A Study on Potential Standing Cabin Effects in Improving the Competitiveness of Low-Cost Airlines

Fairuz I. Romli, Ahmad Redzman Mohamad Noor, and Norhafizah Dasuki

***Abstract*—The main market competition between the airlines today has changed towards the affordability of the offered air transportation service. In other words, airlines are competing to lower their ticket prices as to capture high demands from leisure and business travelers, who are also price-sensitive customers. Theoretically, by having more passengers onboard the aircraft, flight ticket price can be lowered since the imposed operational costs can be shared by more passengers per flight. To achieve this, an idea of standing passenger cabin whereby the passengers are transported in the aircraft cabin in their upright position has been proposed to reduce the operational flight costs and hence the charging ticket price to the passengers. This paper explores the practicality of such idea with an example case study that is focused on domestic flights market in Malaysia. All in all, it can be concluded that the standing cabin idea has a potential to be applied by low-cost airlines servicing short-haul flight markets.**

***Index Terms*—Standing cabin, vertical seat, low-cost airlines, aircraft cabin, passenger cabin**

I. Introduction

In recent years, air transportation has progressively become a vital means of transport. The rise in global businesses and networking requires people to travel from one point to another in a shorter timeframe than before, some even on daily basis. Instead of just being a luxury travel option like in the past, air transportation has become a common choice for many people across the different walks of life. This changing nature of the market forces airlines to transform their operational service approaches to better suit with different economic and social background of their potential customers. Of late, the low-cost airlines have been successful in dominating a large portion of the flying passengers market worldwide. These carriers are able to capture the market by providing a more affordable air transportation service in comparison with the big, full-service airlines. By 1999, such low fare, no frills airlines have already captured 25% of 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 [2]. The success of low-cost airlines can be attributed to their offering of much cheaper ticket fares in comparison to the full-service airlines that are serving similar flight routes. All these highlight high demands for cheap air transportation options.

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The low-cost airline model was pioneered by Pacific South West and then was copied by Southwest in 1973 [3]. Among others, the model suggests several measures to help lower the operational costs that can enable cheaper flight tickets. The low-cost airlines mainly target short-haul flight routes and use only one type of aircraft, which reduce their maintenance cost and maximize the flexibility of their crew. Furthermore, the frequency of their flights is usually maximized to fully utilize their available fleet. For example, the utilization rate of the 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 as operated by easyJet, a low-cost carrier [1]. These contribute to reduction of their operational costs and act as their competitive market advantages against full-service airlines. As the trends shows that more people are keen to travel by air due to cheap flight tickets as offered by low-cost airlines, the challenge nowadays is to ensure that the ticket price is kept low despite the rising cost of jet fuel and other operational costs.

Moreover, there are still several potential commercial air traveler market segments that are currently left untapped, which refer to attracting those people who would otherwise pick cheaper modes of transportation such as buses, taxis or ferries for their travel. In many instances, the prices of using those transportation options are cheaper than the flight ticket price offered by low-cost airlines. One way to lower down the flight ticket price is to increase the number of passengers that can be accommodated within the aircraft. This way, the flight costs can be distributed to a higher number of passengers and subsequently, the contribution from each passenger will be reduced. One revolutionary idea to achieve this is through the so-called standing cabin concept, which is largely inspired by the operation of ground public transportation.

The idea of a vertical passenger seat for the aircraft cabin has been around since 2006, which has been visualized to be comprised of a vertical bench with shoulder harnesses and arm rests [4]. As illustrated in Fig. 1, it is a concept where the passengers are proposed to be transported within the cabin in their upright position, hence the nickname "standing cabin". Because the passengers will be in standing position instead of sitting during flight, the available onboard cabin space can theoretically hold more passengers. Spring Airlines, one of China's low-cost carriers, was among the first to seriously pursue this standing cabin concept back in 2009. The airline was exploring the idea to introduce a standing-room only for some of its Airbus A320 aircraft fleet, which was projected to increase its passengers' cabin capacity by about 40% than the conventional cabin design and reduce the cost by as much as 20% [5]. One of their motivations was to make the operation of air transportation more flexible and affordable like using the public bus: "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" [6]. The idea was picked up by another low-cost carrier in Europe, Ryanair. In 2012, the latter airline has obtained approval from 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 about 50 passengers to stand for their one-hour flights [7].

