

AERONAUTICAL ENGINEERING DIPLOMA CURRICULUM PROGRAM FOR BASIC AIRCRAFT MAINTENANCE TO ANSWER THE DEMAND OF AIRCRAFT MAINTENANCE TECHNICIAN IN INDONESIA

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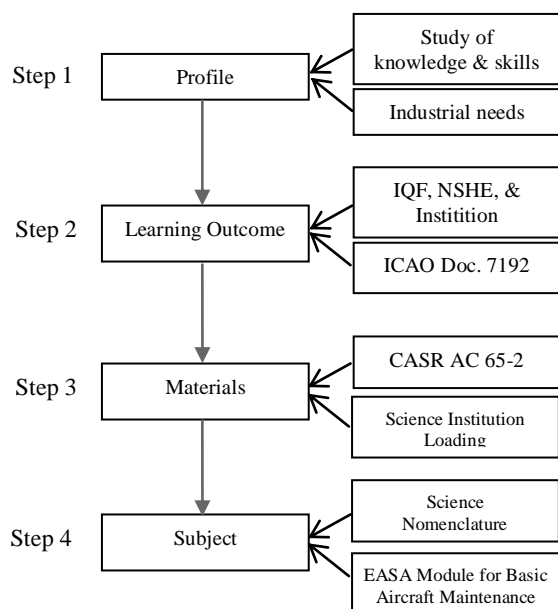
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Graphical abstract



Abstract

The high demand of aircraft maintenance technicians in Indonesia, present challenges to higher education practitioners. In 2015, Indonesia requires at least 6500 aircraft maintenance technicians as the estimated number of active technicians in 2015 is about 3700 technicians, and the number is decreasing due to the retirement. Current institutions which offer the education and training program have the capability to train up to 840 technicians. The Department of Aeronautical Engineering, University of Suryadarma, has redesigned the curriculum and syllabi of the program to match the needs of the aircraft maintenance industry. The approach is to introduce the standard competency, as required by the industry, in accordance with the framework of curriculum standard design for the diploma program. The industry standard competency for aircraft maintenance technician is based on the CASR (Civil Aviation Safety Regulations) Part 147 and, CASR Part 65 recommended by DGCA (Directorate General of Civil Aviation), the Ministry of Transportation of The Republic of Indonesia, and ICAO (International Civil Aviation Organization) Document 7192. The Framework of curriculum design for diploma program is following the Republic of Indonesian Law No. 12 of 2012 for Higher Education, Presidential Decree of The Republic of Indonesia No. 8 of 2012 for IQF (Indonesian Qualification Framework). This paper presents the recommended expected learning outcome and operational curriculum that satisfies the standard competency of aircraft maintenance technician, within the framework of standard curriculum design for the diploma program.

Keywords: Aircraft maintenance technician, national standard for higher education, Indonesian qualification framework

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1.0 INTRODUCTION

The Diploma Curriculum for Aeronautical Engineering at the University of Suryadarma was reevaluated and

rearranged to meet the requirements for aircraft maintenance technicians in Indonesia. Tracer studies indicated that with the development of the aircraft maintenance industry, more technicians will be needed than what the educational institutions could

produce [1]. Technicians who meet the standards are those having the basic aircraft maintenance license, as described in the CASR (Civil Aviation Safety Regulation) Part 65 [2] and CASR Part 147 [3].

On the other hand, with the issuance of Presidential Decree No.8 of 2012 on the Indonesian Qualification Framework (IQF)[4], and regular evaluation of the curriculum, the Aeronautical Engineering Department of University of Suryadarma feel the need to make adaptations to the graduate profile, learning outcomes and teaching materials.

This paper seeks to present the standard competency of aircraft maintenance technicians, as declared by industry, into the Indonesian Qualification Framework (IQF). By comparing the course length and level of study in the industry with IQF, the closest level to meet aircraft technician is level 5, which is equivalent to a Diploma 3 qualification [5]. The incompleteness of the industrial standards in order to achieve the level of competency is complemented by the addition of courses, syllabi and increased levels of learning.

