New Wave Media
Business Navigator

WMU World Maritime University

Marine Learning Systems

MarTID
Maritime Training Insights Database

2019 Training Practices Report

Contents

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Foreword

Technological development with rapid diffusion of Artificial Intelligence (AI), the Internet of Things (IoT) and Big Data into industry has caused various changes in new and evolving working environments. In the maritime industry, four degrees of autonomy were identified at the 100th session of the Maritime Safety Committee (MSC) of the International Maritime Organization (IMO) in December 2018. This indicates a further acceleration of the development of Maritime Autonomous Surface Ships (MASS), a development that has the potential of causing significant and drastic changes in seafarers' working environment.

What competencies do future seafarers need? How do training institutions and companies provide effective education and training for candidates of future seafarers? We really need some lighthouses to help us find the right direction for maritime education and training (MET) to meet the needs of the future.

In the past, education was provided using a blackboard and chalk in a classroom. Students recorded what teachers dictated and/or wrote on the blackboard in their notebook using pencils. The exceptional teacher would occasionally distribute handouts that showed simple two-dimensional drawings which were normally quite tough for students to grasp especially when they were supposed to relate to real images of equipment, for example. Students would only get to see real equipment and understood how they worked when they started onboard training on ships in service.

Since those early times, blackboards and chalks have been replaced by whiteboards and markers. However, these are no longer the only, or even the main tools in a classroom. Instead, sets of computers and projectors with sophisticated software provide students with wonderful circumstances and opportunities for learning and understanding. Learners receive electronic handouts through internet-based learning management systems or most frequently download teaching materials to their laptops through e-learning platforms which contain, for example, three-dimensional videos that show real movement of equipment. Learners also participate in practical training with high fidelity simulation programmes either on campuses or even in the own beds at home.

These days, almost all educational processes are fully supported by information and communication technology. Methods of education and training are changing and, in many cases, becoming more effective. Both teachers and students obtain a lot of benefit from educational technology. However, it is noteworthy that the use of such technology often comes with substantial financial cost.

The Maritime Training Insights Database (MarTID) aims to track such trends as regards education and training in the maritime industry. This 2019 Training Practices Report the second since the first report in 2018, continues to track contemporary training issues, including issues on the operating budget on training. Readers of the report will benefit from training insights from a series of valuable statistical analyses based on the data collected through the 2019 MarTID surveys. The findings on the perspectives of seafarers, shipping companies and training institutions, unique to this report, also add more value to this year's report.

I trust that this report, following the very successful inaugural 2018 report, will continue to position the MarTID initiative as a lighthouse for the maritime community in its quest to understand and benchmark global training practices and to find the right direction for education and training for ship operation in the future.

Dr. Takeshi Nakazawa
Executive Director,
International Association of
Maritime Universities

Preface

Undoubtedly, education and training of its human resources continues to be the backbone of the maritime industry. Seafarers continue to serve the global community as facilitators of a key link in the global logistics chain – shipping – and their optimal training remains paramount. The technical work of seafarers, by and large, keeps the global economy moving.

In 2018, the inaugural report of the Maritime Training Database (MarTID) initiative was published. The initiative is the result of a partnership between the World Maritime University, Marine Learning Systems and New Wave Media. Its mission is "to help ensure safe, efficient and sustainable maritime operations on clean oceans by providing the maritime industry with objective and comprehensive data on how it manages and conducts training for shipboard competencies and the effects of drivers, such as technology, on this training". In 2019, in furtherance of this mission, a second annual set of surveys, this time targeted not exclusively at shipping companies, but also at seafarers and training institutions, was undertaken resulting in this 2019 report. There were three surveys targeted at these three groups of stakeholders.

For all stakeholders involved in the maritime industry, especially those who manage, deliver and/or assess the training of seafarers, as well as those who benefit from the competency and optimum performance of seafarers, the outcome of the 2019 surveys, the patterns they reveal and the insights they afford, should be of tremendous interest.

The MarTID initiative is founded on very high ethical standards. All data is secure, anonymised and objectively interrogated. The partners retain no commercial interests in the initiative and maintain the objective of transparently informing the maritime community of the findings of each annual set of surveys for the goal of contributing to the safe, secure and sustainable operations of vessels on clean oceans.

The 2019 report, thanks to the substantial and meticulous work of the MarTID team, adds further insights into the findings in the 2018 report. As was done for the 2018 report, the 2019 surveys collected benchmark data being tracked annually to help reveal trends with respect to core training issues including training budgets, training models, staff involved in training delivery and administration, the use of technology, major training initiatives, and seafarer demographics. In addition, the 2019 surveys interrogated the impact of autonomous vessel operations (actual and potential) on maritime education and training as perceived by vessel operators/managers, maritime education and training experts and seafarers. This theme of "autonomous shipping" added this

year, is the first of a series of themes that will be present in all subsequent surveys. The MarTID surveys will in the future follow this themed approach, with one section on annually tracked data and a second section on a selected theme of contemporary relevance.

The MarTID partners look forward to the continued tracking of the kind of data sets contained in the 2019 report. Together with future annual sets, they will contribute to analyses and syntheses of comprehensive information that offer a clear and objective premise for discussing training trends, challenges and developments requiring the attention of the global maritime community.

As we extend our profound gratitude to all the respondents of the surveys, we trust that the longevity of the initiative will be assured by your continued active interest and participation in future surveys. We are very pleased that 2019 saw an increase by fifty-eight percent (58%) of the responses received compared to that of the inaugural survey of 2018. Ultimately, the value of this initiative is dependent on the voluntary, meaningful and authentic responses to the annual surveys from the global maritime community.

We hope that this 2019 report, together with future reports, will help you, as a valued member of the maritime community, to make more informed decisions regarding the training of seafarers and to include more perspectives in your decision-making related to optimal choices for a sustainable seafarer training future.

I welcome you to this 2019 report on behalf of the partners and wish you the best in your maritime training endeavours.

Cleopatra Doumbia-Henry
President, World Maritime University,
On behalf of all the Partners

Welcome to the MarTID 2019 Training Practices Report

We, the MarTID steering group, proudly welcome you to the second annual MarTID Report. The Maritime Training Insights Database (MarTID) was launched in 2018 with the release of our inaugural training insights report, assembling and revealing the first comprehensive view of international maritime training practices and trends. The significant positive response to last year's report was gratifying and reaffirmed the need for a comprehensive training practices report of this kind for our industry. This further reaffirms the industry's support of the MarTID effort.

This initiative was developed in the spirit of a shared dedication and commitment to safe, efficient and sustainable operations in the maritime industry. We feel that these can be optimally achieved through best practice training, and that such training can only be achieved if we base our training practices on real data. It is that data which we provide to you, here, in our second report, and that we will continue to provide annually.

The MarTID project is completely non-commercial and reports are free and distributed widely. It is supported by the generous contributions of the three partnering organizations. Furthermore, just as we recognize that training can be continuously improved given the necessary performance indicators, we also recognize that the MarTID initiative can be continuously improved. As such, we invite you to connect with the steering group at any time to offer your feedback and constructive recommendations for an ever improving database of maritime training insights.

This report would not have been possible without the tremendous response and participation from the maritime community. The MarTID steering group would like to sincerely thank all respondents and parties who have generously taken the time to contribute to the survey and offer their perspectives. We hope you share in our excitement regarding this important initiative and we look forward to hearing from you.

Sail safely,
The MarTID Steering Group:
Michael Manuel, *World Maritime University*
Greg Trauthwein, *New Wave Media*
Murray Goldberg, *Marine Learning Systems*

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www.MarTID.org

Executive Summary

BUDGETS RISE, SAFETY RULES, AUTONOMY IMPACTS (A LITTLE!)

Though estimates vary by source, the international shipping industry is responsible for approximately 80-90% of world trade, with more than 90,000 merchant ships trading globally, transporting every type of cargo imaginable, from raw materials to finished products, from nearly 30 million cruise ship passengers to livestock.

While ships, technology and increasingly the logistics chain as a whole garner the headlines, the seafarer is the lifeblood of world commerce, and in total, globally, there are 1,647,500 seafarers (774,000 officers and 873,500 ratings) serving on internationally trading merchant ships[1].

However, the role of the modern seafarer is changing.

Driven by automation on the ship and throughout the transport logistics chain, seafarers today are increasingly asked to operate ever bigger, more complex and technologically sophisticated vessels with smaller crews. They are tasked to deliver ship and cargo safely and efficiently, guided by a rapidly increasing list of regional, national and international rules, with a rapidly decreasing impact on the environment. And by all accounts, they are succeeding.

Shipping losses on vessels more than 100 gross tonnes (GT) dropped to 46 in 2018, the lowest total this century. There were 207 total losses reported in 2000, and 98 in 2017. While total losses are down dramatically, there were 2,698 reported shipping "incidents" in 2018, a 1% year-on-year decline[2]. Improved ship design, regulation, technology and the seafarer all have played a role in this statistical improvement, but since the 'human factor' is cited in more than 80% of ship accidents, a continued focus on seafarer training is justified.

With this as a backdrop, the partners in MarTID 2019 are pleased to present the results of the second annual survey on maritime training practices:

BUDGETS RISE

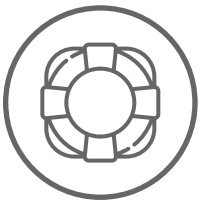
Maritime training budgets continue to trend upwards, compared to the year before: more than 52% of vessel operators reported an increase in training budget, while over 62% of Maritime Education and Training Institutions (METI) reported a larger budget for training. Around 60% of operators and 68% of METIs expect further increases in their training budget for the coming year.

[1] http://www.ics-shipping.org/shipping-facts/shipping-and-world-trade/global-supply-and-demand-for-seafarers

[2] https://www.agcs.allianz.com/news-and-insights/news/safety-shipping-review-2019.html

SEAFARERS SPEND MORE

Interestingly, around 68% of seafarers have increased their personal seafarer training expenditure over the last five years, and more than 55% expect their personal training expenditures to grow in the upcoming year.



SAFETY RULES

While there are myriad training drivers, the top three drivers for MarTID 2019's target groups (Vessel Operators, METI and Seafarers) include:

Operators: Reducing accidents, complying with regulations and managing crew competency;

METI: Complying with regulations, improving safety and improving crew competency, and;

Seafarers: Safety, ship operations and security.

AUTONOMY IS ON THE HORIZON

While automation and autonomy are 'hot' fodder for the trade press, views on the pace of adoption of autonomy on the working waterfront vary widely. General consensus and common sense in the latter context suggest that full automation on oceangoing international routes is a generation or more away. While the technology has quickly matured, major hurdles include matters such as global political agreement, maritime and cyber security, and insurance. More tangible activity is accelerating on local/regional/national fronts where such agreements and arrangements are easier to make.

In overview, vessel operators have the most conservative view on the future of autonomy, while METIs are most optimistic. From the perspective of vessel operators, today 62.5% are at no autonomous function; while 20 years from now 20% expect to reach AL4 (Human in the loop - Operator/supervisory) and approximately 7% expect fully autonomous operations. More than 40% of the METI respondents see an autonomous future in the AL5 and AL6 (Fully autonomous) range.

TRAINING METHODS CHANGE

Predictably, with increasing automation and technology in personal and professional lives, seafarer training methods are changing. While face-to-face and classroom instruction continue to dominate, the tide is turning toward increasing levels of online eLearning and video instruction, music to the ears of seafarers who pay for their own training, as travel and accommodation lead their expense list.

Navigating this Report

For this year's report, we focused our data gathering and reporting into two broad areas. The first focus is on critical basic training metrics gathered each year. The second focus addresses a specific and timely maritime topic of importance to training. This year, the chosen topic is autonomous operations and its implications for training.

Specifically, the report is broken down as follows:

INTRODUCTION

This section of the report provides information on the MarTID initiative and discusses the state of the industry to help place the results in context. It also discusses the survey methodology and provides data on this year's respondents.

ANNUAL, CORE SURVEY DATA

This section is comprised of data that is surveyed by MarTID every year with minimal change from year to year. The goal of this section is to provide data on core training metrics with sufficient consistency to reliably identify trends as they emerge.

Operator and Institution Survey Results
This section presents data gathered from the operator's and METI's surveys. This includes information on crew demographics, budget trends, training models and tools, training initiatives and training drivers.

Seafarer's Survey Results
This section presents data gathered from the seafarer's survey. It includes data on seafarer training expenditures, training models and tools they experience, and their training drivers.

2019 THEME: AUTONOMOUS OPERATIONS

This section presents data on the special topic chosen for the 2019 MarTID survey: autonomous operations. Included here is a short introduction to autonomous operations and the rationale for addressing it in this year's survey. The section then covers respondent's expectations for the future of autonomy, anticipated skill requirements, anticipated training requirements, plans and changes made to prepare for autonomous operations, and their opinions on autonomous operations.

Introduction

Rationale and Background

There is broad agreement that a significant percentage of maritime accidents involve human factor causes. As such, top vessel operators and maritime education and training institutions (METI) are pouring significant resources into creating best practice and innovative training programs.

To a large degree, however, the industry as a whole knows very little about the training approaches and successes of vessel operators and training centers outside personal circles. This means that each training leader is unable to benchmark their training approach and is left to his or her own devices to invent and design best practices. This siloed, rather than collaborative, approach leaves each operator to find their own way, reinventing that which is already invented and repeating the mistakes of others. As a result, industry training approaches will mostly advance by individual original effort, not by continually improving on the state of the art.

MarTID – the Maritime Training Insights Database, is a non-commercial initiative collaboratively founded by the World Maritime University, New Wave Media and Marine Learning Systems. Currently in its second year, it's core principles include ethical integrity, objectivity and confidentiality. Each of the founding organizations is donating its time and resources to make this initiative possible. We are doing this because we believe that sharing information benefits the entire industry.

MarTID will continually grow in depth and value as a resource through the administration of an annual maritime training practices survey. This database provides a global picture of maritime training that is not currently available elsewhere. It provides data on current and emerging training trends and techniques, staffing models, training focus areas, training tools, training resource allocation, and assessment practices. It will allow each organization to benchmark their own practices, and allow governments and other regulatory agencies to be more informed and effective in their oversight and support of the industry. It will help highlight training issues and training successes, and disseminate that information quickly and broadly through a free and widely circulated annual report. The overarching goal is to make the industry safer and more efficient, benefiting everyone.

We believe that the annual MarTID report will continually improve and grow to be a highly anticipated and valuable source of information each year.

The Global Developmental Context

The shipping industry continues to be the "life-blood" of world trade, allowing the populations of the world to continue living in the manner to which they have become accustomed. As at ending 2017, there were about 93,000 vessels (total deadweight tonnage of about 1.9 billion), transporting at least 80% of world trade. To safely, securely and efficiently facilitate this transport, the global community still relies on the about 1.7 million seafarers who crew these vessels. Education and training of these seafarers remain paramount even in a world of increasing digitization and automation.

