbeing.
7.1. Describe and implement sustainable development.
7.2. Recognise moral issues, argue who play a role in these and be aware of his / her own position.
7.3. Assess safety risks both qualitatively and quantitatively; methods for reducing safety risks.
7.4. Analyse and assess the technical, economic and social feasibility of engineering solutions.

8. Attitude to independently maintain professional competence through life-long learning.

8.1. Awareness of the (historic) development of the discipline, of its technological and scientific boundaries, and consequently of the necessity of life-long learning to maintain the desired level.

Appendix 4: Overview of the curricula

Bachelor programme Marine Technology



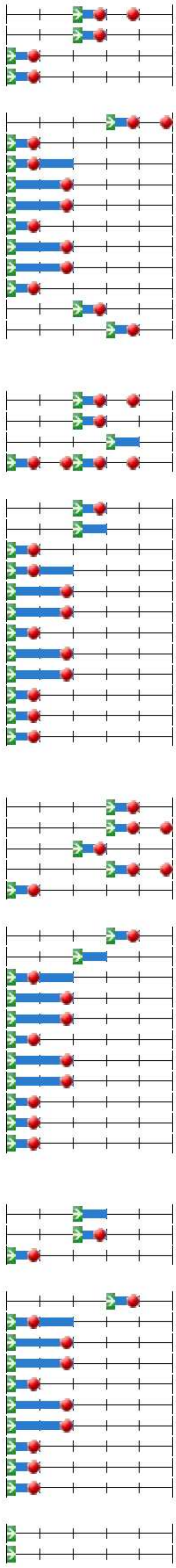
Program overview

28-Nov-2012 15:37

Year	**2012/2013**
Organization	**Werktuigbouwkunde, Maritieme Techniek & Technische Materiaalwetenschappen**
Education	**Master Marine Technology**

Code	Omschrijving	ECTS	p1 | p2 | p3 | p4 | p5
Master MT 2012	**Master Marine Technology 2012**		
MT Track Science (MT-SC)			
Obligatory Courses MT-SC			
MT1401	Law for MT	3	
MT1402	Attending Student Colloquia	1	
MT1405	Introduction Project MT Science	1	
MT514	Ship Movements and Steering 3	3	
MT523-H	Numerical Methods - Hydro	2,5	
MT523-S	Numerical Methods - Structural	2,5	
MT835-12	Hydro Elasticity	4	
WB3250	Signaalanalyse	3	
Specialisation Ship Hydromechanics (MT-SC-SH)			
Obligatory Courses MT-SC-SH			
MT515	Resistance and Propulsion 3	3	
MT524	Hydromechanics of Special Ship Types	3	
Recommended Elective Courses MT-SC-SH			
AE4117	Fluid-Structure Interaction	4	
AE4131	CFD I	3	
CIE4130	Probabilistic Design	4	
MT218	Mechatronics in MT	5	
MT525	Marine Propulsion Systems	2	
WB1424ATU	Turbulence A	6	
WI4007TU	Fourier and Laplace Transformation	4	
WI4011	Computational Fluid Dynamics	6	
WI4014TU	Numerical Analysis	6	
WI4141TU	Matlab for Advanced Users	3	
Specialisation Ship and Offshore Structures (MT-SC-SOS)			
Obligatory Courses MT-SC-SOC			
MT815	Construction and Strength, Special Subjects	2	
MT830	Applications of the Finite Element Method	3	
Recommended Elective Courses MT-SC-SOC			
AE4117	Fluid-Structure Interaction	4	
CIE4130	Probabilistic Design	4	
CIE4140	Structural Dynamics	4	
CIE5122	Capita Selecta Steel and Alumium Structures	4	
CIE5126	Fatigue	3	
MS4141TU	Fracture Mechanics	3	
MT213	Marine Engineering C	2	
MT218	Mechatronics in MT	5	
MT515	Resistance and Propulsion 3	3	
MT524	Hydromechanics of Special Ship Types	3	
MT525	Marine Propulsion Systems	2	
MT816	Composit Materials	2	
WB1405A	Stability of Thin-Walled Structures 1	4	
WB1406-07	Experimental Dynamics	3	
WB1412	Linear & Non-lineair Vibrations in Mechanical Systems	3	
WB1416-11	Numerical Methods for Dynamics	4	
WB1440	Eng. Optimization: Concept & Applications	3	
WB1451-05	Engineering Mechanics Fundamentals	4	
Master Year 2			
MT045-15	MSc Internship	15	
MT071-45	MSc Thesis	45	
MT variant Design, Production and Operation (MT-DPO)	**MT Track Design, Production and Operation (MT-DPO)**		
Obligatory Courses MT-DPO			
MT1401	Law for MT	3	
MT1402	Attending Student Colloquia	1	
MT1403	Progress & Risk Monitoring in Maritime Projects	5	
MT729	Maritime Business Game	3	
TMR4115	Design Methods	7,5	
Specialisation Marine Engineering (MT-DPO-ME)			

