



# SNAME NTUA

February 14, 2012

Vol. 1, Issue 3

www.sname.org/NTUA

## UPCOMING EVENTS

• • 12 March  
Student Meeting  
13:00, NTUA Library,  
Multimedia  
Auditorium  
“The Role of the  
Naval Architect and  
Marine Engineer at a  
Shipyard”  
Speaker: D. Kalligeris

• • 21 March  
Technical Meeting  
19.00, Auditorium  
Maran Tankers, 354  
Syngrou Ave.,  
Kallithea  
“Energy Systems for  
Future Ships”  
Speaker: Christos  
Chryssakis

## NEWSLETTER STAFF

Eleni Lazaratou,  
Section Chair  
Dimitris Mytilinis  
Section Vice-chair  
Michael Pytharoulis,  
Section Secretary  
Treasurer

## First NTUA Speaking Program Continues with Class and Shipyard Safety



**Speaking Program Snapshots (Clockwise from Top Left)** Lampros Chachalis and John Kokkarakis detail the various types of class notations. The active audience numbered more than 30 students. The speakers from BV brought along technical brochures and even baseball caps for the attendees. SNAME NTUA chair Eleni Lazaratou introduces Prof. Emeritus Antony Antoniou and recent graduate Lampros Nikolopoulos whose presentation on the safety of ships in yard included several photos from the presenters personal archives.

by Eleni Lazaratou

The first annual SNAME NTUA Presentation Program continued with success with two presentations in December and January.

### **Bureau Veritas Explains the Role of Class**

On December 13, thirty students attended a presentation by Lampros

Chachalis, Vice President and society.

Regional Chief Executive for the Hellenic & Black Sea Region of Bureau Veritas Greece, along with his colleague John Kokkarakis, Vice President of Technology & Business Development for BV’s Hellenic, Black Sea Region & Middle East. They spoke about the role of the naval architect and marine engineer in a class

Mr. Chachalis kicked off the lively presentation seeking students help to define the job of a classification society. Through his description, students came to see that the role is dual - practical and technical.

In detailing the aspects of class

(Continued on page 2)

# Students Spur 47% Increase in Section Membership in 2013

by Eleni Lazaratou

SNAME NTUA rang in the new year with membership reaching an all-time high of 103 students.

Just a decade since the first Greek students joined, the section has more than tripled its numbers.

The 47% increase compared to last year's membership comes at a time when the economic crisis has put a strain on membership in Greece and worldwide.

The student Executive Committee attributes the rise to the section's increasing activity this year. They hope this activity will continue to serve members needs, retaining old members and attracting new faces in the future.



## Speaking Program Continues with Class and Shipyard Safety

(Continued from page 1)

societies activities that require the naval architect to go on board and examine a vessel, Mr. Chachalis touched on the various documents a ship must have as well as what the representative from class must look for in an inspection.

He then turned the presentation over to Mr. Kokkarakis who focused on the scientific role of classification societies, creating rules and furthering ship design technology.

The presentation and the

presenters' accessible style were well received by the active crowd who asked many questions, keeping the gentlemen on stage until they had to leave for another engagement. The presentation was followed by a small reception with drinks and snacks.

**Shipyard Safety**  
The first presentation of the new year took place on January 15 and featured Professor Emeritus Anthony Antoniou as well as recent graduate Lampros Nikolopoulos of Thenamaris Ships Management Inc.

speaking on the topic of The practical presentation Safety of Ships in Yard - Ship's and Yard's Obligations.

The attendees had the unique opportunity to soak up the experience of the more than 50-year career of Prof. Antoniou. The professor and former Yard Manager (among many other roles) at the Hellenic Shipyards Company at Scaramanga, explained various procedures required to maintain a safe work environment in yard. He emphasized the responsibilities of the future naval architects in the audience whether they be shipping company representatives or employees of the yard. Throughout the presentation, he warned students of several safety pitfalls, including colorful examples from his own experience.

The practical presentation was supplemented by Mr. Nikolopoulos, who showed students online resources on the subject of safety in shipyards. He also presented several photos of ships in various stages of production from his and the professor's personal archives, explaining the production process.

After the full, informative presentation, attendees had the chance to ask the presenters a few more questions over soft drinks and snacks.

### More to come...

A copy of the presentations at NTUA will be uploaded to [www.sname.org/NTUA](http://www.sname.org/NTUA).

The next presentation will take place on March 12, when Dimitris Kalligeris of Eleusis Shipyards will speak about the Role of the Naval Architect in a Shipyard.

## STAY WITH SNAME IN 2013

Please remember to renew your membership before the **drop date** at the end of the month.

**Seniors!** Let SNAME know if you are about to graduate to receive your **graduation gift**.

Remember, for your first year after graduation you will still pay the **student rate of \$35**.

