DEVELOPMENT OF AVIATION SECURITY FACILITY LABORATORY AS A PRACTICAL LEARNING FACILITY AT AVIATION POLYTECHNIC OF SURABAYA

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ABSTRACT

Aviation Polytechnic of Surabaya, a government-affiliated college under the Ministry of Transportation, offers a Diploma 3 program in Air Transportation Management that includes an aviation security training program. One of the practical learning facilities used in this training is Aviation Security Facility (Faskampen) Laboratory. A significant issue identified is the inability of the Faskampen Laboratory to replicate the authentic environment of a Passenger Security Check Point (PSCP) at an airport, which is crucial for effective practical learning. To address this issue, a redesign of Faskampen Laboratory is undertaken to enhance the training experience for students. This development utilizes a Research and Development (R&D) method based on a modified 4D model, by omitting the Disseminate stage. The resulting design is created in both 2D and 3D using Archicad and rendered with Twinmotion. The design is validated by experts, including design specialists, aviation security practitioners, training lecturers, and students, resulting in a final score of 629 and a percentage of 97%, indicating that the redesigned Faskampen Laboratory is suitable for implementation. The outcomes of this research provide a valuable reference for further development of the Faskampen Laboratory at the Aviation Polytechnic of Surabaya.

Keywords: *Development, Laboratory, Aviation Security, Passenger Security Check Point (PSCP), Design*

1. INTRODUCTION

Education is the process of transforming the attitudes and behaviors of individuals or groups as an effort to mature humans through teaching and training (KBBI Online, 2025). In its development, higher education must continuously enhance learning methods to provide high-quality education. One aspect that should be a focus of development is education facilities. In this context, education facilities include both the facilities and infrastructure of education. Education facilities are all facilities that are directly used to support the education process, while education infrastructure refers to facilities that do not directly support the education process (Rosnaeri, 2019). According to Sopian (2019), based on its definition related to education facilities, it can be understood that practical facilities refer to everything directly related to the practical teaching and learning process, whether movable or immovable, to achieve learning objectives effectively and efficiently.

One of the essential education facilities is the laboratory. A laboratory is a place where a group of people conducts various research activities, observations, training, and scientific testing as an approach between theory and practice across various disciplines (Nurhadi, 2018). Laboratories play a crucial role in the education process, where practical learning in laboratories can enhance students understanding through direct practical activities, especially in vocational education programs. Susanti et al. (2021) explain that a laboratory serves as a place for conducting experiments or research. In the learning process, the laboratory functions as a support for theoretical or classroom activities. In fact, the laboratory may even play the main role, while the classroom serves as a supporting activity space.

Sutarna et al. (2020) explain that vocational education refers to education focused on mastering specific applied skills. Therefore, in applied education, learners engage in more practical activities compared to theoretical learning. The main objective of the vocational curriculum is to help students prepare to enter the job market and secure employment in specific fields of their interest (Fauzi, 2024). The study duration for vocational education varies from 1 to 4 years, depending on the diploma program level pursued by the students.

Aviation Polytechnic of Surabaya is a state vocational higher education institution below the Ministry of Transportation, serving as one of the Technical Implementation Units (UPT) of the Central Agency for Transportation Human Resource Development. All study programs are diploma-level vocational program that take 3 years or 6 semesters to complete. Each semester consists of 20-24 course credits (SKS), with a total of 121 SKS required. As a provider of vocational higher education, Aviation Polytechnic of Surabaya has 54 laboratories in various fields of aviation used as practical learning facilities.

One of the study programs offered is Diploma 3 Air Transportation Management. Established in July 2015, this program actively prepare personnel to meet the workforce needs, particularly in the management and operational aspects of aviation. Aviation security (AVSEC) is one of the courses organized by Air Transportation Management study program. Based on ANNEX 17 of Security, Security in aviation means safeguarding civil aviation against acts of unlawful interference. This objective is achieved by a combination of measures and human and material resources.