In the last few years, skills required for contemporary seafarers as well as (and perhaps more prominently) skills for ship operators of the future have increasingly engaged the attention of maritime industry stakeholders. It is recognised by all that it is important that organizations - ship operating companies, training institutions and Government administrations, take steps to critically review training approaches, methods, content and assessment to ensure that the right skills are continuously available for the industry as it evolves in response to global developments, trends and challenges. The development of autonomous shipping has continued with the year seeing the testing of fully autonomous shipping in local and international waters. In December 2018, Rolls-Royce and the Finnish state-owned ferry operator Finferries "successfully demonstrated the world's first fully autonomous ferry in the archipelago south of the city of Turku, Finland"[1]. In Norway, Wärtsilä successfully tested similar systems[2]. Also in Norway, what is touted as "the world's first fully autonomous and zero-emision" vessel - the Yara Birkeland - is on course for launching in 2020[3]. While all of these examples are in local (national) waters, a couple of other initiatives have occurred in international waters, albeit on a smaller scale in terms of ship-size. The "12m-long Uncrewed Surface Vessel (USV) SEA-KIT Maxlimer crossed from West Mersea to Oostende on Monday night ..."[4]. This same craft is scheduled to "attempt the world's first transatlantic crossing without a crew"[5].

As these technological developments continue, work on the legal front is also growing. At the international level the epitome of this is the work currently underway in the International Maritime Organization (IMO). Triggered during the 99th session of the Maritime Safety Committee of the IMO, a Regulatory Scoping Exercise on Maritime Autonomous Surface Ships (MASS) is underway. Covering ten international law instruments (including SOLAS and STCW), the exercise will examine the different approaches taken by IMO Member States in the regulation of autonomous ships.

All these show the traction that technology of a very high standard is gaining in the industry. In tandem with these technological and legal developments has come an increased focus on the knowledge, skills and attitudes required for seafarers. In the year since the publication of the 2018 MarTID report, the focus on skills has continued to grow and there are now numerous studies trying to ascertain the contemporary and future skills required for the industry and how to train for them. They include a study and report on the "Global Maritime Professional", scheduled to be launched by the International Association of Maritime Universities (IAMU) in July 2019. Similarly the European Union has funded a number of large-scale studies to this end.

As it is generally agreed that high-quality training will remain relevant in the short to long term, irrespective of whether ship operating crews are onboard or ashore, there is a continuing need to keep tracking this training. With this in view, in the 2019 survey, we find out the views of shipping companies, maritime education and training institutions and seafarers about training in general and also their perspectives on the development of autonomous shipping.

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[1] Under the Project SVAN (Safer Vessel with Autonomous Navigation) https://www.rolls-royce.com/media/press-releases/2018/03-12-2018-rr-and-finferries-demonstrate-worlds-first-fully-autonomous-ferry.aspx

[2] https://www.wartsila.com/media/news/28-11-2018-wartsila-achieves-notable-advances-in-automated-shipping-with-latest-successful-tests-2332144

[3] https://www.yara.com/news-and-media/press-kits/yara-birkeland-press-kit/

[4] https://www.bbc.com/news/science-environment-48216966

[5] https://www.marinetechnologynews.com/news/meter-first-cross-atlantic-589467

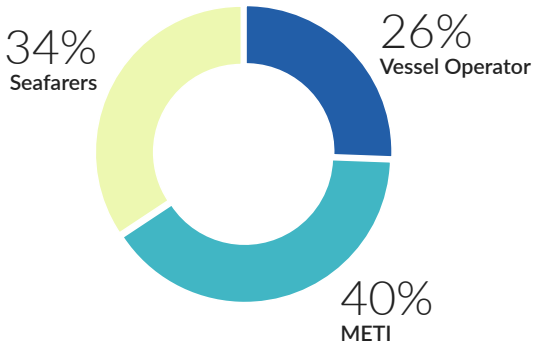
2019 Survey Methodology

For this year's report, we focused our data gathering and reporting into two broad areas. The first focus is on critical basic training metrics gathered each year. These include training budget trends, training models, major training initiatives, training drivers, and other demographics of importance to training. This yearly baseline data will help identify important long-term trends in maritime training. The second focus addresses a specific and timely maritime topic of importance to training. This focus, which will change from year to year, is based on then-current important maritime issues. This year, the chosen topic is autonomous operations and its implications for training.

To collect relevant data for the two foci, we used three surveys targeted at three different categories of stakeholders in maritime training: 1) ship operating/management companies, 2) maritime education and training institutions and 3) seafarers. The surveys (hosted on www.surveymonkey.com) were made available to the public from 26 November 2018 to 28 February 2019. During this period, information on how to access the surveys was distributed via multiple media channels (MarineLink.com, Maritime Reporter, email newsletters), via press releases from the MarTID partners and via links on www.martid.org. The total number of responses from all three groups was one hundred and seventy-four (174) from all global regions. This represents a 58% rise over the one hundred and ten (110) responses received for the inaugural survey.

ABOUT THE RESPONDENTS

Of the three target groups, the Maritime Education and Training Institutions (METI) were the most represented, with 40% of the responses.



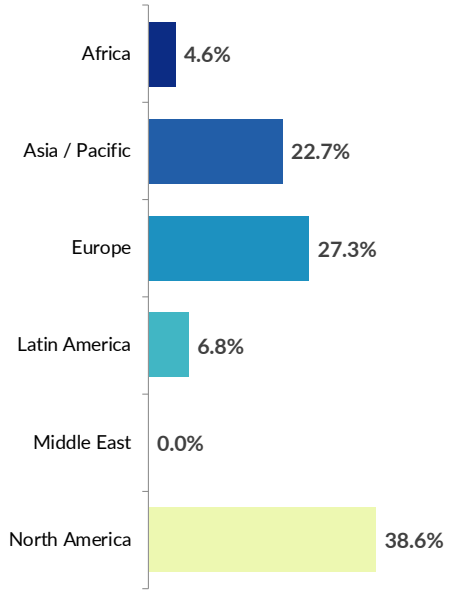
VESSEL OPERATORS

For responding vessel operators, organisation headquarters were spread out mostly between Europe, Asia-Pacific and North America. A smaller percentage of respondents were headquartered in Africa and Latin America.

The average vessel operator has 56 vessels under management. The following table provides a further breakdown, with average number of vessels managed, per type of vessel:

SHIP TYPES	AVERAGE #
Bulker	5.4
Container Ship	84.8
Cruise	22.3
Ferry	12.1
General Cargo	44.9
OSV	23.4
Tanker	13.3
Workboat	2.1

WHICH REGION IS YOUR ORGANIZATION'S HEAD OFFICE LOCATED IN? (OPERATORS)

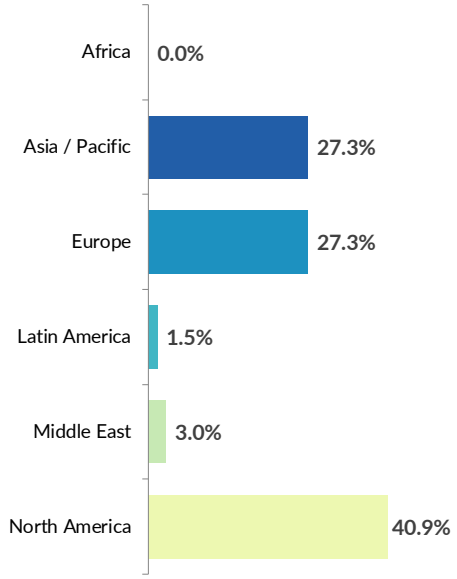


MARITIME EDUCATION AND TRAINING INSTITUTIONS (METI)

Over 33% of responding Maritime Education and Training Institutions operate more than one campus. With that said, for the majority of the respondent's their main campus is located in North America, and an equal number of respondents are headquartered in Asia-Pacific and Europe.

Surprisingly, over 17% of responding METIs have been established for more than 100 years! The majority (63.5%) have been operating for 25 years and more.

WHERE IS THE MAIN CAMPUS OF YOUR INSTITUTION LOCATED? (METI)



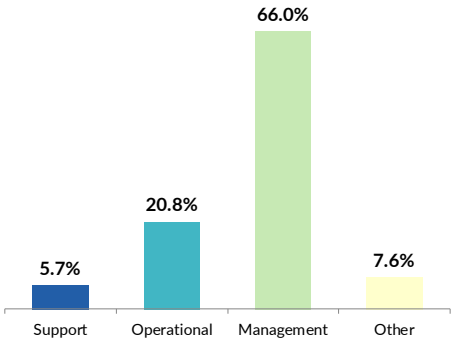
SEAFARERS

96% of the Seafarer respondents are male and the average age was 44 years old at the time of the survey. The average age of last year's survey respondents was somewhat higher at 48 years old. A majority hold a management-level certificate of competency, with an average 17.5 years of experience as a seafarer.

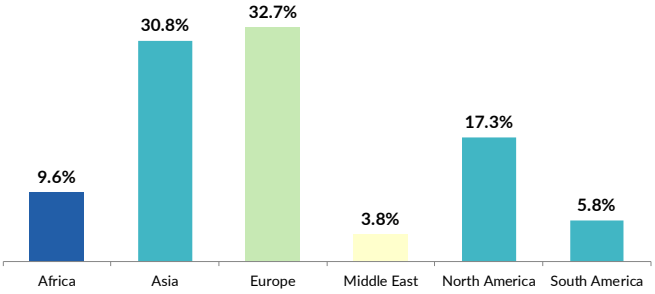
WHAT TYPE OF VESSEL HAVE YOU SPENT THE MOST TIME ON AS A SEAFARER? (SEAFARERS)

Ferry or Cruise	5.6%
Bulker	15.1%
Tanker	32.1%
Container	11.3%
General Cargo	3.8%
Workboat	1.9%
OSV	5.7%
Other	24.5%

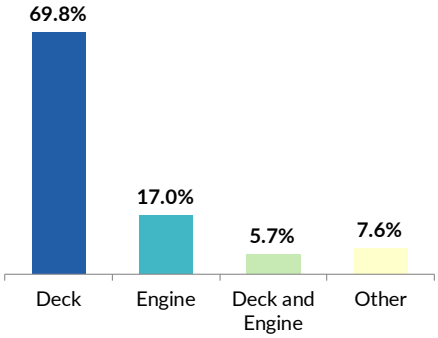
WHAT IS THE HIGHEST LEVEL OF CERTIFICATE OF COMPETENCY THAT YOU HOLD? (SEAFARERS)



WHAT IS YOUR NATIONALITY? (SEAFARERS)



WHICH DEPARTMENT OF SHIP OPERATIONS DO YOU WORK IN? (SEAFARERS)



Operator and Institution Survey Results

The most thoughtful operators have long understood that safety is not a competitive advantage, but rather a shared and collective responsibility. An accident experienced by any operator is a negative event not only for that operator, but indeed for their industry segment and more broadly for the entire industry. With this as context, it is no surprise that reducing accidents and maintaining compliance remain the primary training drivers for operators and METIs respectively. These drivers, along with increasing regulation and complexity of operations contribute to the trend of increased training budgets and a move toward more innovative training models.

Crew Demographics

For responding operators, female seafarers made up an average of 9.1% of the crew, organization-wide, and the average age of a seafarer was 37 years old. In last year's survey, the respondents indicated that in their organizations 12.8% of the crew was female. As the MarTID survey grows in size and establishes many years of data, this will be an important metric to track.

Roughly two-thirds of the respondents do not foresee any future operational issues or training needs due to their crew's current average age. However, the third that did see potential concerns cited the following issues:

- Understanding the difference between experience and competence
- Shifting cultural norms
- Aptitude with technology
- Changing demographics driving increased recruitment needs
- Senior ranks needing to be transitioned soon due to their approaching retirement age

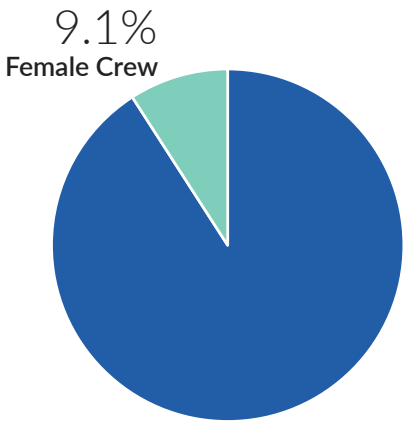
AVERAGE LENGTH OF EMPLOYMENT

17
years

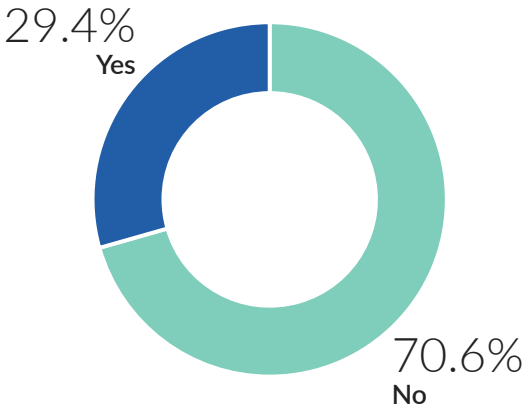
AVERAGE AGE OF CREW

37
years

WHAT IS THE APPROXIMATE PERCENTAGE OF FEMALE SEAFARERS (INVOLVED IN SHIP OPERATIONS) ORGANIZATION-WIDE? (OPERATORS)



DOES THE AVERAGE AGE OF YOUR ORGANIZATION'S SEAFARERS CREATE ANY CURRENT OR FUTURE OPERATIONAL ISSUES? PLEASE EXPLAIN IF SO. (OPERATORS)

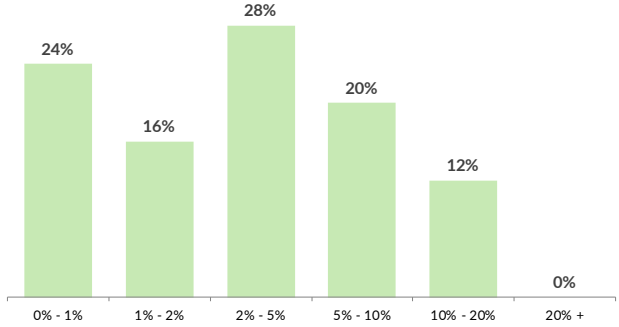


Budget Trends

Most vessel operators spent under 10% of their operating budget on training, with nearly one third allocating around 2% - 5% of their budget to training. This number is similar to last year's which was approximately one quarter. As expected, the percentage of budget allocated to training at METIs was much higher.

Survey results indicate that training budgets continue to trend upwards, compared to the year before. Over 52% of operators reported an increase in training budget, while over 62% of METIs reported a larger budget for training. This is highly consistent with last year's data which showed that almost 60% of respondents expected to increase their training budgets during the 12 months which followed the 2017 survey. Likewise, between 9% and 12% of respondents indicated that their budgets were reduced over the preceding 12 months. This too was consistent with last year's predictions where 9% anticipated a reduction in budget.

