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Aviation Demand Forecasting Discussion Paper

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## **GENERATION SIX DECONGESTED DEMAND ANALYSIS**

“I saw the cloud, though I did not foresee the storm.” (Moll Flanders)

### **I. Introduction**

Demand analysis is the jugular of aviation planning. The government Airport Commission is right to begin their series of study papers with this topic as their initial one. The following is an effort to expand the understanding of this vital area, expansion of understanding being as important as expansion of capacity. It might be mentioned that there is a micro-universe surrounding this topic and even a yearly convention dedicated precisely to these investigations under debate. (International Aviation Forecast Summit – 18<sup>th</sup> Annual 2013). My contribution hopefully will prove to be of service to the Commission.

#### **Introductory Points to Ponder**

1. China, since the fateful year 1989, is in the process of building 200 new airports; London, 2 terminals (no runways).
2. 99% of intercontinental freight goes by sea instead of air.
3. 97% of the world's population has never flown.
4. 92% of Americans hold no passport with which to fly to Europe.
5. No European port is any longer among the world's top ten ports in shipping.
6. Dubai, at 1% of London's population as the jet age began, presently has a clearly better potential of aviation infrastructure.
7. Tourism is the world's number one industry in the 21<sup>st</sup> century.
8. Mega-airport planning can be seen in Denver already in 1980, in Montreal already by 1970, and in Washington-Dulles even in 1955. (Denver – final build-out 12 runways)

9. The sound barrier was first broken in 1949 (Chuck Yeager); the British Concorde flew by 1969, a mere 20 years later.
10. BfT foresees the possibility of a 1% rate of aviation growth until 2050.

## **II. Deficiencies in Current Demand Forecasting Methodologies**

“Finitum non capax infinitum.”

1. The Airport Commission presents several methodologies, of which the BfT receives detailed attention. The Airport Commission study document itself detects, however, certain shortcomings and omissions, and exhibits a certain hesitation in the efficacy of these methods. My own critique is as follows.

2. Just on the face of it, the possibility put forward of a 1% growth rate seems very low indeed. It is questionable whether a report of this consequence would even dare to issue a figure under 1%. And we can conclude that we are faced here with the lowest figure possible to publicise. This is patently too pessimistic as even the occasional traveller can instinctively testify. This is not exactly a Mahatma wager. One percent is self-discreditation.

3. Airport architecture is in itself a testimony in stone to faulty demand forecasting methods; aerial views of major world airports are all different like so many snowflakes.

4. The methodology omits any reference to slot denials. One is reminded of Churchill's remarks regarding the Air Ministry's history of the Battle of Britain without mentioning Dowding's name.

5. The main hitch in the represented methodology and others of that ilk lies in a virtual impossibility. Like an neophyte onlooker arriving at the scene of the Titanic lifeboats and having to gauge the size of the Titanic solely from the residual lifeboat spectacle presented and focussing mainly on the half-empty ones, so too these methodologies are looking at congested airports and half-empty ones and trying to decipher the size of the aviation world that lies submerged. It is like telling how deep a body of water is by running out of sounding rope. The inferences are almost always grossly understated.

6. The results of these methodologies are just plain wrong; and so often wrong that we are left wondering why anybody relies on them. And they forecast with impunity; this does nothing to sharpen accuracy. Aviation currently is a system of mutually assured congestion. Two airports have to have open slots before one flight can take place. Congestion has certain internet qualities, but in a negative sense. And who remembers economically viable slots?

7. The Commission study document deals almost entirely with passengers per annum (ppa). The more important figures concerning movements per annum (ATM - mpa) are mentioned maybe once, maybe twice without reference to their far greater significance. One can cite ppa but the rub is mpa. It is best when both are present, but if only one, then let it be mpa. The size of the aircraft is immaterial at the IATA slot conferences, the slot everything.
8. Another fundamental problem is the fast and loose employment of the terms 'constrained' and 'unconstrained'. For example, the historical 5% average growth rate we assume is constrained, which then switches to an unconstrained 1% growth rate forecast for the future. Here constrained and unconstrained are compared, but not differentiated. Their methodology's most recent over-optimistic prognosis fails to mention that the prognosis was based on an expansion that never occurred, and thus results were constrained. For once they may have been right, except for the non-forthcoming expansion, which would have translated into their optimism. On the other hand, nothing is as easy to forecast as constrained conditions if relatively permanent.
9. But the truth of the matter is, upon inspection, that these methodologies never yet have produced a true unconstrained prognosis. Where would they get that from? They have never seen an unconstrained state, they have never actually seen the Titanic. These methodologies tend to calculate a constrained analysis and simply add arbitrarily a thin icing of a percent or two, and call it unconstrained. True unconstrained would require the ship, when you only have the remnants of the lifeboats. The methodology also seems to shy away from converting its prognosis into hard numbers of runways needed. Since this is the whole point of the exercise, why can't they provide this simple step?
10. The presence of congestion skewers even available statistical results past all reliability for prognostication. I use the term congestion-impacted data. And on top of this, there exists slot-denial impacted data. Fun house mirrors are produced which distort the true picture beyond all recognition. Only when backlog is eradicated can prognostication take place with any degree of accuracy. Everything except capacity is listed as a driver. Figure 2.1 lists supposedly significant historical events, but leaves unmentioned when new capacity was brought online. This is endemic to the mentality of this methodology. But in a congestion system on the order of world aviation capacity, allotment can be considered so important as to warrant the title of sole driver of growth rates.
11. Sometimes the methodology allows itself blatantly false assertions, such as attributing the success of low cost carriers to falling oil prices, when the main boom in low cost carriers paralleled the most spectacular rise in oil price history, from \$10 a barrel in 1999 to a \$150 a

