

# APC E-Rostering System



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## 1 Introduction

According to the Annex 11 – Air Traffic Services, the International Civil Aviation Organization (ICAO) requires the ICAO state members to establish a regulation concerning fatigue management (ICAO, 2016, 2018). To comply with the above requirement, in Thailand, the Civil Aviation Authority of Thailand (CAAT) has published *Manual of Standards Air Traffic Management Services: Air Traffic Services (MOS-ATS)* (CAAT, 2020) and requires air traffic service providers (ATSP) to establish the prescriptive fatigue management limits for working hours and break hours as indicated in item 4.2.2 Air Traffic Controllers’ rostering system(s) (Kearney et al., 2019) such as:

- Maximum duty period. Except where other limits are defined within the MOS-ATS, duty period shall not exceed 12 hours.
- Maximum monthly duty period. Within 720 consecutive hours (30 days), the aggregate of duty periods and on-call duties shall not exceed 200 hours.
- Consecutive duty period. The maximum duration of consecutive duty periods may not exceed 72 consecutive hours (6 days).
- Interval between duty period. There shall be an interval (rest period) of not less than 12 hours between the conclusion of a duty period and the commencement of the next duty period.
- Limit on and interval following consecutive periods of duty. Upon the conclusion of 6 consecutive duty periods within 144 consecutive hours (6 days), there shall be an interval (rest period) of a minimum of 60 hours before the commencement of the next duty period.

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### **Time-in-position**

1. Breaks in time-in-position (partial break). Time-in-position shall not exceed a period of 2 hours without there being taken during, or at the end of, that period a partial break or breaks totaling not less than 30 minutes during which period a controller does not exercise the privileges of their license.
2. At units where workload for any part of the day is judged to be low and the activity is spasmodic rather than continuous, time-in-position, at these times, may be extended to a maximum of 4 hours, provided that the following break is taken pro rata (e.g., 45 minutes after 3 hours or 60 minutes after 4 hours):
  - Takeover of air traffic controllers. To ensure the proper transfer of functions between controllers, the ATSP may extend the maximum duration of the continuous duty period up to a maximum of 15 minutes. The time taken for orderly handover/takeover before a shift starts up to a maximum of 15 minutes shall be considered as time-in-position for the air traffic controller who finishes his/her activity and therefore shall not be considered to form part of the oncoming controller's duty period (Tello et al., 2018).
  - Night duty.
    - A duty which covers all or part of the period of night duty shall not exceed 10 hours.
    - No more than three consecutive duties which cover all or part of the period of night duty shall be performed.
    - A minimum period of 54 hours shall occur between the end of duties which cover all or part of the period of night duty and the commencement of the next period of duty.

It can be seen that the requirements set forth as mentioned above are quite complex so that it is crucial to develop any tools to help manage the working hours and break hours for air traffic control officers (ATCOs) (EUROCONTROL, 2006).

Aeronautical Radio of Thailand Ltd. (AEROTHAI), the sole air navigation service provider (ANSP) in Thailand (CANSO, 2016), is in charge of reviewing ATCOs' scheduling in accordance with the manual of standards and presenting a stagger shift model as an action figure with anticipated availability in 2023.

Previously, the Microsoft Excel program has been used to arrange the air traffic controllers' operating schedules for a long time. Additionally, the requirements of the prescriptive fatigue management limits are quite detailed, and the researchers had an idea to develop a system to simplify the scheduling procedures at the Provincial Approach Control Center, AEROTHAI, where there are a large number of air traffic control services in 17 areas (Orasanu et al., 2011). Therefore, the APC E-Rostering System was developed as a web-based application for ease of use with three objectives:

- To assist in scheduling operations in accordance with the conditions set forth in the fatigue of air traffic controllers.
- To assist in the management and supervise the operation of air traffic controllers effectively.
- To help in collecting data on the operations of air traffic controllers accurately, conveniently, and quickly and that can be examined.

