Global J. of Engng. Educ., Vol.9, No.2
Published in Australia

Gdynia Maritime University: Organisation and Activity Programmes in Education and Research*

Józef Lisowski
Gdynia Maritime University
ul. Morska 83, 81-962 Gdynia, Poland

In this paper, the author describes maritime engineering and technology education, training and research in Poland based on the example of Gdynia Maritime University, Gdynia, Poland. The purpose of the paper is to present an integrated educational and training system for professional staff who are capable of meeting the current demands for maritime specialists of any description from ship-owners and shore-based companies of the sea economy. The integration involves the following: curricula, research projects and the development of scientific staff on the one hand and a course on seagoing services, as well as shore-based industrial experience of marine professionals on the other hand. The paper contains the goals and aims of the system, the profile of a graduate of a maritime university and the educational process that is effected through a multilevel structure of the system. The author concludes by looking at issues that are connected with an improvement of the current system, the establishment of new lines of study, and the quality of the training process with regard to both safety at sea and the effectiveness of shipboard apprenticeship as each year, the world market demands more and better qualified professionals for ship operations, repairs and service.

INTRODUCTION

The present technical standards of ship equipment require a high level of competence and skills from a professional shipboard officer. This is because, within a predictable span of time, world trends in shipbuilding are set to generate even higher demands regarding the qualification standards of a ship's crewmembers.

Despite the present economically difficult situation in Poland, it is still possible – even necessary – to maintain the number of engineers and deck officers to be educated by Polish maritime schools, although a systematic reduction in the costs of their education has also become another necessity.

The following characteristics should be noted:

- The maritime engineering education process has been implemented in accordance with the Bologna Process embarked upon by the European Union (EU);
- University graduates, as a rule, first find their employment with state and private ship-owners in Poland, and then in the global maritime labour market;
- Maritime studies do not repeat, in any way, the study courses at universities or technical universities because of their specifically marine and operational nature;
- The present premises and teaching staff resources justify the maintenance of the usual number of candidates for studies within the seven fields in 19 specialisations, as well as an increase in the number of paying part-time candidates. Both factors have an essential impact on the reduction of unemployment and an increase in the spread of education in Poland.

The Polish maritime education has built a tradition for the past 85 years, and maritime schools have

*A revised version of the Opening Address presented at Opening Ceremony of the *9th Baltic Region Seminar on Engineering Education*, held in Gdynia, Poland, from 17 to 20 June 2005. This paper was awarded the UICEE bronze award (fifth grade) with one other paper by popular vote of Seminar participants for the most significant contribution to the field of engineering education.

survived despite difficult periods in the history of the Polish sea economy [1][2].

THE MISSION AND STRATEGIC GOALS OF GDYNIA MARITIME UNIVERSITY

The mission of Gdynia Maritime University (GMU), Gdynia, Poland, is to train marine officers for shipboard positions on merchant marine vessels and educate managers for positions at land-based enterprises of maritime industries in compliance with Polish, European and international educational standards. This is to be achieved by providing students with a solid basis for their professional careers where the awareness of global labour markets is harmonised with developments in the employment opportunities offered in Polish maritime regions, Poland and the EU.

The strategic goals are as follows:

- Ensure that students are taught by high quality scientific and teaching academic staff;
- Obtain the rights to award PhD and DSc degrees by all faculties;
- Develop a three-stage Bologna system of studies by offering bachelor or engineer degrees (stage one), master of science degrees (stage two), and doctoral degree (stage three);
- Strengthen the specific maritime profile of the University by developing unique fields, minors and majors of study;
- Attain a balance in the number of students studying within the full-time and part-time systems, with a simultaneous development of post-graduate studies offering new professional opportunities;
- Enhance the development of scientific and teaching staff in those domains that constitute a specific maritime flavour of the GMU;
- Participate in the University's research teams in national and international research projects;
- Upgrade laboratory facilities and the quality standards of the University's premises;
- Develop cooperation with national, European and international universities seeking to upgrade educational standards and to undertake scientific research;
- Strengthen the links between the GMU and enterprises, self-government bodies, welfare organisations, as well as regional, national and international scientific and professional associations;
- Strengthen the role of the University as a world centre of maritime education and training.