WHAT PERCENTAGE OF YOUR ORGANIZATION'S OVERALL OPERATING BUDGET WAS ALLOCATED TO TRAINING? (OPERATORS)

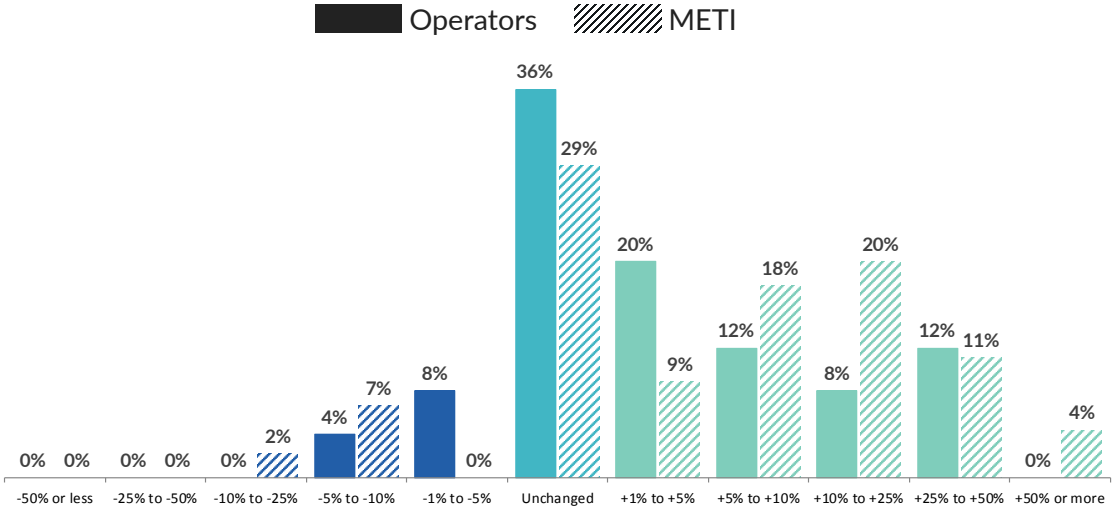


WHAT PERCENTAGE OF YOUR INSTITUTION'S OPERATING BUDGET WAS ALLOCATED TO SEAFARER TRAINING ACTIVITIES AND EQUIPMENT? (METI)

53.28%

average percentage of operating budget for training

BY WHAT APPROXIMATE PERCENTAGE HAS YOUR ORGANIZATION'S TRAINING BUDGET GROWN OR SHRUNK OVER THE PREVIOUS FISCAL YEAR? (OPERATORS AND METI)



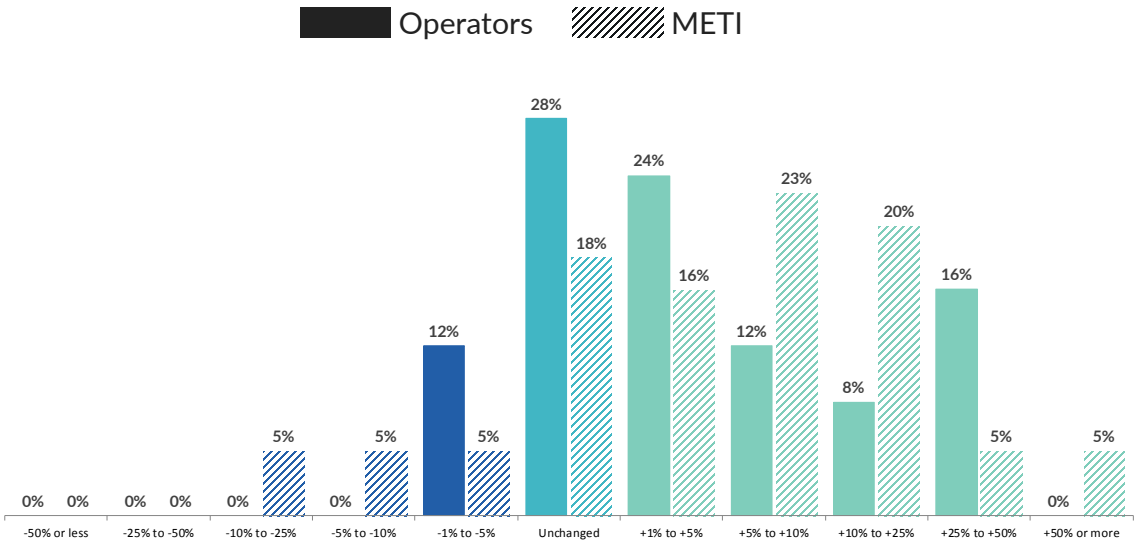
For operators, this increase in training budget was due to a variety of reasons, from new regulatory training requirements, to fleet growth and people management. The most common reason cited for increased training was new equipment being used and systems being installed (such as LNG and BRM training, or the installation of SMS - which comes with new procedures).

Meanwhile, for maritime education and training institutions, the increased budget comes from new training opportunities, increased student population, the installation of new technology (such as simulators and training software / Learning Management Systems).

These drivers of increased training budgets are reasonably consistent with last year's which cited increased regulatory requirements, increased safety focus, and expenditures on new technologies as the most often-cited drivers.

The trend toward higher training budgets continues as a majority anticipate either an increase in the budget for the upcoming year or no change at all. Around 60% of operators and 68% of METIs expect further increases in their training budget.

BY WHAT APPROXIMATE PERCENTAGE DO YOU EXPECT YOUR ORGANIZATION'S TRAINING BUDGET TO GROW OR SHRINK IN THE UPCOMING FISCAL YEAR? (OPERATORS AND METI)



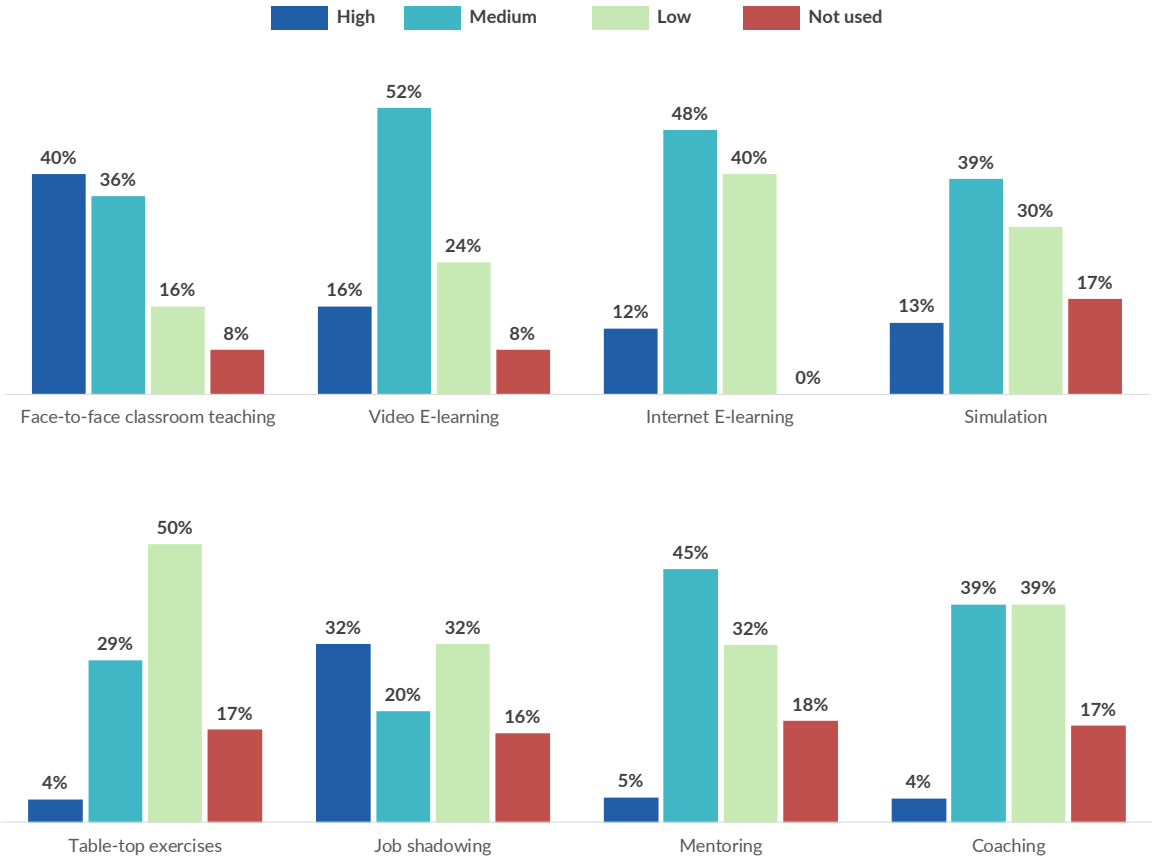
Training Models and Tools

VESSEL OPERATORS

Traditional classroom teaching and job shadowing remain the most frequently used training methods for operators, with over third of the respondents reporting high usage. This is relatively unchanged from last year's survey results.

Around 68% of operators indicated high to medium use of e-learning with video sources, and approximately 60% report the same for online e-learning. While the previous year's MarTID report surveyed all types of organizations, these percentages are very similar to last year's numbers (70% and 60% respectively). Interestingly, all vessel operators surveyed reported at least some use of internet-based e-learning usage.

PLEASE INDICATE BELOW WHICH TRAINING METHOD(S) YOUR ORGANIZATION USES, AND TO WHAT DEGREE THEY ARE USED. (OPERATORS)

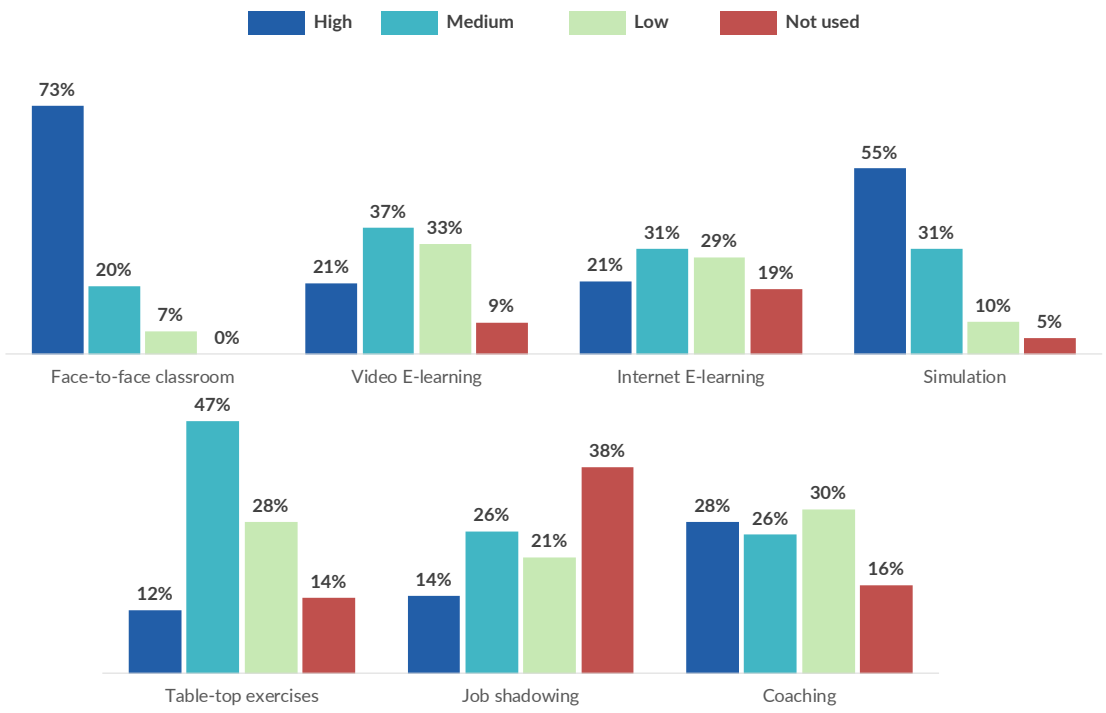


MARITIME EDUCATION AND TRAINING INSTITUTIONS (METI)

As expected from maritime education and training institutions, in-person classroom teaching and simulator training are the most highly used training methods. Table-top exercises were also reported to be moderately used by nearly half of the surveyed institutions.

For video and internet-base e-learning, the results were relatively consistent with those from vessel operators, and with the results from last year's data. Having said that, this year METIs were somewhat more likely to report high use of these training techniques (21% of METIs compared to 12% - 16% of vessel operators), and somewhat less likely to report "medium" use of these techniques (37% and 31%, respectively, compared to 52% and 48% of operators).

PLEASE INDICATE BELOW WHICH TRAINING METHOD(S) YOUR INSTITUTION USES, AND TO WHAT DEGREE THEY ARE USED. (METI)

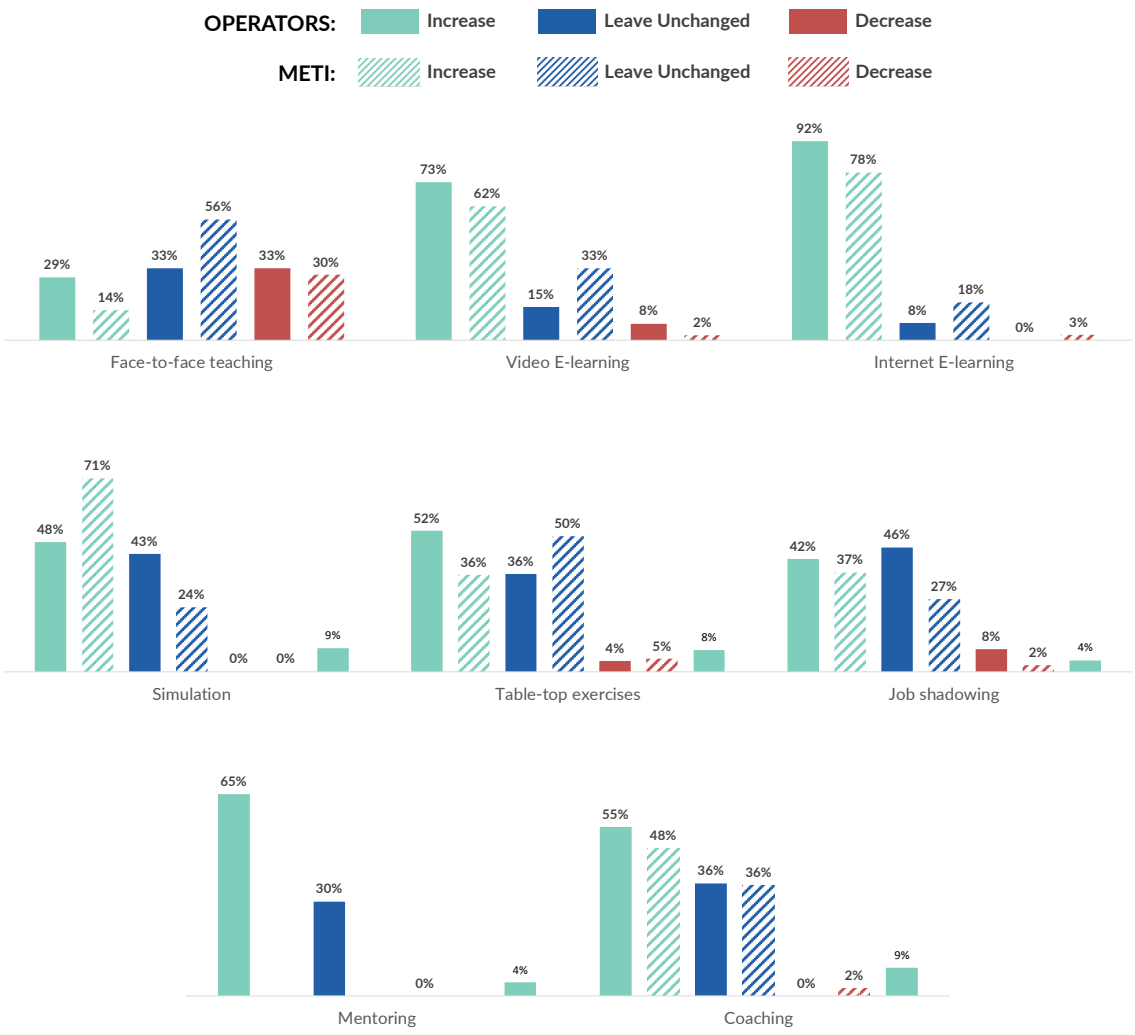


In addition to data on techniques being used now, it is particularly interesting to understand expectations as to which training techniques will be more relied on or less relied on in the future. This helps us understand overall satisfaction with particular training models. In terms of techniques expected to see less use, face-to-face classroom training stands alone in its anticipated abandonment. Roughly ⅓ of METIs and operators expect to decrease their reliance on face-to-face teaching. The next closest training technique in terms of anticipated decrease is job shadowing amongst vessel operators. 8% of operators anticipate a decreased reliance on this technique in the future.