This training is widely open to the general public and cadets of the study program. Through aviation security training, students are expected to carry out a series of security activities to maintain flight safety at airports in accordance with applicable regulations and rules. Mansur (2024) explain that the main task of AVSEC involve protecting flight crew, passengers, ground personnel, public, and airport agencies from unlawful acts. AVSEC is also responsible for complying with aviation regulatory standards, both international and national regulation.

In the teaching and learning process, this study program is equipped with Aviation Security Facility (Faskampen) Laboratory as a practical learning facility. The Faskampen laboratory is a space used for aviation security practical learning, equipped with various facilities and security devices commonly used at airports, such as X-Ray machine, Walkthrough Metal Detector, and others. The use of the Faskampen laboratory can be adjusted according to the basic, junior, or senior Aviation Security training programs. Utilizing the Faskampen laboratory as a practical learning facility can provide students with real and maximum practical experience.

Based on th.e current condition of Faskampen laboratory, the authors identifiy a problem where the laboratory has not been able to optimally represent the actual Passenger Security Check Point (PSCP) at the airport. As KM 39 of 2024 explained PSCP is a security screening area for departing passengers and their carry-on baggage before boarding the aircraft. Airport security checkpoints represent a critical bottleneck in airport operations, but few studies aim to empirically understand them better (Janssen, 2020).

As the impact, students are not fully prepared and do not understand the workflow and tasks that must be performed in the actual work environment. However, arranging the laboratory conditions to closely resemble field condition is crucial in the practical learning process. Therefore, Faskampen laboratory needs to be developed to provide a realistic representation of the Passenger Security Check Point (PSCP) at airport.

The research focuses on developing the interior design of Faskampen Laboratory as a practical learning facility at Aviation Polytechnic of Surabaya. The purpose of this research is to develop and visualize the laboratory design concept to provide a realistic representation similar to Passenger Security Check Point (PSCP) at an airport. The primary references used in designing Faskampen Laboratory are the government regulation KM 39 of 2024 concerning the National Aviation Security Program and SKEP 2765 of 2010 concerning Procedures for Security Screening of Passengers, Aircraft Personnel, and Carry-on Items Transported by Aircraft and Individuals.

The research output is presented in the form of 2D and 3D drawings, featuring an optimized layout and complete equipment for the Faskampen Laboratory. The results of this interior design development serve as an alternative layout design for the laboratory, providing campus management with a better approach to organizing the Faskampen Laboratory as an effective practical learning facility.

2. METHOD

This study uses the Research and Development (R&D) method. The research and development method is a research approach used to produce a specific model and test its effectiveness (Sugiyono, 2019). Research and development aim to create a product that serves as the subject of the study. This research is carried out based on a needs analysis relevant to the issues encountered in the real field, resulting in a new model through a process of development and optimization.

The model used in this research is the 4D development model (Define, Design, Development, Disseminate). The 4D model is one of the R&D research models introduced by Sivasailam Thiagarajan, Dorothy Semmel, and Melvyn Semmel in 1974. According to Arywiantari et al. (2015), the 4D research model has advantages in developing learning media. In this study, the 4D model is adjusted by omitting the Disseminate stage, as the design produced does not include physical realization for dissemination.

The design concept is developed by optimizing the use of space and facilities. Space utilization includes designing the layout of practical facilities to resemble a miniature PSCP, adjusted to match the passenger and baggage screening flow at PSCP. In addition, facility utilization involves adding various practical equipment that is not yet available, particularly those resembling actual PSCP conditions and other aviation security facilities.

After creating the design concept, it is visualized using Archicad application to produce 2D and 3D drawings. These designs are then rendered with Twinmotion application to achieve a more realistic image. Once the design process is completed, the developed design undergoes validation by experts. The purpose of this validation is to assess the level of improvement made to Faskampen Laboratory as a practical learning facility.

