Some Observations on Recent Development of Aerospace Engineering Education in Taiwan

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Abstract: Recent development of aerospace engineering education in Taiwan is noted that more multi-disciplinary courses are being offered in university departments in reply to the needs of manpower in aerospace industry. In this report, comments are made on the concerns in conjunction with restructuring the departmental curriculum, the mechanism of university-industry collaboration, and the effectiveness of international cooperation, based on observations on current aerospace education.

Keyword: aerospace, education, development

1. Introduction

The trend of economic globalization has shown tremendous impacts on engineering education, emerged as a focused issue in the recent meetings of which the present author was aware. For instance, in the Annual Summer Meeting of ASME, Division of Fluids Engineering, of 1999 [1], and the AIAA Aerospace Sciences Meeting and Exhibits of 2000 [2], among the papers on education presented some of which [3] was concerned with impacts due to the global business environment and the interests of student learning. In the conference of ICEE'99 at Ostrava 1999 [4], topics on the future trend of engineering education and the usage of computer information technology for teaching and learning were noted in a number of papers. Here, the present author would like to provide his comments on the recent development of aerospace engineering education in Taiwan, which is also attributed to the impact of economic globalization.

University aerospace engineering education in Taiwan has been established for more than three decades. The traditional aerospace engineering education in Taiwan placed emphasis on the fundamental subjects of aerospace engineering, which provide a sound background relevant to the discipline of aircraft design. During the last decade the aerospace industry in Taiwan has developed into a diversified trend. The demand of manpower in the defense industry was decreased sharply on one hand, while the needs of manpower in the civil aviation industry and the space industry is growing on the other hand. The civil aviation industry in Taiwan is referred to the airline operators and the aircraft component manufacturing companies. The space industry is mainly represented by the National Space Program Office, a governmental agency for promoting space technology. There are also some private companies showing their interests in manufacturing the satellite parts and components. In response to the diversified growth of aerospace industry described above, the aerospace engineering departments in the three universities in Taiwan, namely Tamkang University, Fon-Chia University and National Cheng Kung University, now are offering elective courses on aviation safety, CAD/CAM, aerospace quality assurance, avionics and space system engineering, which were not seen in the traditional curriculum.

As pointed out by the present author [5], the recent development of aerospace engineering education can be summarized into four directions, namely aerospace manufacturing, civil aviation technology, space engineering and aerospace design. Currently the aerospace engineering departments are striving to improve their undergraduate curricula along these directions with the resources available. Speaking of the resources available, each of the departments not only counts on the resources internally, but also looks for the resources outside the department. Collaborations with other departments and industrial organizations are being sought, since departmental resources are always limited whereas the new courses mentioned are of multi-disciplinary in nature.

Governmental support to the recent development of university aerospace education is worthwhile mentioning. Since 1997 the Ministry of Education has been providing special fund to universities and colleges for those who committed to offer courses in the areas of aircraft maintenance, aircraft manufacturing, aerospace quality assurance and avionics. These areas are recognzied as the ones of which manpower is urgently needed in the local

aerospace industry. It should be mentioned that this program emphasizes on collaboration between university and industry in order to improve the courses established in universities and colleges.

In the following, comments on the recent development of aerospace engineering education in Taiwan are given. Being an educator in university, the present author is concerned particularly with the departmental curriculum, the mechanism of university-industry collaboration and the effectiveness of international cooperation of current aerospace education.

2. On the Scope of University Aerospace Engineering Education

During the past three decades the aerospace engineering education in Taiwan has been doing successfully to produce high-quality engineers and scientists, who earned their commendable reputation in industry, research organizations and academic community. As known, the traditional curriculum was designed to emphasize the fundamental subjects in physics, mathematics and engineering, which provided students with a sound background relevant to the discipline of aircraft design.