On the other side of the coin are those techniques that are expected to see increased usage in the future. As expected, the standout here is e-learning. For vessel operators in particular, an overwhelming majority plan to increase their usage of e-learning, both Internet-based (92% expect to increase) and video-based (73% expect to increase). Up next are mentoring and coaching where a majority of vessel operators plan to increase their usage (65% and 55% reporting anticipated increases respectively).

Similar themes can be seen with METIs. A majority of training institutions plan to increase their usage of technology, with roughly 78% planning to increase their online e-learning, and over 70% planning to use more simulation at their facilities.

PLEASE INDICATE BELOW HOW YOUR ORGANIZATION/INSTITUTION PLANS TO CHANGE ITS USAGE OF THE FOLLOWING TRAINING METHODS FOR THE FUTURE. (OPERATORS AND METI)



ASSESSMENT OF TRAINING OUTCOMES AND NEEDS

When it comes to assessing seafarers, in-person competency evaluations and assessments are the most commonly used tool for vessel operators. Work-based performance measurement is the second most common, with around half of the surveyed operators reporting use of this method.

Unfortunately, over 15% of surveyed operators do not assess trainees' achievement of learning outcomes at all.

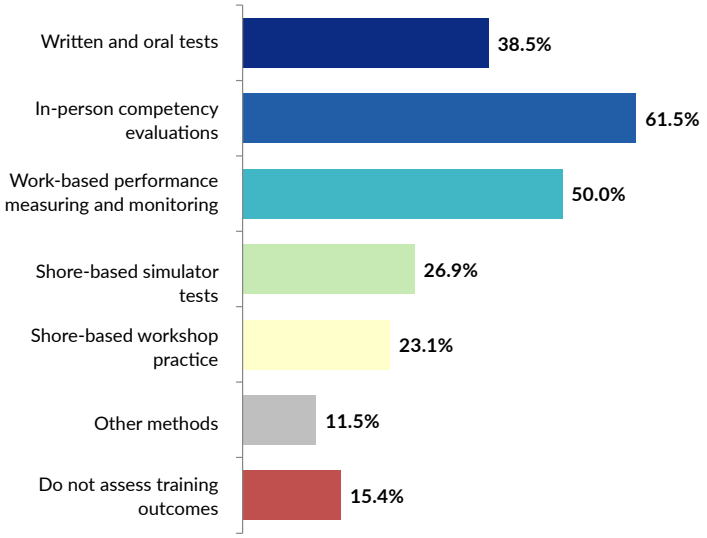
Other methods of assessment not included in the survey options, but mentioned for vessel operators include supervisor surveys and employee feedback.

For maritime education and training institutions, the main tool for assessment comes in the form of written and oral tests. Unsurprisingly, over 86% also employ simulator-based assessments. Additionally, over half of METIs take feedback from their industry clients as a way to measure their training performance.

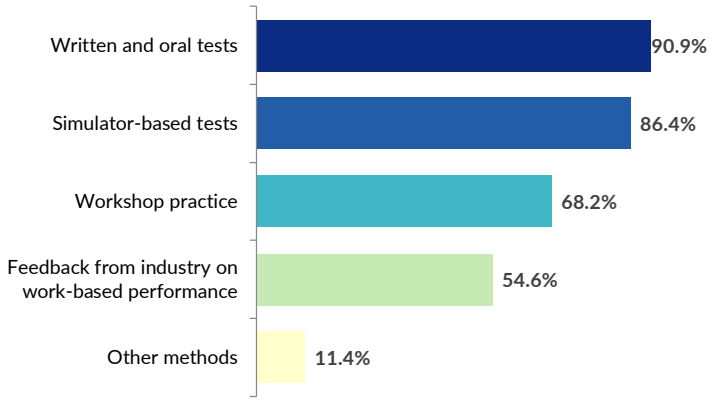
Other methods of assessment for METIs include practical demonstrative exams, and student/supervisor feedback.

For operators, the vast majority have a formal process to identify their training needs. While many processes were mentioned, over one third use employee appraisal and assessments, and just under a fifth rely on feedback from internal stakeholders such as instructors, managers and superintendents. Other examples of processes used to identify training needs include analytics from learning management systems, regulatory requirements, incident reports / noncompliance issues, internal audits, and the A.D.D.I.E. (Analysis, Design, Development, Implementation, Evaluation) model.

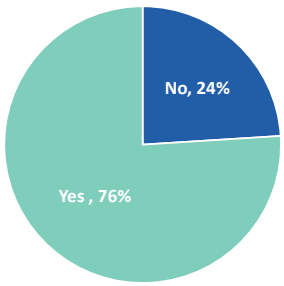
HOW DOES YOUR ORGANIZATION ASSESS TRAINING OUTCOMES? SELECT ALL THAT APPLY. (OPERATORS)



HOW DOES YOUR INSTITUTION ASSESS TRAINING OUTCOMES? SELECT ALL THAT APPLY. (METI)



DOES YOUR ORGANIZATION HAVE A FORMAL PROCESS FOR THE IDENTIFICATION OF TRAINING NEEDS? (OPERATORS)

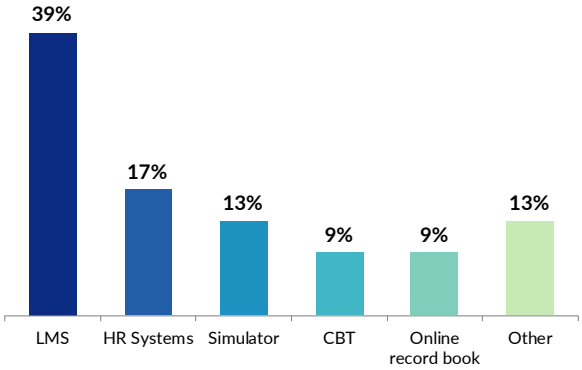


TRAINING TOOLS FOR VESSEL OPERATORS

The 2019 MarTID survey also asked operators about the various technology and systems they used in training operations. Below are a collection of their responses:

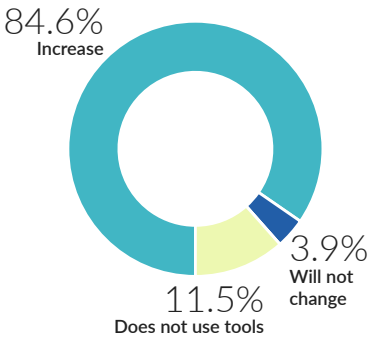
Technology or tools to manage crew competency

PLEASE LIST ANY TECHNOLOGICAL SYSTEMS OR TOOLS YOUR ORGANIZATION USES TO MANAGE CREW COMPETENCY.



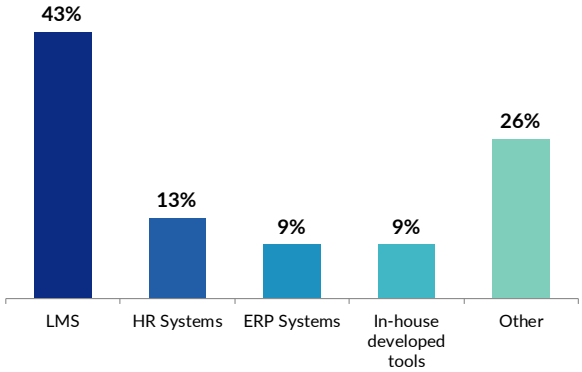
Other systems or tools mentioned: In-house developed software systems; Excel spreadsheets; Online tools

HOW DO YOU EXPECT THE USAGE OF THESE TECHNOLOGIES TO CHANGE IN THE FUTURE?



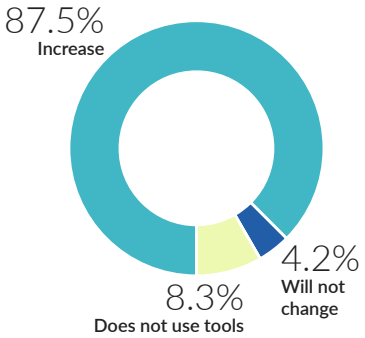
Technology or tools to manage crew training

PLEASE LIST ANY TECHNOLOGICAL SYSTEMS OR TOOLS YOUR ORGANIZATION USES TO MANAGE CREW TRAINING.



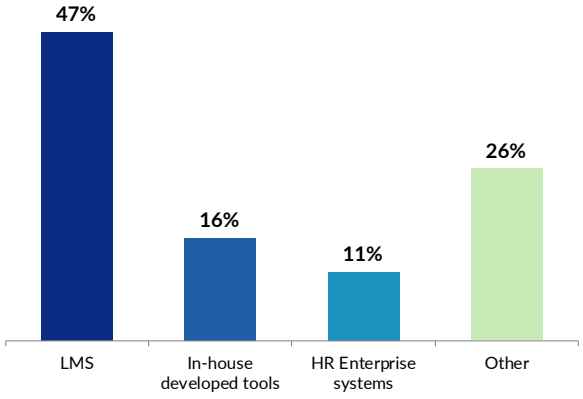
Other systems or tools mentioned: CBTs; Online portal; Simulators; Training calendar; Web conference; Policies

HOW DO YOU EXPECT THE USAGE OF THESE TECHNOLOGIES TO CHANGE IN THE FUTURE?



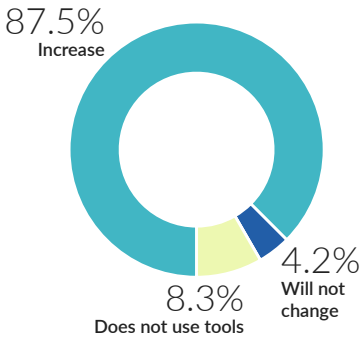
Technology or tools to manage crew training

PLEASE LIST ANY TECHNOLOGICAL SYSTEMS OR TOOLS YOUR ORGANIZATION USES TO MANAGE CREW ASSESSMENT.



Other systems or tools mentioned: In-person interviews; Online software tools; Third party assessor; VR assessment

HOW DO YOU EXPECT THE USAGE OF THESE TECHNOLOGIES TO CHANGE IN THE FUTURE?



Training Initiatives

CURRENT INITIATIVES

The following is a selection of important training initiatives that are currently underway or planned for the near future to gain a sense of the trends being indicated by current projects. Common themes for both operators and METI include improved simulation training, implementing of e-learning, more comprehensive topics, and virtual and augmented reality.

Vessel Operators

- Simulator-based assessment
- Implementing an organization wide learning management system
- Competency framework
- Library of videos linked to the SMS
- Assessment tool to manage competency for emergency procedures and drills - to identify training gaps and trends
- Various new course topics (HESS, Safety Culture, Customer Service, LNG, Ballast water management)
- Enhanced simulator facilities
- Mobile Performance Support (accessed with crew device)
- CBT development and procurement
- Continue to evolve our Learning Management System
- Virtual Reality and Augmented Reality
- Employing qualified Marine assessors
- Leadership and Management refresh training
- Digitalization, blended learning and distance learning

Maritime Education and Training Institutions

- New interactive e-learning concept
- Implement blended learning or creating an e-learning platform
- Mooring Deck Equipment Operational testing and maintenance
- Various new course topics (LNG, Confined Space Entry, Voyage Planning using ECDIS, Rope inspection, Radar Navigation, Port/Vessel Security, etc.)
- Improvement of LMS features
- Expansion into residential multi-skilled training on-board ships
- Obtaining an additional small vessel for enhanced boat handling skills.
- Aligning courses with STCW competency tables for Officer in Charge of an Engineering Watch and Management Level endorsements
- Digitalization, virtual and augmented reality
- Additional simulator programs
- Use of 360-degree videos
- Diversifying course portfolio towards electro technical officer training, more bespoke company provision and higher level post graduate qualifications.
- Introduction of robotics subject and advanced automation, along with acquisition of the newest models of laboratory equipment for advanced automation
- Programmes for students under 18
- Course program reform focused on applied work

"IDEAL" INITIATIVES

We also asked respondents what types of training initiatives they would implement if budget and company resources were not a limiting factor. Below is a selection of their responses. Common themes included comprehensive training, especially for leadership and management development opportunities, and high-tech solutions such as serious games, virtual reality and augmented reality.

Vessel Operators

- Training ship
- E-learning
- Competent assessor program
- Single IT system for competency management
- Individual learning profiles for each rank with defined career structure
- Exciting serious games in order to increase critical thinking and problem-solving
- Increased use of simulation, table top exercises, and shipboard assessments
- Career pathing software
- Top to bottom leadership development
- Increased practical training sessions
- Navigational Skills Assessment Program (NSAP) for mates and Engineering Skills Assessment Program (ESAP) for all engineers to provide an assessment to determine needs.
- Field trips abroad
- Navigation Assessment
- Mooring assessment
- ECDIS operation Assessment
- Real time cargo operation assessment
- Engine operation assessment.
- Increased opportunities for Leadership and Management development at earlier and more structured/frequent interval
- Augmented and virtual reality
- Scrubbers operation

Maritime Education and Training Institutions

- Increased real world training, i.e. a training ship operated outside of the normal academy structure
- Combined training solutions utilizing the most beneficial learning solution to the specific learning requirement focused on more individual based learning content and focus.
- Development of high quality, interactive, advanced e-learning content
- Coaching
- More comprehensive topics (STCW & OPITO Safety Training, MARPOL Convention Spill Response, Ice Navigation)
- Computer based modeling
- Virtual and Augmented Reality (3D Training)
- After Hour Group Setting Trainings
- Increased simulator training and assessment
- CBT in an offline environment
- Video based training for introduction and review of critical operational activities
- Updated / More advanced simulation for LNG marine fuel, engine-room, personal survival craft and fast rescue boat
- ECDIS simulators
- Smaller group sizes for lectures
- More time for training new staff (training of trainers, Continuing Instructor Development Program)
- Using Block chain technology and Big Data
- Using Software as a Service (SaaS) Technology
- International programs

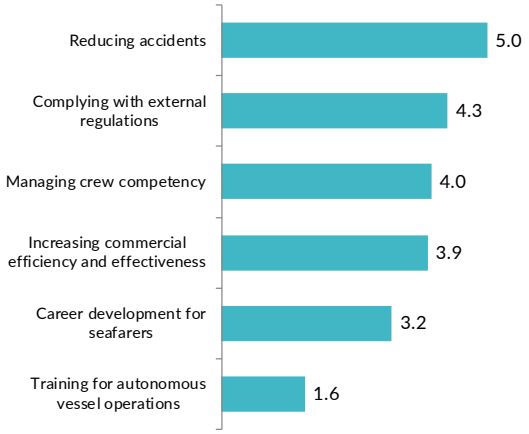
Training Drivers

We surveyed responding operators and maritime education and training institutions on the importance of different training drivers, and what factors they found most important to what they found of least importance. Both groups have very similar views on training drivers: for both operators and institutions, reducing accidents or improving safety and complying with external regulations were regarded as the most important factors that drove training. On the other hand, seafarer career development and training for autonomous vessel operations are considered less important drivers for training.