PROFILE OF A GRADUATE OF MARITIME STUDIES

A graduate of maritime studies at the university level is a highly educated specialist who is prepared to work onboard ships, for shore-based sea-oriented companies and the shipping industry. The professional competence of such a graduate may be described by the following characteristics:

- He/she holds the following professional degrees: BSc, Eng, MSc and science degrees - PhD, DSc and title of Professor;
- Shipboard and shore-based workshop apprenticeship experience, as well as the qualifications that, when combined, make it possible for him/her to apply for a merchant fleet officer's certificate issued by the Polish Maritime Administration (PMA);
- Professional apprenticeship and qualifications to assume operational positions with a sea economy oriented and regional seaside enterprises;
- Military training completed within the course of maritime studies with the rank of a reserve navy officer.

The aim of the integrated system is to optimise the maritime education of professional staff for the needs of the sea economy, with very limited financial resources allocated by the State budget, on the basis of a curricula that is harmonised with the educational standards and requirements contained in the provisions of the following organisations:

- International Maritime Organization (IMO);
- The Ministry of National Education and Sports (MNES);
- The State Accreditation Commission (SAC);
- The European Association of Engineers (FEANI);
- The International Standards Organization (ISO).

The system is complemented by apprenticeship experience conducted on simulators and training ships and through wide cooperation with foreign maritime universities [3].

THE INTEGRATED MARITIME EDUCATION AND RESEARCH SYSTEM

Polish maritime universities in Gdynia and Szczecin, apart from conducting their own curricula, have also assumed the role of coordinators in charge of the development and effectiveness of the integrated

system of staff education for the sea economy under the authority of the Ministry of Infrastructure (MI). The structure of the integrated system is shown in Figure 1 and is conducted at the following four levels:

I. Secondary maritime education, supervised by the MI, covering:
   - Basic maritime education;
   - Apprenticeship onboard training ships, and the supply of candidates to maritime academies that educate the teaching staff for these schools. Moreover, maritime post secondary schools have been established in response to the needs of the labour market. These schools are both private and state run and offer two-year education courses.

II. Graduate studies:
   - One-level or two-level, full-time studies in Gdynia that are free of charge;
   - Two-levels, part-time, payable studies in Gdynia, Malbork and Wejherowo.

III. Postgraduate studies:
   - Postgraduate courses in updating and completing knowledge in a particular specialisation;
   - Permanent postgraduate maritime training for shipboard officers at the operational and management levels.

