

Autonomous ships -

Inevitable reality at sea

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PLACE

Gdansk University of Technology

Narutowicza 11/12

80-233 Gdańsk, Poland

„Autonomous ships – Inevitable reality at sea” Conference – Gdansk, 19th March 2019

Space Sciences Committee Polish Academy of Sciences / Gdansk Branch and Gdansk University of Technology in cooperation with the Baltic Sea & Space Cluster invites for a joint conference entitled “Autonomous ships – Inevitable reality at sea”

Gdansk University of Technology, Gdansk, 19th March 2019

CONFERENCE PROGRAMME

- 8.30 **Registration and coffee**
- 9.00 **Opening Session** – chaired by Prof. Edmund Wittbrodt
- 9.00 Welcome by Prof. Jacek Namieśnik, Rector of Gdansk University of Technology
- 9.15 *The need for systematic and systemic management of safety in autonomous shipping*, by Prof. Osiris Alejandro Valdez Banda, PhD, Aalto University, Finland
- 9.45 **“Young Stars” Session** – chaired by Dr. Paweł Chyc
- 9.45 *Sea navigation – challenges of the control algorithm for autonomous sailing units*, by Ms. Daria Lewandowska, SIMLE Stud. Organization, Faculty of Mechanical Engineering, Gdansk University of Technology
- 10.00 *Project DUCKIET as a platform for teaching and popularizing issues related to autonomous vehicles and autonomous port*, by Mr. Mateusz Dyrda (Student’s Association of Robotics SKALP)
- 10.15 *Green technologies for autonomous vehicles developed by students science club K.S.T.O. KORAB*, by Mr. P. Pruszek and P. Swatowski, Faculty of Ocean Engineering and Ship Technology, Gdansk University of Technology
- 10.30 *Legal policy on autonomous ships*, by Mr. Wojciech Zawadzki, Post-graduate Student of University of Business and Administration in Gdynia
- 10.45-11.15 **Coffee break**
- 11.15 **Applications’ Session** – chaired by Prof. Marek Grzybowski
- 11.15 *Introduction to practical aspects of autonomous ships*, by Mr. Adam Potrykus, President of Nauta Shipyard Ltd. (S.A.)
- 11.40 **Panel debate** with participation of representatives of: Mr. Zbigniew Zienowicz (HYDROMEGA, President), Mr. Grzegorz Kozłowski (CADOR CONSULTING), Cpt. Alfred Naskręt (Gdynia Maritime University), Mr. Dariusz Włodarczyk (IMPEL), Prof. Mirosław Gerigk (Gdansk University of Technology)
- 12.30-13.15 **Lunch break**

- 13.15 Research Session** – chaired by Prof. Andrzej Stepnowski
- 13.15 *Control system configuration of marine autonomous surface*, by Prof. R. Śmierzchalski, Dr. Tomasz Zubowicz, Dr. Krzysztof Armiński, Dr. Anna Witkowska, Gdansk University of Technology
 - 13.30 *Autonomous platforms - challenge and responsibility for engineering education and research*, by Prof. Henryk Lasota, Prof. Roman Śmierzchalski, Prof. Cezary Specht, Gdynia Maritime University, Mr. Piotr Cywiński (Navinord), Mr. Łukasz Kulas, Gdansk University of Technology
 - 13.45 *UUV and AUV vehicles as the autonomous systems for navy applications*, by Prof. Lech Rowiński, Gdansk University of Technology
 - 14.00 *Challenges, solution proposals and research directions in safety and risk assessment of autonomous shipping*, by Prof. Jakub Montewka, Gdynia Maritime University
 - 14.20 *Hybrid Propulsion for Future Smart and Green Autonomous Ships*, by Prof. Wojciech Litwin, Mr. W. Leśniewski, Mr. D. Piątek, Mr. K. Niklas, Gdansk University of Technology
 - 14.40 Discussion and closing session

In front of the Senate of GUT Room will be presented exhibition prepared by the Baltic Sea &Space Cluster and Student's Scientific Organisations presenting activities in the field related to the subject of the conference.