It goes without saying that safety is always the paramount issue in the commercial aviation industry. To ensure this, the seat design and standing cabin arrangement have to comply with currently applied standards by the aviation regulatory bodies. For such very-high-density seating concept, it must be able to ensure that all passengers can evacuate the cabin within the allowable time limits during any emergency cases. On top of that, the vertical seat design need to pass required test to ensure that it provides the necessary level of protection and passengers' restraint as outlined by the crashworthiness requirements. The materials used in building the seats need to be tested and has to comply with the required criteria such as non-flammable and non-toxic. In a nutshell, the seat design needs to satisfy the requirements for aircraft seat as outlined in the FAR/JAR Part 23 Regulation.

As of today, there is no vertical seat design or standing cabin arrangement that has been approved for commercial transport use. In addition, no prominent study that has been published on the vertical seat designs for standing cabin is found in public domain. Nonetheless, it is encouraging to note that such standing seats are not illegal by the current standards of several governing aviation bodies. For instance, Federal Aviation Authority (FAA) does not enforce that the passenger must be in sitting position during both takeoff and landing procedure, as long as the passenger has been properly secured [8]. Furthermore, Air Transport Association (ATA) does not officially impose any specific standards for the seat comfort or seating configurations [8]. All in all, it seems that standing cabin concept can be a real possibility for future commercial short-haul flights.

This paper aims to highlight the potential of implementing the standing cabin concept for low-cost airlines, especially in increasing their market competitiveness. In this sense, the main focus will be on how low the ticket price can be reduced by adopting this cabin concept and how that will affect the appeal of low-cost flight travel in comparison to other modes of transportation. An example case study will be presented to demonstrate the arguments.

II. Conceptual Vertical Seat Design

Aviointeriors Company, one of the leading aircraft seat and interiors manufacturers, has unveiled a standing seat design known as SkyRider at the Aircraft Interiors Expo Americas 2010 in Long Beach, California. The SkyRider is designed and advertised as an ultra-high density seat to allow low-cost airlines to reduce their ticket prices while still maintaining a sound profit over their flight operations. Even with a reduced seat pitch, an adequate passengers' comfort level is expected as the seating position is much like riding the tourist motor- scooter [9]. As can be noted, with SkyRider, the passengers will not be in a full standing position but more like sitting on a saddle. During the expo, this seat was said to be in the final testing stage and such seating position had been predicted to be comfortable for flights with duration up to three hours as many cowboys ride around eight hours daily on their horses without feeling any discomfort in the saddle [10].

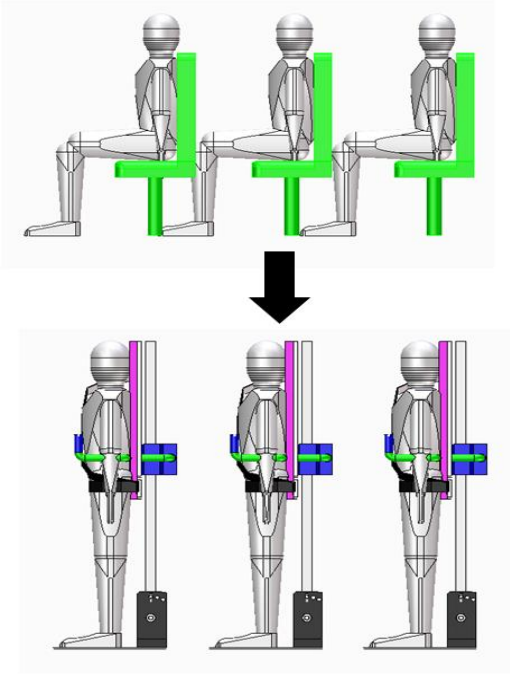

Fig. 1. Standing cabin concept

A comparatively more radical approach to standing cabin is by transporting the passengers in their full standing position, much like the concept depicted in Fig. 1. This approach has been pursued by Ryanair that envisions their passengers to be flying while leaning against a flat-padded backboard and are strapped with the safety belt stretching over their shoulders during takeoff, landing and turbulence [11]. In fact, Airbus, one of the world's leading aircraft manufacturers, had been researching over the idea in 2003 but abandoned the pursuit due to lack of interests from the airlines at that time. While there are many oppositions and obstacles for the full vertical standing seat to be operated on commercial transport aircraft under the current aviation regulations, it is believed that the idea is not entirely impossible in the future especially if the design of the seats can fulfill all safety regulations that have been set forth. For this study, to examine the potential impact of standing cabin concept, a full-standing vertical seat design will be considered.