Obligatory Courses MT-DPO-ME		
MT213	Marine Engineering C	2
MT218	Mechatronics in MT	5
TMR4275	Modelling, Simulation and Analysis of Dynamic Systems	7,5
TMR4290	Diesel Electric Propulsion Systems	7,5
Recommended Elective Courses MT-DPO-ME		
MT525	Marine Propulsion Systems	2
TMR4130	Risk Analysis & Safety Management	7,5
TMR4135	Fishing Vessel & Workboat Design	7,5
TMR4162MT	Applied Procedural Programming	7,5
TMR4190	Finite Element Methods in Structural Analysis	7,5
TMR4200	Fatique and Fracture of Marine Structures	7,5
TMR4215MT	Sea Loads	7,5
TMR4235MT	Stochastic Theory of Sealoads	7,5
TMR4295	Design of Mechanical Systems	7,5
WB4408A	Diesel Engines A	4
WB4408B	Diesel Engines B	4
Specialisation Ship Production (MT-DPO-SP)		
Obligatory Courses MT-DPO-SP		
ME1403	Advanced Operations Management	3
MT218	Mechatronics in MT	5
MT727	Shipyard Process, Simulation and Strategy	4
WB3423-04	The Delft Systems Approach	3
Recommended Elective Courses MT-DPO-SP		
MT724	Shipfinance	3
MT728	Salvage	3
TMR4130	Risk Analysis & Safety Management	7,5
TMR4135	Fishing Vessel & Workboat Design	7,5
TMR4162MT	Applied Procedural Programming	7,5
TMR4190	Finite Element Methods in Structural Analysis	7,5
TMR4200	Fatique and Fracture of Marine Structures	7,5
TMR4215MT	Sea Loads	7,5
TMR4235MT	Stochastic Theory of Sealoads	7,5
TMR4275	Modelling, Simulation and Analysis of Dynamic Systems	7,5
TMR4290	Diesel Electric Propulsion Systems	7,5
TMR4295	Design of Mechanical Systems	7,5
Specialisation Ship Design (MT-DPO-SD)		
Obligatory Courses MT-DPO-SD		
MT044-06	Naval Ship Design	3
MT113	Design of Advanced Marine Vehicles	3
MT218	Mechatronics in MT	5
MT514	Ship Movements and Steering 3	3
TMR4130	Risk Analysis & Safety Management	7,5
Recommended Elective Courses MT-DPO-SD		
MT725	Inland Shipping	2
MT728	Salvage	3
TMR4135	Fishing Vessel & Workboat Design	7,5
TMR4162MT	Applied Procedural Programming	7,5
TMR4190	Finite Element Methods in Structural Analysis	7,5
TMR4200	Fatique and Fracture of Marine Structures	7,5
TMR4215MT	Sea Loads	7,5
TMR4235MT	Stochastic Theory of Sealoads	7,5
TMR4275	Modelling, Simulation and Analysis of Dynamic Systems	7,5
TMR4290	Diesel Electric Propulsion Systems	7,5
TMR4295	Design of Mechanical Systems	7,5
Specialisation Shipping Management (MT-DPO-SM)		
Obligatory Courses MT-DPO-SM		
MT313	Shipping Management	3
MT724	Shipfinance	3
TMR4130	Risk Analysis & Safety Management	7,5
Recommended Elective Courses MT-DPO-SM		
MT725	Inland Shipping	2
TMR4135	Fishing Vessel & Workboat Design	7,5
TMR4162MT	Applied Procedural Programming	7,5
TMR4190	Finite Element Methods in Structural Analysis	7,5
TMR4200	Fatique and Fracture of Marine Structures	7,5
TMR4215MT	Sea Loads	7,5
TMR4235MT	Stochastic Theory of Sealoads	7,5
TMR4275	Modelling, Simulation and Analysis of Dynamic Systems	7,5
TMR4290	Diesel Electric Propulsion Systems	7,5
TMR4295	Design of Mechanical Systems	7,5
Master Year 2		
MT046	Individual Assignment for DPO	15
MT071-45	MSc Thesis	45
Annotation Entrepreneurship		



