

## Avionics Education in Taiwan's Vocational University

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**ABSTRACT:** *The purpose of this paper is to report the content and status of the avionics education in Taiwan's vocational universities. To incubate qualified and skillful avionics technician human resource in Taiwan, the Ministry of Education (MOE) developed an avionic division in the Aeronautical Engineering Department of the National Hu-wei University of Science and Technology (NHUST) in 1995. After that, an avionic division was also established in the Electronic Engineering Department of the Kao-Yuan Institute of Technology and an Avionic Engineering Department was established in China Institute of Technology. Out of the 9 faculties in NHUST's avionic program, three major in Power Electronics Engineering, two major in Navigation and Control Engineering, two major in Communication Engineering, two major in Information Technology. Meanwhile, international cooperation is also processed to obtain the most updated information and technologies about aircraft maintenance and avionics for reforming and enhancing the education program. The avionics curriculum and the resource center were also established for the avionics education among Taiwan's vocational Universities and will be described in this paper.*

### 1 AVIATIONS INDUSTRY OF TAIWAN

Aerospace industry consists of advanced technologies from various engineering areas such that it becomes the driving force for other industries. Aerospace industry is the indicator for a country's industry development; it also bears the dual mission of national defense and economy. The products of aerospace industry stand for high technology, high quality and high value. Aerospace industry usually is supported from government investment for it is a capital and technology-intensive industry with very closed market. Since 911 disasters, European and United States aerospace companies have moved their production line to other countries to reduce the production cost. It thus becomes an opportunity for Taiwan's domestic aerospace companies to work with international aerospace partners and to manufacture the subsystems and components the international partners require. Besides, the Defense Department of Taiwan also released the military aircraft maintenance to the civil segment. As a consequence, Taiwan's Ministry of Economy has estimated that the aerospace industry investment will increase from 3.5 billions to 5 billions during 2004 fiscal year, which equals to 43 percentage increase.

### 2 CURRENT AVIONICS INDUSTRY IN TAIWAN

Taiwan's traditional avionics industry mainly focus on Differential Global Positioning System (DGPS) navigation system, automatic inspection, and cabin personal entertainment system. As new technology progresses, improvement of avionics system and digitalization of flight management and control system have becoming the new trend. Traditional flight control system has changed from mechanical control to electronic control, i.e., it shifts from control-by-cable to control-by-wire, such that the aircraft can obtain more precise and better flight dynamic and attitude control through utilization of computer. Other advanced avionics and navigation system, such as electronic instrument system, center malfunction display system, flight diagnosis system, and automatic landing system have becoming the essential subsystem in the modern aircraft system Taiwan made. To increase the comfort of air travel, active noise reduction and control system is also adopted to the civil aircrafts. With the advanced information technology capability Taiwan's electronic companies bear, the design and development of advanced aircraft personal entertainment system has also achieved. Taiwan's avionics companies has also transfer the technologies used in the personal entertainment system to other similar system, such as

mass transit system, high-speed railway system, hospital bedside information system, and freeway transportation and bus system, etc... Besides, considering the foreigner companies' investment in Taiwan's avionics industry, Snecma, the French company, has invested 9 hundred millions to build a joint-venture company. Becker Avionics is in cooperation with Taiwan Jon-Ke Yuan's institute of Electronics to establish a research center for avionics. It is said that Becker Avionics will gather 32 hundreds Taiwan dollar to establish a avionics certificate company. All of the evidence shows that the proliferation of avionics industry will be in need of well-trained aerospace professionals.

### **3 TAIWAN'S AVIONICS HIGHER EDUCATION**

In Taiwan, there are three vocational institutes focus on avionics education and training, which include National Hu-wei University of Science and Technology (NHUST), China Institute of Technology and Kao-Yuan Institute of Technology. The Aeronautical Engineering (AE) Department in NHUST has spend many efforts on aerospace education and won world-wide recognition. The student training education in the AE Department of NHUST includes the related fields of both aircraft mechanics and avionics. This is very different from other aerospace related institutes or postgraduate education that is mostly oriented to fulfill the students with the ability of theory analysis on aerospace subjects. AE Department of NHUST provides students with various training programme and, therefore, how to quickly promote the training programme to the aerospace industry and society has became one of the most urgent tasks the administrator need to do. Thus, the school also looks for the cooperation and support from other higher education aerospace institute around the world.