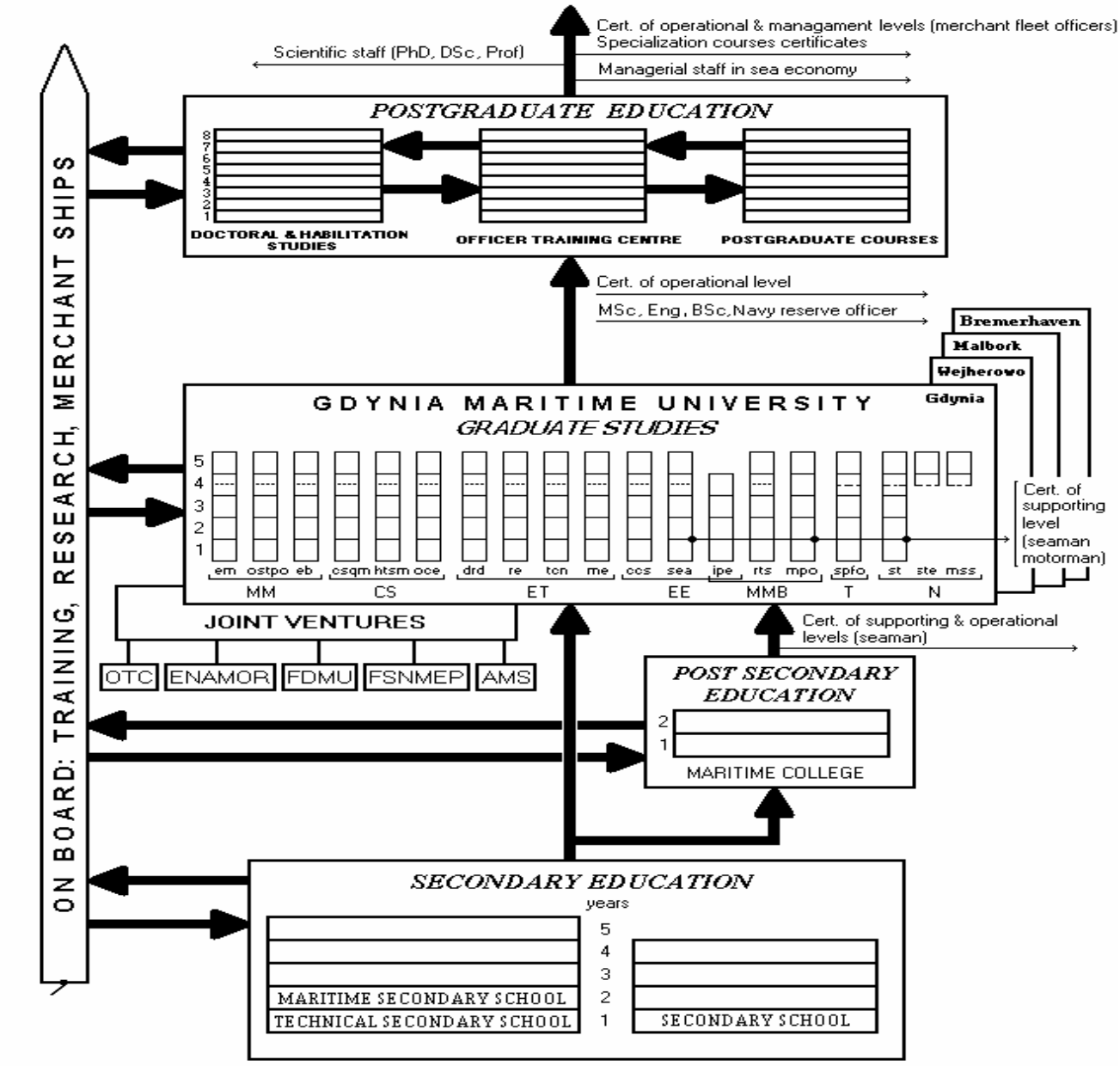

Figure 1: The structure of the integrated engineering maritime education and research system in the GMU.

IV. Doctoral and Habilitation studies that lead to:

- The Doctoral studies (PhD);
- The Habilitation programme (DSc);
- The title of Professor.

The essence of the system is its effectiveness in the professional promotion; ie each level ensures the appropriate coverage of marine competence and performance (deck or engine rating, engineer, MSc, merchant fleet deck or engineer officer, doctor, associate professor and professor). Furthermore, the system enables students to obtain dual marine certificates (navigator-engineer, navigator-electronical engineer, navigator-electrician, engineer-electrician, etc) and also dual diplomas for academic teachers (professor - master mariner, professor - chief engineer, doctor - ship electrician, etc).

This system is based on the following:

- Education financed by the Ministry of Infrastructure (MI);
- Scientific research financed by the Ministry of Science and Computerisation (MSC);
- International scientific and educational cooperation between maritime academic establishments under direct agreements or within such programmes as *Socrates-Erasmus*, *Leonardo da Vinci*, etc [3][4].
  For example, from the academic year 2005/2006, Gdynia Maritime University will cooperate with 13 European universities, namely: Hochschule Bremerhaven (Germany), Fachhoch-schule Stralsund (Germany), Universidad de La Coruna (Spain), Universidad de Vigo (Spain), Universidad de Cadiz (Spain), Universitat Politecnica de Catalunya (Spain), Universidad de la Laguna (Spain), Universidad del Pais Vasco (Spain), Universita degli Studi del Sannio (Italy), Universita degli Studi di Perugia (Italy), Kymenlaakso Polytechnic in Kotka (Finland), Cork Institute of Technology (Ireland), University of Glamorgan (UK) under the *Socrates-Erasmus* programme for student and staff mobility in maritime studies;
- For many years, the GMU has been collaborating with over 30 esteemed and renown international maritime academies Europe, as well as in such diverse countries as the USA, Australia, China, Vietnam, Korea, Japan and Russia, to name a few;
- Student apprenticeship on training ships and ships owned by national and international carriers, as well as industrial apprenticeship with shipyards, ship-owner operations and manufacturing plants.

INTERNATIONAL MARITIME REQUIREMENTS

The paramount objective of education in this area of maritime engineering is to convey required knowledge of the construction and operation of a ship's systems in accordance with the requirements of the International Maritime Organization (IMO) as formulated in the STCW 78/95 Convention. The requirements concerning the officers have been distributed over three levels of competence:

- Supporting Level, concerning seaman and motorman certificates;
- Operational Level, concerning all shipboard officers;
- Management Level, concerning chief officers and masters.