Appendix 5: Quantitative data regarding the programmes

Data on intake, transfers and graduates

Table 1 Intake and drop-out of VWO freshmen in the Bachelor's programme (1 October 2011)

Cohort	VWO freshmen	Re-enrolled after 1st year	Drop-out in the 1st year	
	# students	# students	# students	Percentage
2002	55	47	8	15%
2003	46	36	10	22%
2004	44	36	8	18%
2005	43	39	4	25%
2006	42	30	12	29%
2007	64	50	14	22%
2008	58	52	6	10%
2009	62	42	20	32%

Table 2 propaedeutic yield per cohort of 'VWO freshmen' (1 October 2011)

Cohort	Cohort size	Cumulative propaedeutic yield within n years						Still enrolled	Total drop-out	Maximum attainable yield
		<=1	<=2	<=3	<=4	<=5	>5			
	55	13%	36%	51%	58%	64%	71%	0%	29%	71%
	46	20%	26%	35%	46%	48%	48%	13%	39%	61%
	44	7%	34%	50%	55%	66%	70%	2%	27%	73%
	43	0%	35%	47%	58%	60%	70%	9%	21%	79%
	42	0%	36%	48%	52%	55%		2%	43%	57%
	64	14%	25%	39%	48%			8%	44%	56%
	58	10%	33%	40%				34%	26%	74%
	62	8%	19%					45%	35%	65%
	59	12%						66%	22%	78%

Table 3 Bachelor yield per cohort of 'VWO freshmen' who re-enrolled after their first year. (VSNU)

cohort	cohort size	cumulative Bachelor yield within n years				
		<= 3	<= 4	<= 5	<= 6	> 6
2002						
2003						
2004						
2005						
2006						
2007						
2008						
2009						

Teacher-student ratio achieved

Table 4 Student-staff ratio for the Faculty 3mE

year	number of students 3mE as per December 1st	total staff 3mE [FTE] as per December 31st	student/staff
2005	1,803	113.2	15.9
2006	1,914	126.2	15.2
2007	2,090	133.7	15.6
2008	2,308	133.3	17.3
2009	2,525	136.3	18.5
2010	2,633	137.8	19.1
2011	2,809	135.9	20.7

Average amount of face-to-face instruction per stage of the study programme

Table 5 Overview of hours of study time in the three course years of the Bachelor's curriculum

Course year	Lectures All students	Instructions Groups of 25 – 50 students	Project Groups of 2 – 8 students	Thesis	Self study	Total study load.
	Hours	Hours	Hours	Hours	Hours	Hours
1	280	220	60	-	1120	1680
2	380	125	50	-	1125	1680
3	330	90	80	190	990	1680

Table 6 Overview study hours in Master MT Science and DPO tracks

Year	Track	Contact	Practical	Individual study	Projectwork	Total
Year 1	Science	418	120	1134	83	1680
	DPO	377	171	588	626	1680
Year 2		80	0	0	1600	1680