As mentioned before, there is no formal study that has been published on the vertical seat design is found in the public domain. Airbus had been considering the idea of a standing cabin for their aircraft since early 2000's and in fact, they had filed a pattern over their proposed concept [12]. However, not much detail is available regarding that vertical seat design. For this study, conceptual design of the vertical seat has been derived from scratch to understand better the expected driving requirements behind their design. Initially, three alternative concepts of vertical seat are considered and they are discussed in details in Ref [13]. Based on several design requirements and characteristics that have been identified in the literatures, these vertical seat concepts can be compared to each other. As the result from the comparative

study, the chosen vertical seat design concept is depicted in Fig. 2.

III. Cabin Arrangement

The vertical seat is expected to be much thinner and lighter than the normal seats. Most importantly, because passengers are now standing instead of sitting, the pitch between the seats can be reduced since there is no need for a big legroom. The SkyRider seat from the Aviointeriors is advertised to be able to be squeezed into the cabin with only 23-inch pitch, a sharp reduction from the current typical 30-inch seat pitch between the rows [9]. A side-by-side comparison between the normal and vertical seats in a typical 30-inch pitch cabin arrangement is shown in Fig. 3, which indicates the extra space available between the rows for vertical seats. This means that the pitch can be reduced and this enables more rows of vertical seats to be implemented into the passengers' cabin.

Due to anticipated tolerable flight time that passengers can withstand in such standing position, this concept of standing cabin is ideally more applicable to short-haul flights with the duration of between only one to two hours. This type of flights perfectly suits the target operation of the low-cost airlines. To compare the cabin arrangement with that of the normal seats, the cabin of Boeing 737-300 aircraft is selected as a reference platform. This choice is based on the fact that the Boeing 737 is one of the most common aircraft models currently used to serve the short-haul flight routes. Using the existing cabin size and dimension of this aircraft, several alternative layouts can be derived for standing cabin concept. In doing so, the main challenge to fit the vertical seats into the aircraft cabin is the height of the cabin as illustrated in Fig. 4. Since the shape of the cabin cross-section is not rectangular, low height towards the sides of the cabin makes it impossible to have the vertical seats close to the cabin's wall. One way to remedy this is to remove the overhead bins and place them at the side as shown in Fig. 4. Using this convention and taking into account the FAA regulations such as required aisle width and emergency procedures, arrangement for the standing cabin is constructed.

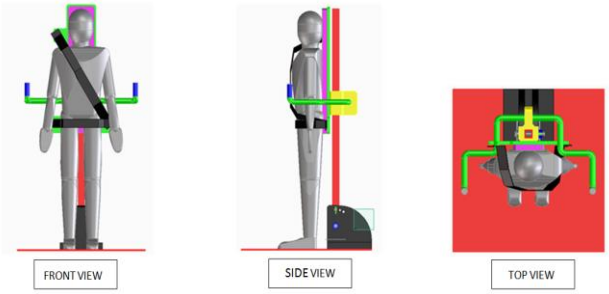

Fig. 2. Three-view drawing of chosen vertical seat design concept [13]

Based on the expected dimensions of conceptual vertical seat design derived in the previous section, a seat pitch of only 20-inch is deemed possible. The eventual cabin arrangement chosen for this study is illustrated in Fig. 5, where a 3 + 2 seat arrangement is selected. Overall, the number of passengers with this cabin arrangement is increased from maximum 149 passengers in a single-class seating with the normal seats to 180 passengers with the vertical seats. This is 21% increment in the number of passengers that can be accommodated within the cabin.