Details are specified in the STCW Code separately for navigators and marine engineers in the form of *minimum standards of competence for officers in charge.*

MARITIME UNIVERSITY LEVEL EDUCATION AND RESEARCH

Graduate Studies

The higher education provided at Gdynia Maritime University is conducted in four faculties, seven fields and in 19 areas of specialisation [4-6]. These are described in more detail below.

The Faculty of Navigation conducts full-time and part-time studies in two fields, as follows:

- *Navigation* (N) with specialisations in Sea Transport (ST), Sea Traffic Engineering (STE) and Marine Safety Systems (MSS);
- *Transport* (T) with a specialisation in Sea Port and Fleet Operation (SPFO).

The Faculty of Marine Engineering carries out full-time and part-time studies in one field, namely:

- *Mechanics and Machine Building* (MMB) with specialisations in Marine Propulsion Plant Operation (MPO), Repairing Technologies of Ship Equipment and Harbour Facilities (RTS) and Industrial Plant Engineering (IPE).

The Faculty of Marine Electrical Engineering educates students within full-time and part-time studies in two fields a follows:

- *Electrical Engineering* (EE) with specialisations in Ship Electro-Automation (SEA) and Computer Control Systems (CCS);
- *Electronics and Telecommunication* (ET) with specialisations in Marine Electronics (ME), Digital Radio Communication (DRC), Radio Electronics (RE) and Tele-Computer Networks (TCN).

The Faculty of Business Administration has both full-time and part-time studies in two fields, specifically:

- *Commodity Science* (CS) with specialisations in Commodity Science and Quality Management (CSQM), Hotel and Tourism Service Management (HTSM) and the Organization of Commercial Enterprises (OCE).
- *Management and Marketing* (MM) with specialisations in Enterprise Management (EM), Organisation of Seaborne Trade and Port Operations (OSTPO) and E-Business (EB).

The curricula of all the specialisations of studies consist of a subject's timetable with approved credit points in the European Credit Transfer System (ECTS) for the BSc and MSc degrees. One credit equals about 40 hours of student work: 16 teaching hours and the rest is the individual work of the student. One year of studies is equalised to 60 credits [7].

From the academic year 1995/1996, both the Faculty of Marine Engineering and the Faculty of Marine Electrical Engineering provide a specialisation in Industrial Plant Engineering (IPE) on the basis of a European Union programme obtained from Hochschule Bremerhaven, Germany.

The GMU has to its name two training vessels, namely the famous tallship *Dar M³odzie¿y* (*Gift of Youth*), which is used to facilitate sea practice for future marine personnel and the teaching/research vessel *Horyzont II*, which is used for practice in manoeuvring and radar positioning, as well as polar science carried out in collaboration with the Polish Academy of Sciences at Spitsbergen and Antarctica.

Postgraduate Studies

Basically, postgraduate studies are realised by the Faculties in the following fields:

- Postgraduate studies in tourism and hotel management;
- Postgraduate studies in accountancy;
- Postgraduate studies in management;
- Postgraduate studies in the formation and evaluation of food and nourishment quality;
- Postgraduate studies in information technology for e-business.

It should be mentioned that permanent postgraduate maritime training is conducted by the Officer Training Centre Ltd (OTC) in the form of the following courses:

- Courses for certificates of competence for:
  - Operational level (deck, engine, electrician engineer, radio-electronic);
  - Management level (deck, engine).
- Specialist courses for the following certificates:
  - Personal safety and social responsibilities IMO 1.21;
  - Ship security officer;
  - Company security officer;
  - Port facility security officer;
  - Bridge resource management;
  - Bridge team management;
  - Radar/ARPA operational level;
  - Radar/ARPA management level;
  - Global maritime distress and safety system (GMDSS), restricted operator certificate (ROC) and general operator's certificate (GOC);
  - Engine room resource management;
  - Engine room team management;
  - Voyage planning navigation and manoeuvring in ice;
  - Emergency procedures during ships manoeuvring on a visual simulator;
  - Advanced chemical tanker operations 1.04;
  - Advanced fire fighting IMO 2.03;
  - Advanced LPG tanker operations IMO 1.06;
  - Advanced oil tanker operations IMO 1.02;
  - Basic safety training in elementary first aid IMO 1.13;
  - Basic safety training in fire prevention and fire fighting IMO 1.20;
  - Cargo safety and hull integrity onboard ro-ro passenger ships;
  - Cargo safety and hull integrity onboard vessels other than ro-ro passenger ships;
  - Chemical tanker familiarisation IMO 1.03;
  - Crisis management and human behaviour onboard ro-ro passenger ships;
  - Crisis management and human behaviour onboard vessels other than ro-ro passenger ships;