Appendix 6: Programme of the site visit

time	subject	invited persons	additional info
08.45-09.00	reception of the committee	Prof. dr. T.S. (Theun) Baller	dean
		Prof. dr. ir. J (Hans) Hellendoorn	director of education
		Dr. ir. D (Dick) Nijveldt	QA/QC staff member
9.00-10.00	management 3mE	Prof. dr. ir. J (Hans) Hellendoorn	director of education
		Dr. ir. S.A. (Sape) Miedema	programme director ODE
		F.P.M. (Frans) van der Meijden	head ESAD
		L.J.H. (Leonie) van den Boom	head M&C
		Dr. ir. D (Dick) Nijveldt	QA/QC staff member
10.00-11.00	students BSc and MSc ME	B.M. (Bart-Jan) van Roekel	*BSc 4th year*
		J.C.R. (Joris) Molenaar	BSc 3rd year
		N.J. (Nils) Velders	BSc 3rd year
		R.M.M. (Romy) Welschen	BSc 2nd year
		S (Sander) van Weperen	MSc-BMD
		S.F. (Sander) van den Broek	MSc-PME
		V (Vincent) Oldenbroek	MSc-TE
		J (Johann) Dugge	MSc-SFM
11.00-11.45	lecturers BSc and MSc ME	Prof. dr. ir. J (Jerry) Westerweel	BSc/MSc
		Prof. dr. R (Robert) Babuska	BSc/MSc
		Dr. ir. S.E. (Erik) Offerman	BSc/MSc
		Dr. R (Roelof) Koekoek	BSc
		Dr. ir. G.J.M. (Gabrielle) Tuijthof	BSc/MSc
		Dr. ir. A (Anton) van Beek	BSc/MSc
		Prof. dr. ir. A.I. (Andrzej) Stankiewicz	BSc/MSc
		Ir. E.J.H. (Edwin) de Vries	BSc/MSc
11.45-12.15	education committee (ME)	Prof. dr. R (Robert) Babuska	chairman
		Dr. ir. W (Wiebren) de Jong	lecturer
		Ir. J.J.L. (Jan) Neve	lecturer
		Dr. ir. D.L. (Dingena) Schott	lecturer
		Dhr. P.G.J. (Pieter) Smorenberg	student
		Mw. C (Carmen) Molhoek	student
		H.C. (Dick) Kramers	student
12.15-13.00	committee lunch (private)	-	
13.00-13.45	tour of the facilities (ME and MSE)	Prof. dr. ir. J (Hans) Hellendoorn	director of education
		F.P.M. (Frans) van der Meijden	head ESAD
		Dr. ir. D (Dick) Nijveldt	QA/QC staff member
13.45-14.00	break	-	
14.00-14.30	students MSc ODE	V.H.R.I. (Vincent) Doedee	student
		R.A. (Robert) Weegenaar	student
		J.A. (Juri) Vogel	student
		M.W. (Marnix) Broer	student
14.30-15.00	lecturers MSc ODE	Dr. ir. S.A. (Sape) Miedema	lecturer
		Prof. dr. ir. M.L. (Mirek)	lecturer

		Kaminski	
		Prof. dr. ir. C (Cees) van Rhee	lecturer
		Prof. dr. ir. RHM (René) Huijsmans	lecturer
		A.B. (Gus) Cammaert	lecturer
		Ir. J.S. (Jeroen) Hoving	lecturer
		Ir. N.F.B. (Niels) Diepeveen	lecturer
15.00-15.30	students MSc MSE	S.T. (Shoshan) Abrahami	Int. student
		W.S. (Wouter) Geertsma	Student
		W (William) Mao	Int. student
		D (Dany) Enciso	Int. student
		X (Ashley) Zhang	Int. student
		A.J. (Arnold) Kolk	HBO student
		M.C.J. (Maarten) van Ramshorst	Student
15.30-16.00	lecturers MSc MSE	Prof. dr. B.J. (Barend) Thijsse	lecturer
		Dr. M.H.F. (Marcel) Sluiter	lecturer
		Prof. dr. I.M. (Ian) Richardson	lecturer
		Dr. A.J. (Amarante) Böttger	lecturer
		Dr. ir. L (Lucia) Nicola	lecturer
		Dr. ir. J.M.C. (Arjan) Mol	lecturer
		Dr. ir. M (Michael) Janssen	lecturer
16.00-16.30	education committee (ODE)	Prof. dr. ir. C (Cees) van Rhee	chairman
		Prof. dr. A (Andrei) Metrikine	lecturer
		V.H.R.I. (Vincent) Doedee	student
		R.A. (Robert) Weegenaar	student
	education committee (MSE)	Prof. dr. J (Joris) Dik	chairman
		Dr. E (Eduardo) Mendes	lecturer
		T.W. (Tomas) Verhallen	student
		H (Harini) Pattabhiraman	Int. student
16.30-17.15	board of examiners 3mE	Dr. ir. C.A. (Carlos) Infante Ferreira	chairman
		Dr. ir. S.A. (Sape) Miedema	lecturer
		Dr. ir. R.A.J. (Ron) van Ostayen	lecturer
		Dr. ir. A.J. (Arjan) den Dekker	lecturer
		Prof. dr. I.M. (Ian) Richardson	lecturer
		Dhr. E.P. (Ewoud) van Luik	secretary
17.15-18.00	alumni 3mE	Anton Paardekooper	professional field ME-MSE-BME-S&C
		Clemens van der Nat	professional field MT-ODE
		Florian Wasser	alumnus ODE
		Sjoerd Hesdahl	alumnus ME-PME
		Tjark van Staveren	alumnus MSE
		Kevin Runge	alumnus MT-DPO
		René Hiemstra	alumnus MT-SC

