

# **Innovation of Naval Architecture & Ocean Engineering Curriculum at Seoul National University**

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## **Abstract**

In this paper, it is described how the curriculum for naval architecture and ocean engineering (NAOE) of Seoul National University (SNU) will be changed in the era of modern IT technology. Since its foundation in 1946, the Department of NAOE at SNU has played the leading role in naval architectural education and research in Korea, which is currently ranked the top position of the world in the area of production and order book of new ships. However, the Department of NAOE at SNU is now suffering from the lack of new students, as studying NAOE has become unattractive to young students. In order to overcome such problem, we are now trying to innovate our curriculum in two ways, which are discussed in this paper. Through such innovation, we hope the number of new students to the Department of NAOE at SNU will increase significantly.

## **I. Introduction**

Seoul National University (SNU) has long been regarded as the best university in Korea in every respect since its foundation in 1946. Among the 16 colleges in SNU, Engineering College is the largest one consisting of 6 schools and 4 departments. These have been transformed from 19 departments: The 6 schools were established quite recently under the so-called school reform whereby 2 or 3 departments were merged into one<sup>1</sup>. For example, in the case of the School of Mechanical and Aerospace Engineering, three former departments-Mechanical Engineering, Mechanical Design and Production, Aerospace Engineering-were merged. The main objective of the school reform was to expose students with diverse courses and to allow them to choose their major from a rather broad field.

In addition, freshmen are admitted to the Engineering College without being designated a fixed major. They would decide their major after having completed the freshman year. These students will be offered to take introductory courses for engineering majors each semester to help them grasp the kinds of studies they will be going to do and the kind of career path awaiting them after they finish the undergraduate course, which they have chosen. Under the framework of the introductory course, each major is allowed to hold 12 hour lectures.

However, many faculty members of our department are already doubtful of such system, *i.e.* they expect that the effect will be minor, simply because high techs like IT, BT and NT are too attractive for young people to think otherwise. They are concerned about a clear divide between popular and unpopular majors. Unfortunately our major belongs to the latter case, irrespective of the fact that the shipbuilding industry in Korea is booming. Nevertheless, most faculty

members of our department firmly believe that the goal of our department should be to educate specialists rather than generalists who are able to contribute to the enhancement of ship and ocean technologies that our shipbuilding industry relies on. To realize this goal, they believe, an independent educational program must exist at SNU.

## II. Enrollment and Industry

Fig.1 shows the annual production of new ships by Korean shipbuilding industries from 1960 to 2000. As clearly indicated in the figure, the ship production in Korea was negligible until 1970, but it increased rather drastically afterwards. Although there were fluctuations from time to time, particularly in 1979, 1987, and 1993, manufacturing of ships has been steadily increasing and last year, it reached a record high of 11.8 millions GT. It is expected that the high conjuncture in Korean shipbuilding industry will last for a while. Many factors have been involved in such a success. Among these, the most important one is indeed the engineering education at the university level, particularly at SNU.

The number of graduates from our undergraduate program is illustrated in Fig.2, together with that of those among the graduates who work either at shipyards or at shipbuilding related institutions. In the figure, the quota of entrance to our department is also depicted by the shadow area, which shows a continuous fluctuation. Until 1967, the quota was 13 each year, after which it increased to 20 in 1968, 30 in 1971 and 50 in 1974. It reached its maximum 65 in 1981, and then the number started to decrease to 40 in 1986, and increased again to 65 in 1993. But the actual number of enrollment has always been less than the quota, and the size of a class is in general gradually decreasing, particularly at the junior year. The reason is, on one hand, many students go on leave from school for military service, when they finish the sophomore course. The military service is mandatory for all Korean men. On the other hand, quite a number of students give up naval architectural study and try to find other possibilities.

It is interesting to note by comparing Fig.1 with Fig.2 that the number of graduates has a close relation with the ship production with a time delay of about 5 years. For example, the first peak in the number of graduates was in 1978. The majority of them entered our department in the academic year of 1974, when Korean government pushed an ambitious plan for developing heavy industries including shipbuilding and consequently the ship production started to leap. After then a deep hump in the number of graduates is to observe in the year of 1984. There was a sharp recession in shipbuilding worldwide, when these students entered university. In recent years, the number of graduates in average is slightly more than 40. The reason why such a relatively large number of graduates could be maintained is partially due to the enrollment system, *i.e.* students were accepted to each department. Although a certain part of students have no will to study naval architecture & ocean engineering, they choose our department simply because it is an easier way to attend the Engineering College of SNU. But with the new system, it is hardly expected to have such students of unwillingness.