Exhibition and show of smart ships on the Model Water Pool at the Ships and Ocean Technology Faculty of Gdansk University of Technology

KONGSBERG SIMILATOR DEMONSTRATION in Gdynia Maritime University is offered, the day before the Conference, 18th March 2019, 09:00-10:00, Gdynia, Polska Street 13A

Professor Edmund Wittbrodt

President of the Space Sciences Committee of the Polish Academy of Sciences, Branch in Gdansk

Conference entitled „Autonomous Ships – Inevitable Reality at Sea” has been organized by the Committee on Space and Satellite Research of the Polish Academy of Sciences, Branch in Gdansk in cooperation with Baltic Sea & Space Cluster, under the auspices of the Rector of Gdansk University of Technology, Professor Jacek Namieśnik. This is already the third conference in the cycle of six events planned in academic year 2018/2019. Previous ones were held in Sopot and Gdynia.

This conference is dedicated to engineering issues connected with space and satellite technologies, particularly to unmanned floating vessels. The conference will consist of four sessions. In the first, opening session we will discuss problems associated with the safety of autonomous ships – their full-fledged operation seems to be around the corner. During the second session the achievements of students, PhD students and young scientific personnel in the area of unmanned vessels. Third session, in turn, will be held in the form of a debate and will bring closer the actions undertaken by companies in order to practically launch unmanned floating vessels. Finally, the fourth session will be dedicated to scientific research on floating unmanned vessels undertaken by universities and scientific institutions.

The conference is accompanied by an exhibition presenting the achievements of companies and student science circles in the areas associated with the subject of the conference, as well as by a display of models of unmanned floating vessels held at the model basin of the Faculty of Ocean Engineering and Ship Technology at Gdansk University of Technology.

I would also like to announce the next of the planned conferences, „Institutional Cooperation at Sea & (Outer) Space Essential Adjustments Needed to Boost Full Potential”, which will be held on 16 May 2019 at the Faculty of Law and Administration of the University of Gdansk. I would already like to invite everyone to this event.

The need for systematic and systemic management of safety in autonomous shipping

Osiris Valdez-Banda, PhD, Aalto University.

Abstract

The date when the first fully autonomous ship starts operations seems to be close. The readiness of technology for creating the operational components of an autonomous ship provide strong evidence to believe that the maritime transport industry is prompt to witnessing this date. However, technology is not the only element that has to be set in order to initiate the operations of these new smart ships. Other crucial elements have to be systematically and systemically integrated into the initial design phase of autonomous maritime ecosystems. In this presentation, a general review of critical elements for building the initial safety management

strategy of autonomous ships is presented. The presentation introduces some examples of applications and development of autonomous maritime ecosystems in the Finnish maritime cluster.

Sea navigation – challenges of the control algorithm for autonomous sailing units

Mrs. Daria Lewandowska, SIMLE Student's Organization,
Gdansk University of Technology

Abstract

Autonomous sail units are robotic vessels whose only power and control is the strength of the wind. The use of unmanned boats can have many practical applications, including the field of oceanography, environmental patrolling and measurements of water pollution. There are many advantages of such solutions, which is why autonomous marine units are in the phase of strong development. Currently, some technical limitations have been exceeded due to the availability of powerful electronics, flexible computer systems, reliable communication devices and high quality renewable energy sources. At the same time, they have been relaxed in the case of real scenarios. However, autonomous navigation implies many challenges related to software and hardware.

One of the main challenges of the Seafarer autonomous yacht project is the implementation of a deterministic navigation algorithm. This algorithm is the main part (and most advanced) of the autonomous unit software set next to the management module and the module for handling incorrect and critical situations.

The first stage of software development is the collection of environmental data. The hardware and programming solutions have been used for this. To conduct a safe route for a sailing vessel, the following data should be monitored on an ongoing basis:

- * weather forecast and data from on board sensors,
- * AIS – automatic communication for avoiding collisions between ships,
- * basic information about the current position of the unit,
- * static spatial data about lands, islands and closed areas.

However, they are not the only key to safe navigation. There are a lot of restrictions on the route for sailing boats due to the physics of the boat. Not all points of sail are navigable, if the target is against the wind the straight line route is not navigable. In this case the sailor has to take a zig-zag course against the wind. The sailboat executes a tack maneuver when it changes course as it zig-zags upwind. Also very important aspect is fact that there is no way to control the speed of the boat. That's why the skill of tacking is useful.