# **Lampros Nikolopoulos Awarded Annual Diploma Thesis Competition Prize by SNAME Greek Section**

**Charalambos Souliotis, Nikolaos Stamoudis, Evangelia Velentza Nominated**

The January technical meeting of the Greek Section featured four students from the National Technical University of Athens presenting their diploma theses.

Each thesis was selected by one of the four departments of the School of Naval Architecture and Marine Engineering.

From the Department of Ship Design and Maritime Transport, Lampros Nikolopoulos presented "A Holistic Methodology for the Optimization of Tanker Design and Operation and its Applications" (Supervisor: Prof. A. Papanikolaou).

Evangelia Velentza represented the Department of Ship Hydrodynamics with her thesis, "Calculation of Potential Flow past a Sailing Yacht" (Supervisor: Prof. G. Tzambiras).

The Department of Marine Engineering selected Nikolaos Stamoudis to present "A Two Component Evaporation Model for Marine Diesel Engines". (Supervisor: Ass. Prof. L. Kaiktsis).

Charalambos Souliotis presented "Study of the Loading on Stranded Ships and their Response, with the Finite Elements Method" (Supervisor: Prof. Manolis Samuelides) from the Department of



**Awarding Excellence** From left to right: SNAME Greek Executive Committee Substitute Member Nikos Dionysopoulos, competing students Nikolaos Stamoudis, Evangelia Velentza, Lampros Nikolopoulos, Charalambos Souliotis and Greek Executive Committee Secretary/Treasurer Petros Lalangas

Marine Structures.

The criteria for the award were value and usefulness of the thesis topic, quality of the thesis work and research done and the quality of presentation. A six-person panel selected to judge the contest named Lambros Nikolopoulos the winner. His award included a 500 euro prize and certificate from the Greek

Section.

The Greek Section also awarded the other three contestants with a free SNAME membership for 2013.

The winning thesis can be found at the NTUA online library at:  
[http://dspace.lib.ntua.gr/bitstream/123456789/6557/3/nikolopoulos\\_l\\_tanker.pdf](http://dspace.lib.ntua.gr/bitstream/123456789/6557/3/nikolopoulos_l_tanker.pdf).

## **Lloyd's List Honors Greek Section for Technical Achievements**

On December 7, 2012, the universally respected maritime newspaper Lloyd's List awarded the Greek Section of the SNAME its prestigious technical achievement award.

The award was sponsored by Germanischer Lloyd Headquarters in Hamburg. The section's current chairman Prof. Apostolos Papanikolaou as well as section founder and current secretary/treasurer Petros Lalangas were present at the gala dinner and awards ceremony to accept the honor.

In accepting this award the following was stated:

"Many thanks for this prestigious award, which we accept

also on behalf of all members of the Greek Section, who worked hard for its growth. The Section started back in 2002 with 160 members and now has double that number.

This growth & achievements of the Greek Section were accomplished also because of the support & hospitality provided by the Mr John Angelikousis' Group of Companies and of the ELKCO Marine Group of Companies, who provide their facilities free of charge for the technical meetings and for office space of the Section and of the SNAME European Regional Office in Paleon Faliron, respectively. Their support is deeply appreciated."

# ***SNAME Student Work: North American ECA Regulations and LNG Fuels - A Viable Solution?***



by **Yvonne-Effrosyni Damianidou**

## **INTRODUCTION**

The purpose of this paper is first, to present an overview of the relatively recent North American Emission Control Area (ECA) Regulations imposed by the International Marine Organization (IMO) amendment to the International Convention for the Prevention of Pollution from Ships (MARPOL, Annex VI) in 2010, as well as to show how other organizations, namely the United States Environmental Protection Agency (EPA) have been instrumental in promoting the implementation of these

regulations. Within the North American ECA context, this paper also examines the prospect of liquefied natural gas, commonly referred to as LNG, potentially becoming “a fuel of the future for the shipping industry”. This not a new idea. In fact according to the American Bureau of Shipping, this is already on the way of becoming a reality, as it is undoubtedly a better solution to conventional fuels in terms of air and sea pollution. However, although statistics relative to LNG’s emission and subsequent pollution reduction are overwhelmingly in its favor, there are still

implementation and regulatory challenges that need to be addressed, as well as other crucial issues regarding technological implications, vessel design, fuel availability, commercial feasibility, and of course, health and safety.

Furthermore, the question of whether LNG fuels do indeed offer a viable alternative solution for the shipping industry will be examined, illustrating the pros and cons, while focusing on issues of bunker supply and demand and future global implications.