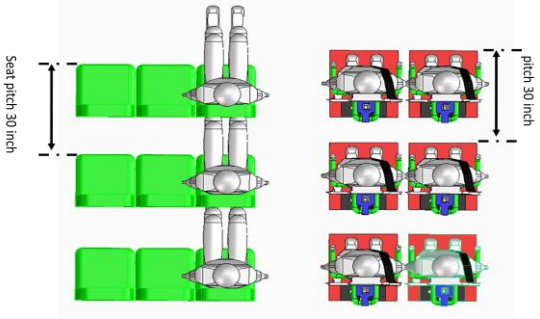

Fig. 3. Normal and vertical seats arrangement with 30-inch pitch

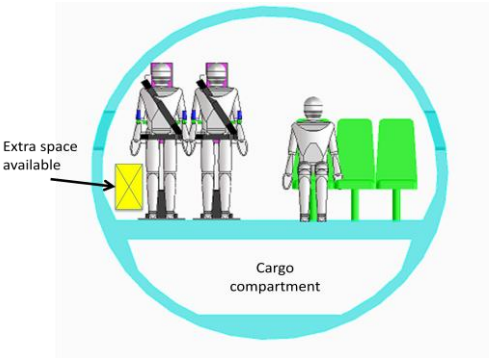

Fig. 4. Fitting vertical seats into the existing cabin

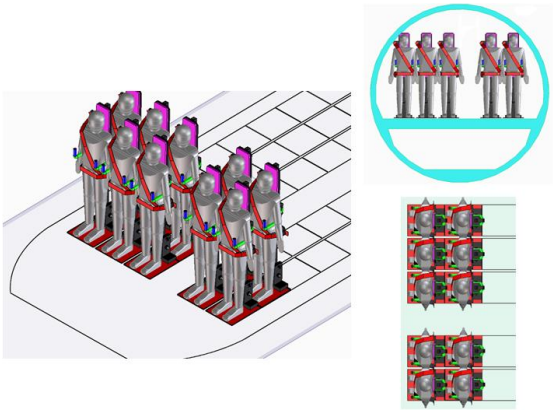

Fig. 5. Standing arrangement in boeing 737-300 aircraft's cabin

IV. Case Study: Domestic Flight Markets in Malaysia

Similar to the other worldwide markets today, the domestic flights in Malaysia have been progressively dominated by the local low-cost carrier, AirAsia. As of 2005, the airline has managed to secure 30% market share of the local domestic market and this is a notable achievement given the airline's inception was only four years earlier [14]. To highlight the advantage from the implementation of standing cabin concept in terms of ticket price, a comparison is made between the projected reduction in ticket price with the ones offered by both AirAsia (low-cost carrier) and also Malaysia Airlines (full-service carrier) for several domestic flight routes in Malaysia. This comparison is tabulated in Table I, where the flight ticket prices are obtained from the respective airlines' website (accessed on 31th August 2013 for the Monday, 2nd September 2013 flights). Note that the fare

offered by AirAsia is taken as the reference baseline to calculate the potential flight ticket price reduction for standing cabin. In this case, assuming that the Boeing 737-300 aircraft is used to serve these flight routes, the flight cost can be roughly estimated by multiplying the single ticket price with the total number of passengers. For the case of standing cabin, the same total cost is divided with increased cabin capacity to derive an estimate for a single flight ticket.

TABLE I: COMPARISON OF MINIMUM OFFERED FLIGHT TICKET PRICES IN RINGGIT MALAYSIA (RM)

Domestic Flight Route	Flight Duration (mins)	AirAsia (Low Cost)	Malaysia Airlines (Full-Service)	Standing Cabin Aircraft
Kuala Lumpur – Johor Bahru	45	RM 94.00	RM 140.00	RM 77.80
Kuala Lumpur – Pulau Pinang	50	RM 101.00	RM 125.00	RM 83.60
Kuala Lumpur – Kota Bahru	55	RM 111.00	RM 125.00	RM 91.90

It can be concluded from Table I that the flight ticket price can be reduced by as much as 17% from the currently offered by the low-cost carrier. In comparison with the offer from the full-service airline, the price difference could be as much as 44% lower for certain flight routes. While this comparison is crudely done and does not include the considerations of other market and flight operational factors such as the airport taxes, profit margin and flight route demands, it nevertheless shows the potential benefits of standing cabin concept in reducing the flight ticket prices.

While the current success of many low-cost carriers have been relying on attracting air travelers with lower flight ticket price, there are still a huge portion of potential customers that is left untapped. At present, many travelers still tend to choose alternative ground transportation options such as buses, trains and taxis against air transportation due to notable differences in travel costs. In fact, one of the main drivers in introducing standing cabin concept is attract some of them to switch to the low-cost air transportation. To see if the reduced flight ticket price is enough to enable low-cost airlines to better compete with the ground transportation options, a suitable comparison index is needed to adequately capture the trade-offs between the different types of transportation. Although it is known that the choice of travel options depends on many personal and economic factors including travel comfort, privacy and cost, the major difference between ground and air transportation is the time taken for the travel trip. The air transportation clearly has a large advantage in terms of the duration of travel time in comparison to the ground transportation alternatives like the buses and trains. However, the fact that many travelers still choose to travel with the latter options indicates that time and cost have different levels of weight in their decision-making. The question is how much people are willing to pay extra cost for a shorter travel time?