## 2 Method

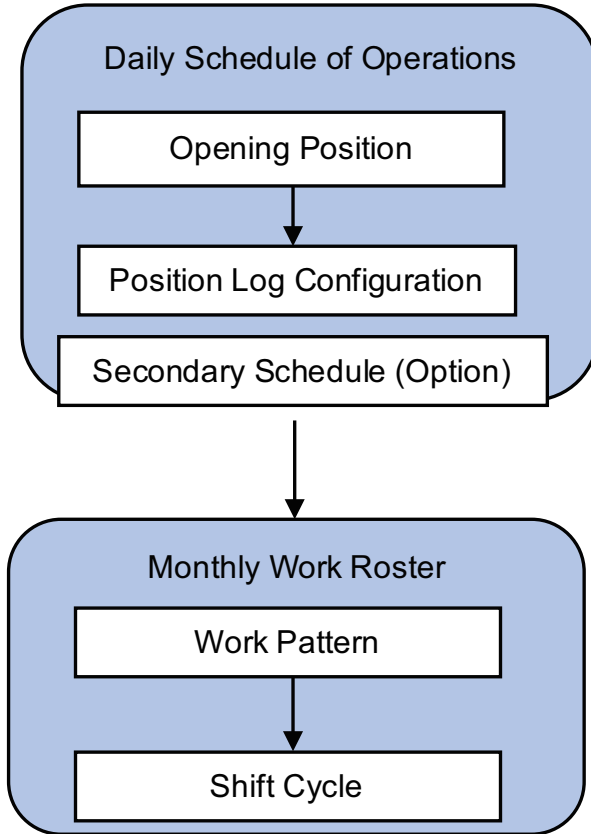
This research was conducted in collaboration with air traffic controllers and system developers. AEROTHAI found a way to arrange ATCOs' working schedules in accordance with the requirement of prescriptive fatigue management limits. Meetings with the officers involved in scheduling operations were conducted to collect preliminary data (Romano et al., 2008). The key data obtained from the meetings is the ATCOs' attendance pattern. It was found that the ATCOs are commonly required to work 4 days (10 hours per day) and have a break during a shift followed by 3 rest days. However, since there was an epidemic of coronavirus (COVID-19) which inevitably affects the aviation industry, the pattern was then adjusted according to the reduction of flight volumes as well as the fatigue requirements. The researchers created a tool called "the APC E-Rostering System" with the aim to help support the operations and prevent the spreading of COVID-19 among the ATCOs at AEROTHAI. Most importantly, the system was developed to support three different tasks as follows:

### 2.1 To Create a Roster

To schedule the ATCOs' operations, it is an action in the initial part of planning to arrange suitable air traffic control services workload for ATCOs and to manage fatigue for maximum efficiency. The procedure of creating roster is divided into two parts as follows:

To begin with, the first part will be the daily schedule of operations, which is to arrange the number of ATCOs in operation (opening position) based on the amount of air traffic. Once the opening position is checked abide by the fatigue requirements, position log configuration is obtained. That is in the stagger shift form. The system is not only designed to support a normal position log for working schedule but the system is also designed to accommodate a secondary schedule as a minimum schedule that can be supported in case the numbers of ATCOs need to be reduced.

For the second part, a monthly work roster is used to arrange work days and rest days for ATCOs in each month (work pattern). Once the work pattern has been assigned to each ATCO, this section is called the shift cycle. Both operations must comply with the air traffic controllers' fatigue management requirements. The



**Fig. 1** Workflow of rostering diagram

functional design of the APC E-Rostering System requires that users in all parts of the system can easily access it and use it efficiently. The summary of two parts is shown in Fig. 1.

## ***2.2 To Manage and Supervise Staffs***

The daily management of ATC operations is an integral duty of ATC managers. Because when we planned the arrangement of air traffic controllers in the first part, it is normal for changes to occur especially employee leave (as described in Fig. 2). In which part of the leave, the ATCOs shall follow AEROTHAI’s regulations. AEROTHAI uses the System Applications & Products in Data Processing (SAP) to process leave-related activities. We therefore connect leave information from the SAP system to the APC E-Rostering System so that ATC managers can stay informed of the leave request and rearrange appropriate manpower. We make

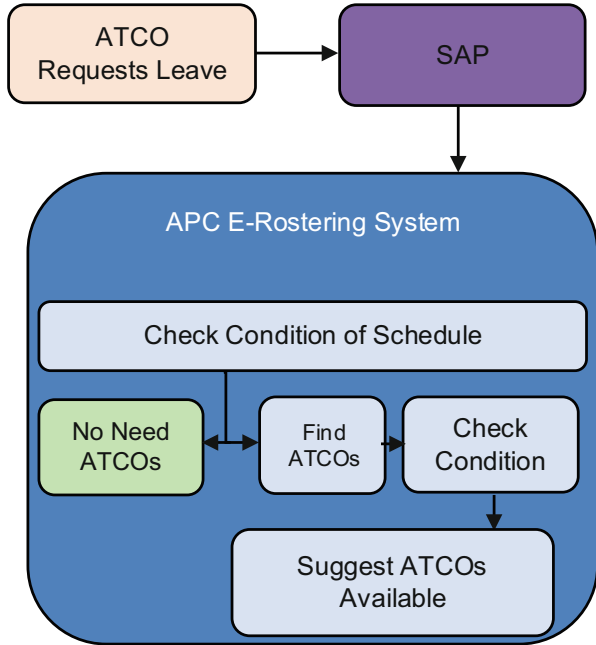


Fig. 2 Workflow of leaving management

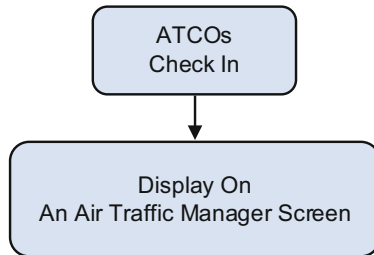


Fig. 3 Workflow of monitoring and oversight

arrangements for recruiting staff in lieu of leave, and preparations are being made for the reduction of the number of air traffic controllers.

