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ASSEMBLY—40TH SESSION

TECHNICAL COMMISSION

Agenda Item 30: Other issues to be considered by the Technical Commission

FATIGUE MANAGEMENT FOR FLIGHT CREW

(Presented by Japan)

EXECUTIVE SUMMARY

Regarding fatigue management for flight crew members, some States have established and are imposing detailed regulations based on scientific proof, which include ICAO guidance contents. Japan is concerned about increasing flight crew workload with an increase in aviation demand. To prevent accidents and incidents resulting from flight crew members of domestic air carriers under the influence of fatigue in flight, the Civil Aviation Bureau of Japan (JCAB) organized a panel of experts to discuss fatigue management and then introduced the detailed science-based regulations for fatigue management. JCAB plans to sequentially apply the regulations to domestic air careers ready for application from October 2019 to December 2022. This paper introduces Japan's efforts in studying and establishing the regulations which are based on the results of the fact-finding investigation of domestic air carriers.

Strategic Objectives:	This working paper does not relate to any Strategic Objectives.
Financial implications:	Not applicable
References:	Annex 6 — *Operation of Aircraft* Doc 9966, *Manual for the Oversight of Fatigue Management Approaches*

1. INTRODUCTION

1.1 In Japan, the upper limit standard of flight time has been uniformly set by the government. Each domestic air carrier has specified the flight time within the upper limit and is implementing the measures against fatigue of flight crew members in consideration of the respective operational characteristics.

1.2 Japan is also concerned about increasing flight crew workload with an increase in the future aviation demand. To prevent accidents and incidents resulting from flight crew members of domestic air carriers under the influence of fatigue in flight, JCAB organized a panel of experts to discuss fatigue and then introduced the detailed science-based regulations for fatigue management. Japan has studied the regulations based on the contents of ICAO guidance and the results of the fact-finding investigation of domestic air carriers where there are no figures specified.

2. DISCUSSION

2.1 JCAB investigated to find the fact of continuous flight time with two-men crew. This investigation for the fatigue level was conducted at the beginning and end of actual flight duties by using the methods to measure the reaction rate by psychomotor vigilance test (PVT)[1] and the subjective Samn-Perelli scale[2] (Fatigue Severity Classification for 7 Scores: Perceived levels of fatigue) which are shown in the ICAO guidance, and the investigation targets were the total 285 flights with 79 pilots-in-command, of which two-men crew operations were 210 flights with 59 pilots-in-command. Firstly, for two-men crew operations, the investigation of the effects to fatigue in the following categories was conducted:

a) "Length of flight time" (15 flights for 5 hours and 15 flights for 7-10 hours);

b) "Time of the day" (15 flights each for three time zones containing full or a part of or no Window of Circadian Low (WOCL, 02:00 - 05:59)); and

c) "Number of flight cycle" (15 flights each ranging from one flight cycle to six flight cycles).

2.2 The result of the fact-finding investigation is shown in Table-1 below.

Subject	Results
Flight time	Fatigue tends to accumulate as the flight time increases.
Time of the day	Fatigue tends to accumulate depending the length of WOCL (02:00 - 05:59) contained. (If WOCL was fully contained in the flight time, the reaction time of flight crew members measured after flight duties became 11 pre cent longer than prior to the flight duties).
Number of flight cycle	Fatigue tends to slightly accumulate as the number of flight cycle is increasing.

Table 1. Summary of the investigation results of two-men crew operation

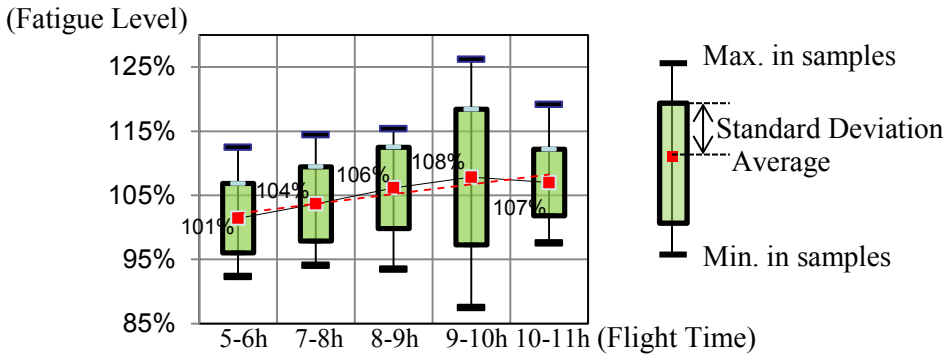

Figure 1. Relationship between flight time and fatigue levels
(The reaction time after flight duties compared with that before flight duties)

[1] The psychomotor Vigilance Test is a sustained-attention, reaction-timed test that measures for 5 minutes the speed with which subjects respond to a randomly turned-on light.

[2] Samn-Perelli scale is the quasi-quantitative method to measure the subjective fatigue severity by scoring 1 (Fully awake, wide awake) to 7 (completely exhausted, unable to function effectively).

2.3 The current maximum flight time is 12 hours in Japan, but it was amended to be lowered to 10 hours based on the result and in reference to foreign regulations, because the results of the investigation show that fatigue accumulated as flight time increased. Containing the time zone (17:00~04:59) and three or more flight cycle in a operation reduce one hour for each from the current maximum flight time based on the results of the fact-finding investigation.