DRIVERS FOR TRAINING, FROM MOST IMPORTANT TO LEAST (OPERATORS):

PLEASE RANK THE FOLLOWING DRIVERS FOR TRAINING IN YOUR ORGANIZATION IN ORDER OF IMPORTANCE

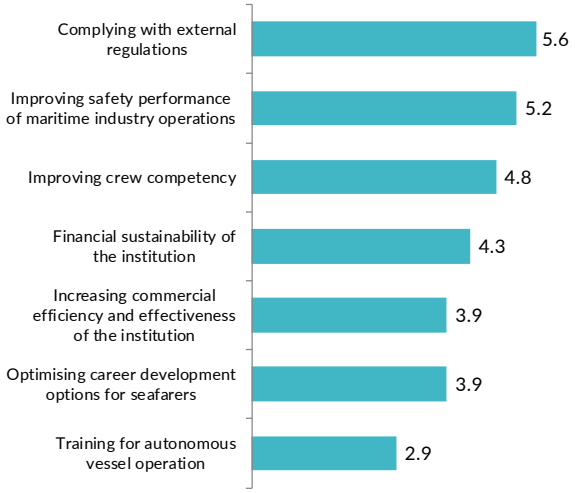
(The numbers represent the average weighted score, with 5 being the most important to 1 being the least important)



DRIVERS FOR CURRICULUM DELIVERY, FROM MOST IMPORTANT TO LEAST (METI):

PLEASE RANK THE FOLLOWING DRIVERS WITH RESPECT TO THEIR INFLUENCE ON TRAINING CURRICULUM DEVELOPMENT AND DELIVERY IN ORDER OF IMPORTANCE.

(The numbers represent the average weighted score, with 6 being the most important to 1 being the least important)



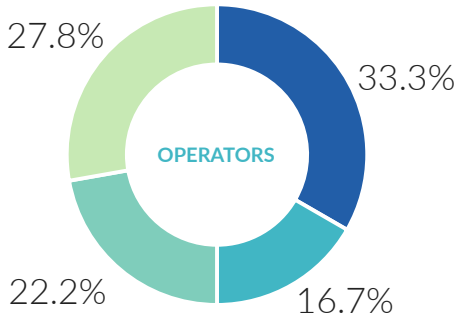
IMPACT OF IMO ISSUES AND INITIATIVES

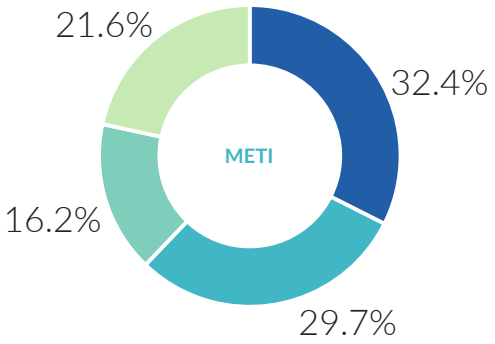
As "Complying with external regulations" was cited as a top training driver by both operators and METI's in the 2019 survey, here we look at the level of impact that various IMO regulatory issues have on operators' and METI's training plans. The Sulphur 2020 Cap has the most impact for both vessel operators and institutions, whereas autonomous surface ships have the least (especially with operators).

PLEASE INDICATE THE LEVEL OF IMPACT THAT THE FOLLOWING IMO ISSUES AND INITIATIVES HAVE HAD OR WILL HAVE ON YOUR ORGANIZATION'S FUTURE TRAINING PLANS:

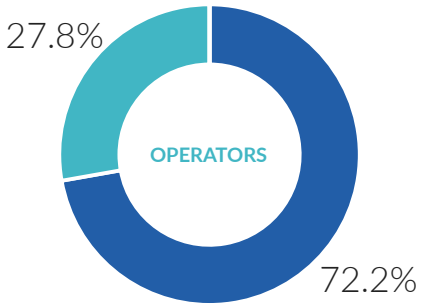
Significant Impact | Some Impact | Little Impact | No Impact

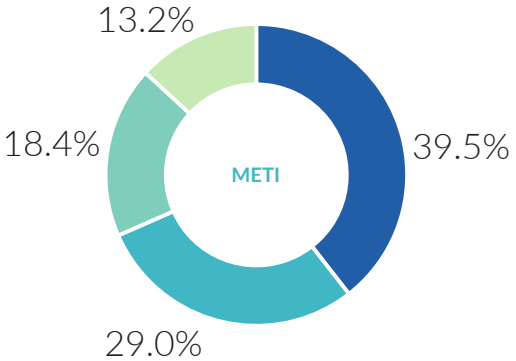
Sulphur 2020 Cap re: Marine Fuels and Greenhouse Gases



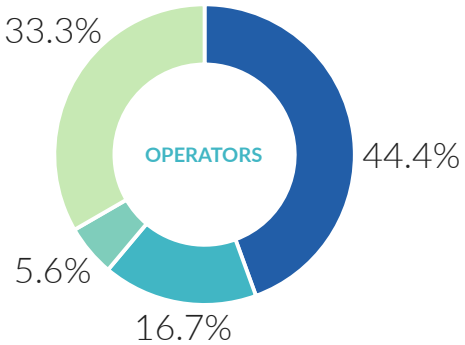


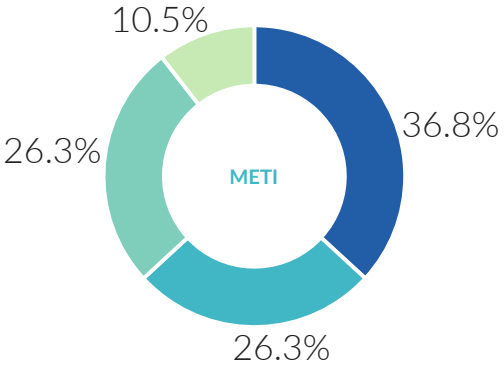
Scoping Exercise on Maritime Autonomous Surface Ships





UN Sustainable Development Goals





Recurrent Training and Collaboration

We are seeing an increased focus on recurrent training, as a majority of training institutions report increasing customer demand for recurring (or refresher) training.

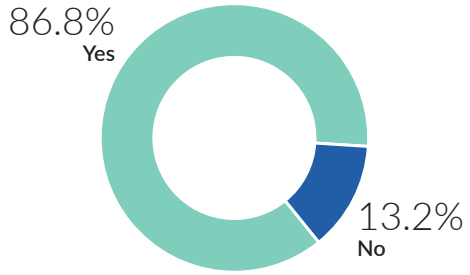
Similarly, every operator delivers some form of recurring training. Nearly half of responding operators, on average, require their crew to participate annually in routine, recurring training to maintain and upgrade their seafarer skills and knowledge. A little over a tenth go one step further and have their crew refresh their skills twice a year, on average. Some respondents mentioned that recurrent training varies depending on what subject is the focus of training: some training can be done annually while STCW-related topics are refreshed every five years.

OPERATOR AND INSTITUTION TRAINING COLLABORATION

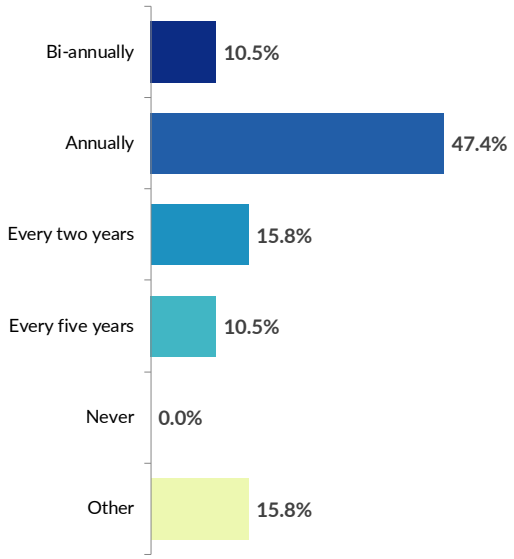
A majority of maritime education and training institutions collaborate and work with industry for their seafarer training programmes. We surveyed the areas of collaboration and the most common form was the creation of bespoke, company-specific training courses and simulations, and direct partnerships where the institution provides all the training needs of the customer's ship-based personnel. Other common forms of collaboration that were mentioned multiple times include:

- Customer/Industry advisory boards
- On-board assessment
- On-board training
- Cadet training programs
- Equipment familiarization
- Technical collaboration
- Sharing of best practices and informal feedback

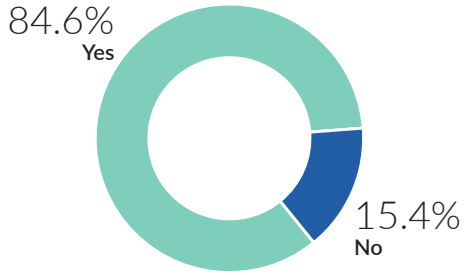
IN YOUR OPINION, IS YOUR INSTITUTION SEEING A CUSTOMER-DRIVEN NEED FOR INCREASED RECURRENT TRAINING? (METI)



HOW OFTEN ARE YOUR SEAFARERS, ON AVERAGE, REQUIRED TO PARTICIPATE IN ROUTINE, MANDATORY RECURRING TRAINING TO MAINTAIN AND UPGRADE THEIR SKILLS AND KNOWLEDGE? (OPERATORS)



DOES YOUR INSTITUTION COLLABORATE WITH VESSEL OPERATORS FOR SEAFARER TRAINING DELIVERY? (METI)



Seafarer Survey Results

Seafarers today are in the spotlight, arguably more than ever, with an increased international focus on seafarer issues such as health and wellness, both physical and mental. At the same time the maritime industry, following trends on land and in the air, pursues various levels of automation which will eventually change the responsibilities, the roles and perhaps even the very definition of "seafarer." The path is clear, the pace of change is not. Regardless, training and education will remain a core tenant for seafarers, and increasingly seafarers are picking up the cost of their own training.

Training Expenditures

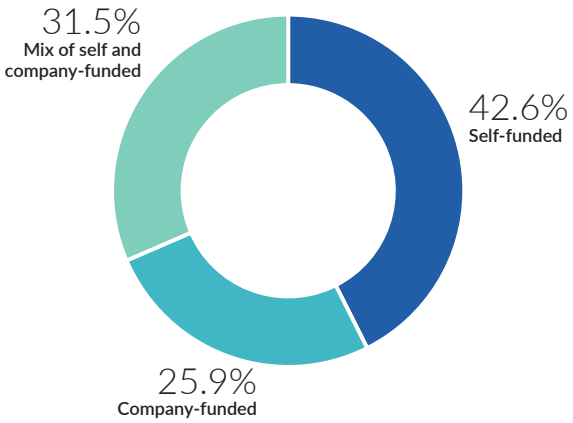
The highest proportion of responding individual seafarers reported being fully responsible for funding their training, as opposed to companies paying for their training. For those who reported that their seafarer training was a mix of the two sources, the average distribution was roughly equal (their company funded around 50.6%, and the individual paid for around 49.4%).

Nearly a fifth of the responding seafarers spent 10% - 20% of their annual income on seafarer training.

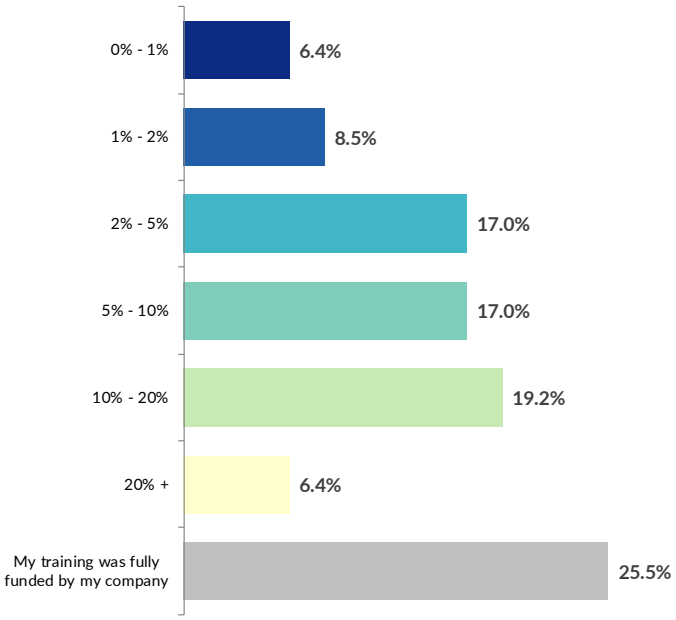
Where is this personal expenditure going? Mostly towards travel-related expenses and required training/retraining for certification purposes. Some reported spending on training for leadership and non-technical skills.

- Certificate of Competence
- Hotel, travel (transportation and living expenses)
- STCW certification, refreshers
- Oil and Chemical advanced training
- Various topics: ECDIS, HELM, BRM, DP, RADAR
- Leadership training
- Recertification and renewal
- Environmental training
- Chief Mate training program
- Self-study for upgrading skills and career progression
- Courses not covered by matrix
- Education programs on social and non-technical skills
- Medical First Aid

WHO IS RESPONSIBLE FOR FUNDING YOUR SEAFARER TRAINING?

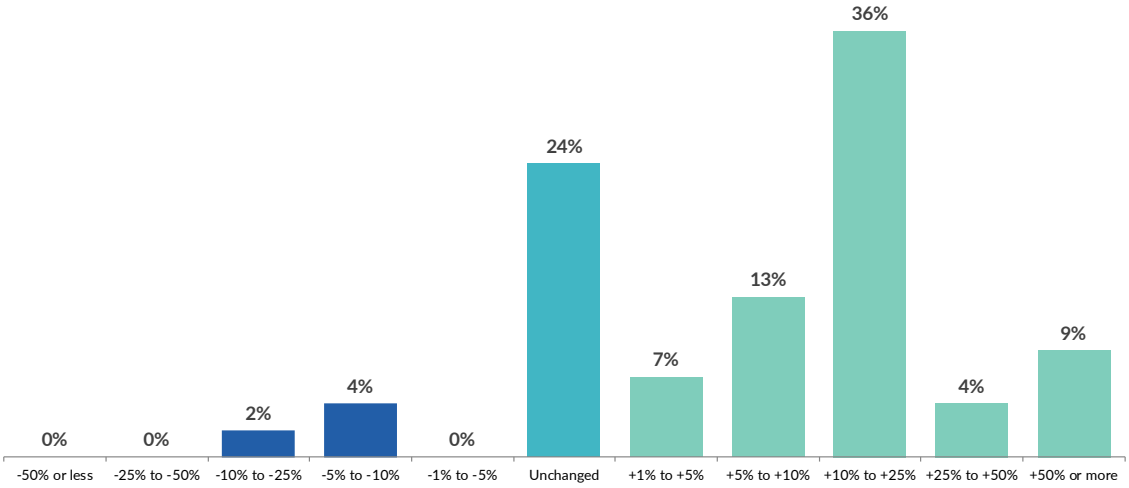


IN A TYPICAL YEAR, WHAT APPROXIMATE PERCENTAGE OF YOUR ANNUAL INCOME IS ALLOCATED TO SEAFARER TRAINING?