Recently comments received from the aerospace engineering graduates are that the department should have offered more courses on applied subjects. These comments are understandable because of the diversified development of local aerospace industry in the past decade. The manpower needed is not only in the area of aircraft design but also on manufacturing, operation and maintenance. In fact, outgrowth of aircraft maintenance and manufacturing industry in the recent years creates more job opportunities than the traditional job market in the area of aircraft design. As a result, having realized the recent changes in the industry, the aerospace engineering departments in the three universities mentioned are now offering new elective courses on the subjects such as quality assurance, CAD/CAM, aviation transportation management and aviation safety. Despite finding qualified instructors for these courses among the full-time faculty members could be a problem, the departments somehow managed this problem by searching for the qualified instructors from other departments or even from industry.

Generally speaking, the current aerospace engineering curriculum consists of the new courses, which are of multi-disciplinary in nature, and the courses that are more on the fundamental subjects. Hence, streamlining or re-organizing the course structure is realized to be necessary and important. A department should be able to provide students guidelines concerning required and elective courses necessary for specialized disciplines. One may refer to the curricula offered by Department of Aeronautics and Astronautics, Massachusetts Institute of Technology, U. S. A. [6], and the Faculty of Aerospace Engineering, Delft University, Netherlands [7], for examples. As far as offering the new courses are concerned, the department has to evaluate its resources in terms of the faculty specilities and the laboratory equipment. Moreover, the department should consider the possibilities of collaboration with other departments and industry. Through collaboration, the department is able to establish a closer relationship with the industry, and on the other hand students can gain benefit from the collaboration.

Overall speaking, current aerospace curricula seen in the universities are evolving in reply to the diversified development of the local aerospace industry. In this process, the present author is concerned with the quality of courses, in particular the contents of the courses how to enchance students' creativity and ability of problem solving. After all, the university graduates are expected to be engineers and scientists making contributions to various areas, even in the non-aerospace field.

3. Effectiveness of University-Industry Cooperation

Cooperation between university and industry is realized to be very crucial to the development of the new multi-disciplinary courses mentioned above. Nevertheless, implementation of this concept is not straightforward.

First of all, both parties of university and industry should identify the directions or items mutually beneficial. Clearly, in order to reach an agreement on cooperation, sufficient understandings between both parties are necessary and important.

Subsequently, the present author finds that cooperation could be started with two levels at least. The fist level is on teaching and training. The elective courses can be offered jointly by university and industry, hence that students can gain benefits not only on the academic ground but also in the respect of hands-on experiences, which would be greatly appreciated by the industry.

The second level is on student design projects. Normally, in an aerospace engineering department the course of design projects is offered to senior or junior students. The design projects are frequently based on the ideas from the supervising professors. The present author finds that it is worthwhile to invite professionals from industry to join in as co-supervisors, who are able to provide their inputs in various phases of the course.

Possibilities are that some of the design projects derived from the practical problems could be even more interesting and challenging to students and professors. For instance, some successful examples sponsored by industry in the universities in United States were reported by Anderson [8]. According to Anderson [8], the results of some of the student design projects later became of practical value to the sponsored companies.

It is worthwhile to mention that strong support from Ministry of Education on university-industry cooperation since 1997 has received very positive responses from universities. On the other hand, evaluating the results of university-industry cooperation on education is not yet clearly defined. In the future the effectiveness of university-industry cooperation has to be measured by certain specific criteria.

4. International Cooperation on Education

One has to say that most of the international cooperation efforts conducted by universities in Taiwan are on research. Not until recently, attention has been paid to the international activities on education. For instance, in the summer of 1998, a group of 17 students led by the professors of Department of Aeronautics and Astronautics, National Cheng Kung University, visited Delft University, Netherlands, for a three-week workshop on aerospace engineering education. In 2001, an international aerospace education fair organized jointly by Ministry of Education and CASID, Ministry of Economic affairs, will be held in Taipei.

Despite that international activities on aerospace education get pronounced in Taiwan, the present author finds that the effectiveness of current activities is rather sporadic, no consistent or follow-up plan for each of the individual activities. Hence, in order to be more effective the items relevant to long-term interest of cooperation should be emphasized in the future.

5. Concluding Remarks

The recent development of university aerospace engineering education in Taiwan is noted to be more multi-disciplinary and more collaborative with industry. In this paper, the present author made comments on how to improve the current aerospace education with the mechanisms of university-industry cooperation and international cooperation.

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