2.4 Secondly, for three-men crew continuous flight time (75 flights with 20 pilots-in-command), the fatigue levels were measured by using the PVT and the Samn-Perelli methods at the beginning and end of actual flight duties. The effects of the following subjects were investigated;

a) "Length of flight time" (15 flights each for 12, 13 and 14 hours).

b) "Time of the day" (15 flights each for two time zones, one containing WOCL and another not).

2.5 The results of the fact-finding investigation are shown in Table 2.

Subject	**Results**
Flight time	There was no significant relationship between flight time and fatigue.
Time of the day	There was no significant relationship between flight time of the day and fatigue.

Table 2. Summary of the investigation results for the three-men crew operation

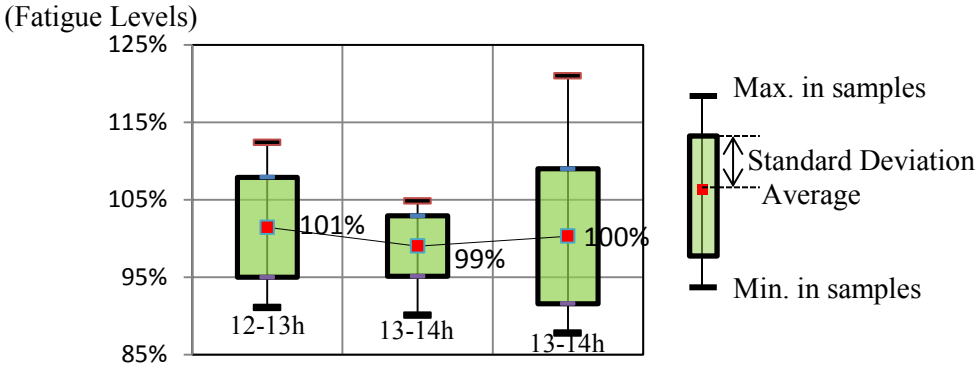

Figure 2. Relationship between flight time and fatigue levels
(The reaction time after flight duties compared with that before flight duties)

2.6 Fatigue recovering and avoidance of long wakefulness can be expected by taking a nap on board and the results of the fact-finding investigation showed that the fatigue level did not accumulate until 15 hours; taking these into consideration, the maximum flight time for operation by three-men crew is determined to be 15 hours, provided that Class 1 in-flight rest facilities shall be equipped and a rest pattern not exceeding 8 hour continuous duty shall be set. In addition, the maximum flight time for operation by three-men crew is set to 17 hours, based on the tendency of operation by three-men crew.

2.7 The International Standards and Recommended Practices (SARPs) mandate the aviation authorities to establish prescriptive regulations regarding required rest period of flight crew members. Furthermore, ICAO guidance describes the authorities to establish a minimum rest period including 7 to 9 hours of sleep, additional rest considering the influence of late night and early morning duties and the

regular rest (at least two consecutive nights) to prevent cumulative fatigue. Based on the results of the fact-finding investigation which show that the fatigue was significantly affected by the late night and early morning duties, Japan has established the following new regulations regarding the additional rest period in order to prevent cumulative fatigue.

a) a minimum rest period before flight duty is 10 hours which must include an 8-hour or more sleep in rest facilities such as beds. After the late night and early morning duties, air carriers shall add following rest:

   1) 2 hours in case the duty contains less than 2 hours WOCL; or

   2) 4 hours in case the duty contains 2 hours or more WOCL; and

b) air carriers shall assign, every 168 hours, the regular rest period of 36 or more consecutive hours containing two consecutive nights. If air carriers assign duties with 4 or more flights in seven consecutive days including WOCL, the next regular rest period shall be 60 hours or more.

2.8 The flight duty period is set by reference to ICAO guidance and foreign regulations. The amended regulations define the flight duty time limitations, strictly considering the flight crew briefing time before flights, standby time and fatigue. Additionally, the upper limit of the standby time is clarified based on incident reports overseas.

2.9 The concept of jet lag adaptation is introduced by reference to ICAO guidance and foreign regulations. The amended regulations stipulate additional requirements for rest periods considering the influence of jet lag.

3. CONCLUSION

3.1 The fatigue level was measured by the PVT and the Samn-Perelli methods at the beginning and end of actual flight duties, targeting 79 pilots-in-command and 285 flights in total. On the basis of the results, Japan has amended the domestic regulations for fatigue management of flight crew members.

3.2 It is important for air carriers to ensure the education about fatigue mechanism for flight crew members and other employees, to properly follow the PDCA cycle by collecting, analyzing and improving fatigue information, to introduce careful fatigue management appropriate to the operating circumstances, and to enhance the daily health management for flight crew members.

3.3 In order to engage flight duties in an appropriate condition, it is important for flight crew members to secure a rest day and enough sleep before flight duties and to properly report their fatigue information to the air carriers in addition to the management of daily physical-mental health.

3.4 The Assembly is invited to urge States to survey and review laws and regulations of Member States that require fatigue management for flight crew members in line with the current ICAO SARPs and guidance material if appropriate, to investigate fatigue levels of flight crew members in actual flight duties and, if necessary, to amend the fatigue management regulations.

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