The AE department of NHUST currently has three faculties majoring in power electronics engineering, two faculties majoring in communications, two faculties majoring in Navigation and Control, and another two faculties majoring in Information Technology. Seven other PhDs major in aerospace engineering in the mechanics division. Each year, the department will have 200 students, which is separated into mechanics and avionics. The students are normally required to study 4 years for the bachelor degree. The first two years are basic training, which focuses on the aircraft and electronics related knowledge. The goal of the first two year education is to prepare student with the basic knowledge and skill for avionics and electronics. The curriculum for the first two year is shown in Table 1. The second two years is specialty training, which including courses in communications, navigation & control, information technology and power electronics. The core course for the basic and advanced power electronics is shown in Table 2 and Table 3, respectively. There are two laboratories for the aviation power electronics courses which including power electronics lab and aircraft electrical lab. The core course for the basic and advanced Navigation & control is shown in Table 4 and Table 5, respectively. The core course for the basic and advanced communication is shown in Table 6 and Table 7, respectively. The core course for the basic and advanced information technology is shown in Table 8 and Table 9, respectively.

### **4 THE AVIATION MAINTENANCE RESOURCES CENTER (AMRC)**

Considering the human resources demand of the aerospace industry in Taiwan is increased, the Aerospace Engineering Program Office (ASEPO) has been established since 1997. The ASEPO manages to promote the Aerospace Science and Technology Education by developing the cooperation mechanism of industry-academy strategic alliance and by establishing resources centers and partner schools in four major industry-related fields, which includes aerospace quality assurance and certification, avionics, aerospace parts and components manufacturing, and aviation maintenance. National Hu-wei University of Science of Technology (NHUST) has established the Aviation Maintenance Resources Center (AMRC), and 8 partner schools has joined to promote the aviation maintenance education for Taiwan's aviation industry. The center also coordinates and shares the international cooperation with partner schools, including certificated short course, workshop training course, overseas experts, summer student oversea practice, and academic exchange program. In past two years, with the concerted efforts of the work team, the academy-industry alliance has made great achievements as follows:

- (1) Being the sponsor for "2002 IEEE/ASME International Conference on Advanced Manufacturing Technologies and Education in the 21<sup>st</sup> Century",
- (2) Being the cosponsor for the 2001 international aviation and education exhibition in Taipei,

- (3) Student avionics training program with the Civil Aviation University of China in People Republic of China (the accumulated number of students is up to 50 during 2001 and 2002 summer).
- (4) Inviting experts from the certified center in Australia for the evaluation on the aviation maintenance education: The school has obtained the basic scope for being an ATO certification unit from the final assessment report.
- (5) Holding numerous workshops and intensive short courses by inviting experts and professors from advanced countries including France, USA, Canada, Australia, and China.
- (6) Obtaining experiences in aviation education from visiting nine universities in five countries, and reaching agreements with them.

## **5 THE AVIONICS EDUCATION RESOURCES CENTER (AERC)**

Since 1997, Taiwan government has established the Aerospace Engineering Program Office (ASEPO). The mission of ASEPO is to promote the Aerospace Science and Technology Education by developing the cooperation of industry-academy strategic alliance and by establishing resources centers and partner schools in four major industry-related fields. The main fields include aerospace quality assurance and certification, avionics, aerospace parts and components manufacturing, and aviation maintenance. The Avionics Educational Resources Center (AERC) is established in the National Cheng Kung University (NCKU) and it has 12 partner schools together to promote the avionics education with Taiwan's aviation industry. The AERC coordinates educational resources in support of relative Taiwan's vocational high schools, technology colleges, and universities and their students. For developing the special educational objectives, the center is divided according to the partners into 4 groups, which contains the Micro Avionics System Teaching Lab, the Flight Simulation Teaching Lab, the Avionics Maintenance Teaching Lab, and The Other members. The AERC also develops collaborative programs within its network and with other organizations, along with its industrial members. For acquiring the updated technology in the aviation technology education, the center also coordinates and shares the international cooperation with partner schools, including certificated short course, workshop training course, overseas experts, summer student oversea practice, and academic exchange program.

## **6 THE INTERNATIONAL COOPERATION IN AVIATION TECHNOLOGY EDUCATION**

The goal of the international cooperation in aviation technology education is to respond to the industrial demand. In the past two years, many forms of international cooperation have been carried out through the dedicated efforts from the Aeronautical Engineering Department of NHUST. The international cooperation includes partner schools, student exchange programs, visiting professors, research cooperation, intensive and certificated short courses, workshops, and students' summer practical training. The following two events have been sponsored by the department:

### **(1) Taipei International Aerospace Education Fair**

The goal of this Fair is to combine the industrial demand with aerospace educational achievements through industrial cooperation. "International Aerospace Technology and Education Fair" was held by CASID and MOE on August 2003. The committee invited many international Aeronautical and Academic Organizations to take part in these symposiums. It promoted the discussion, exchange between the organizations, and more intimate cooperation between companies and academies. This fair intended to offer students more information on study opportunities locally and overseas, in addition, and to enhance international cooperation on aerospace education and promote the regional industry development.