The system will also assist in finding other ATCOs who will be available to replace those who are absent. The system will check the key conditions in terms of license rating, fatigue conditions, and the number of previous working hours in order to provide ATC managers information for taking further actions.

As shown in Fig. 3, moreover, the oversight of operations is another duty of the ATC manager. The system was also designed to include a “Check In” menu for ATCOs and ATC managers to conveniently enter registration information for each hour of operation. This information will be displayed in a “Position Log Monitoring” menu to facilitate the supervision of ATC managers.

From the operations mentioned above, the system will keep the operational data up to date regarding the record of change made in order to be able to monitor various operations easily and quickly.

### ***2.3 To Prevent Accidental Update***

The system was designed to prevent any accidental updates on the information currently in the system by specifying different rights to access its functions. According to the roles and duties, the system defines roles of a roster man, an ATC manager, and ATCOs.

A roster man is responsible for the overall scheduling planning. This position has permission to access and edit all information as ordered by the executive. This position will be primarily responsible for creating daily and monthly work schedules so that ATCOs will be informed of their own schedule in advance.

An ATC manager is a person who uses the system on a daily basis to manage manpower and supervision of air traffic control in a safe and efficient manner. Based on the manager's duty, the system allows the manager to update the ATCOs' work schedule information right after a roster man has created the work schedule. This position will also be able to oversee the operations of ATCOs in an orderly and safe manner.

Finally, an ATCO can only view the data without permissions to edit data. If an ATCO needs to make some changes on the operational data, the data shall be submitted to ATC manager who has a permission to make changes instead. Another important function for the ATCO is the use of the check-in menu when entering an assigned position.

## **3 Results and Discussion**

After testing the APC E-Rostering System, it was found that the system can support and suggest effective scheduling in stagger shift format.

According to Table 1, the system currently provides a new model that is suitable for ATCOs during the epidemic of COVID-19 called the "Shelter Operating Model" which can be divided into two types of work schedules. The first type suggests the ATCOs to have 6 work days and 6 rest days (W6R6). The second type suggests ATCOs to have 6 work days and 12 rest days (W6R12). Both types require ATCOs to work 12 hours a day divided into 8 work hours and 4 break hours. In addition, the system also suggests an additional model which allows the ATCOs to have 4 work days and 3 rest days (W4R3). The additional model requires the ATCOs to work 10 hours per day and have a break during the day according to the requirements. It can be seen that this system is flexible for modifying both working styles as well.

**Table 1** The results to comply fatigue requirements

Work model	Shelter model		W4R3
	W6R6	W6R12	
Maximum duty period	Pass	Pass	Pass
Maximum monthly duty period	Pass	Pass	Pass
Consecutive duty period	Pass	Pass	Pass
Interval between duty period	Pass	Pass	Pass
Limit on and interval following consecutive periods of duty	Pass	Pass	Pass
Time-in-position	Pass	Pass	Pass
Takeover of air traffic controllers	Pass	Pass	Pass
Night duty <sup>a</sup>	–	–	Pass

Note: <sup>a</sup>There are no air traffic control services between 01.30 and 05.29 am (night duty) since the opening and closing times for regional airports have been renovated in the current situation

**Table 2** The satisfaction surveys of the APC E-Rostering System in August 2021

Overall score	1	2	3	4	5
Number of participants	–	–	–	7	4
Percentage (%)	–	–	–	64	36

Note: 1 to 5 is poor to excellence

The APC E-Rostering System was formally tested by the participants including ATC managers and ATCOs in August 2021. Both groups were asked to evaluate the performance of the system by completing the provided satisfaction surveys. According to Table 2, the results reveal that the system can still meet the usage very well, but there are still parts that need to be improved as the advice of the test participants.

Additionally, it is expected that the APC E-Rostering System should be improved and be officially used in early 2022. The situation of the coronavirus 2019 epidemic in Thailand should be better than the present. The limitations of personnel management in the matter of the epidemic of the virus would also be relaxed. We may encounter new problems that we have not encountered at this time. However, we try to develop the system to be more responsive to automated usage.

## 4 Conclusion

The APC E-Rostering System was developed to help the Provincial Approach Control Center to arrange the work schedule of ATCOs that should be appropriate to the amount of air traffic control workload and the fatigue requirements. This system will assist in recommending the work schedule and giving notice when the information related to the schedule of ATCOs does not comply with the fatigue regulations enforced by CAAT.

Based on the results, the researchers highly expect that the APC E-Rostering System will be able to effectively assist the air traffic control agency in scheduling management tasks. If the implementation in the Provincial Approach Control Center is successful, it will be further expanded for use in other air traffic controls.

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