The first stage is Define. At this stage, the authors identify issues in Faskampen Laboratory through observation, interview, and documentation. This process is carried out to determine the background of the problems in Faskampen Laboratory, analyze the current condition of the laboratory, and examine the potential for developing the design by reviewing various references.

The next stage is Design. At this stage, the authors carry out the interior design process for Faskampen Laboratory based on the provisions of KM 39 of 2024 regarding PSCP equipment and the division of roles for AVSEC officers, as well as SKEP 2765 of 2010 regarding the PSCP layout image. The design results are presented in the form of 2D and 3D drawings of Faskampen Laboratory.

After the Design stage, the next stage is Development. In this stage, the validation process is carried out on the developed design. The validation involves several individuals including design expert, aviation security practitioner, aviation security training instructor, and aviation security training students

. The design validation is conducted using a questionnaire as the instrument. The questionnaire is an instrument used to collect data through a series of questions to measure research variables (Sekaran & Bougie, 2016).The validation questionnaire is based on the Likert Scale. In this scale, scoring or rating of statements presented to respondents follows a positive tendency. For example, "very good" is assigned a score of 4, "good" a score of 3, "poor" a score of 2, and "very poor" a score of 1. The results of the design validation questionnaire are then processed in a simple way to get the final score and the feasibility percentage of the developed design of Faskampen Laboratory.

3. RESULT AND DISCUSSION

3.1 Define

The initial stage of this research, referred to as the Define process, involved a series of activities including interview, observation, and documentation to identify the underlying issues of Faskampen Laboratory, assess its current condition, and explore potential design improvements through collected references.

The interview was conducted with Dr. Didi Hariyanto, S.Pd., M.Pd., an instructor for aviation security training program at Aviation Polytechnic of Surabaya. The interview revealed the necessity of developing Faskampen Laboratory in response to advancements in learning technology. This development aims to support vocational education standards, which emphasize 70% practical and 30% theoretical learning. It was noted that On-the-Job Training (OJT) alone is insufficient for comprehensive understanding. Therefore, practical learning in the laboratory prior to OJT or workfield is essential. The enhanced laboratory should replicate the actual Passenger Security Checkpoint (PSCP) at airport, aligning with the transition from SCP1 & SCP2 to PSCP & HBSCP systems.

Observation was conducted at Faskampen Laboratory, accompanied by Mr. M. Jatayu, A.Md.M.Tr.U. as the laboratory manager. The laboratory managed under the D3 Air Transportation Management program, currently serves for aviation security training and other activities such as educational visit, audit, and verification. The room measures 9.6 x 10.8 meters with a height of 3.2 meters, accommodating 24–30 participants. It is equipped with essential aviation security facilities such as X-Ray, WTMD, HHMD, ETD, OTP, STP, and CCTV, along with furniture and other utilities. However, the spatial arrangement and positioning of equipment do not yet optimally reflect a PSCP layout, indicating a need for interior design improvements.

Figure 1 Aviation Security Facility (Faskampen) Laboratory at Aviation Polytechnic of Surabaya

Documentation involved collecting images and layouts of aviation security laboratories from both domestic and international aviation training institutions. These references were used to guide the development of a new design for the Faskampen Laboratory at Aviation Polytechnic of Surabaya.

Figure 2 AVSEC Laboratory at Aviation Security Training Center of Korea Airports Corporation South Korea (left up), Hong Kong International Aviation Academy Hong Kong (right up), School of Aerospace Technology Indonesia (left down), and Indonesia Pilot Academy (right down)

3.2 Design

The design process of Faskampen Laboratory aimed to replicate the conditions of a Passenger Security Check Point (PSCP) by referring to the requirements stated in KM 39 of 2024 regarding the National Aviation Security Program and the equipment layout specified in Appendix 2 of SKEP 2765 of 2010 on security screening procedures for passengers, crew, and carry-on baggage.