- Crowd management onboard ro-ro passenger ships;
- Crowd management onboard vessels other than ro-ro passenger ships;
- Direct service to passengers space onboard ro-ro passenger ships;
- Direct service to passengers space onboard vessels other than ro-ro passenger ships;
- Electronic charts display and information systems;
- Familiarisation onboard ro-ro passenger ships;
- Familiarisation onboard vessels other than ro-ro passenger ships;
- Hazardous cargo carriage on vessels IMO 0.02;
- ISM code training;
- Large vessel ship handling and manoeuvring IMO 0.10;
- LPG tanker familiarisation IMO 1.05;
- Medical care IMO 1.13;
- Medical first aid IMO 1.14;
- Oil tanker familiarisation IMO 1.01.

Doctoral and Habilitation Studies

The constant development of teaching staff has been assured by doctoral and habilitation study programmes. They are initiated at other educational institutions, but conducted within the scientific laboratories at the GMU.

The studies cover the following fields of scientific research:

- Geodesy, cartography and navigation;
- Machine construction and operation;
- Automatics and robotics;
- Computer science;
- Electronics;
- Electrotechnics;
- Commodity expertise;
- Management.

Scientific Maritime Research

The University is supported by the Ministry of Science and Computerisation (MSC) and European Union (EU) research grants in the following forms:

- National research funds: base and statute, allowed according of the scientific and research obtained results in the past years;
- National grants: promotor's PhD, research projects, development projects, allowed by national competition way;
- EU projects;
- International projects.

Each year, the GMU has realised about 20 national and 10 European and international projects. The GMU is now completing certain projects, for example:

- A system for an optical search for survivors at sea (see Figure 2);
- Development of the means to secure underwater works and deep diving that protects human life;
- Development of individual pyrotechnic life saving kit for people in life-threatening situations in water;
- Dynamic stability and probability of a deformable life raft's capsizing on a wave;
- Asymptotic approach to reliability analysis and the optimisation of complex transportation systems;
- Intelligent agent system to solve difficult optimisation problems;
- Evolutionary planning of the paths of passage of movable objects in dynamic environments;
- Optimal model of transport infrastructure financing in Poland in the post-accession period;
- The monitoring and control system of a ship's engine room (see Figure 3);
- Evaluation of the influence of the quality of electrical power quality deterioration on selected devices' operation in a ship electrical power networks;
- A new generation device for the measurement of torque, rotation speed on the shaft of a medium-speed diesel engine with the possibility of estimation and diagnostics of a ship's engine state (see Figure 4);
- Elaboration of a new method and measuring instrumentation for the rapid estimation of electrical power quality;

Figure 2: Console of the system for an optical search for survivors at sea, installed onboard the research-training ship m/s *Horyzont II*.

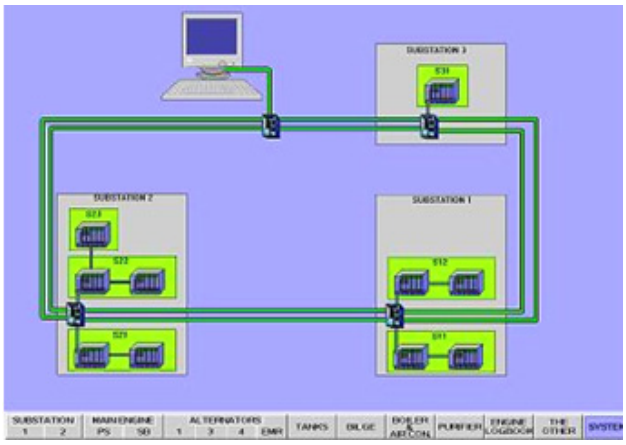

Figure 3: The monitoring and controlling system of a ship's engine room EMOS 3.3 on a ferry m/f *Wawel*.

Figure 4: The torque meter ETMN 8.

