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Preliminary Study of Standing Cabin Concept for Domestic Commercial Flights in Malaysia

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***Abstract* —The market competition between airlines today has basically changed towards the affordability of air transportation service. The airlines are competing to lower their ticket prices as to capture high demands from both leisure and business travelers who are also price-sensitive customers. An idea of standing cabin, where the passengers are transported in a cabin of an aircraft in an upright position, has been proposed to reduce the operational flight costs and hence the charging price to the passengers. This paper explores the practicality of such idea with a case study that is focused on the domestic flights market in Malaysia. All in all, it can be concluded that the idea has a big potential to be applied by the current airlines servicing the market.**

***Keywords*—vertical seat, standing cabin, aircraft cabin**

I. Introduction

Air transportation has increasingly become a vital means of transport in recent years. The rise in global businesses and also networking requires people to travel from one point to another in a much less time than before, some even on daily basis. The commercial airline industry has dramatically changed from its early days. Instead of being a travel option that has been aimed only for the riches, many new airlines are currently providing more affordable air transportation service to take advantage of the high demands from air travelers across the different social and economic classes. This is evident by the increased number of successful low-cost carriers that are targeting price sensitive leisure and business travelers. By 1999, such low fare, no frills airlines have already captured 25% of the domestic US travel market [1]. In Europe, these low-cost carriers have transported about 20.7 million passengers in 2000 and the numbers are on a strong increasing trend since then [2]. All these highlight the high demands for cheap air transportation options.

The main competitive aspect of the low-cost airlines is their offering of much cheaper ticket fares in comparison to the full-service airlines that are serving the same flight routes. The low cost model utilized in their operation was pioneered by Pacific South West and it was then copied by Southwest in 1973 [3]. Among others, the model suggests several measures to lower operational costs, which will enable cheaper flight tickets. The low cost airlines mainly target the short-haul flight routes and use only one type of aircraft, which reduce their maintenance cost and maximize the flexibility of their crew. Moreover, the frequency of their flights is usually maximized to fully utilize their available fleet. For example, utilization rate of a Boeing 737-300 aircraft by British Airways is about 7.1 hours per day while the same aircraft has a utilization rate of 10.7 hours per day by low-cost carrier, easyJet [1]. All these contribute to the reduction of their operational costs and act as their competitive market advantages against the full-service airlines.

To date, there is still a significant amount of commercial air traveler market segment that is left untapped. The main idea of low-cost airlines is to attract people who would otherwise pick cheaper modes of transportation such as buses, taxis or ferries for their travel. In many instances, the charging price of these latter options is still cheaper than the flight ticket price offered by the low-cost airlines, which causes the airlines to lose some of their potential customers. Hence these low-cost airlines are striving to further lower their ticket prices. High fuel cost, for instance, is one of the stumbling blocks that create difficulties for the carriers to lower their operational costs.

One revolutionary idea to lower the costs is by introducing a so-called standing cabin. It is a concept where the passengers are transported in a cabin of an aircraft in an upright position. A conceptual design of a seat for the standing cabin is shown in Fig. 1, which largely takes the cue from how a transport bus operates on the ground. According to this notion, the price of the flight tickets can be reduced by having more passengers in the cabin [6]. These new seats are anticipated to be thinner and lighter than the current seats, and because the passengers will be in a standing position instead of sitting during the flight, the available onboard cabin space can be fully used to hold more passengers. This paper aims to explore the practicality of such cabin design for local domestic flights in Malaysia.

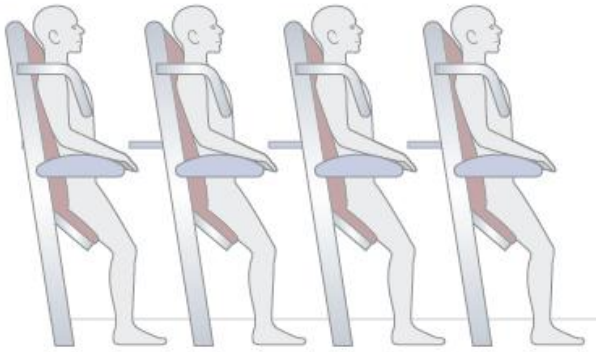

Figure 1. Standing Cabin Concept [13]