Duckie Town – as a platform for teaching and popularizing issues related to autonomous vehicles in the context of an autonomous port

Mr. Mateusz Dyrda, Student

Abstract

Autonomous vehicles are appearing in more and more areas of human life in recent years. The autonomous vacuum cleaner is no longer something unusual, at the airports they start. In the future, more and more industries will be reaching for robotic technologies, highly specialized staff will be needed to develop this sector. As the SKALP Robotics Association, we believe that the best method of learning is to involve students in a large project, which is why we planned to start a project related to autonomous vehicles and artificial intelligence for 2019.

In the presentation I will present various open source educational projects on the theme of autonomous vehicles. Then, I will present their advantages and disadvantages, potential development opportunities and the required project start-up costs. I will also present barriers that hinder the start of a given project, both financial and hardware. I will also present the prospects of participation of people with little experience in the mobile robotics and machine learning industry. In summary, I will try to demonstrate why we chose the DuckieTown project, presenting more precisely the assumptions, goals and challenges of the entire project.

In the second part of my presentation, I will present a plan to add to the DuckieTown system elements that extend its functionality for learning and research related to logistics chains containing robotic, autonomous vehicles. We plan to add physical elements to the project, which will be exemplified by an autonomous container crane, as well as program extensions that will allow to duplicate solutions developed by us in other instances of the DuckieTown project.

Legal Policy on Autonomous Ships

Mr. Wojciech Zawadzki, Postgraduate Student of University of Business Administration in Gdynia

Abstract

Maritime law is considered a highly traditional and conservative branch of law. Some of its institutions, such as the general failure or contract of carriage have their roots in times of Phoenicians and Rhodians. Since then seafarers have faced many significant changes in maritime technology, such as the evolution from oars to sail and then from sail to engine powered craft. Despite the sweeping changes of technology one factor has remained constant, the role of a human as the most important element of the vessel's steering system. Up to now; as the fourth industrial revolution, upon which threshold the world is currently standing, brings an evolution which will for the first time challenge the above-mentioned principle with the introduction of autonomous ships. This raises the issue of the applicability of existing rules to those new type vessels. Institutions of maritime law that were born from practice reflect the characteristics of sea shipping. The principle of the most important role of a human in maneuvering the vessel has also been contained

in a significant amount of rules of maritime law, at both international and national levels. In light of the above, the implementation of autonomous ships into the system of maritime shipping in many ways may be considered as an unprecedented legislative undertaking. Predicted socioeconomic benefits of autonomous shipping make this project highly important and urgent.

The hierarchy of legal sources means that there is a need for cascading change of legal acts, starting from adequate international conventions. The first, very important step has been taken, as the IMO – the supervisor of the most significant international conventions referred to the maritime shipping – has agreed on the importance of autonomous ships for the efficiency of maritime shipping and has started the legislative procedure aimed at the international implementation of this type of vessel. At the current stage, member states with affiliated organizations are proceeding with a regulatory scoping exercise of respective conventions to establish the extent to which the international regulatory framework should be modified to integrate the technology of autonomous ships. It has been already determined that regulatory arrangements shall encompass regulations referred to *inter alia* safety, security, environmental protection, liability, compensation and insurance. The purpose of the next stage is to introduce a draft of regulations on autonomous ships that shall be a remedy for known gaps and obstacles in the current legal framework. Nevertheless, some participants have already expressed concerns regarding the technical and operational aspects of autonomous ships. Among lots of questions, one thing is for sure – the current work of the IMO is determining the future development of autonomous ships technology, as it will influence the worldwide shape of any new regulations.

Introduction to practical aspects of autonomous ships

Mr. Adam Potrykus, President of Nauta Shipyard S.A.

93 years ago, on 7th October 1926 the Town Council of Gdynia passed the resolution for the necessity of establishing a shipbuilding enterprise, defined its shape and the site for its location. That day is the date of establishment of NautaShip repair Yard.

Today Nauta, after acquiring simultaneously substantial part of land and water area of the former Gdynia Shipyard together with SDI graving dry dock and the Newbuilding division in Gdansk with two slipways, is one of the leading Polish shipyards that specializes in building vessels and hulls, repairs and special surveys of all kind of vessels and maintenance and construction of naval ships. Nauta is a member of Mars Shipyard & Offshore Group and Polish Armament Group.