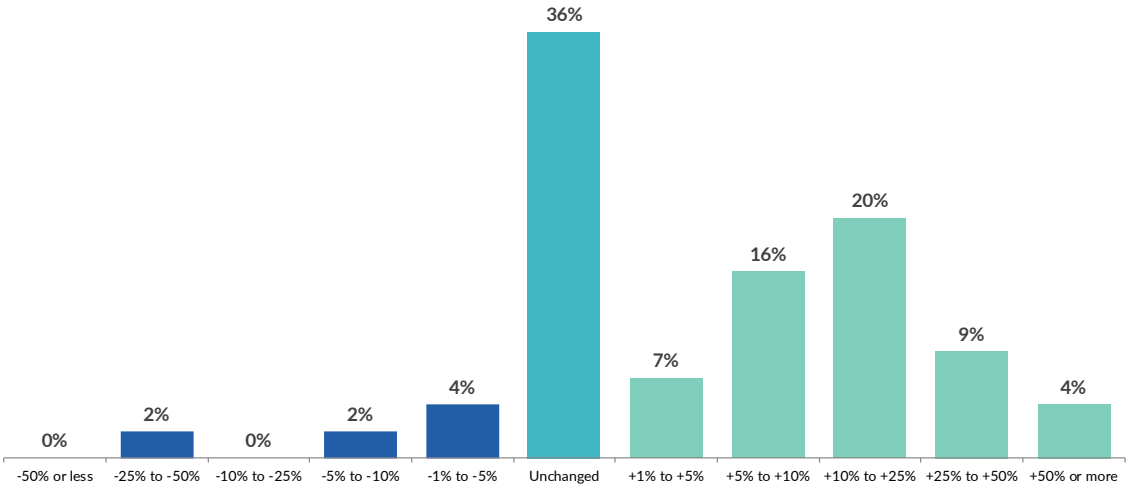


As seen with vessel operators and training institutions, spending for individual seafarers is also increasing. Over 68% of seafarers have increased their training expenditures over the last five years, and more than half expect their spending to increase in the upcoming year.

BY WHAT APPROXIMATE PERCENTAGE HAS YOUR PERSONAL SEAFARER TRAINING EXPENDITURE GROWN OR SHRUNK OVER THE LAST FIVE YEARS?



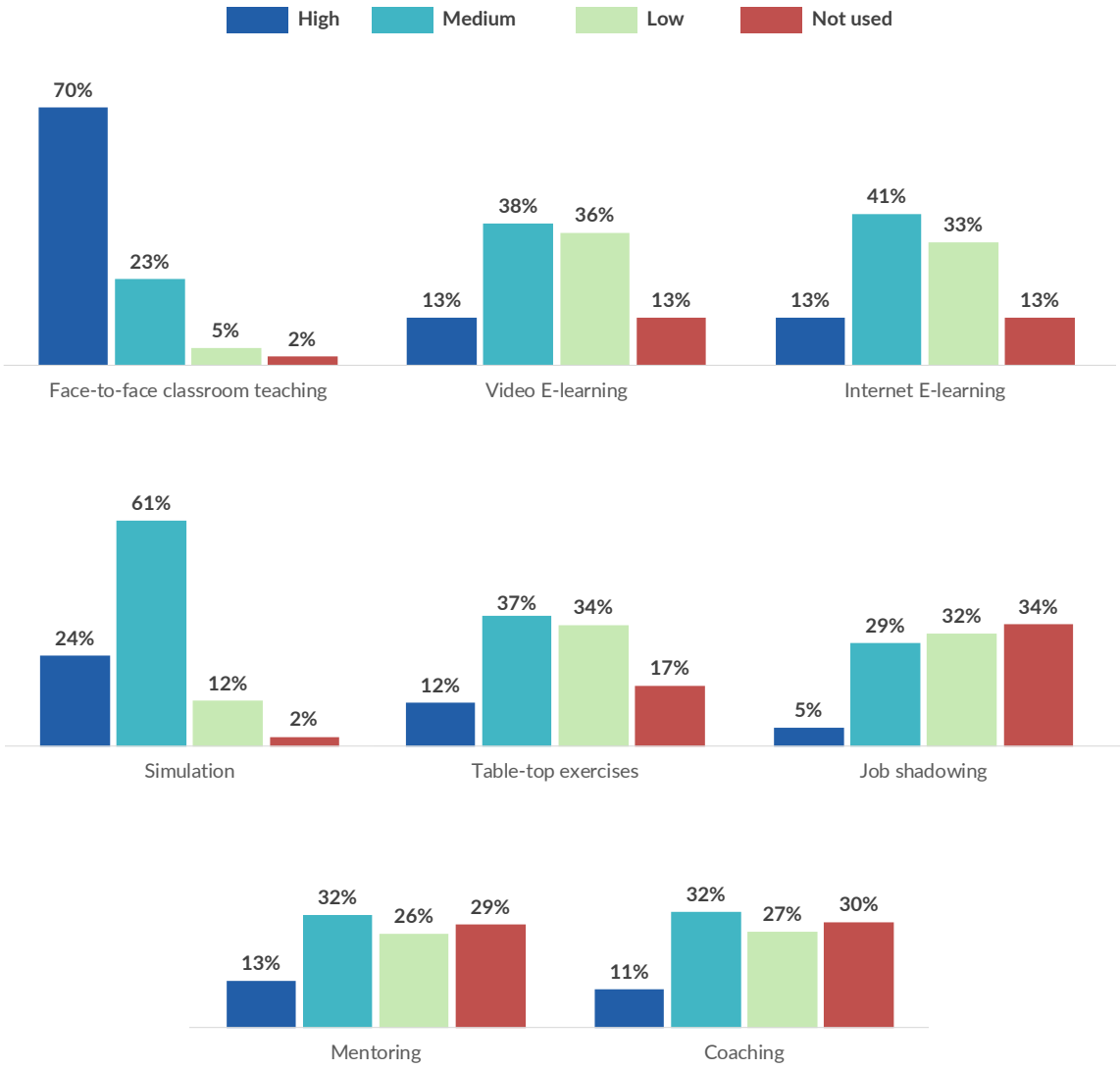
BY WHAT APPROXIMATE PERCENTAGE DO YOU EXPECT YOUR PERSONAL SEAFARER TRAINING EXPENDITURE TO GROW OR SHRINK IN THE UPCOMING YEAR?



Training Models and Tools

Traditional classroom teaching remains the most frequently experienced training method for seafarers, with nearly 70% of the respondents reporting high usage. Simulation training is also widely used, with around 60% reporting a medium degree of usage in their training. This may reflect the fact that nearly all seafarers will go through a training centre at some point in their career (where classroom teaching and simulation training is more common).

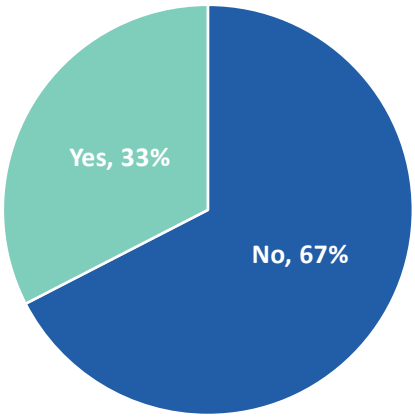
PLEASE INDICATE IN THE TABLE BELOW WHICH TRAINING METHOD(S) YOU'VE ENCOUNTERED IN YOUR SEAFARER TRAINING AT YOUR CURRENT ORGANIZATION, AND TO WHAT DEGREE THEY ARE USED.



Around a third of the responding seafarers are currently employed in an organization that assesses how their actual work performance is impacted by training. The most common method mentioned was oral exams or verbal interviews/ appraisals. Other assessment methods mentioned include:

- Internal inspections
- Continual questionnaires
- Periodic audit by senior faculty
- Mentorship appraisals
- KPI/KRA Performance
- Assessments and general appraisals
- Monitored progression of training
- Oral exam
- Annual career development panels
- Weekly drills and computer based trainings on-board

DOES YOUR ORGANIZATION ASSESS THE IMPACT OF YOUR TRAINING ON YOUR WORK PERFORMANCE?



"IDEAL" TRAINING

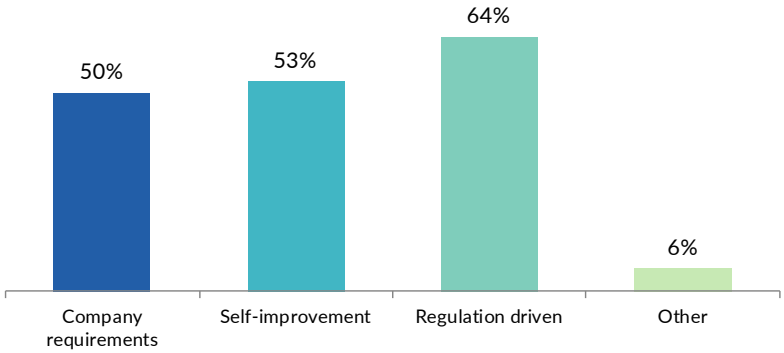
We asked respondents what new training they would most like to be exposed to, if there were no limitations. While there were a wide variety in responses, the most commonly cited response, representing around 12% of the respondents, was improved simulator and more practical, on-board training. E-learning, mentoring, coaching and leadership training were tied as the second most mentioned types of 'ideal' training. A selection of their responses can be found below.

- More simulation or hands-on / practical training
- Video, e-learning and on-board training
- Mentoring, coaching
- Leadership training
- Polar code training
- DP and Advanced Gas Tanker training
- Electronics
- A better understanding of the WHOLE ship operations - Deck, Engine, Steward departments, as well as the business side of operating a ship. Too many seafarers lack appreciation for other departments, or do not grasp the big picture of ship operations.
- Developing realistic simulation interfaces that provide consistently robust and impeccable response to ever changing conditions of wind, sea and weather
- Guided sea training for any offshore types
- Additional Damage Control Scenarios
- Human Resources and Ship Handling
- Graduate studies
- Hands-on first aid for common injuries
- Hand-on training in ME-GI
- Simulation on bridge handling
- Advanced ship handling (not only in maneuvers but in high density traffic)
- Six Sigma
- On-board decision support system
- Contemporary IT and software technology
- Training for complex situations
- Sea-to-shore transition training

Training Drivers

A majority of responding seafarers cite regulations as their primary reason for engaging in seafarer training. However, it is positive to see that more than half also train for self-improvement purposes.

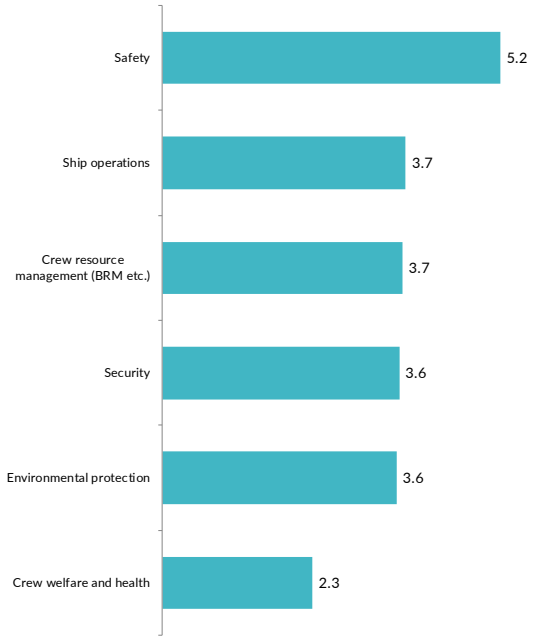
WHAT ARE THE PRIMARY DRIVERS (OR MOTIVATION) FOR YOUR SEAFARER TRAINING? PLEASE SELECT ALL THAT APPLY.



In terms of what seafarers experience at their organization, complying with external regulations seems to be the most important driver of training, in their view. However, safety training is the area they most frequently receive training in.

DRIVERS FOR TRAINING IN YOUR ORGANIZATION, FROM MOST IMPORTANT TO LEAST :

PLEASE RANK THE FOLLOWING SEAFARER TRAINING AREAS IN ORDER OF TRAINING FREQUENCY, WITH 6 BEING THE AREA IN WHICH YOU RECEIVE THE MOST TRAINING IN TO 1 BEING THE AREA YOU RECEIVE THE LEAST TRAINING IN.



2019 Theme: Autonomous Operations

The MarTID partners agreed that each year the MarTID survey will, in addition to its core set of questions, offer a different themed section of the survey that is deemed timely and topical. The theme for 2019 is Autonomous Operations. Autonomy is all around us, pervasive in nearly every transport and logistics sector, from aerial drones and self-driving cars to robotic cargo systems and subsea vehicles. Fully autonomous ships traversing the world's oceans is likely in a generation or two in the future, with a number of technical, political and insurance hurdles to clear, to name a few. However, steps toward increasing levels of automation onboard ships are taking place now, steps that will impact maritime training.

We surveyed the three groups – owners, METIs and seafarers – on the trend towards autonomous operations and their thoughts on the impact this will have on training current and future mariners.

Throughout this section, we refer to different levels of autonomy in vessel operations, adapted from Lloyd's Register Classification Description on autonomy[1]. We've included the description of these levels below for your reference:

AUTONOMOUS LEVEL

AL0: Manual - No Autonomous Function. All action and decision-making is performed manually - i.e. a human controls all actions at the ship level. Note: systems on board may have a level of autonomy, with 'human in the loop'.

AL1: On-ship Decision Support. All actions at the ship level are taken by a human operator, but a decision support tool can present options or otherwise influence the actions chosen, for example DP Capability plots and route planning.

AL2: On & Off-ship Decision Support. All actions at the ship level taken by human operator on operator on board the vessel, but decision support tool can present options or otherwise influence the actions chosen. Data may be provided by systems on or off ship, for example DP capability plots, OEM configuration recommendations, weather routing.

AL3: 'Active' Human in the Loop. Decisions and actions are performed autonomously with human supervision. High impact decisions are implemented in a way to give human operators the opportunity to intercede and over-ride them. Data may be provided by systems on or off the ship.

AL4: Human in the Loop - Operator/Supervisory. Decisions and actions are performed autonomously with human supervision. High impact decisions are implemented in a way to give human operators the opportunity to intercede and over-ride them.

AL5: Fully autonomous. Unsupervised or rarely supervised operation where decisions are made and actioned by the system, i.e. impact is at the total ship level.

AL6: Fully autonomous. Unsupervised operation where decisions are entirely made and actioned by the system, i.e. impact is at the total ship level.