## III. Innovation of Curriculum

In order to overcome the expected extremities, we have decided to innovate our curriculum, *i.e.* to make it attractive that many students would consider to choose naval architecture and ocean

engineering as their major. Before we discuss further on this topic, let us examine the current curriculum, which took its shape in 1996, when the minimum credit necessary for graduation was reduced by 10 credits to 130 credits. In general, one course is equivalent to 3 credit hours lecture including experiment per week. One semester extends to 16 weeks. The standard curriculum is shown in Table 1. The first column of the table denotes the year, the second and third ones correspond to spring semester and fall semester, respectively. In the table, the symbols have the following meanings:

- mandatory for all engineering students
- ⊙ mandatory for NAOE students
- Ⓛ offered biannually

All students at SNU engineering college are required to take at least one course in computer science and two courses in engineering mathematics. In addition, as NAOE students, they are obliged to study fundamental mechanics such as Ship Hydrodynamics I, Fundamentals of Marine Structural Statics and the fundamentals to naval architects like Ship Stability in the sophomore year, and some applied mechanics and naval architectural subject like Ocean Wave Dynamics, Ship Resistance and Propulsion, Ship Motion and Maneuverability, Ship Structure Analysis, Structural Analysis and Design of Ocean Structures, Introduction to Ship Production Engineering in the junior year, and finally Basic Ship Design and Communication Skills in the senior year. The basic principle for the revision was

- (1) to integrate similar courses into one or two courses,
- (2) to include experiment in corresponding courses,
- (3) to relate all courses with design, explicitly with Basic Ship Design in the senior year,
- (4) to reduce NAOE courses so that students may take other courses in related engineering fields or other fields such as humanity, sociology, management,
- (5) to introduce a new course on Communication Skills.

The last one was determined in order to meet the needs of the industry and also for accreditation process, for example see ABET EC2000<sup>2-3</sup>. In the Communication Skills, students learn how to solve problems collectively with their classmates, to write technical reports, and learn how to present their result with the help of audio-visual media. The students are required to participate in a teamwork project twice: First they are given the freedom to form a group of 5 people, but for the second teamwork they are randomly allocated into groups. Through such opportunities, they experience in working with other people. In addition to the course on Basic Ship Design, all students are asked to take part one of the design teams. The resulting designs are to be submitted to the Student Design Contest annually organized by the Society of Naval Architects of Korea.

We are now trying to design new curriculum in two ways: One is to introduce IT and IT-related courses such as “Programming Method and Language”, “Data Structure for Programming”, “IT in NAOE”, “CAD/CAM in NAOE”, “Digital Shipbuilding”, etc. In order to accommodate these new courses, we have to cut down the number of existing courses by merging two or three related courses into one. The other one is to rename courses somewhat more interesting to young people such as “Flow Around a Ship” instead of the traditional course name “Hydrodynamics” and “Ocean Environment and Our Life” instead of “Ocean Wave Dynamics”, etc.

#### **IV. Concluding Remarks**

Although the Department of NAOE at SNU has educated many young talented people, who are currently playing a leading roll at Korean shipbuilding industries, and hence has gained its reputation as the best educational institute in this country, it is encountering a serious problem of a sharp decrease in the number of new students.

In order to overcome such difficulty, we are now trying to innovate our curriculum in two ways: One is to reduce the number of existing courses by merging two or three related courses into one and renaming them somewhat more interesting to young people. The other one is to introduce IT and IT-related courses. Through the innovation, we hope the number of new comers to the department of NAOE at SNU will increase largely

#### **References**

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(<http://www.snu.ac.kr/engsnu/>)
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Table 1. Standard Curriculum of NAOE at SNU

