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Tenth Meeting of the South China Sea Traffic Flow Review Group (SCSTFRG/10)

Video Teleconference, 31 May – 02 June 2021

Agenda Item 4: Discussion on PBN Routes Development and FLAS/FLOS Optimisation

ANALYSIS OF FLIGHT LEVEL USAGE OF ATS ROUTE M772

(Presented by Indonesia)

SUMMARY

This paper presents the analysis of the applied flight level, the allocated flight level and optimum flight level to find out the issues of current flight level usage scheme which are fuel saving and reducing gas emission if the optimum level occupied. In other hand to enhance the quality of air traffic services, Jakarta FIR along with the neighboring ATC units, airlines and other stakeholders have been working together for a long time to allocate the optimal cruising flight level for the aircraft overflying this area. This analysis is the continuous effort and initiative of Indonesia respecting to Final Report of Ninth Meeting of the South China Sea Traffic Flow Review Group (SCSTFRG/9) in Para 4.5.

1. INTRODUCTION

1.1 All Aircrafts operating at preferable cruising levels at the optimum level could reduce fuel consumption and obtain the best fuel economy. The optimum flight level is very important for the aircraft, especially for long-distance flights. Therefore, the impact of cruising level assignment is an important element of the crowded air space of the regions to reduce fuel consumption and environmental issues.

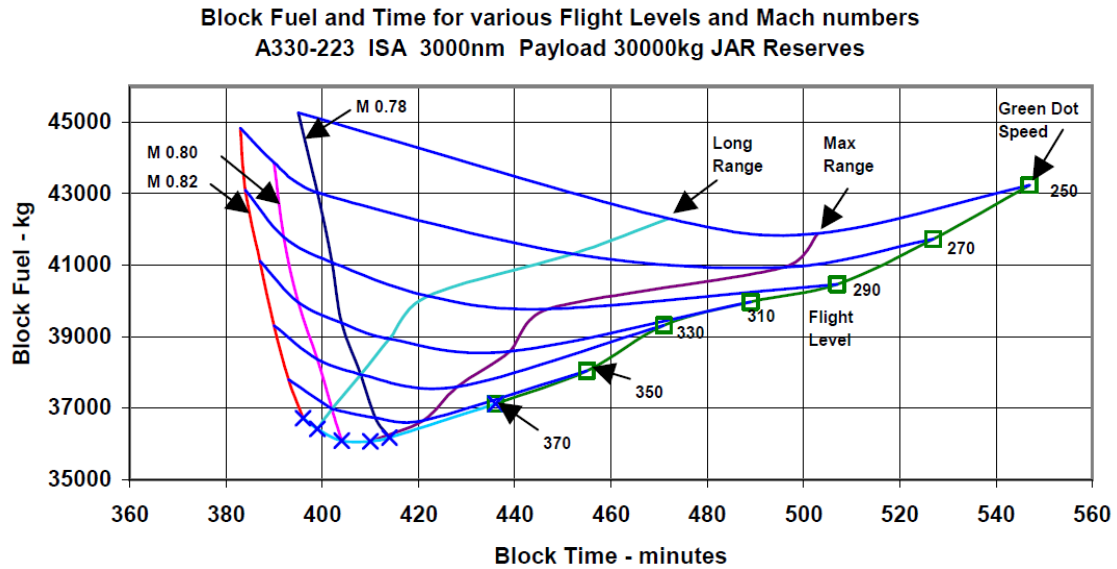
1.2 To improve air traffic services in the South China Sea, Jakarta FIR along with the neighboring ATC units, airlines, and other stakeholders have been working together for a long time to allocate the optimal cruise flight level for the aircraft overflying this area.

1.3 In recent years, during a pandemic, amount of the flight in Indonesia is very low, although the amount of traffic is low the allocation of flight level is limited as well. The allocation of flight level for route M772 is only F300 and F380.

2. DISCUSSION

2.1 The cruise phase is the most important phase regarding fuel savings. As it is the longest for long haul aircraft, it is possible to save a lot of fuel. So discipline must be exercised particularly in this phase.

2.2 The two variables that most influence cruise fuel consumption are the cruise speed (IAS or Mach Number) and the altitude or flight level. The following shows their influence on a single sector assuming standard climb and descent procedures.



2.3 The correct selection of the cruise parameters is therefore fundamental in minimizing fuel or operating cost. This chart shows the normal laws that aircraft consume less fuel when flown slower or when flown higher. However there are limits to these laws. Flying lower than the maximum range speed will increase the block fuel, as will flying higher than an optimum altitude.

Crossover altitude

2.4 In order to minimize fuel burn, the aircraft should therefore be flown at the optimum altitude. However this is not always possible. Performance limitations such as rate of climb or available cruise thrust can lead to a maximum altitude below the optimum, as can buffet limitations. At low weights, the optimum altitude may be above the maximum certificated altitude. In addition, Air Traffic Control restrictions can affect the flown flight level.