2.0 MATERIAL AND METHOD

The Indonesian Qualification Framework was officially designated by the Presidential Decree No. 8 of 2012. The explanation of the method of implementation in the field of education is stated by the Minister of Education and Culture Decree No. 73 of 2013. The last decree stated was designed to accommodate qualification of attitudes, skills and knowledge of the various paths that can be taken by the key players.

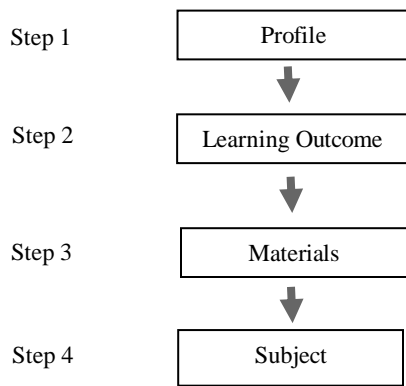


Figure 1 Process of designing curriculum for higher education

The paths involved the education sector, industry, professionals and the self-taught participants based on the guidelines. These regulations provide appropriate guidelines for curriculum development in higher education. The preparation to build the higher education curriculum in IQF is schematically presented in Figure 1.

The first stage of the process of curriculum development is to determine the profile of graduates

for the Aeronautical Engineering Diploma 3 Course. This requires an analysis of two different pathways. The first pathway is the study of science, where aeronautical engineering is a part of aerospace technology science. As a core science this science can be supported by group areas of skill and knowledge, which is described in Table 1. From this study, Aeronautical Engineering Diploma 3 courses approached the field of maintenance and operational expertise which means requires a basic knowledge of structure, flight systems, man-machine systems, production engineering, and system engineering.

The second pathway is a tracer study that can show the gap of what is available and what is demanded [1]. Trends indicate that this gap will widen in the next five years. In 2015, Indonesia requires at least 6,500 aircraft maintenance technicians. However, the estimated number of active technicians in the field is about 3700 technicians, and the number is decreasing due to the retirement.

This initial analysis forms the basis for the description of the profile of the aeronautical engineering course program graduate. With reference to the Curriculum Development Design Guide, Indonesian Qualification Framework and the National Standard of Higher Education, graduate profiles must fulfil the following points [7]:

- What role do new graduates will have
- Adhere to the vision and mission of the institution
- Associated with similar courses

Table 1 Group of Knowledge and Group of Skills for Aerospace Technology [6]

GROUP OF SKILLS	GROUP OF KNOWLEDGE					
	Flight Physics	Flight Sstructure	Flight System	Man-Machine System	Production Engineering	System Engineering
Computational Numeric	√	√	√	√	√	√
Testing	√	√	√	√	√	√
Design	√	√	√	√	√	√
Maintenance & Operational		√	√	√	√	√

√: required

With regards to the first point, the industrial standard requires the aeronautical engineering diploma 3 course program graduates to be capable of doing the job as an aircraft maintenance technician. At the time of graduation from the diploma program, it is expected that the fresh graduate already possesses considerable skills as an Associate Expert (Ahli Madya) and is ready to play a direct role in the aircraft

maintenance industry. This expectation is in accordance with the vision and mission of the study program at the University Suryadarma.

Study program with similar course are only a few in Indonesia. Several institutions of higher education will begin to establish the course program in 2015. Over time, the cooperation between the study programs of this kind will continue to be coordinated.

The next step is determining the learning outcomes, which consists of four parts of competency as illustrated in Table 2. The first and the second parts, are attitude and general skills, specified by the National Standard for Higher Education, while the third and fourth parts are special skills and knowledge, are formulated by the institution with the Indonesian Qualification Framework [8]. Materials and subjects of study will be discussed by combining the level of study and the topics of the course. Both are taken from the higher education standard and the industrial needs.