NAUTA TODAY:

Diversified core business activity based on 3 segments:

- Repairs & conversions of vessels
 - We offer a 24 hour – 7 day – 365 days per annum service;
 - Over 120 projects performed every year;
 - Comprehensive repairs and special surveys of all kind of vessels;

- Significantly increased production assets offering complex engineering, mechanical, welding, electrical, fitting and hull services;
 - Number complicated conversions and lengthening/shortening projects irrespective of the line of the cut, including conversions of oil and gas drilling rigs;
 - A team of highly skilled professionals and a number of meticulously selected co-operators, all of whom are always ready to meet the growing demands of our clients;
 - Installations of exhaust gas cleaning systems supplied by such leading manufacturers as Wärtsilä, EcoSpray and Alfa Laval;
 - Installation of Ballast Water Treatment Systems in co-operation with key manufacturers;
 - Hydro blasting up to 2500 Bar;
 - More than 3050 m of berths;
- Newbuildings
 - Over 500 vessels of various types and sizes designed and built in 90 years of activity;
 - Specialization in construction of advanced research vessels, fishing vessels and offshore vessels, both turnkey vessels and partly outfitted hulls;
 - Technical consultancy support helping to choose best solutions for the Ship owners;
 - Two slipways capable of launching vessel with LOA up to 240m;
 - Steel cutting capacity of 5,000 tons per month;
 - Production hall with area of 9648 square meters;
 - Closed grit blasting and painting chambers
 - Defense production
 - Know-how and experience in providing services in the area of repairs, modifications and building of the naval vessels.
 - Certificates confirming compliance with the requirements of ISO9001:2008, ISO 14001:2004, PN-N-18001:2004, AQAP 2110-2009, Industrial Security Certificates of the second degree with a “SECRET”, “NATO SECRET” and “SECRET UE/EU SECRET” Clause, NATO Commercial and Government Entity Code.
 - Over 300 completed projects for the Polish and foreign navies, including Guided Missile Frigates, ASW corvettes, submarines, Fast Attack Crafts, LST, patrol boats and auxiliaries.
 - Co-operation with R&D and education institutions with the goal of introducing innovative solutions for military purposes

Reliable, quick developing entity:

- Significant growth of sales
- Sales revenues in 2018 five times bigger than in the year of 2010.

We have a lot of experience in repair, rebuilding and new building. That’s why we are ready for the next step which is rebuilding of traditional ships into autonomous ships.

CADOR CONSULTING sp. z o. o. is an authorized partner of the world leader – Siemens PLM Software. We specialize in technical consultancy and implementa-

tion of CAD/CAE/CAM/PLM software in companies and R&D units from various industries, e.g. maritime, automotive, aerospace and heavy engineering. Moreover, we provide postprocessors for CNC machines.

Our team includes experienced engineers who provide services in the field of design and various types of numerical analyzes (such as FEM and CFD). We also organize professional training in offered software usage and provide technical and substantive support. We can boast of many successful implementations and satisfied customers with whom we maintain long-term cooperation.

By implementing the system to manage the entire design and production process, we can support both the shipyards and manufacturers of the necessary components (mechanical, hydraulic, pneumatic or electric) in the scope of ship conversion to autonomous units.

Basing on our tools in the field of CAD/CAE and many years of experience, we can easily and quickly create a project for such a reconstruction and carry out the necessary numerical analyzes in the field of strength, flows and thermals. Our solutions, following the Industry 4.0 idea, make it possible to transfer engineering ideas to the “virtual world”, verify its various variants and choose the best solution to create an optimal autonomous vessel.

The M & N Training Centre and The Agmor Maritime Training Centre have merged their interests in 1998 to form the privately owned training establishment trading under the style of The Gdynia Maritime School Limited (GMS) in Gdynia, Poland. Working in close collaboration with The Polish Maritime Administration, GMS has developed a fast track Diploma Courses on the Management Level in accordance their own programmes based on IMO Model courses 7.03 (Officer in Charge of a Navigational Watch), 7.01 (Master and Chief Mate), 7.04 (Officer in Charge on an Engineering Watch) and 7.02 (Chief Engineer Officer and Second Engineer Officer), approved by the Polish Maritime Administration. The course for Deck Officers lasts for 2,5 years and will include a minimum of 12 up to maximum of 14 months at sea, while the course for Engine Officers lasts for two years and six months and will include a minimum of 12 months at sea.