time	Subject	invited persons	additional info
09.00-10.00	students BSc and MSc MT	H.W. (Hedde) van der Weg	BSc 2nd year
		M (Menno) Sonnema	BSc 3rd year
		A.F. (Floor) Spaargaren	BSc 4th year

		D.P. (Daniel) Langereis R (Roel) Karstens A (Arno) Dubois M.J. (Myriam) Koopmans	BSc 3rd year MSc-DPO MSc-SC MSc-SC
10.00-10.45	lecturers BSc and MSc MT	Dr. ir. P (Pepijn) de Jong Ir. P (Peter) de Vos Prof. dr. ir. R.H.M. (René) Huijsmans Prof. dr. ir. M.L. (Mirek) Kaminski Ir. R.G. (Robert) Hekkenberg Ir. J.F.J. (Jeroen) Pruyn	BSc/MSc BSc/MSc BSc/MSc BSc/MSc BSc/MSc BSc/MSc
10.45-11.00	Break	-	
11.00-11.30	education committee (MT)	Prof. ir. J.J. (Hans) Hopman Prof. dr. ir. RHM (René) Huijsmans Ir. R.G. (Robert) Hekkenberg Dr. Ir. P (Pepijn) de Jong J.M. (Jurrit) Bergsma C.W. (Coen) Bouhuijs J (Koos) Meerkerk A.F. (Floor) Spaargaren	chairman lecturer lecturer lecturer student student student student
11.30-12.15	tour of the facilities (MT & ODE) / individual consultations as requested in parallel	Prof. dr. ir. J (Hans) Hellendoorn F.P.M. (Frans) van der Meijden Dr. ir. D (Dick) Nijveldt	director of education head ESAD QA/QC staff member
12.15-13.00	committee lunch (private)	-	
13.00-13.30	preperation for the 2nd meeting with the management	-	
13.30-14.30	2nd meeting with the management 3mE	Prof. dr. ir. J (Hans) Hellendoorn Dr. ir. SA (Sape) Miedema F.P.M. (Frans) van der Meijden L.J.H. (Leonie) van den Boom Dr. ir. D (Dick) Nijveldt	director of education programme director ODE head ESAD head M&C QA/QC staff member
14.30-16.30	internal discussion session of the committee, assessment and preperation breefing session	-	
16.30-17.00	briefing session	public session	
17.00-18.00	get-together' with drinks	public session	

Appendix 7: Theses and documents studied by the committee

Prior to the site visit, the committee studied the theses of the students with the following student numbers:

Bachelor:

1369512	1359029
1509721	1358685
1518267	1365525
1221221	1363018
1369547	1269526
1371762	1369482
1364057	1320378
1547771	1362828
1159666	

Master:

1108743	1383450
1203940	1218395
1180576	1180592
1091468	1187449
1262173	1148028
1173766	1013017
1173626	1098438
9701306	1108271
1532189	1291874
1394169	1143484
1532065	1011138

During the site visit, the committee studied, among other things, the following documents (partly as hard copies and electronically distributed documents, partly via the institute's electronic learning environment):

Course materials for courses and projects:

- Course outlines
- Assignments
- Answers and assignment papers by students
- Evaluation forms

Educational Committee:

- Annual educational reports
- Course evaluations

Board of Examiners

- Annual reports
- Letters and communications to staff

Professional Field Advisory Board

- Minutes

Appendix 8: Declarations of independence

nvao
nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: BARBARA VAN BALEN

PRIVÉ ADRES:

KLEINE HOUTWEG 8
2012 CH HAARLEM

IS ALS ~~DESKUNDIGE~~ / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Mechanical Engineering, Materials Science and Engineering, Marine Technology, Offshore and Dredging Engineering

AANGEVRAAGD DOOR DE INSTELLING:

TECHNISCHE Universiteit Delft.