Table 2 Parameters and description of learning outcome [8]

Parameter	Description
Attitude	defined by National Standard for Higher Education
General Skills	
Special Skills	defined by forum of studied program as a result of tracer study, university values & scientific vision
Knowledge	

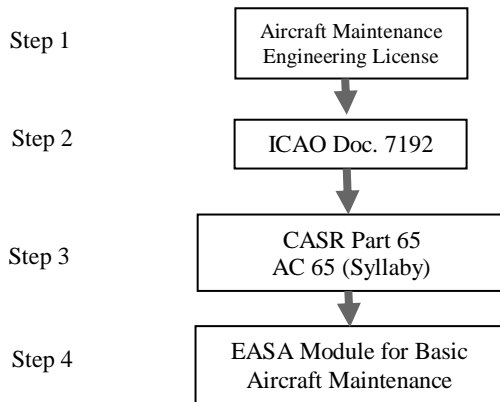


Figure 2 Procedure of defining syllabi of aircraft technician in industrial course [9]

In the aircraft maintenance industry, competency of technician is defined by the Directorate General of Civil Aviation (DGCA) of the Ministry of Transportation, Republic of Indonesia. The procedure to determine the materials, level of study and length of the course is illustrated in Figure 2.

3.0 DISCUSSION AND CONCLUSION

The objective of this paper is to discuss how the standard aircraft maintenance technicians meet the level of IQF. As stated before, Level 5 within the IQF is closest to the Diploma 3 qualification. Illustration of combining the standards is represented by Figure 3.

By the method used in this paper, the output profile of fresh graduate of the Aeronautical Engineering Diploma 3 Program is defined. The formulation of this study program graduate profile is the aircraft maintenance technician. In addition, the graduate profile is accompanied by a description of the profile. Therefore, the profile and its description are defined and described in Table 3.

The next point of discussion is to determine the learning outcome. With reference to Table 2, the parameter of attitudes and general skills sections have been specified by The Minister of Education and Culture of Republic of Indonesia in the National Standards for Higher Education [5].

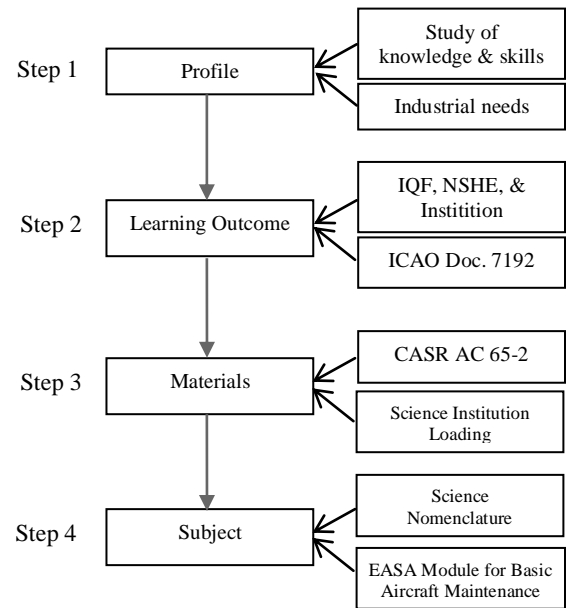


Figure 3 Procedures of defining the subject of the course

The approach of this paper is to determine the specific skills and knowledge for the learning outcome by installing ICAO Doc. 7192 and AC 65 of CASR to Level 5 of IQF based on the complete learning outcome of Diploma 3 Aeronautical Engineering Program as described in Table 4.

When the learning outcome has been defined, the next discussion is determining materials of study to complete the level of competency. Materials of the course, either theoretically or practically, are taken from two parts. The first is from CASR AC 65, refer to ICAO (International Civil Aviation Organization) Document 7192 [10], and the second is from standard

knowledge of aeronautical engineering in the institution [11].

Materials of CASR AC 65, refer to ICAO Doc. 7192 Part D-1, contents the core of knowledge and special skill that an aircraft maintenance technician should accomplish. But those materials are not fully satisfied the competency of Diploma 3 for aircraft maintenance technician refer to the study of science. Therefore, the curriculum brings several of the original materials such as statistics, concept of thermodynamics, Bahasa Indonesia, citizenship, environmental study and religion.

Finally, to declare the subject of study, the curriculum use EASA standard module of aircraft maintenance technician course. This choice is taken from the standard used by the biggest aircraft maintenance industry in Indonesia as the sample [12-13]. By converting hours of EASA module, used by the industry, to semester credit, both theoretical and practical, the operational curriculum of Diploma 3 Aeronautical Engineering is defined as shown in Table 5.