According to KM 39/2024, Subsection 8.2.2 point (b), for airports with an A security system, domestic passenger screening points must include at least the following equipment and supporting facilities:

1. One multi-view cabin X-ray machine with an active Threat Image Projection (TIP) function;
2. One body inspection machine;
3. One Walk-Through Metal Detector (WTMD);
4. One Explosive Trace Detector (ETD);
5. Two Hand-Held Metal Detectors (HHMD);
6. Plastic trays for electronic devices and other items to be screened;
7. One transparent prohibited item box;
8. One table and one inlet roller before the X-ray machine;
9. One outlet roller and one table after the X-ray machine;
10. One private screening room;
11. Partitions at least 2 meters high in front and behind, adapted to the PSCP layout;
12. Digital aviation security information media;
13. Closed Circuit Television (CCTV) covering the entire screening area;
14. Aviation security testing equipment;
15. An alert system connected to security supervisors, unit leaders, and/or the Airport Operation Control Center (AOCC);
16. One table for manual cabin baggage inspection;
17. Communication devices linked to the head of aviation security unit;
18. One cabinet or computer for storing logbooks and documents.

Additionally, Appendix 2 of SKEP 2765/2010 provides the recommended layout for equipment placement at the second security checkpoint (SCP-2) or PSCP. These standards served as the primary reference in designing the upgraded Faskampen Laboratory to ensure compliance with real-world aviation security procedures.

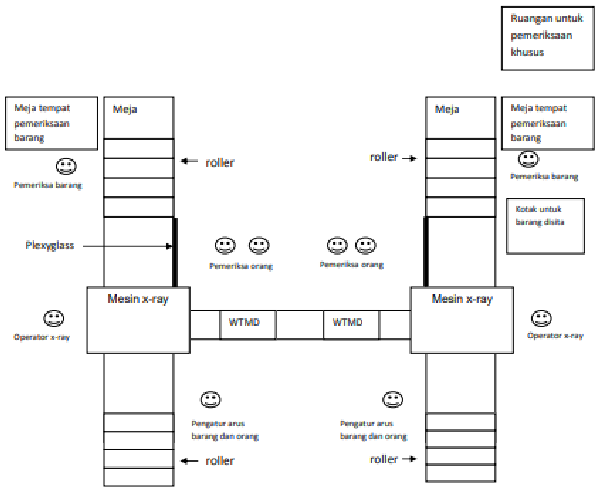

Figure 3 SCP 2/PSCP Layout in Appendix 2 of SKEP 2765 of 2010

The redesign process of Faskampen Laboratory includes adding, removing, and rearranging facilities and equipment used for both practical learning and general laboratory functions. This redesign is implemented using Archicad application to create detailed 2D and 3D images. The 2D layout are generated directly within Archicad by exporting the design views, resulting in a comprehensive 2D layout plan for Faskampen Laboratory.

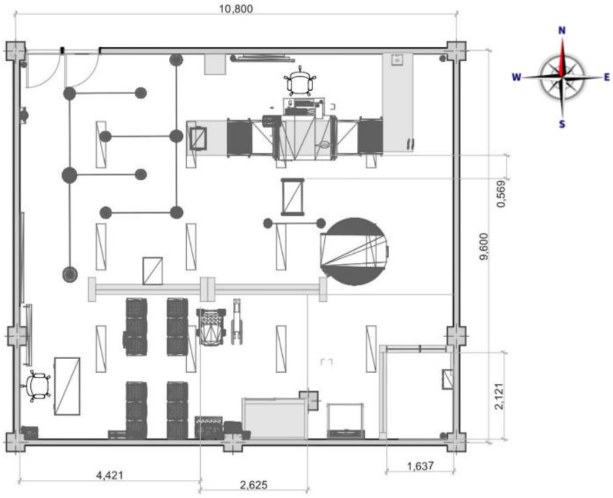

Figure 4 The 2D Layout of Developed Faskampen Laboratory

In the process of creating 3D images, the design developed in Archicad is rendered using an additional application, Twinmotion. Twinmotion enhances the visual quality by producing more detailed and realistic 3D representations of Faskampen Laboratory. The developed Faskampen Laboratory is divided into 3 main areas: a practical learning area, an equipment storage area, and a briefing & waiting area.