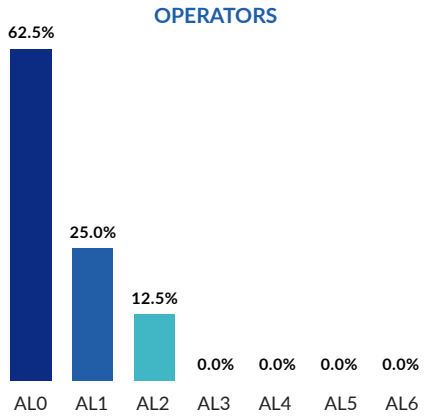
[1] Used with permission: Lloyd's Register Group Limited. (July, 2016). *Cyber-enabled ships. ShipRight procedure - autonomous ships.* Retrieved from http://info.lr.org/l/12702/2016-07-07/32rrbk

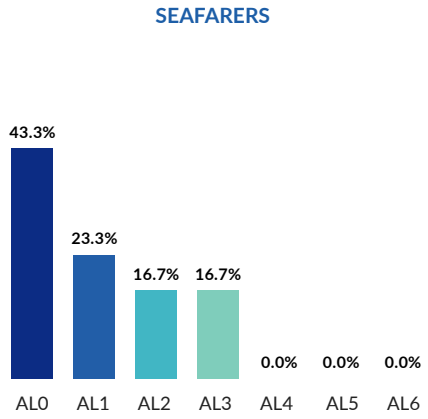
TODAY'S LEVEL OF AUTONOMY

Autonomous operations is not perceived to be common on today's ship by both reporting operators and seafarers who have recently (or are currently) working onboard a vessel. Over 62% of operators and 43% of seafarers report Autonomous Level 0 (AL0), where ship operations is completely manual. Interestingly, a little over 16% of seafarers also report working on a vessel where decisions and actions are performed autonomously with human supervision (AL3).

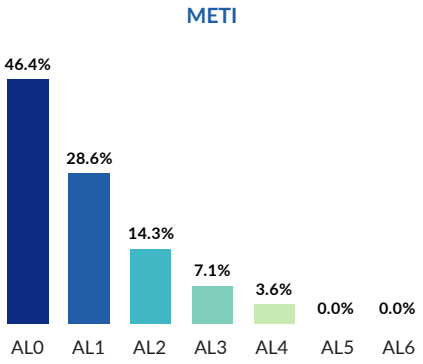
Maritime education and training institutions seem to be further along in adopting and implementing programs for autonomous operations compared to industry, with a higher percentage of training ready for Autonomous Level 2 to 4.

PLEASE INDICATE THE HIGHEST LEVEL OF AUTONOMY YOUR ORGANIZATION / MOST RECENT VESSEL IS CURRENTLY AT.





PLEASE INDICATE THE HIGHEST LEVEL OF AUTONOMY FOR WHICH YOUR INSTITUTION HAS TRAINING PROGRAMS READY FOR TODAY.



AUTONOMOUS LEVEL REFERENCE

AL0: Manual - No Autonomous Function.

AL1: On-ship Decision Support.

AL2: On & Off-ship Decision Support.

AL3: 'Active' Human in the Loop.

AL4: Human in the Loop - Operator / Supervisory.

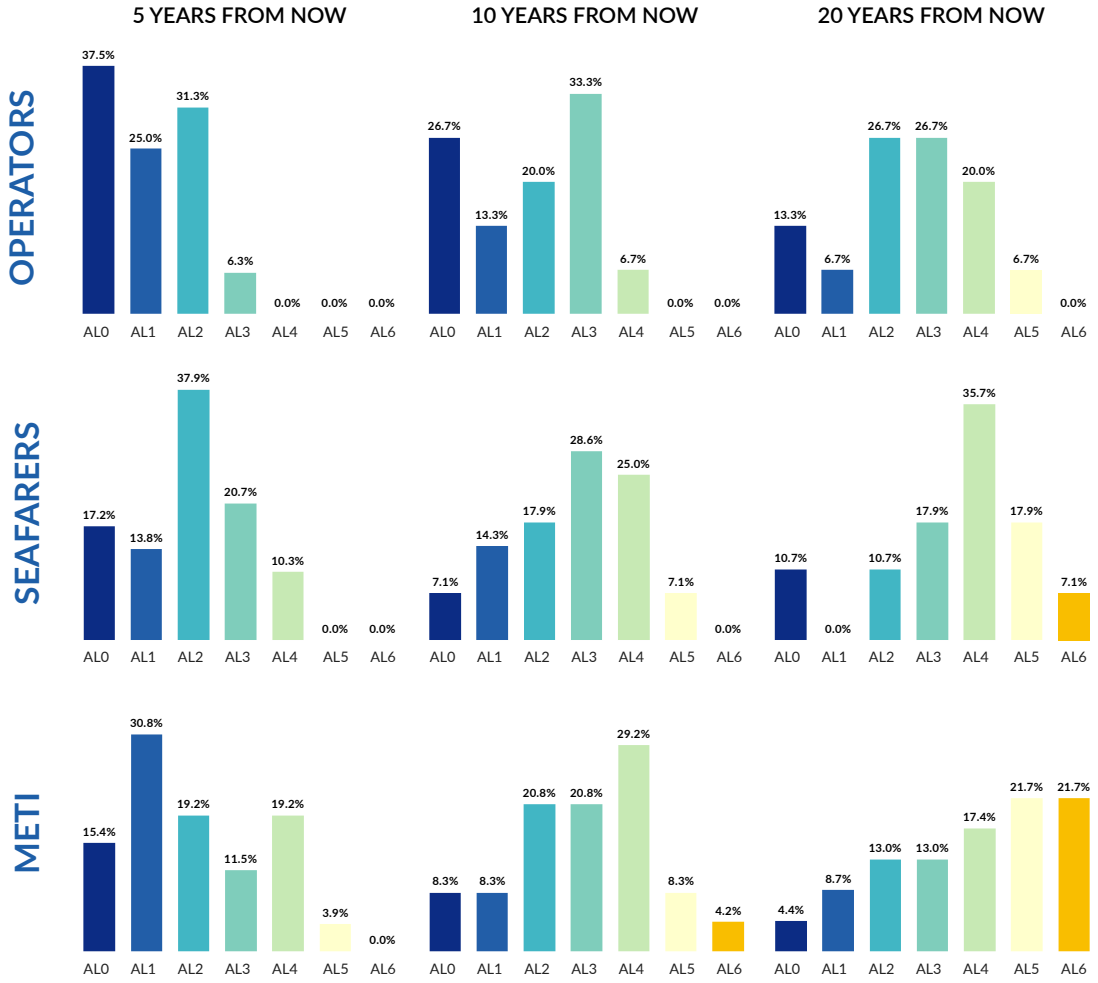
AL5: Fully autonomous.

AL6: Fully autonomous.

EXPECTED FUTURE LEVELS OF AUTONOMY

When asked about expected future levels of autonomy, in regards to actual operations (for operators and seafarers) or to the training programs that will be in place, vessel operators have the most conservative opinion. None of the responding operators expect full levels of autonomy (AL6) in 20 years, compared to seafarers - 7% of whom believe that full autonomy will be possible. Training institutions have the most optimistic view, with over two-fifths believing that full autonomy will be possible in the future (AL5 and AL6).

WHAT, IN YOUR OPINION, IS THE HIGHEST LEVEL OF AUTONOMY THAT YOUR ORGANIZATION EXPECTS TO ACHIEVE, OR HAVE TRAINING PROGRAMS IN PLACE FOR, IN THE NEXT 5, 10, AND 20 YEARS?



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AL5: Fully autonomous.

AL6: Fully autonomous.

SKILLS NEEDED TO SUPPORT AUTONOMY

All three responding groups have common beliefs that a deeper understanding of on-board systems, human-factors skills, management and decision making skills, and collaborative/ communication skills are necessary to support future levels of autonomy. A selection of their responses can be found below.

IN YOUR OPINION, WHAT PRIMARY SKILLS ARE NEEDED IN ORDER TO SUPPORT YOUR SELECTED LEVELS OF AUTONOMY?

OPERATORS

- Automation tools
- Knowledge to ships mandatory equipment
- Human factor training, unwilling complacency - situational awareness, alert management, utilization of all control surfaces effectively to resolve any issue - making it the new norm for all generations
- Higher technical education
- Knowledge to how to interact with the systems and how to go back to full human control.
- Move from navigators 'hands on' to 'monitoring' Fleet Operations Center - monitoring and processing skills - same as air traffic control.
- Unsure at this time of the risk of cognitive overload

SEAFARERS

- How to operate our equipment, and what faults they may have.
- Bridge Navigational Watch-keeping
- Basic automation scenarios
- SCDA integration and signal processing
- Understanding of complex control systems and on-board systems
- Deeper understanding of DSS
- Adapted BRM training
- Technological glitch and resolving any issues raised from the action
- Leadership and collaborative decision making in human machine teams
- Human interference to check compatibility and incident review
- Multi discipline operation.

METI

- Leadership, management and decision making
- Equipment and Navigation System operational understanding
- Systems and troubleshooting knowledge
- Computer and online literacy
- Understand and effectively employ decision support technologies
- Situational awareness
- Bachelor-level education
- Traditional navigational and collision avoidance training
- Enhancement of todays skills, basic technical insight - increased contingency training and continuous simulated training exercise
- Understand capabilities and limitations of autonomous vessel technologies; ability to take corrective actions to intercede and over-ride
- Communications skills

TRAINING NEEDED TO SUPPORT AUTONOMY

Both seafarers and vessel operators stress the importance of on-board training and technical training that is aligned to Original Equipment Manufacturer (OEM) practices in order to support future levels of autonomy. Training institutions answered similarly, with an emphasis on better and increased use of simulation. Below are a sample of responses when asked what type of training is needed to support operations 5 years from now.

IN ORDER FOR YOUR ORGANIZATION TO REACH YOUR CHOSEN LEVEL OF AUTONOMY IN 5 YEARS, WHAT DO YOU BELIEVE IS REQUIRED IN TERMS OF TRAINING (I.E. TYPE OF TRAINING NEEDED, RESOURCES NEEDED, ETC.)?

OPERATORS

- Younger trainers
- More advanced simulators
- Shore-side management training in resource management and systems
- Training that is aligned to manufacturer requirements for OEM practices
- Creation of a regulation body (e.g. similar to how DP operations is approached)
- VTS type reporting requirements
- Alarm management protocols and actions
- Improved risk assessments
- Extensive CBT and E-Learning
- Actual shipboard/on-board training to stimulate real situation awareness
- *Autonomous vessel operation will not change in 5 years*

SEAFARERS

- E-Learning
- On-site / on-board training
- Simulation
- Up to date training on new equipment to support the level of automation we evolve to (supervision systems, emergency operations and protocols)
- A complete review of current skills and competences
- Technical training to understand limitations and capabilities of new systems
- OEM control system operator & maintainer training
- *Autonomous operations will not happen in the near future, ships are too old*

IN ORDER TO ACCOMMODATE AN INDUSTRY TREND TOWARD AUTONOMOUS SHIPS, HOW DO YOU THINK YOUR INSTITUTION'S TRAINING APPROACH MUST CHANGE IN THE NEXT 5 YEARS (I.E. TYPE OF TRAINING NEEDED, RESOURCES NEEDED, ETC.)?

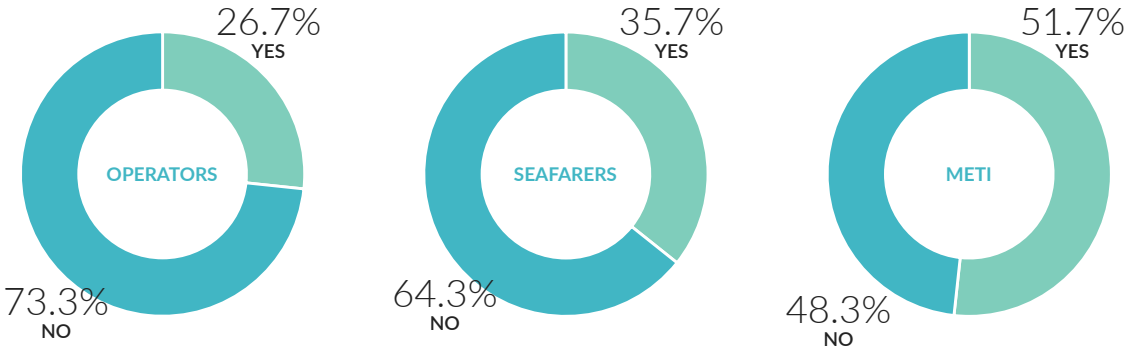
METI

- More individual training based on high quality assessment. Change from generic simulated training to simulated training on "real" vessel bridge environments (similar to aviation industry). Instructors/ trainers are to become coaches as well, being available with expert advice to operators.
- Initial set up with simulation ability resources, with plans to migrate some part of these skills onto an online or virtual component for exportable training.
- Increased use of simulation, e-learning.
- Outcomes-based education
- Remote simulator operators
- Stay informed and modify existing curriculum as autonomous vessel technologies are advanced and operationally implemented to address the additional skill requirements identified.
- In the next five years, very little; perhaps just towards on board computer decision making/leading
- *Accommodating and/or supporting instruction relevant to autonomously operated vessels is not a priority.*

PLANS FOR AUTONOMY

In line with their previous responses to expected future levels of autonomy, a majority of responding vessel operators do not plan to increase their level of autonomy. Maritime training institutes have the highest proportion of respondents who believe that autonomous operations will become more common in the future, with a little over half of respondents having plans to change their training offerings to match increased levels of autonomy.

DOES YOUR ORGANIZATION HAVE PLANS TO INCREASE THEIR LEVEL OF AUTONOMY? / DOES YOUR INSTITUTION HAVE PLANS TO CHANGE ITS TRAINING OFFERINGS TO MEET HIGHER LEVELS OF AUTONOMY?



For those who do have plans to accommodate autonomous vessel operators, we asked them to rank their reasons for doing so. Efficiency and cost-reduction ranked higher for both operators and seafarers. However, it appears that operators place a higher value on safety than seafarers do, as related to autonomy.

For METI, their plans to change offerings are highly tied to what they believe will be relevant to the industry and customers.

OPERATORS

1. Efficiency
2. Safety
3. Cost-saving
4. Crew Reduction
5. Demand from customers
6. Regulation

SEAFARERS

1. Crew Reduction
2. Efficiency
3. Cost-saving
4. Regulation
5. Safety
6. Demand from customers

METI

1. Anticipated relevance to industry
2. Demand from customers
3. Efficiency in educational delivery
4. Legislative imperatives
5. Competition with other institutions

CHANGES MADE TO SUPPORT AUTONOMY

The three responding groups were asked different questions on how their organization has changed in response to, or in anticipation of, a move to more autonomous operations in the industry.

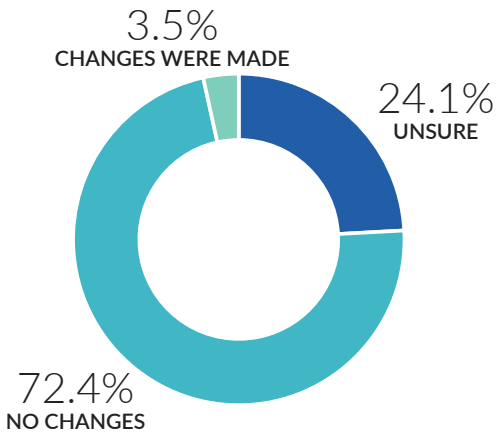
OPERATORS

PLEASE LIST ANY CHANGES YOUR ORGANIZATION HAS MADE TO TRAINING IN ANTICIPATION OF, OR AS A RESULT OF, A MOVE TO MORE AUTONOMOUS OPERATIONS.