	Spring Semester	Fall Semester
1	-Introduction to Computer ●	-Introduction to Naval Architecture & Ocean Engineering
2	-Engineering Mathematics 1 ● -Ship Hydrodynamics 1 ⊙ -Fundamentals of Marine Structural Statics ⊙ -Computer-Aided Ship Drawing	-Engineering Mathematics 2 ● -Ship Hydrodynamics 2 -Fundamentals of Marine Structural Dynamics -Ship Stability ⊙
3	-Ocean Wave Dynamics ⊙ -Ship Resistance and Propulsion ⊙ -Numerical Analysis of Marine Structures -Introduction to Ship Production Engineering ⊙	-Engineering Mathematics 3 -Ship Motion and Maneuverability ⊙ -Ship Structure Analysis ⊙ -Design of Propulsion Devices -Structural Analysis and Design of Ocean Structures ⊙
4	-Numerical Fluid Dynamics -Basic Ship Design ⊙ -Ship Vibration and Noise -Ocean Environmental Engineering ① -Design of Ocean Equipments ① -Communication Skills ⊙ -Topics in Naval Architecture	-Ship System Design -Computer-Aided Ship Design -Ship Production System ① -Maritime Management ① -Topics in Ocean Engineering

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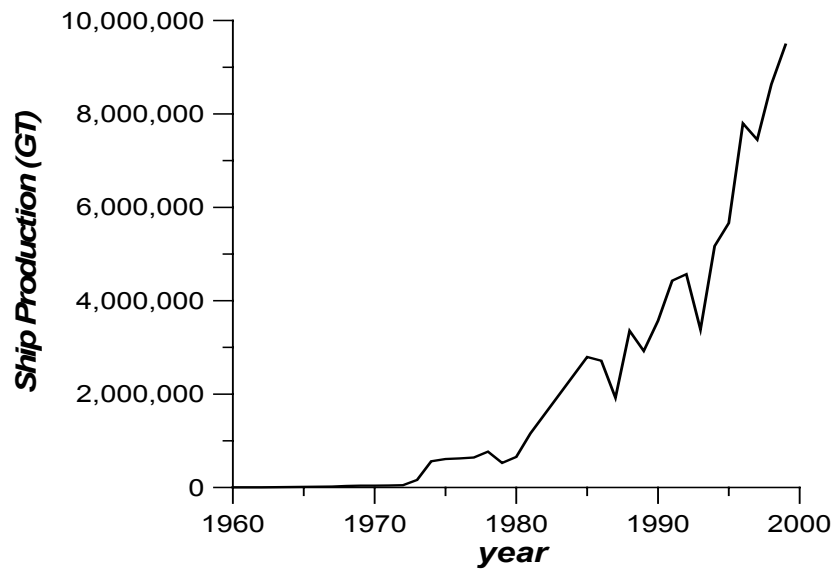


Figure 1. Annual Ship Production in Korea

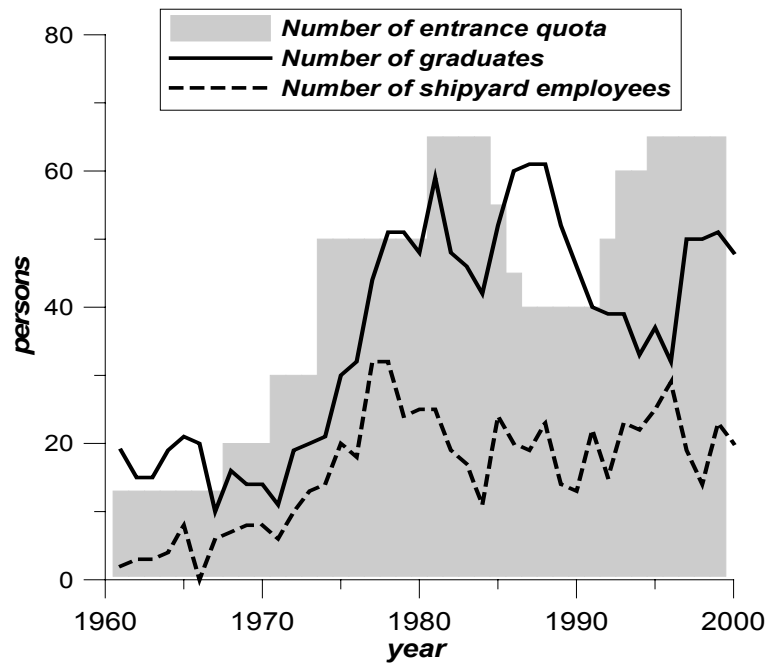


Figure 2. Number of Student Quota, Graduates and Graduates Employed at Shipyard

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Hang S. Choi is a Professor of Naval Architecture & Ocean Engineering at Seoul National University, Korea. He received a BS and a MS in the field of naval architecture from Seoul National University, and a Dr.-Ing. from Technical University of Munich, Germany. His area of research interest includes marine hydrodynamics, motion and control of floating structures, AUV design and control.