*(EXCERPT)*

**LNG FUELS – A VIABLE**

**SOLUTION?**

## **Advantages**

There are many advantages in using LNG as a marine fuel. First of all, liquefied natural gas as a fuel for ships produces less corrosive and more silent combustion than MDO or Marine Diesel Oil, (also known as #2 Diesel), or HFO, Heavy Fuel Oil, (or Bunker C). LNG is cleaner than these crude oil derivatives, which are to a great extent unrefined and very thick and consequently need to be heated to very high temperatures by steam, thus reducing their viscosity in order to allow them to flow.

Other serious considerations in favor of using LNG have to do with the environment. Bearing in mind that maritime traffic majorly contributes to atmospheric pollution, it follows that LNG fuel, which offers lower emissions of NOx and no emission of SOx, as it contains no sulfur, is more efficient and significantly reduces environmental pollution, which in turn translates into increased cost effectiveness. This tremendous advantage of cleaner air, particularly in

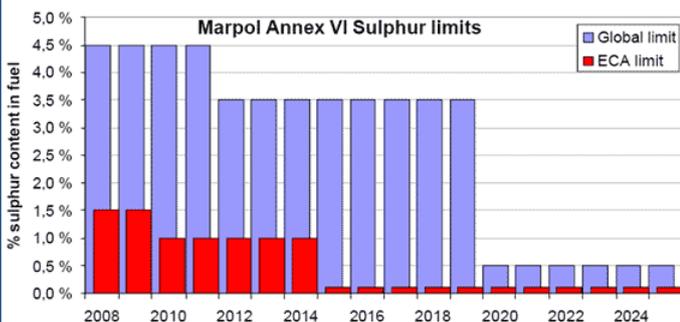
## ***About the Author...***



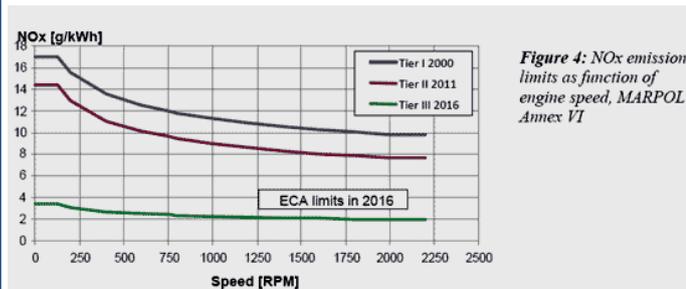
A senior student at NTUA, Yvonne-Effrosyni Damianidou has kept busy through her studies completing part of her thesis at École Nationale Supérieure d'Arts et Métiers (member of ParisTech), volunteering to teach English through the Global Volunteer Network Program in Peru and following a summer course with BEST (Board of European Students of Technology) at Ghent University (Belgium) Faculty of Engineering. She has also completed several internships including at United Nations High Commissioner for Refugees in Geneva, Switzerland where she did research on Urban Displacement in connection with refugees. Another internship was at Fivos Zoukis Marine Technical Bureau & Consultants where she participated in ship inspections and survey and learned about regulations pertaining to the management of passenger ships. Finally, during her current senior year, she also completed an internship at COSCO Shipping Agency – Hellas and Piraeus Container Terminal S.A

large commercial harbors, coastal cities and open seas, suggests that in the coming decade, the majority of contracted ships will most probably be using LNG. In fact, if we examine the actual impact of using LNG, we come up with astounding results: For example, five LNG fueled ferries, like the Norwegian “Glutra”, the first to run on LNG, have reduced NOx emissions by 90%, as compared to running on marine diesel oil, which is equivalent to removing 160,000 cars from a heavy traffic area.

Findings such as these were instrumental in the International Marine Organization’s creation of the regulations that designate the acceptable limits of the sulfur content in fuel, as per the chart below:



Similarly, the graph below, which can also be found in MARPOL Annex VI, shows the restriction of NOx limits, as a function of engine speed:



Other advantages in support of the use of LNG have to do with the fact that natural gas possesses several properties which make it an excellent fuel for internal combustion engines. These properties allow for the designing of highly efficient gas fuelled engines with low exhaust emissions. Listed below are the technical features of LNG used as a ship fuel:

- It contains a high methane number, which allows for a high power ratio within the knocking margin
- It can be easily mixed with air to obtain a homogenous charge, thus allowing it to burn with high flame velocity even at high air access. High peak temperatures and pressures during combustion are avoided in this way, resulting in reduced emissions of NOx as high as 90% less, compared to residual oil or marine diesel oil,

which dramatically increases its efficiency. It contains no sulfur, therefore no SOx emissions, and no particulate matter.