The students will commence at the age of 19 and emerge as 3 / O's, 4 'th Engineers at the age of 22. Entry Standards: High School certificate, an entry exam in English and a psychological test. In order to assist the student in financing the course, GMS is entering into contacts with Ship Owners and Managers to provide guaranteed sea berths to enable them to complete their statutory sea time. The salary earned by the students or shipowners' sponsoring will help finance their Diploma courses and living expenses. GMS runs on a profit making commercial basis of the future for a seagoing career with the sponsoring Owner.

In addition to the above, GMS will continue to provide the full range of qualification and specialist courses required by the STCW Convention .

GMS is investing in state of simulators to support their teaching and in new premises for their Diploma Courses . GMS possess the following simulators: GMDSS, Full Mission 3 bridges Simulator with full visual system, made by Norcontrol, including DP class A and C standards, ARPA / Radar /AIS, ECDIS and a variety of PC based training programmes produced by leading Norwegian company “Seagull”, Engine Simulator ,including LPG bunkering modules and HV stand , made by UNITEST, Poland and Liquid Cargo Handling Simulator (LNG, Crude Oil / Prod-

uct & Chemical Tanker), made by Ship Analytics Inc. ,HUET and Free-Fall Life Boat (NI recognitions) simulators and Fire Fighting training facilities.

GMS believes that this fast track approach will provide both students and Owners with available way forward to produce highly qualified Officers.

To provide a high level of studies in School, in December 1998 an agreement has been signed between the Gdynia Maritime school and a Norwegian company Seagull AS. It dealt with a creation of the first in Poland and another world-wide training facility authorized by Seagull. The training facility, named Baltic Seagull Training Centre, provide its clients with a high quality training, identical to that offered by this company around the world. From July 2007 we started the training of professional sailors. Please visit www.morska.edu.pl.

Sail on safe water

IMPEL Group

The Impel Group, having been providing physical and technical security services for over 27 years, has decided to expand the scope of its activity to include the virtual and cybernetic sphere. As a leading supplier of technological solutions we know how important it is to secure not only physical access and data, but also intangible assets.

The main aim of the company dedicated to cybersecurity — **Impel Cyber** — is to build a partnership which will provide genuine support in that important area of business security.

Impel Cyber provides services connected to cybersecurity by offering expert support, raising the level of security and building the company's resistance to existing and future threats to ICT systems. This includes supporting the company with maintaining the desired level of security and offering a conceptual insight into the ICT infrastructure.

The wide range of services rendered by Impel Cyber facilitates an assessment of the level of cybersecurity, adjustment of the existing solutions to system, legislative, legal and industrial requirements, design and implementation of security mechanisms, running of operational activities as well as introduction of actions aimed at increasing the awareness of cyber threats.

We specialise in:

- diagnosing and analysing company maturity in the scope of cybersecurity, especially with regard to organisational and technological aspects and processes;
- penetration tests of ICT infrastructure and WEB applications,
- building the company's maturity and resistance through security audits, designing and implementing solutions improving the company's ability to prevent, detect and respond to cyber threats;
- efficient maintenance of the desired level of cybersecurity with regard to technological and organisational aspects through the services provided, such as: Security Operations Centre,

- efficiently handling incidents in the scope of ICT security;
- building awareness of threats and methods of responding to cyber threats at the company.

Digitisation and technological progress have a growing impact on the operation of machines and devices, including ships, which is why in order to meet the needs of the market Impel Cyber offers a wide range of services for autonomous ships with the overriding aim to ensure monitoring and cybersecurity of such vessels.

The Impel Group has been present on the services market for nearly 30 years. It is the largest supplier of outsourcing services in Poland, with the most developed range of services for institutions and businesses. This allows it to remain the leader and to introduce unique outsourcing solutions intended for specific segments of the market.

Impel Group companies render services in three business areas: Facility Management, Industrial Services and Digital Services & BPO. An extensive network of 16 branches allows the Impel Group to provide its services all over Poland.