With reference to ICAO Doc. 7192 Part D-1, materials of CASR AC 65 contain the core of knowledge and special skill that an aircraft maintenance technician should accomplish. However, these materials do not fully satisfy the competency of

Diploma 3 for the aircraft maintenance technician. Therefore, the curriculum brings in several of the original materials such as statistics, concept of thermodynamics, Bahasa Indonesia, citizenship, environmental study and religion.

Finally, to formulate the subjects of study, the curriculum uses the European Aviation Safety Agency (EASA) standard module of aircraft maintenance technician course. This choice was taken from the standard used by the biggest aircraft maintenance industry in Indonesia as the sample [1]. By converting hours of EASA module, used by the industry, to semester credit, both theoretical and practical, the operational curriculum of Diploma 3 Aeronautical Engineering is defined as shown in Table 5.

Table 3 Output profile for aeronautical engineering diploma 3 study program

Output Profile	Description
Aircraft Maintenance Technician	Aircraft Technician Associate Expert (Ahli Madya) for basic and general maintenance parts airframe, power plant and avionics

Table 4 Learning outcome for aeronautical engineering diploma 3 study program

Parameter	Description
Attitude	<ul style="list-style-type: none"> Devoted to God Almighty Possesses excellent moral, ethics and personal identity in carrying out her/his duties Acts as a citizen who is proud of and loves her/his nation and has faith in world peace Capable of working in teams and attest compassion to social, community and environmental issues Values diversity in culture, vision, beliefs and regional as well as appreciate patent and property rights Esteems law enforcement and demonstrates the spirit to put priority to national and public needs
Common Skills	<ul style="list-style-type: none"> Capable of completing wide coverage job tasks, choosing appropriate methods from a variety of undefined and defined selections by analysing data and demonstrating performance with measurable quality Possess capacities to manage team work and construct comprehensive written reports Responsible for her/his own job and be assigned the responsibility of the attainment of team work performance
Special Skills	<ul style="list-style-type: none"> Ability to perform the privileges of aircraft or part of aircraft maintenance such as airworthy after an authorized repair, modification or installation of power plant, accessory, instrument, and/or item of equipment and to sign a maintenance release following inspection, maintenance operations, and/or routine servicing On the job training
Knowledge	<ul style="list-style-type: none"> Mastering general theoretical concepts of : (a) civil aviation requirements, laws and regulations (b) natural science and general principles (c) aircraft engineering and maintenance Capable of formulating related problem solving procedures

Table 5 Subject and credits of curriculum for aeronautical engineering diploma 3 study program

First Semester		Second Semester	
Subject	Credits	Subject	Credits
Pancasila and Citizenship	3	Statistics and Probability	2
Religion	2	Basic Thermodynamics	2
Applied Mathematics	3	Propeller	3
Applied Physics	3	English II	2
Human Factors	3	Basic Electricity	2
English I	2	Basic Electricity (Workshop)	1
Environmental Knowledge	2	Basic Electronics	2
		Basic Electronics (Workshop)	1
		Basic Aerodynamics	2
		Basic Aerodynamics (Workshop)	1
		Aviation Legislation	3
Third Semester		Fourth Semester	
Subject	Credits	Subject	Credits
Aircraft Materials	2	Aircraft Structure	2
Aircraft Hardware	2	Components of Aircraft Structure	2
Aircraft Materials (Workshop)	1	Aircraft Structure (Workshop)	4
Aircraft Hardware (Workshop)	1	Components of Aircraft Structure (Workshop)	4
Aircraft Maintenance System	2	Digital Technique	2
Aircraft Maintenance Technique	2	Digital Technique (Workshop)	1
Aircraft Maintenance System (Workshop)	4	Aircraft Instruments	2
Aircraft Maintenance Technique (Workshop)	4	Aircraft Instruments (Workshop)	1
Bahasa Indonesia	2		
Fifth Semester		Sixth Semester	
Subject	Credits	Subject	Credits
Aircraft System	2	Applied Gas Turbine Engine	2
Aircraft Electrical System	2	Applied Gas Turbine Engine (Workshop)	4
Aircraft System (Workshop)	4	Technical Report	2
Aircraft Electrical System (Workshop)	4	On The Job Training	3
Gas Turbine Engine	2	Seminar	1
Gas Turbine Engine (Workshop)	4	Final Project	3
Helicopter System	2		
Total Credits 112			

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