- Investigation of the influence of selected phenomena on the parameters of thermal models of power semiconductor devices and integrated circuits;
- Method to estimate nitric oxide emission levels based on measuring two stroke ship engine work parameters;
- Modelling and analysis of certain classes of pulse stabilisers with thermal phenomena taken into account;
- Development of a hybrid system of steering movable objects in a dynamic environment (see Figure 5);
- The use of honey to act as an environmental marker;
- The safety and reliability of industrial systems and structures (EU project);
- A maritime transport coordination platform (EU project);
- Maritime English (EU *Leonardo da Vinci* project);
- State of advanced measuring of control ship's systems (Poland-China project);
- Safety and economic efficiency improvements of ship technical system exploitation (Poland-China project);
- Maritime education and training system and overseas recruitment of seafarers (Poland-China project);
- The combined simulation of a marine power plant and integrated electric propulsion system (Poland-China project);
- Processing, morphology and property relationships in polystyrene/polybutadiene blends (Poland-India project).

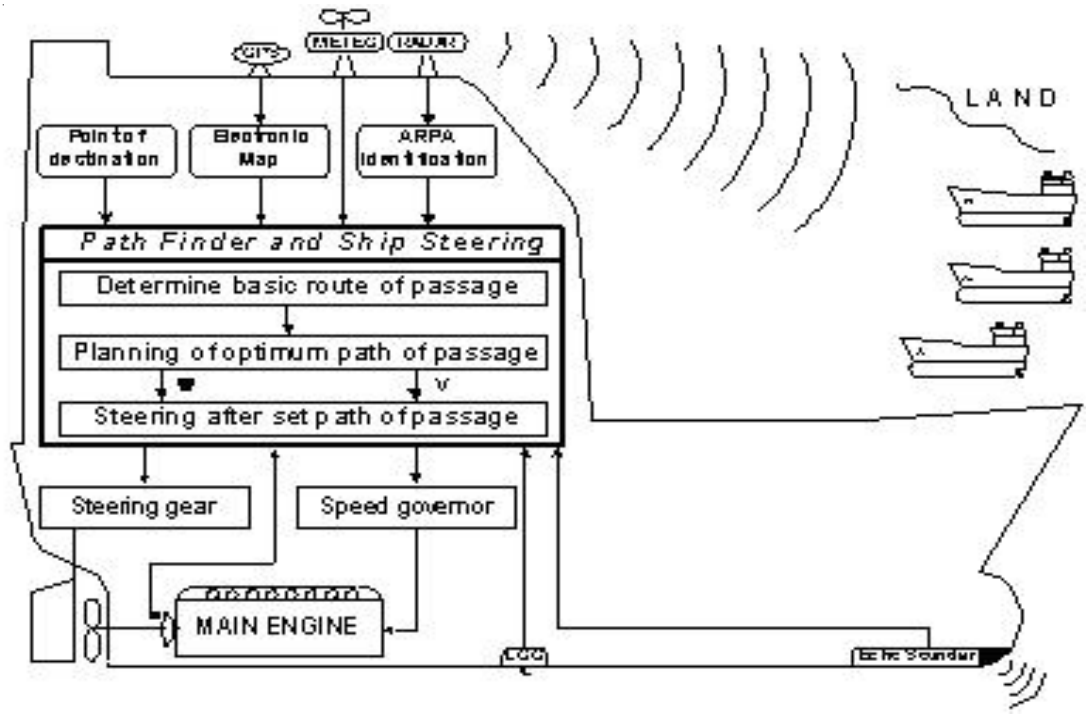

Figure 5: Structure of ship steering in a collision situation at sea.

JOINT VENTURES

Gdynia Maritime University is engaged in the following joint ventures that support its activities:

- Officer Training Centre Ltd (OTC): postgraduate maritime training;
- Research-Production Enterprise for Maritime Industry Ltd (ENAMOR): projects for shipyards, ship-owners, navy and maritime administration, services in the range of overhauling and repairing ship equipment concerning communication and navigational, marine power plant, electrical and deck gear and cargo handling;
- Foundation for the Development of the Maritime University (FDMU): training in the area of sea survival, foreign languages, computer operation and trading activities including sailors' equipment, photocopiers, computer equipment, etc;
- Foundation for Safety in Navigation and Marine Environment Protection (FSNMEP): ship-handling practical training course for foreign pilots, masters and senior officers, and the use of five manned models of large ships at $^1/_{16}$ and $^1/_{24}$ scales situated on a lake;
- Academy Maritime Services Ltd (AMS): crewing of Polish officers and ratings for traditional and specialised tonnage and personnel for offshore industry.