Impel Group – More than services



Sail on safe water Autonomy of the double-mode AUV vehicles

Miroslaw K. Gerigk

Abstract

Some results of research devoted to development of a double-mode AUV-Stealth vehicle are presented. Between the major aims of research was to obtain a limited hydro-acoustic signals generated by the AUV-Stealth vehicle. The AUV-Stealth concept is presented. The method of research is introduced. The key design drivers are presented. Between them are the AUV-Stealth hull form, arrangement of internal spaces, materials, hull covers, energy supply and propulsion system. The key research problem is to obtain the AUV-Stealth vehicle as a stealth vehicle which may operate autonomously under the water surface. In such the case the steering, navigational and communication AUV-Stealth subsystems required to be very advanced. Some information on the autonomy of the AUV-Stealth double-mode vehicle is introduced. Some performance characteristics of the AUV-Stealth vehicle are briefly presented as well. The final conclusions are given.



Control system configuration of marine autonomous surface ship (MASS)

R. Śmierchalski, Tomasz Zubowicz, Krzysztof Armiński, Anna Witkowska,
Gdańsk University of Technology

Abstract

The presentation introduces the structure of autonomous control of seagoing ships – marine autonomous surface ships (MASS). Based on the multi-layered control structure, the configuration of the ship's navigation system has been developed, assuming the highest degree of autonomy, i.e. full autonomy. Different operating conditions of a fully autonomous vessel have also been taken into account. It provides an overview of hardware and software selection.

Autonomous platforms – challenge and responsibility for engineering education and research

Henryk Lasota (Gdańsk University of Technology) Roman Śmierchalski
(Gdańsk University of Technology), Cezary Specht (Gdynia Maritime University),
Piotr Cywiński (Navinord), Łukasz Kulas (Gdańsk University of Technology)

Abstract

The results of the great reconnaissance projects MUNIN, AAWA, MASRWG are crystal clear – **autonomous ships are inevitable reality at sea. The only remaining question is not if but when.** The Polish Register of Shipping (PRS) also develops issues of commercial unmanned ships under the name Maritime Autonomous Surface Ships (MASS), in accordance with the recommendations of the International Maritime Organization (IMO) Maritime Safety Committee (MSC). The representatives of Gdańsk University of Technologies (GUT) take part in the work of the MSC subcommittee at PRS. The development of information and communication technologies (ICT) has reached a level that is in fact a surprise for the world of technology. Functional capabilities of already available solutions are extremely high, and the cost of their implementation turns out to be surprisingly low. One of the most surprising fields of technology comes from RC modelling hobbyists. Extended radio control (R/C) with increasing ability to obtain information about the controlled object (remote health maintenance) and – which may be the most important – information about the object immediate surroundings (situational awareness).

Now even small-business players can construct advanced autonomous aircraft or vessel. In this way, one of the global technological trends with immeasurable economic potential was discovered. Such vehicles can be remotely, automatically or autonomously controlled. These technologies have found numerous applications in ground (AGV) and flying (UAV) as well as underwater (UUV) and water-surface (USV) systems. The rapid development of autonomous platforms requires the simultaneous adaptation of available technologies such as wireless communication systems or new sensors, but also stimulates the development of new technologies that can be enriched by artificial intelligence. In addition to stimulating technological development in the field of information and communication technologies (ICT), autonomous platforms open the possibility of new applications, and also enable the creation of new business models, for example “Hydrographic Platform as a Service”. The presentation shows examples of such ideas and possible applications along with challenges for education and research in the field of “Engineering 4.0”. To guarantee safe and reliable operation of platforms, validation and verification procedures can be successfully used, in particular for wireless communication systems that are vulnerable to jamming and spoofing. Responsible education is the one that should contribute to real challenges met by relevant industry stakeholders, in particular ship owners. Responsible education will be capable to fulfill R&D tasks carried out for industry as part of European projects.