### **(2) International Cooperation in aviation technology education between Taiwan and France**

The International Cooperation in aviation technology education between Taiwan and France was established using the French Aeronautics and Space Industry Award (FASIA) in 1998. The IAS (Institut Aéronautique et Spatial) is responsible for running FASIA and provides Taiwan's institutions with whole range of integrated support and training solutions in France's Aviation Industry. The number of students coming from Taiwan has reached 16 in the different major study.

## 7 CONCLUSION

An innovative Avionics Education curriculum has been well-prepared and carried out by Aeronautical Engineering Department of NHUST, which is sponsored by the MOE and aeronautical industry. The basic aviation technique education is established by the department through the industry-academy strategic alliance, such as ASEOP, AERC, and AMRC. Besides, the international cooperation is also processed to obtain the updated information and technologies about aircraft maintenance and avionics for reforming and enhancing the education program. By going through all these activities, the aviation power electronics education can be rooted into the higher education in Taiwan and the experience obtained can also be shared among all the partners in the strategic alliance.

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Table 1. Course names of the avionics education in first two years

Course name	Credits	Hour per semester
English	4	80
English Listening comprehensive	2	80
Advanced English	2	40
Calculus	6	120
Engineering Math	6	120
Physics	6	120
Chemistry	2	60
Electronic Circuit	6	120
Microelectronics	6	120
Aircraft	2	40
Introduction to Aircraft System	3	60
Fundamental of Aircraft Repair	3	60
Introduction to Computer	2	60
Digital Logics	3	60
Principle of Microprocessor	3	60
Signal and System	3	60
Principle of Computer Network	3	60
Digital Logic Lab	1	60
Microelectronics Lab	1	60
Aircraft Repair Lab	1	60
Avionics Lab	1	60
Applications of Microprocessor Lab	1	60

Table 2. Core Course names of the Aviation power electronics education in Second two years

<b>Course name</b>	<b>Credits</b>	<b>Hour per semester</b>
Control System	3	60
Power Electronics	3	60
Aircraft Electrical System	3	60
Aircraft Electrical driven System	3	60
Digital Control System	3	60
Aircraft Power Electronics System Lab	1	60
Aircraft Electrical System Lab	1	60
Aircraft Electrical driven System Lab	1	60

Table 3. Advanced Course names of the Aviation Power Electronics engineering education in second two years

<b>Course name</b>	<b>Credits</b>	<b>Hour per semester</b>
Switching Power Converter	3	60
Satellite Power Converter design	3	60
Power Converter Design Lab	1	60

Table 4. Core course names of the Navigation & Control engineering education in Second two years

<b>Course name</b>	<b>Credits</b>	<b>Hour per semester</b>
Control System	3	60
Digital Control System	3	60
Computer Interface Theory	3	60
Communication Theory	3	60
Digital Communication	3	60
Communication and Navigation	3	60
Aircraft Communication and Navigation Lab	1	60

Table 5. Advanced course names of the Navigation & Control engineering education in second two years

<b>Course name</b>	<b>Credits</b>	<b>Hour per semester</b>
Embedded System	3	60
Satellite System Engineering	3	60
Aircraft Servo System	3	60
Satellite Communications	3	60

Table 6. Core course names of the Communication engineering education in Second two years

<b>Course name</b>	<b>Credits</b>	<b>Hour per semester</b>
Communication Theory	3	60
Digital Communication	3	60
Communication and Navigation	3	60
Probability Theory	3	60
Theory of Electric Magnetic Engineering	3	60
Microwave and Radar System	3	60
Communication System Simulation	3	60
Aircraft Communication and Navigation Lab	1	60

Table 7. Advanced course names of the Communication engineering education in second two years

<b>Course name</b>	<b>Credits</b>	<b>Hour per semester</b>
Satellite Communications	3	60
Mobil Communication Theory	3	60
Statistical Communication Theory	3	60
Error Correction Code	3	60
Aviation Radar	3	60
Microwave and Radar System	3	60

Table 8. Core course names of the Information Technology education in Second two years

<b>Course name</b>	<b>Credits</b>	<b>Hour per semester</b>
Introduction to Computer Networks	3	60
Computer Programming	3	60
Internet Programming	3	60
Data Structure	3	60
Computer Organization	3	60
Computer Interface Theory	3	60

Table 9. Advanced Course names of the information Technology education in second two years

<b>Course name</b>	<b>Credits</b>	<b>Hour per semester</b>
Multimedia Network	3	60
Imagine Processing	3	60
Neural Network	3	60