INTERNATIONAL INVOLVEMENT IN ENGINEERING EDUCATION

It should be emphasised that the GMU is a partner institution of the UNESCO International Centre for Engineering Education (UICEE), and is the host of the host of the *Centre for Maritime Engineering Education* (CMEE), a satellite centre of the UICEE. Academic staff of the GMU actively participate in research into engineering education, by undertaking projects, attending conferences and publishing research papers in this area.

CONCLUSIONS

The current integrated education system, although serving its purpose well, could be further developed through the following means:

- Its already functioning elements:
  - Curricula harmonisation at the secondary level of education;
  - Cooperation between maritime higher education establishments and other industry schools;
  - Wide cooperation of higher education establishments in Poland with foreign institutions.
- Starting up new lines of studies that meet the current needs of the market economy, for example: oil platform operations, mechatronic equipment operations, geographic information systems, commanding large deep sea yachts, etc;
- Starting up new training programmes to improve sea safety;
- Introduction of the licensee system to be awarded by the Ministry of Infrastructure for the training centres to improve their quality and to ensure better standards of safety at sea;
- Reduction in costs of education through the establishment of a single Ship Operation Unit that serves both higher and secondary maritime schools in view of the effective management of the fleet of training and research vessels.

REFERENCES

1. Lisowski, J., Gdynia Maritime Academy – organization and programme of activities. *Polish Maritime Review*, 1, **2**, 18-19 (1994).
2. Lisowski, J., The integrated engineering education and research system in Poland for the sea economy and shipping industry. *Proc. 2nd Asia-Pacific Forum on Engng. and Technology Educ.*, Sydney, Australia, 303-307 (1999).
3. Mitkowski, S.A. and Pudlowski, Z.J., An assessment of the quality of studies at Polish education institutions and some related issues in engineering education. *Proc. 8th UICEE Annual Conf. on Engng. Educ.*, Kingston, Jamaica, 173-176 (2005).
4. Lisowski, J. and Wyszkowski, J., The new curriculum of education training and certification of marine electrician officers at the Gdynia Maritime Academy. *Global J. of Engng. Educ.*, 3, **3**, 279-285 (1999).
5. Gierusz, W. and Lisowski, J., The education of marine engineers in control engineering in accordance with the IMO requirements contained in the STCW'95 Convention. *Global J. of Engng. Educ.*, 2, **2**, 231-238 (1998).
6. Lisowski, J., Gil, A., Kaminski, K., Morawski, L. and Wasilewski, L., Computer-based teaching of ship automation. *Global J. of Engng. Educ.*, 1, **2**, 151-161 (1997).
7. Lisowski, J. and Œniegocki, H., The Finnish and Polish credit transfer systems for maritime studies. *Global J. of Engng. Educ.*, 3, **3**, 243-248 (1999).

BIOGRAPHY

Józef Lisowski has been a professor of automation at Gdynia Maritime University (then Gdynia Maritime Academy), Gdynia, Poland, and was Head of the Department of Ship Automation. He received his MSc, PhD and DSc degrees from the Electrical Engineering Faculty of the Technical University of Gdañsk in 1967, 1973 and 1979, respectively. From 1989 to 1996, he was Rector of the then Gdynia Maritime Academy. In 2002, he was re-elected as Rector and continues in this position today.

He has published widely and held various key positions for conferences in engineering education. His research interests include control theory applications in shipping and the synthesis of optimal, adaptive and safety elements in ship steering systems. He also undertook a research project to develop methods for computer safe ship control.

Prof. Lisowski is a member of the UNESCO International Centre for Engineering Education (UICEE), and is a Fellow of the Polish Merchant Navy Officers' Association of London, the Polish Society for Measurement, Automatic Control and Robotics, and the Maritime Club of Poland.

Prof. Lisowski was awarded the UICEE Silver Badge of Honour at the *90th Anniversary Jubilee Seminar on Engineering Education* in Wismar, Germany, in 1998, and most recently received the prestigious UICEE Gold Badge of Honour at the *9th Baltic Region Seminar on Engineering Education*, held at Gdynia Maritime University in mid-June 2005.