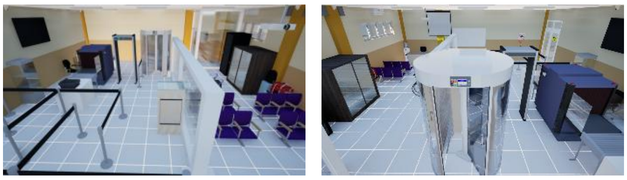

Figure 5 Faskampen Laboratory point of view from the west side (right) and the east side (left)

Practical learning area is designed to replicate an actual Passenger Security Check Point (PSCP) at an airport. It includes counters for identity and boarding pass checks, manual cabin baggage inspection tables, prohibited items storage boxes, digital aviation security information displays, Body Inspection Machine, and the arrangement of X-Ray machine, WTMD, and ETD equipment. At the far end, there is a special inspection room for special passenger inspection. Additionally, a CCTV server box is placed in this area to facilitate surveillance practice through CCTV monitors.

Figure 6 Practical Learning Area at Faskampen Laboratory

On the other side of Faskampen Laboratory, there is a storage area designed to keep unused practical equipment. This storage area is located adjacent to the practical learning area, specifically next to the special inspection room and the CCTV server box. It is positioned between the practical learning area and the briefing & waiting area.

Figure 7 Storage Area at Faskampen Laboratory

At the front of Faskampen Laboratory, there is a seating area with multiple functions: it serves as a space for students to attend pre- and post-briefing sessions led by instructor, as well as a passenger departure waiting area during practical sessions.

Figure 8 Briefing & Waaiting Area at Faskampen Laboratory

The placement of fire extinguishers complies with PER.04/MEN/1980, requiring the top to be 1.2 meters from the floor and the bottom at least 15 cm above it. First Aid boxes follow PER.15/MEN/VIII/2008, which mandates they be clearly visible, easily accessible, well-lit, marked with clear signs, easy to carry, and adequate for the number of users.

Figure 9 Placement of Fire Extinguisher & First Aid Kit at Faskampen Laboratory

Before the practical learning session begins, instructor provide a briefing to students regarding the tasks and role assignments, which are carried out in the briefing area. Roles are assigned based on KM 39 of 2024 Chapter 8 Point 8.3.2, which requires at least: 1 flow controller, 1 baggage controller, 1 X-Ray operator, 1 baggage screener & ETD operator, 1 passenger screener, and 1 body inspection machine operator. Additional roles for training purposes include an access control officer, a CCTV monitor, five regular passengers, and two special needs passengers. Each group consists of 15 students to perform one practical session. With a class of 30 students, the session is conducted in 2 times rotation.

Practical learning process in Faskampen Laboratory begins with passengers queuing for identity and boarding pass verification by AVSEC officer. Afterward, passengers arrange their belongings as instructed for screening via X-Ray or manual inspection, while officer monitor the items on the X-Ray display. Passengers then proceed through the WTMD or Body Inspection Machine. if no alert is triggered, they are cleared, but if an alert occurs, secondary screening is performed. When suspicious images appear on the X-Ray monitor, the operator instructs a manual baggage inspection to ensure safety. Throughout the process, all activities are monitored by a CCTV operator, and exit access from the passenger waiting area to the public area is secured to prevent unauthorized entry into the sterile area.

3.3 Development

On the development stage, a validation test is conducted to the developed Faskampen Laboratory. The purpose of this validation is to assess the effectiveness of Faskampen Laboratory development as a practical learning facility at Aviation Polytechnic of Surabaya. The design validation is carried out by various stakeholders, both directly and indirectly related to Faskampen Laboratory, including design expert, aviation security practitioner, aviation security training instructor, and a group of aviation security training students.