- Enhanced recruiting for trainers
- Implementing a fleet operations center - no common standard yet but watch keeper training is conducted
- OEM training enforced by manufacturer to ensure equipment performance
- Nominal changes, as this is not a priority for us
- Inclusion of a Business Research and Business Development Team

SEAFARERS

HAS THE OPERATOR YOU WORK FOR, OR LAST WORKED, MADE ANY CHANGES TO TRAINING IN ANTICIPATION OF, OR AS A RESULT OF, THE MOVE TO MORE AUTONOMOUS OPERATIONS?



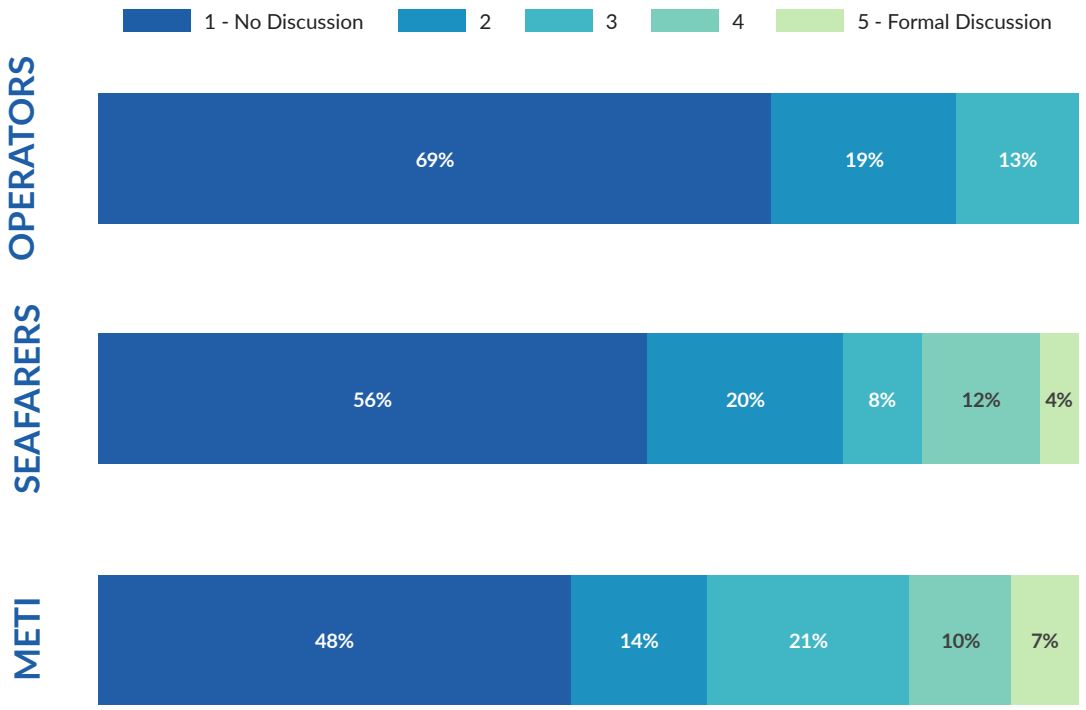
METI

PLEASE LIST ANY CHANGES YOUR INSTITUTION HAS MADE TO ITS TRAINING APPROACH AND COURSE OFFERINGS IN ANTICIPATION OF, OR AS A RESULT OF, A MOVE IN THE MARITIME SECTOR TO MORE AUTONOMOUS OPERATIONS.

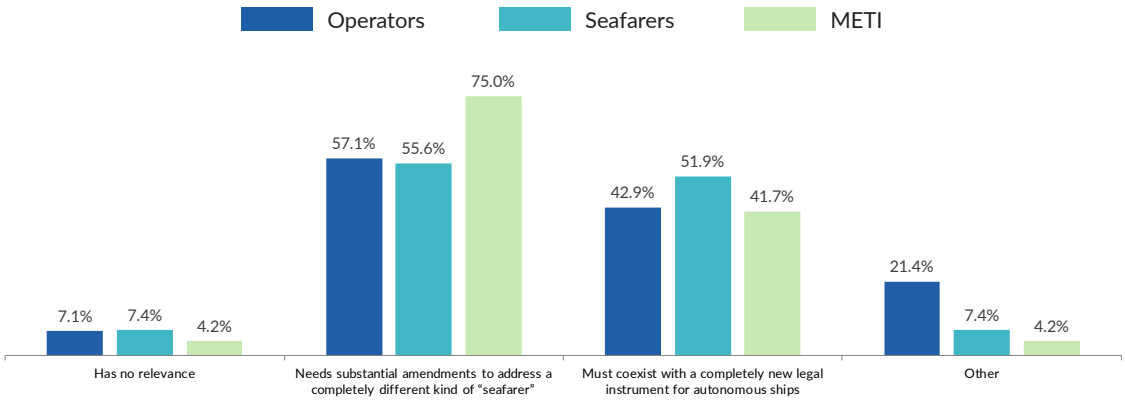
- Increase in simulation based training
- Electronic positioning, charting, voyage planning and navigation execution skills.
- Certified training on national and international standards
- Involvement in research projects looking at training aids.
- Increased training in evolving technology
- Courses on robotics, advanced automation, IT
- Increased focus on data communications and networking systems and technologies
- Incorporating basic awareness of autonomous vessel technologies and potential navigation risk factors into existing curriculum
- Research papers
- More emphasis on applied research skills and 21st century skills

Vessel operators report the lowest level of discussion on training needs for an autonomous future, with a majority having no discussion on autonomous operations. Training institutions are further along, with a little over 50% having at least some discussion on training needs for an autonomous future.

PLEASE INDICATE TO WHAT EXTENT YOUR INSTITUTION IS DISCUSSING TRAINING NEEDS FOR AN AUTONOMOUS FUTURE ON A SCALE OF 1 TO 5, WHERE 1 REPRESENTS NO DISCUSSION AND 5 REPRESENTS EXTREMELY DETAILED, FORMAL DISCUSSION AND ENGAGEMENT.



WHAT RELEVANCE DO YOU BELIEVE THE STCW 1978, AS AMENDED, HAS ON AN AUTONOMOUS SHIPPING FUTURE?

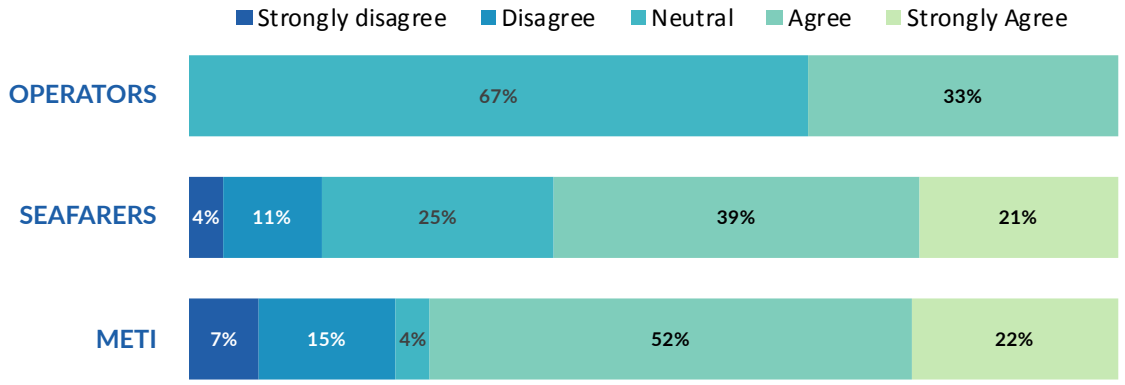


OPINIONS ON AUTONOMY

We asked the three groups of respondents for their opinion on (whether they agree or disagree with) several statements regarding autonomous shipping and its relationship with the industry, jobs and safety.

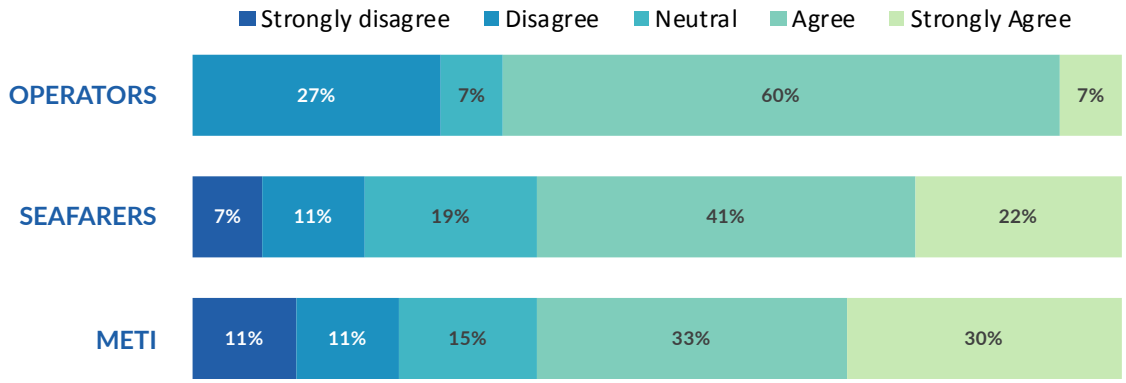
INCREASING THE LEVEL OF AUTONOMY OF SHIPS WILL PROVIDE ADVANTAGES FOR THE MARITIME INDUSTRY.

Vessel operators are the most neutral on their opinion that autonomous operations will provide advantages for the industry, while maritime education and training institutions are generally the most positive: nearly 75% agree that autonomy will be advantageous to the industry. Seafarers have a more mixed reaction to this statement.



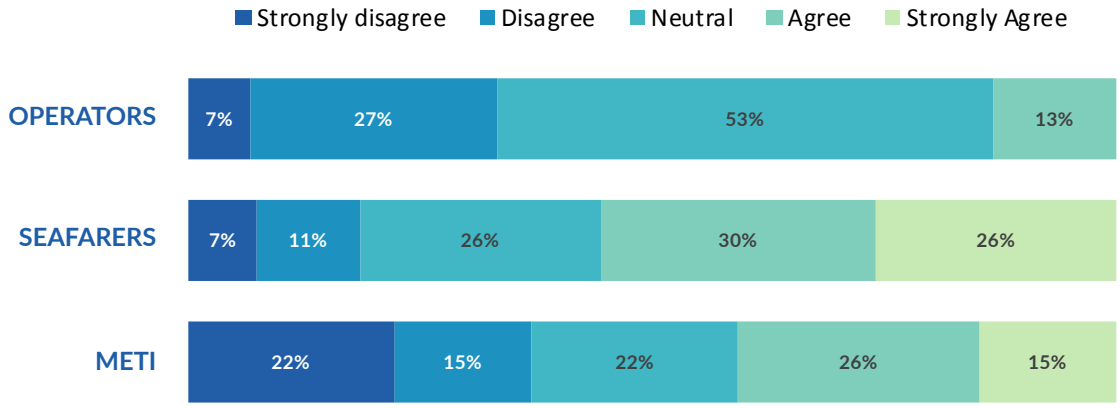
AUTONOMOUS SHIPPING IS A THREAT TO SEAFARING JOBS.

The majority of all three target groups believe that autonomous shipping will be a threat to seafarer jobs, with over 60% in each group agreeing with this statement. Both METIs and seafarers have significantly high "strongly agree" percentages.



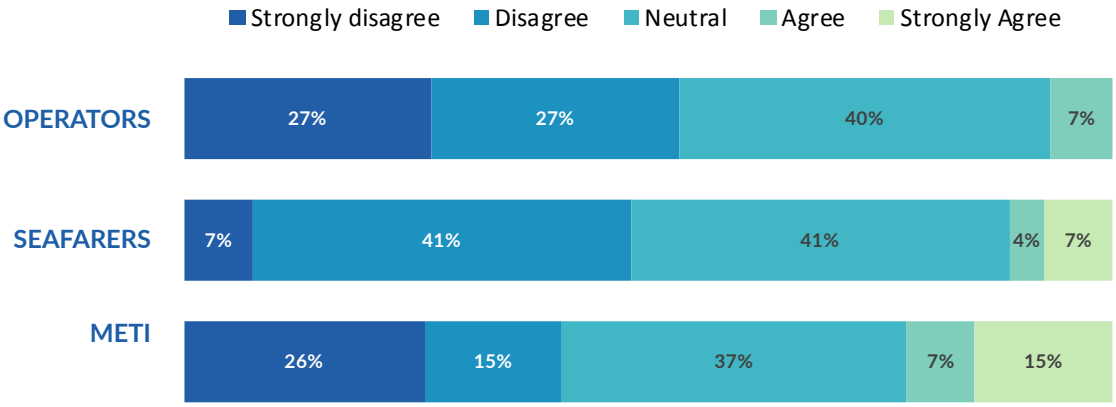
AUTONOMOUS SHIPPING IS A THREAT TO THE SAFETY OF MARITIME OPERATIONS IN GENERAL.

Operators are the most ambivalent on the effects of autonomous shipping; a little more than half neither agree or disagree that autonomous operations would negatively impact maritime safety. Seafarers, on the other hand, are more concerned: around 56% agree that such technology is a threat to safety in general.



AUTONOMOUS SHIPPING MUST BE RESISTED BY THE MARITIME COMMUNITY.

Operators and seafarers are generally in agreement: more than half of each responding group believe that autonomous shipping should not be resisted by the community. METI are slightly more mixed, with at least 15% strongly agreeing that the community should be actively resisting such a trend.



I AM CONCERNED ABOUT THE POSSIBLE NEGATIVE IMPACT OF AUTONOMOUS SHIPPING ON MY SEAFARING CAREER.

Seafarer opinion is mixed about their concern as to whether autonomous shipping will negatively impact their career.

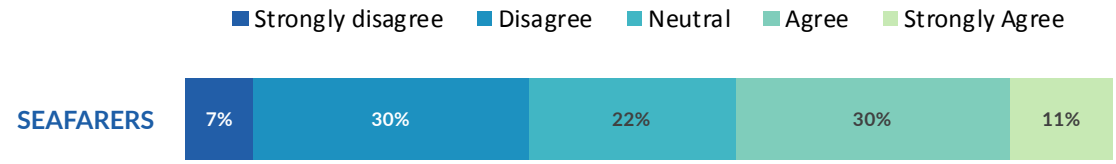


Photo Credits

Cover
The cover picture is from the series *Seamotion* by Herbert Boettcher.

It shows the fully loaded Hamburg Süd ship, Cap San Antonio, on its way to the next Brazilian port. Boettcher is a professional German photographer who works for shipping operators around the world to capture photos of merchant ships with his unique visual language.
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Contents - Page 2

Introduction - Page 11
Operator and Institution Survey results - Page 18

Seafarer Survey Results - Page 33

2019 Theme: Autonomous Operations - Page 39

www.martid.org

Source: *MarTID 2019 Training Practices Report*

Authors: *The MarTID Working Group: World Maritime University, New Wave Media and Marine Learning Systems.*

Full Report: *MarTID.org*

New Wave Media Business Navigator
WMU World Maritime University
Marine Learning Systems