II. Standing Cabin

The idea of a vertical passenger seat, which comprises of a vertical bench with shoulder harnesses and arm rests, has been around since 2006 [7]. One of the first serious pursuits for this standing cabin was made by Spring Airlines, a low-cost carrier in China. The airline was looking to introduce a standing-room only for some of its Airbus A320 aircraft. By doing so, it was projected that 40% more passengers can be accommodated in the cabin than the conventional cabin design and the cost can be reduced by as much as 20% [4]. As stated by the President of the Spring Airline, "For a lower price, passengers should be able to get on a plane like catching a bus, no seat, no luggage consignment, no food, no water" [5]. The idea was also picked up by another low-cost carrier in Europe, Ryanair. In 2012, the airline has obtained approval by the regulatory body to operate a series of 100 trial flights, in which the last five rows of seats in their aircraft's passenger cabin were removed to allow up to 50 passengers to stand for their one-hour flights [8]. The ticket price for this standing seat was offered at only £2 per person.

The Aviointeriors Company, one of the leading aircraft seat and interiors manufacturers, has proposed standing seat design known as SkyRider, which is illustrated in Fig. 2 and Fig. 3. The SkyRider is designed as an ultra-high density seat to allow the possibility of reducing ticket prices while still maintaining sound profits for low-cost airlines. A new seating class below the current economy class in the cabin arrangement is targeted for this seat design. Even with reduced seat pitch, an adequate passengers' comfort level is expected as the seating position is much like "riding a tourist motor-scooter" [9]. This seat was first unveiled at the Aircraft Interiors Expo Americas 2010 in Long Beach, California and it was then said to be in the final testing stage [10].

Safety consideration is a paramount issue in the commercial aviation industry. For this very-high-density seating concept, it has to be able to ensure that passengers can evacuate the cabin within the allowable time limits during emergency. On top of that, the seats also have to undergo tests to ensure that they are able to provide adequate passenger restraint for satisfying the crashworthiness requirements. Nonetheless, in terms of current regulation, such standing seats are not illegal by the standards of several governing aviation bodies. For instance, the Federal Aviation Authority (FAA) does not entail that a passenger be in sitting position during the takeoffs and landings as long as the passenger has been properly secured [12]. Moreover, the Air Transport Association (ATA) does not impose any specific standards for seat comfort or seating configurations [12]. All in all, it appears that the standing cabin concept is very much a possibility for future commercial short-haul flights.

III. Case Study: Domestic Travel in Malaysia

Similar to other worldwide markets today, domestic flights in Malaysia have been progressively dominated by local low-cost carrier, Air Asia. As of 2005, the airline has managed to secure 30% market share of the local domestic market and this is a notable development given that the airline's inception was only four years earlier in 2001 [11]. In general, the duration of many domestic flight routes in the Malaysia market are around one to two hours, which suits the anticipated tolerable flight time that passengers can withstand in such standing position. At present, it can be said many Malaysians still tend to choose the alternative ground transportation options like buses, trains and taxis against air transportation due to notable differences in costs. Table 1 shows the costs of different available modes of transportation in comparison with the prices of flight ticket for similar routes, along with the duration of travel time taken for the trip.

Trying to derive a suitable index that indicate the preference of local travelers based on the time taken and cost of the trip is hard. Air transportation clearly has a large advantage in terms of duration of time taken for the trip in comparison with other ground transportation alternatives like buses and trains. The fact that many still choose to travel with the latter options also indicates that time and cost parameters have different levels of weightage in the decision-making.

