DISCLAIMER - This document forms the basis of a new manual which will update the corresponding information in the existing ICAO Circular 303. It may be refined when incorporated into the final manual.

12.1 In addition to employing operational measures that reduce fuel burn and emissions from aircraft by optimising the flight profile, as addressed in other chapters, fuel efficiency is also affected by payload. Specifically, as the fuel efficiency of one flight compared to another is determined on the basis of the amount of fuel consumed relative to the amount of revenue generating payload – i.e., passengers and cargo – transported.

12.2 Commercial aircraft payload for a certain flight may be limited by a number of factors like demand, mission distance, performance limitation, airport features, flight conditions and interior configuration. The maximum payload on passenger aircraft types may be either volumetrically or structurally limited and it is determined by the seating configuration selected by the airline. On the contrary, maximum payloads on cargo aircraft tend to be structurally limited. Market conditions dictate the number and type of seats, according to the kind of service airlines choose to offer. High density seating implies greater payload and, potentially, higher proportional fuel efficiency when the cabin is full.

12.3 For any given flight, a payload increase means higher fuel efficiency in relation to productivity. With air fares and air shipping fees set in a highly competitive air transport market, airlines are motivated to achieve the highest load factor possible on every flight in order to attain the best revenue per flight. The steady increase in load factor reported over the years is evidence of the airlines' general desire to fill available capacity

12.4 Coupled with the greater fuel efficiency potential afforded by airline investment in new aircraft and engine technology and operational measures to conserve fuel, increased load factor has generally helped add to overall flight fuel efficiency.

12.5 The airlines' effort to maximize revenue yield has been aided by the development of sophisticated computer techniques allowing them to better manage their inventory of available seats and cargo capacity (both freighter cargo and hold cargo). These computer programmes, sometimes called yield management systems, and the pricing freedom introduced with deregulation, have allowed carriers to use pricing to fill seats that otherwise would have gone unsold. Also, the internet and other distribution channels have helped the airlines reach more potential passengers. By filling more seats, airlines have been able to reduce the average price of all seats, thereby stimulating greater demand.

12.6 Load factors may change from flight to flight and over time due to changes in passenger (and air shipment) demand. In addition to seasonal peaks, there are also weekly and daily peaks that are driven by leisure and business travel demands. For example, business travellers increase the weekly demand on Monday through Friday and the daily demand on morning and early evening flights. The new inventory management computer packages allow airlines to reduce prices during low-demand periods in order to fill empty seats. The peak load factor during holiday and summer peaks can average 85 per cent, or even higher, on a daily basis. This high load factor would be difficult to maintain on a year-round basis because of the lack of demand during off-peak periods. Alternatively, there are certain times of the day, or days of the week where demand in some markets is so low that pricing or using smaller aircraft will not stimulate enough demand to make an operation profitable. As a consequence, some airlines have adopted "day of week" flying: specifically, flights are not scheduled at these low demand times. This scheduling practice has

the dual benefit of increasing load factors on other flights and reducing emissions.

12.7 To the extent possible, airlines try to optimise the deployment of specific aircraft families, types or, in some cases, even individual aircraft, on particular routes. For example, air carriers have purchased more of the smaller- and medium-sized jets to serve routes with less demand. The concept of aircraft family allows the use of last minute change of aircraft techniques, like Demand-Driven Dispatch, increasing load factors by using the right size for last minute demand variations, where they are available.

12.8 A primary risk associated with a high load factor is that during peak periods of demand, airlines will not be able to accommodate all travellers. A traveller whose schedule is not flexible with respect to time may not be able to find a seat and may then choose not to travel. This unaccommodated demand, or "spill" factor, should be considered when setting prices and load factor goals.

12.9 There also can be challenges with tracking load factor statistics. Actual load factor may differ from what is recorded due to the following challenges:

a) non-revenue , passengers and cargo may not be taken into account

b) cargo on passenger aircraft usually is not included in the load factor; and

c) aircraft performance considerations may limit the actual maximum payload capability to less than the nominal maximum, but the load factor remains based on the latter.

Therefore, because flights may actually be more fuel-efficient than statistics show, there may be less room for increasing the load factor than there appears to be.

12.10 Occasionally, an operator's ability to achieve the most fuel efficient load factor may be reduced due to performance limitations and/or noise abatement constraints. Similarly, because operators have to manage complex and dynamic route networks, sometimes a less than optimum load factor for an individual flight is acceptable in order to achieve a greater efficiency for another flight or for the entire route network. It is important therefore, that a holistic perspective covering interdependencies, is maintained by rule-makers, procedure designers and when evaluating load-factor efficiency performance generally.

12.11 As more market performance data is accumulated and more sophisticated computer revenue and yield management tools become available, load factors will continue to increase and the airlines will have a greater ability to maximise load factor. However, there still remain practical and physical limits as to how much improvement can be made in the future. Load optimisation may be able to increase load factors up to 100% on some flights, however the practicalities of booking and operations make it difficult to obtain, and maintain, load factors close to the maximum through the whole network. In this respect, there are limits to the role that improved load factor can play in operational fuel efficiency.

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