A relative metric that approximately relates the traveler's decision based on the time taken and the trip costs has been derived in Ref. [15] for several domestic trip routes within Malaysia. Using data for buses and trains options as presented in Table II, a very rough estimation of the relationship can be established. The main notion behind this is that due to a much higher travel popularity of buses in comparison to trains, it can be used to predict how much people are willing to pay for one-hour saving of travel time, as tabulated in Table III. The metric is then extended to the flight time duration to obtain the 'competitive' flight ticket price for each of the trip routes.

TABLE II: BUSES AND TRAINS TRAVEL DATA

Trip Route	Ground Transportation Option	Travel Time (hours)	Ticket Price (RM)
Kuala Lumpur – Johor Bahru	Bus	4 – 5	31.10
	Train	5 – 6	27.00
Kuala Lumpur – Pulau Pinang	Bus	4 – 5	35.00
	Train	10	15.00
Kuala Lumpur – Kota Bahru	Bus	9 – 10	40.10
	Train	12 – 13	26.00

TABLE III: TIME AND COST RELATIVE METRIC

Trip Route	Travel Time Difference (hours)	Cost Difference (RM)	Estimated Cost per Each Extra Travel Hour (RM)
Kuala Lumpur – Johor Bahru	1	4.10	4.10
Kuala Lumpur – Pulau Pinang	5	20.00	4.00
Kuala Lumpur – Kota Bahru	3	14.10	4.70

In Table III, the additional travel cost per each extra hour on the trip is found to be rather consistent to each other. This can be taken to mean that, for each hour less on the road, people are willing to pay an extra cost of about RM 4.30 on average. Using this relative metric on the flight services, the projected amount that people would be willing to pay for the reduced travel time can be estimated as tabulated in Table IV. It can be observed that the estimated flight ticket price for the standing cabin is still above the projected ticket price to better compete with the ground transportation options. Of interesting note, the difference is closing when the trip distance is longer, as highlighted by the calculated values for the Kuala Lumpur – Kota Bahru route. This hints at an optimum point between the distance and time taken for the trip where the standing cabin concept could be a superior transport option. However, care must be taken to not over-extend the flight time beyond the point passengers can withstand the less comfortable nature of having to stand throughout the whole flight duration.

TABLE IV: PROJECTED COMPETITIVE TICKET PRICES IN RINGGIT MALAYSIA (RM)

Trip Route	Projected Competitive Price	Standing Cabin Aircraft
Kuala Lumpur – Johor Bahru	RM 49.60	RM 77.80
Kuala Lumpur – Pulau Pinang	RM 54.40	RM 83.60
Kuala Lumpur – Kota Bahru	RM 77.95	RM 91.90

V. Conclusion

Due to increasing operational cost of flights, airlines are effectively looking for new ways to reduce the prices of their flight tickets as market demands for cheap air transportation options are on the rise. This needs to be achieved while still maintaining a sound profit over their operations. One of the revolutionary means that has been proposed to address this pursuit is by implementing standing passenger cabin concept onboard their aircraft fleet. By having the flying passengers standing rather than sitting allows more passengers onboard as the full-standing vertical seat is expected to be much lighter and consume less space than the current seats. Maximizing the possible number of passengers that could be accommodated in the cabin for each flight allows the costs to be theoretically better distributed among the passengers, hence lowering their ticket prices. However, this standing passenger cabin concept works best only for short-haul flights.

In this study, based on the expected dimensions of chosen vertical seat design concept, the standing cabin arrangement is conceptually established. A rough analysis is done to study whether the implementation of the standing passenger cabin can significantly help in making low-cost air transportation more competitive against the cheaper ground transportation options using an example case study of domestic travels in Malaysia.

It is concluded that in general, this cabin design concept has a potential for future implementation and there exists a cut-off point where the concept works best against other competing travel alternatives. Further study is necessary to establish this minimum requirement and also to analyze in details possible impact of changing the normal seats to the standing seats in terms of the aircraft performance (hence the operational cost). In addition, more details on full-standing vertical seat design are also required and its suitability for implementation and use in commercial transport aircraft cabin has to be analyzed in greater details.

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