barrel peak a short nine years later in July 2008. And at 3.17 (2) in the report it is simply asserted that the recent rapid aviation growth from newly industrialised countries is not expected to continue, no supporting proof given. Is not the opposite the case? Such assertions, and there are others, are patently untrue.

12. Nowhere does the BfT methodology analyse the level of overcrowding, i.e. congestion at England's main airports. Benchmarking in general is vague; specs unavailable for inspection. And the term 'constrained' conveys very little of the truth. And the term 'unconstrained' turns out to be totally constrained, being as the trigger to expand, i.e. need, or quote "as required," somehow never arises. The term unconstrained is disingenuous. One is reminded of the Gulag doctors certifying last leggers as healthy for heavy timbering. As long as these parameters go unchallenged, all discussion is futile. These are the most congested airports on the planet. A swimming pool can contain many more people treading water (underuse) and maybe thereby earn the term unconstrained if there still is room to get wet. But all swimming has effectively stopped, and the point of the swimming pool is to swim. Constrained begins for this methodology on the far side of congestion. Namely congestion is in full swing before constrained is ever applied. To call Heathrow and Gatwick constrained is to refer to a vessel of Vietnamese boat people as pleasantly crowded. The Queen Mary has been turned from an ocean liner (1500 pax) into a troop transport ship (15,000 pax). And if your understanding of congestion is off, your understanding of demand forecasting will be doubly off.

13. Misleading in the extreme is the haphazard use of relative and absolute figures. For example, the rate of growth of GDP growth in China this year may fall, but being as it is applied to a much larger base, in absolute terms the growth represents a significant increase, not a decrease. Such confusion is delivered by these methodologies.

14. The most significant mistake of the methodology is to treat capacity and results as somehow two distinct entities. They should and can only be considered as a continuum. I call this the relativity theory of aviation versus Newtonian separatism. We are continually confronted with statements such as, airport X produced Y passenger levels as if these were distinct, but like as time and space have to be considered together now (*Raumzeit*) as inseparable, so also we may only speak of 'capacity allotment-results', and allotment-results under an  $n^{\text{th}}$  degree (condition) of congestion. Namely you cannot separate or uncouple capacity allotment and results, nor can you omit the conditions and degree of congestion under which this is occurring.

15. As regards the other methodologies cited and their differing approaches, these at root engage in the same errors. For example, all of these assume heavy congestion. Broadly

speaking they are all congestion based methodologies, “To differ, a degree of same; conform, the pinnacle of am.” (E. E. Cummings). Some are just a median of congestion-entrapped opinions. We need decongestion, that is to say, we need a ‘clean room’, purified of the spores of congestion in which to conduct all demand forecasting experiments, and we cannot get there through these methodologies.

16. There are incredible gaps in these methodologies, some of which the Commission Paper rightly spotlights. First of all, methodologically, you should start from the whole world and analyse down to England instead of starting from London and analysing up. Even the gaps pointed out by the Commission Paper (4.7 points 2 and especially 3) are not mere outriders that can be tweaked into some semblance of reliability. These in and of themselves are knock-out punches that would scrap any other methodology. The omission of slot denials has already been cited, but there is something that constitutes a whole category that has never been considered. No employment ministry in the developed world would leave the unemployed unmentioned, or not even have a category for discouraged workers. But these methodologies do both. But that is precisely what we find in all these aviation demand forecasting methodologies. If you were a minor airline, would you bother applying for slots at Heathrow? ‘Discouraged slot applications’ (or applicants – ‘DSA’) constitute the main oversight of the forecasting industry. Part III seeks to provide a Titanic against the backdrop of which these can be adjudicated.

17. The above are sins of omission on the scale of the ratings agencies issuing AAA credit ratings to a Lehman Bros. or an AIG. Whilst the experts in this field certainly are and remain at the top of their profession, they just were not getting a full picture due to fundamental misunderstandings of the financial world and its submerged shoals. The brilliance of their econometrics had to wait until the submerged emerged.

18. Which leads us to the ultimate problem. At the bottom of all this is a bogus a priori world picture of aviation parading as an a posteriori. Aviation demand is presented in the sedate and coy terms of the queue at the non-alcoholic punch bowl in the early morning hours of a Cambridge May Ball while in reality it resembles nothing so much as the Stalingrad pocket airlift in January of 1943. This misapprehension is the source of 90% of the problem in demand forecasting and exerts an unseen a priori control over much of the sub-conscious thinking in aviation. The Commission should consider it their duty to attend every slot conference till they issue their final report. They may also wish to conduct their meetings in Calcutta.