UUV and AUV vehicles as the autonomous systems for navy applications

Lech Rowiński

Abstract

There is a growing pressure to investigate how to design and build the unmanned underwater vehicles of different types which are devoted towards performing many tasks under the water surface according to the data missions. During the recent years the Department of Ship Design and Subsea Robotics, Faculty of Ocean Engineering and Ship Technology, Gdansk University of Technology designed and built a few types of unmanned underwater vehicles to satisfy the navy activities. Between the vehicles is the MORSWIN vehicle which is a multipurpose high power fully electric Remote Operated Vehicle (ROV) system. The MORSWIN system may be utilized as an observation ROV vehicle without the additional equipment. To extend its capabilities the purpose oriented modules can be installed. A standard module weights up to 60 kg and is 0.3 meters high. Higher modules may be designed to contain the requested equipment. The next example is the GLUPTAK Disposable Mine Destruction Vehicle (DMDV) system which can be used to identify and destroy the naval mines. Its target can be located up to 400meters under the water surface from a launch point. A typical mission profile calls for destruction of a target detected by other means. Normally the target would be detected by means of bow sonar of a mine hunting ship. the missions against targets indicated by the other sources are also very likely. Another example of our design is the autonomous underwater vehicle called ALBATROS. This is a simple cruise platform. It is similar to a small, slowly swimming torpedo. It is able to carry a sensor suite along pre-planned route and depth. the basic equipment can be used for the oceanographic measurements, cartography and imaging of sea bottom and linear

industrial structures as well. For the precise navigation and remote control the ALBATROS vehicle is equipped with several navigation means including the compass, Doppler velocity log, GPS receiver and hydroacoustic transponder. A remote control at minimum level is assured by the underwater hydroacoustic link as well as GSM and WiFi modems for the surface control and communication.

Challenges, solution proposals and research directions in safety and risk assessment of autonomous shipping

Jakub Montewka, DSc, Gdynia Maritime University

Abstract

Maritime Autonomous Surface Ships (MASS) are becoming reality in the shipping industry. Besides numerous anticipated advantages this type of ships has there are new potential hazards as well that have to be addressed. This needs to be done at the design stage of transportation system that will encompass such vehicles, to make sure that the new system's safety can be guaranteed at the acceptable level.

To this end numerous methods can be utilized pertaining to the field of safety and risk assessment. Those methods however are of different scope and may have different application areas.

Therefore in this paper we discuss selected methods suitable for safety assessment and quantification of transportation systems including goal-based safety case approach, system theoretic process analysis and risk assessment. Challenges and opportunities of those approaches are highlighted and the recommendations are given regarding the application areas of the methods.

Hybrid Propulsion for Future Smart and Green Autonomous Ships

W. Litwin, W. Leśniewski, D. Piątek, K. Niklas

Abstract

Maritime industry is getting closer and closer to the milestone of the technological development of unmanned ships. The use of autonomous vessels is slowly becoming a reality for selected applications. An important element of the new generation ships is the development of ecological and economic drives. In many applications, hybrid drives are increasingly important. The paper presents the results of research on drive efficiency for a selected hybrid propulsion system. Experimental studies with the use of natural scale drive were performed. The most important results of tests carried out for a parallel diesel-electric drive are shown. The hybrid propulsion in 'zero emission' mode enabled increasing the energy efficiency by several times compared to a conventional drive. High flexibility of such a drive enables the use of a smart power control technology. The use of the presented type of hybrid drive in both manned and unmanned ships leads to significant economic and ecological benefits.

Space Sciences Committee Polish Academy of Sciences / Gdańsk Branch in cooperation with Baltic Sea & Space Cluster

invites for joint conferences

- 20th September, 2018
Baltic Sea & (Outer) Space
New perspective for our region
Instytut Oceanologii Polskiej Akademii Nauk, Sopot
- 22nd November, 2018
Seaport + Space Infrastructure
Synergic Network under common management
Wyższa Szkoła Administracji i Biznesu, Gdynia
- 19th March, 2019
Autonomous ships
Inevitable reality at sea
Politechnika Gdańska
- 16th May, 2019
Institutional Cooperation at Sea & (Outer) Space
Essential adjustments needed to boost full potential
Uniwersytet Gdański, Wydział Prawa i Administracji
- 19th September, 2019
Remote-sensing
Challenges in gather and sharing data
Instytut Oceanologii Polskiej Akademii Nauk, Sopot
- 14th November, 2019
Sea and underwater drones
"Unidentified Sea Objects"
Akademia Marynarki Wojennej, Gdynia