2.5 The next table shows the effect of flying at the crossover altitude instead of optimum flight levels. The 1st optimum flight level has been chosen for the short sectors, whereas longer sectors assume step climbs with FL300 and 380 being available. This assumes ISA conditions and a take-off weight for a typical sector with max passengers and some freight (2500kg for the A320 family, 5000kg for A330 and the other aircraft).

Aircraft type	Sector Distance	Cross-over altitude	Optimum Flight Levels	Gained time (min)	Increase in fuel consumption
A300B4-605R	2000nm	29000 ft	310/350	7	1190kg
A310-324	2000nm	30000ft	350/390	3	2160kg
A318-111	1000nm	29000 ft	370	3	740kg
A319-112	1000nm	29000 ft	370	3	650kg
A320-214	1000nm	29000 ft	350	2	580kg
A320-232	1000nm	29000 ft	340	2	440kg
A321-211	1000nm	29000 ft	330	2	350kg
A330-203	4000nm	31000 ft	350/390	9	5040kg
A330-223	4000nm	31000 ft	350/390	9	5780kg
A330-343	4000nm	31000 ft	350/390	10	6380kg
A340-212	6000nm	29000 ft	310/350/390	17	10900kg
A340-313	6000nm	29000 ft	310/350/390	14	8410kg
A340-313E	6000nm	29000 ft	310/350/390	17	9310kg
A340-500/600	6000nm	29000 ft	310/350/390	18	2430kg

2.6 This table shows that flying at crossover altitude increases the fuel burn significantly for a relatively small reduction in block time.

Optimum Flight Level

2.7 The following table shows the specific range penalty of not flying at optimum altitude, assuming a cruise Mach No of 0.8. It should be noted that each airframe/engine combination has different values. It should be noted that these are average values and there are slight variations with different weight/optimum altitude combinations.

Specific Range Penalty for not flying at Optimum Altitude

Aircraft	+2000ft	-2000ft	-4000ft	-6000ft
A300B4-605	2.0%	0.9%	3.4%	9.3%
A310-324	1.9%	1.4%	4.4%	9.3%
A318-111	0.7%	1.6%	5.0%	10.0%
A319-132	1.0%	3.0%	7.2%	12.2%
A320-211	**	1.1%	4.7%	9.5%
A320-232	1.4%	2.1%	6.2%	12.0%
A321-112	2.3%	1.4%	4.6%	15.2%
A330-203	1.8%	1.3%	4.2%	8.4%
A330-343	3.0%	1.0%	3.2%	7.2%
A340-212	1.4%	1.5%	4.0%	8.0%
A340-313E	1.5%	1.6%	5.2%	9.5%
A340-642	1.6%	0.6%	2.2%	5.1%

** Above Maximum Altitude

2.8 Optimum Flight level for type A330 based on FPL is FL350, flying just 5000 ft below the fuel optimum level could increase fuel burn by up to 4.2% fuel on FL300.

2.9 If it does not climb to FL 350 for ATC or other reasons, it will consume more fuel. The following table shows the difference in fuel burn for a 500nm still air cruise, when cruising at FL 300 instead of FL 350.

Aircraft type	Fuel Increase (kg)	Fuel Increase (%)
A310-324	221	5.3
A319-132	184	7.9
A320-211	158	6.2
A321-112	155	5.7
A330-203	324	4.2
A330-343	342	5.6

2.10 We can calculate as distance 500 nm of route M772, the increase of fuel burn is about 5040 kg + 324 kg = 5.364 kg for every flight (A330).

2.11 On the other hand, the emission increased by 3,15 gram/fuel x 324 kg = 1.020 kg. the average ±1 tons of carbon emissions for every flight (A330).

Suggestions

2.12 Based on the analysis of the usage of M772 routes in Jakarta FIR, the operational efficiency of the major traffic flow in the South China Sea region can be further optimized by:

- a) *Harmonizing the optimum level.* The aircraft with some particular levels such as FL300 and FL380 on M772 have to further change their flight level to optimum levels to meet the transfer requirement of downstream FIR. This not only increases the ATC workload and risk, but also is harmful for the aircraft flight to maintain preferable flight level during the cruise phase. Harmonized handover flight levels will be one of the most important measures to optimize the efficiency of ATC operation.
- b) *Optimizing the route structure.* With the sustained and rapid growth of flights, frequent flight level changes lead to the potential conflict point increasing, and the ATC operation risk is intensified. Optimizing the route structure of M772 and other routes which are listed as the busiest route in the South China Sea to cope with the future continued growth of flights.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information contained in this paper;
- b) discuss the feasibility of the harmonic on transfer flight levels in South China Sea region;
- c) discuss any relevant matters as appropriate.