Additionally, methane (CH<sub>4</sub>), the main component of LNG, has a simple molecular structure, thus when it burns, fewer CO<sub>2</sub> emissions are produced, in comparison to those resulting from the burning of more complex molecules of conventional liquid fuels such as diesel oils. Stoichiometric combustion of natural gas yields 9.5% CO<sub>2</sub>, as opposed to diesel, which yields 13.4% CO<sub>2</sub>. The simplicity of the CH<sub>4</sub> molecule combined with the absence of sulfur in natural gas also result in the avoidance of particle emissions.

The table below shows the differences between indicated emissions based on engine output in kWh, from LNG ship fuels, to liquid petroleum fuels for ships. (Indications are based on typical medium speed engines built after the year 2000 without exhaust cleaning.)

Fuel type	SOx (g/kWh)	NOx (g/kWh)	PM (g/kWh)	CO2 (g/kWh)
Residual oil 3.5% sulphur	13	9-12	1,5	580-630
Marine diesel oil, 0,5%S	2	8-11	0,25-0,5	580-630
Gasoil, 0.1% sulphur	0,4	8-11	0,15-0,25	580-630
Natural gas (LNG)	0	2	~0	430-480

Source: Marintek

### Safety Issues

Although the benefits of using LNG as an alternative marine fuel are undoubtedly numerous, one of the main ones being that there are no environmental hazards that can result from any accidental discharge of LNG, there are several potential problems that remain unsolved and that are a matter of concern both to the IMO, as well as to governmental organizations such as the EPA.

On the one hand, LNG does not have the corrosive effects on storage tanks that result from water vapor and other contaminants, as it is more consistent and more refined than other fuel products. On the other hand, LNG has no natural odor of its own, hence making leak detection extremely difficult, unless the leak is large enough to be exteriorly visible in a localized area of a storage tank. This necessitates the addition of an odorant, which, given the cryogenic temperature at which LNG must be stored renders it nearly impossible. Consequently, the placement of methane gas detectors in any area where LNG is being stored or transferred is essential.

Although the possibility of an explosion of a LNG storage tank is highly unlikely, it could happen in the event of the complete failure of the pressure relief system. Other potential safety issues include the possibility of the rupturing of a LNG vessel during transport, resulting in a spill into an adjacent body of water and a high probability of fire. This would occur as a

result of the immediate formation of a flammable natural gas vapor/air mixture near the LNG pool.

Commonly referred to as a rapid-phase transition (RPT), this danger results from the rapid transformation from the liquid phase to vapor. If significant vaporization occurs in a short time period, the process can, and usually does, resemble an explosion. Observed in a number of situations, the RPT "explosion" phenomenon for LNG on water has been closely examined and studied extensively using laboratory as well as large scale tests. Two of the key factors in determining whether an RPT will take place are the temperature of the water and the actual composition of the LNG.

Potential exposure of personnel to cryogenic temperatures can result in cryogenic burns caused by direct bodily contact with cryogenic liquids, metals, and cold gas. Direct contact with or exposure to LNG can cause severe skin tissue damage much more rapidly than mere exposure to vapors. This danger

can be reduced by appropriate protective multilayer suits. Unlike CNG (Compressed natural gas), LNG, as previously mentioned, cannot be odorized. Some concerns have therefore arisen around the issue of the ability of personnel detection of TVL concentrations, yet another reason which makes it mandatory to place methane detectors in areas where workers could be exposed. Finally, although methane, ethane, and propane, which are the principal components of natural gas, are not considered to be toxic, they are nonetheless classified by the American Conference of Governmental Industrial Hygienists (ACGIH) as asphyxiants. This constitutes a health risk since, in a closed environment, they can significantly displace oxygen.

#### CONCLUSION

To summarize, the continued development of LNG as a marine fuel, as well as its future as a viable solution to the need for the replacement of conventional fuels is a complex issue. On the one hand it is heavily dependent on

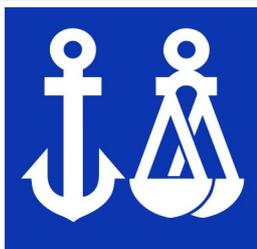
legislative and environmental factors, but technology and availability will play a major role as well.

Although several shipping companies consider LNG operation the best option from both environmental and economic perspective and are already in the process of planning new ways of operation of their vessels in 2015, at which point, more stringent SOx emission standards will be in effect in ECA (North America) and SECA areas (North and Baltic Seas), complete LNG takeover is still a long way away.

The evidence is overwhelmingly positive and the technology required to further improve the conditions of LNG use is readily available and well documented. However, before it can totally replace traditional marine fuels, further advancement of storage tank construction, as well as the solution of potential safety and health issues will have to be addressed.

*This paper was presented in the student papers track of the SNAME Annual Meeting in Providence, RI 2012.*

## **Thank you to the generous past and present sponsors of SNAME NTUA**



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