First, the design validation is conducted by Mr. Fahrur Rozi, S.T., M.Sc. as a lecturer in the D3 Civil Airport Engineering study program at Aviation Polytechnic of Surabaya. He assesses the developed Faskampen Laboratory design as feasible, meeting safety and interior construction standard similar to actual airport facilities. The design is considered suitable for aviation security training, earning a final validation score of 18 (90%) with criteria "very good".

The second design validation is conducted by Mr. Asruri RM, Head of the Aviation Security Unit at BLU UPBU Class I Utama Juwata Tarakan, North Kalimantan. As an aviation security practitioner, he assesses the Faskampen Laboratory design as feasible, noting its effectiveness in replicating real Passenger Security Check Point (PSCP) conditions at real airport. The arrangement of security facilities such as cabin X-Ray, WTMD, prohibited items box, manual inspection table, and other equipment closely resembles actual PSCP settings. Therefore, the design is considered suitable for aviation security training at Aviation Polytechnic of Surabaya, with a final validation score of 20 (83%) and criteria "very good".

The design is also validated by Dr. Didi Hariyanto, S.Pd., M.Pd., the instructor of aviation security training at Aviation Polytechnic of Surabaya. The validation results in a perfect score of 28 (100%) with criteria "very good". According to the assessment, the Faskampen Laboratory design effectively supports instructor in delivering practical learning materials to students.

The aviation security training students, as direct user of Faskampen Laboratory, also validate the developed design. This group consists of 24 cadets from D3 MTU 8A who have experience in AVSEC On the Job Training, making them capable of providing objective assessments. The final score from the students is 563, with a percentage of 97.7% and criteria "very good". Based on the accumulated validation scores, Faskampen Laboratory design is considered feasible for use as a practical learning facility in aviation security training at Aviation Polytechnic of Surabaya. This indicates that the design effectively enhances understanding and provides a realistic representation of a PSCP as found in actual airport settings.

Based on the overall results of design validation carried out by the validators, a comprehensive calculation is conducted to obtain the final score and percentage in order to draw conclusions regarding the condition and feasibility of the developed Faskampen Laboratory design. The accumulated score indicates a very good level of feasibility, with a total score of 629 and a final percentage of 97%.

4. CONCLUSION

A practical learning facility, such as laboratory, plays a crucial role in helping students gain hands-on experience and apply theoretical knowledge in real-world scenarios. The Aviation Security Facility (Faskampen) Laboratory at Aviation Polytechnic of Surabaya serves as a valuable space for such learning and research activities. However, one major issue is that the current design of the lab does not accurately represent the actual conditions of a Passenger Security Check Point (PSCP) at an airport. This lack of realism limits the effectiveness of practical training. To address this problem, the laboratory needs to be improved and redesigned so it can better simulate real aviation security operations.

First, the design of Faskampen Laboratory is developed using Archicad for 2D and 3D modeling, and rendered with Twinmotion to produce realistic visualizations. The research employed a Research and Development (R&D) method, using the modified 4D model, which in this study included the stages of Define, Design, and Development. The design and development process was carried out in a structured manner, resulting in 2D and 3D models that effectively represent the real conditions of a Passenger Security Check Point (PSCP) at an airport.

Second, the 2D and 3D designs were evaluated and validated by a group of experts, including design professional, aviation security practitioner, training instructor, and students of aviation security training program. The validation process produced a total score of 629 and a percentage of 97%, which falls into the "very good" category. These results indicate that the developed design is feasible and suitable as an alternative model for Faskampen Laboratory, serving as a practical learning facility for aviation security training at the Aviation Polytechnic of Surabaya.

The output of this research consists of detailed 2D and 3D design drawings, developed to closely resemble the layout of a real PSCP at an airport. This design is expected to enhance the training experience by providing realistic scenarios and environments for aviation security students. Therefore, the proposed design may be adopted by the institution as a reference or alternative in developing Faskampen Laboratory.

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