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

1

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Utrecht DATUM: 28-8-2012

HANDTEKENING:

2

nvao
nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Paul VAN HOUTTE

PRIVÉ ADRES: WIJNGAARD 23
BE-3110 ROTSELAAR
BELGIË

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Werktuigbouwkunde 3TU OW 2012

AANGEVRAAGD DOOR DE INSTELLING:

T.U. DELFT

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

1

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Rotselaar

DATUM: 4 / 9 / 2012

HANDTEKENING:

2

nvao nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: JORIS DE SCHUTTER

PRIVÉ ADRES: TH. VAN RYSWYCKLAAN 1
B-2850 BOOM
BELGIE

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

WERKTUIGBOUWKUNDE

AANGEVRAAGD DOOR DE INSTELLING:

TU Delft, TU Eindhoven
Universiteit Twente

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

1

nvao
nederlands - vlaamse accreditatieorganisatie

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Boom DATUM: 2 september 2012

HANDTEKENING:

nvao
nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Elze Porte

PRIVÉ ADRES:

Toekomststraat 64
7521 CT Enschede

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Werktuigbouwkunde

AANGEVRAAGD DOOR DE INSTELLING:

TU Delft

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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nvao
nederlands - vlaamse accreditatieorganisatie

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VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Rotterdam DATUM: 04-09-2012

HANDTEKENING:

nvao
nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: G. Calis

PRIVÉ ADRES: Plasweg 50
3768 AN Soest

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Werktuigbouwkunde (en Maritieme Techniek)
aan TUD, TUE en UT

AANGEVRAAGD DOOR DE INSTELLING:

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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nvao
nederlands - vlaamse accreditatieorganisatie

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Rotterdam DATUM: 4 sept. 2012

HANDTEKENING:

2

nvao
nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: ir H. Grunefeld

PRIVÉ ADRES:

Wevelaan 55
3571 XS Utrecht

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

werktuigbouwkunde, maritieme techn. TUD
werktuigbouwkunde TUE

AANGEVRAAGD DOOR DE INSTELLING:

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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nvao
nederlands - vlaamse accreditatieorganisatie

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Rotterdam

DATUM: 4 september 2012

HANDTEKENING: H. Grunefeld

2

nvao
nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Marc Vantorre

PRIVÉ ADRES:

Drakenhoflaan 61
B 2100 Antwerpen

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Werktuigbouwkunde

AANGEVRAAGD DOOR DE INSTELLING:

TU Delft
Univ. Twente

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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nvao
nederlands - vlaamse accreditatieorganisatie

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/~~HAAR~~ BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Rotterdam

DATUM: 4/8/2012

HANDTEKENING:

2

Addendum

The following tables replace the tables in the Assessment Report of the Marine Technology Programmes Delft University of Technology 30 November 2012 Appendix 5 page 55.

Table 2 propaedeutic yield per cohort of 'VWO freshmen' (1 October 2011)

Cohort	**Cohort size**	**Cumulative propaedeutic yield within n years**						**Still enrolled**	**Total drop-out**	**Maximum attainable yield**
		<=1	<=2	<=3	<=4	<=5	>5			
2002	55	13%	36%	51%	58%	64%	71%	0%	29%	71%
2003	46	20%	26%	35%	46%	48%	48%	13%	39%	61%
2004	44	7%	34%	50%	55%	66%	70%	2%	27%	73%
2005	43	0%	35%	47%	58%	60%	70%	9%	21%	79%
2006	42	0%	36%	48%	52%	55%		2%	43%	57%
2007	64	14%	25%	39%	48%			8%	44%	56%
2008	58	10%	33%	40%				34%	26%	74%
2009	62	8%	19%					45%	35%	65%
2010	59	12%						66%	22%	78%

Table 3 Bachelor yield per cohort of 'VWO freshmen' who re-enrolled after their first year. (VSNU)

cohort	**cohort size**	**cumulative Bachelor yield within n years**				
		<= 3	**<= 4**	**<= 5**	**<= 6**	**> 6**
2002	**49**	**0%**	**6%**	**27%**	**39%**	**63%**
2003	**36**	**0%**	**14%**	**22%**	**44%**	**58%**
2004	**36**	**3%**	**8%**	**17%**	**33%**	
2005	**39**	**0%**	**8%**	**21%**		
2006	**31**	**3%**	**19%**			
2007	**51**	**6%**				
2008	**50**					
2009	**50**					