TABLE I. COMPARISON OF SEVERAL MODES OF DOMESTIC TRANSPORTATION MEANS IN MALAYSIA

Trip Route	Bus	Train	LCC Flight
Kuala Lumpur – Johor Bahru	RM 31.10 (4 to 5 hrs)	RM 27.00 (5 to 6 hrs)	RM 94.00 (45 to 50 mins)
Kuala Lumpur – Pulau Pinang	RM 35.00 (4 to 5 hrs)	RM 15.00 (10 hrs)	RM 108.00 (45 mins)
Kuala Lumpur – Kota Bahru	RM 40.10 (9 to 10 hrs)	RM 26.00 (12 to 13 hrs)	RM 129.00 (45 to 50 mins)

Figure 2. SkyRider Vertical Seat Design Concept [9]

Figure 3. SkyRider Prototype Cabin [10]

Since this study aims to analyze whether the introduction of the standing cabin concept will enable the low-cost airlines to better compete with the cheaper ground transportation options, the relative metric that relates the traveler's decision based on time taken and costs is derived from the data of the latter. In this case, by using the data in Table I for bus and train options, a crude estimation of the relationship can be calculated and it is tabulated in Table II.

TABLE II. TIME AND COST RELATIVE METRIC

Trip Route	Time Difference	Cost Difference	Cost per extra Travel Hour
Kuala Lumpur – Johor Bahru	1 hour	RM4.10	RM 4.10
Kuala Lumpur – Pulau Pinang	5 hours	RM 20.00	RM 4.00
Kuala Lumpur – Kota Bahru	3 hours	RM 14.10	RM 4.70

It can be seen in Table II that the additional travel cost per each extra hour on the trip is rather consistent with each other. This can be taken to mean that, for each hour less on the road, people are willing to pay an additional cost of about RM 4.30 on average. Now, using this relative metric on flight services, the projected amount that the people would be willing to pay for the reduced travel time is estimated and shown in Table III. The calculated reduction of ticket price has to be achieved by having more passengers onboard per flight trip. The question is, can the concept of standing cabin enables enough people to be fit into the aircraft?

TABLE III. PROJECTED COMPETITIVE PRICE FOR DOMESTIC FLIGHTS

Trip Route	Current Ticket Price	Projected Ticket Price	Price Difference
Kuala Lumpur – Johor Bahru	RM 94.00	RM 45.00	– RM 49.00
Kuala Lumpur – Pulau Pinang	RM 108.00	RM 45.00	– RM 63.00
Kuala Lumpur – Kota Bahru	RM 129.00	RM 75.60	– RM 53.40

For these domestic flights, the aircraft type that is typically used to serve the routes is the Boeing 737-400 aircraft. Based on the current cabin size and dimension of this aircraft, several alternative layouts are derived for the standing cabin concept to enable a comparison of potential ticket price reduction. The development of these proposed standing cabin concepts takes into account several criteria of the safety regulations imposed by FAR on design parameters such as the minimum required seat dimension, seat pitch and aisle width.

The first standing cabin concept design, as illustrated in Fig. 4, transforms the normal seating cabin of the Boeing 747-400 into a full standing cabin. By this arrangement, the number of passengers that can be accommodated in the cabin is increased from 168 (with 30 inches of seat pitch) to 228 (with 23 inches of seat pitch). The seat pitch can be reduced since the leg room can be smaller as the passengers are now in standing position throughout the flight instead of sitting in the normal cabin. On the other hand, for the second proposed arrangement as shown in Fig. 5, the number of available capacity is increased to 210 with similar seat pitch of 23 inches. Last but not least, the third design can accommodate 216 passengers, also with 23 inches of seat pitch, as depicted in Fig. 6. Note that the dimensions of the standing seat utilized in deriving these cabin arrangement options have been determined from the anthropometric data of Asian people. The considered standing seat design concept in this study, which is different from the one by Aviointeriors, is shown in Fig. 7. The overall required vertical length and width of each seat have been estimated as 1.7 meters and 0.5 meters, respectively.

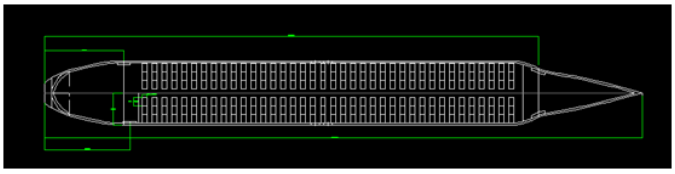

Figure 4. Standing Seat Cabin Arrangement 1

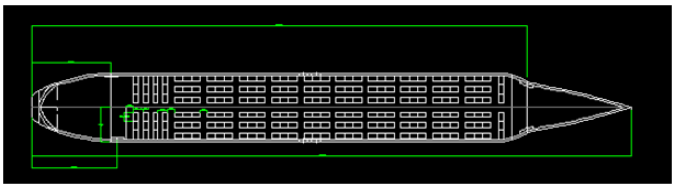

Figure 5. Standing Seat Cabin Arrangement 2

Figure 6. Standing Seat Cabin Arrangement 3

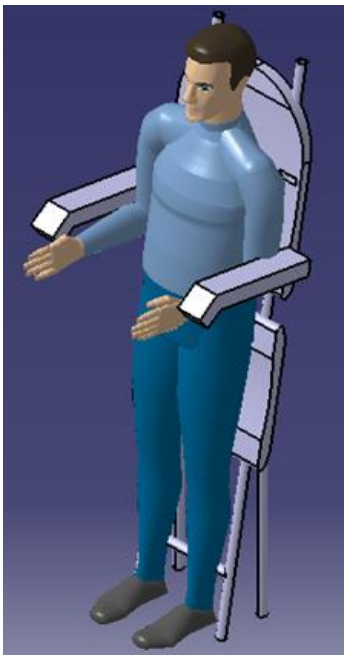

Figure 7. Considered Standing Seat Design

IV. Results and Discussion

Assuming that the effects of changing from the normal seats to the standing seats on total aircraft gross weight is negligible (hence the operating costs should almost remain the same), the potential reduction of ticket prices can be estimated. In reality, the standing seat is expected to be about 6.8 kilograms lighter than the normal seat [12]. However, this weight reduction will be countered by the increase in the passengers loading. Higher detailed assessment will be needed to better estimate this trade off but for this study, it is presumed that both will balance out each other. With this assumption, the current flight ticket price can be totaled up for the full number of passengers to estimate the overall operational costs (including percentage of profits) for the airline. This amount can then be equally distributed to the new passengers' capacity for the proposed standing cabin arrangements to get the new possible price for the flight ticket. All these are tabulated in Table IV and Table V.

TABLE IV. ESTIMATION OF TOTAL FLIGHT OPERATIONAL COST

Trip Route	Current Ticket Price	Total Estimated Flight Operational Cost (plus Required Profits)
Kuala Lumpur – Johor Bahru	RM 94.00	94 x 168 = RM 15792
Kuala Lumpur – Pulau Pinang	RM 108.00	108 x 168 = RM 18144
Kuala Lumpur – Kota Bahru	RM 129.00	129 x 168 = RM 21672

TABLE V. ESTIMATION OF NEW TICKET PRICE FOR STANDING CABIN

Trip Route	Concept 1	Concept 2	Concept 3	Projected Competitive Ticket Price
Kuala Lumpur – Johor Bahru	RM 69.30	RM 75.20	RM 73.10	RM 45.00
Kuala Lumpur – Pulau Pinang	RM 79.60	RM 86.40	RM 84.00	RM 45.00
Kuala Lumpur – Kota Bahru	RM 95.05	RM 103.20	RM 100.30	RM 75.60

It can be seen from Table V that the estimated ticket price is still above the projected ticket price to better compete with the ground transportation options, even with the implementation of standing cabin concept. However, the difference is closing when the trip distance is getting longer, as highlighted by the calculated values numbers for the Kuala Lumpur – Kota Bahru route (i.e. for Concept 1). This hints that there is an optimum point between the distance and time taken for the trip where the standing cabin concept can be a superior transport option. Care must be taken to not over-extend the flight time beyond the point where the passengers can withstand the less comfort nature of having to stand throughout the whole flight duration.

V. Conclusion

In this study, several alternative concepts of standing cabin arrangements have been developed and their potential to assist the reduction of flight ticket price is roughly analyzed. This is done to evaluate whether the implementation of standing cabin can help in making air transportation more competitive against cheaper ground transportation options for domestic travels in Malaysia. It can be concluded that this cabin design concept has a potential for future implementation but there exists a cut-off point where the concept will work best against competing travel alternatives. Further study is required to establish this minimum requirement and also analyze the possible impact of changing the normal seats to the standing seats in term of the aircraft performance (hence the operational cost).

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