19. Moreover, and this may be hard to swallow, but in some sense aviation has nothing whatsoever to do with GDP or econometrics. The GDP-airports relationship is much more reciprocal than one thinks; it is certainly not a one-way proposition. Take Dubai, for example; it is more correct to say that the two Dubai airports influence their GDP than that their GDP influences their airports, as is maintained in most textbooks. In the financial crisis, Dubai boomed right along, which should not have happened according to textbook thinking. The only dip was due to congestion more than the economy. In this vein, when you forecast a one percent growth rate in aviation in the British Isles, you condemn your own economy.

20. Also, Heathrow is not constrained once you get past the runways. In fact, it is the least constrained of all British airports when you consider the vital criterion that it alone in Britain possesses critical mass (in everything but its runways), the Holy Grail of aviation success. (Maybe Gatwick too – but critical mass with one runway?) No other British airport enjoys this most important of all advantages. It is the other British airports that are capacity constrained even with slots available. A reference to unconstrained is of cold comfort when standing in a pouring rain on the tarmac at East Midlands to get through immigration.

21. The worst thing you can do to your city or to your country is to congest your airports. England, however, is proud of it, glorying in their shame. While Gatwick strives to shoehorn three runways' worth of passengers onto a single runway, the negative fallout from this attempt goes unnoticed. This school of Japanese underground station pushers has unforeseen consequences that are devastating. Congestion is quantifiable and there are decongestion techniques available, such as the new Shanghai city airport terminal uses for crowd control. These are clogged arteries that are damaging the heart, not writing the Guinness Book.

22. There is an additional problem, which I refer to as 'dimensionality', or the ability to take on board quantum leaps or orders of magnitude. It is the difference between the Dieppe raid and D Day. There are those who can understand oceanography but may not be able to come to grips with the inner galactic distances involved in cosmology. During the Battle of Britain, on a good day you might have found 500 British fighters opposing 500 German fighters. Roosevelt took one look at this and ordered up 50,000 fighters for the U.S. And that was the end of that.

23. A final problematic that serves as a bridge to the next section of this discussion: Uncertainty and backlog are mutually exclusive. We can concern ourselves with the ins and outs of uncertainty after we have untangled and absorbed the obvious backlog of demand that we have presently. There is no uncertainty in a backlog and as long as it remains, uncertainty

is superfluous. As we will see, the only uncertainty that should concern us here is not in the methodological realm; if anything, we may find it in the political realm.

24. We should not leave out debatable issues in the approach of the Airport Commission itself. For example, the Airport Commission is seemingly not allowed to advise the government to do 'big ticket' expansion immediately or in the short term. This option is off the table. But if this is the best item, the Commission is being asked to choose among second best options. This is neither advisable nor free and open, as advertised. The oft-repeated slogan of their remit to examine the nature, scale and timing, etc., is not accurate, being as a certain option is left out. The level at which rejection takes place should be post presentation at the government stage, not at the assessment level. It is the government's rightful option to reject the Commission's proposals, but it is the Commission's remit to follow the evidence wherever it leads. Short term, big ticket expansion might be just what the doctor ordered. Perhaps we should not be sitting around like Joseph's brothers. If the evidence reveals something like the Oklahoma Land Rush elsewhere in regards to expansion, the Commission should be allowed to advise that Britain join the Sooners. Finally, an instructive analysis of the history of British infrastructure aviation expansion since the jet age is a *sine qua non* for a proper understanding of our present predicament.

### **III. Revisionist Generation 6IX Demand Analysis**

“And if merchandise is to be carried over the sea, skilful sailors will also be needed, and in considerable numbers? Yes, in considerable numbers.” (Plato Republic II)

1. To escape the gravitational pull of congestion and create a forecasting clean room against which the global top 100 cities can be compared, we select a new approach model involving a twin sister transportation system that can provide insight, both historical and objective, by way of its comparative features, and whose demand patterns parallel former and future aviation demand paths. The selected model is the rise of container shipments (TEU) over mathematical generations. By linking shipping and flying we strive to obtain a more accurate picture of demand forecasting and provide a hard backdrop against which to adjudicate demand growth. One of its main uses is to calculate discouraged slot applications.

### Transportation Generations

Year	Generations	mpa (ATM)	Generations	TEUs	mpa Planning
1900 - 1925	1.	100 - 1000	2.	1000 – 10,000	2.
1925 - 1950	2.	1000 – 10,000	3.	10,000 - 100,000	3.
1950 - 1975	3.	10,000 - 100,000	4.	100,000 – 1M	4.
1975 - 2000	4.	100,000 – 1M	5.	1M – 10M	5.
2000 - 2025	5.	1M – 10M	6.	10M – 100M	6.
2025 - 2050	6.	10M – 100M	7.	100M – over 100M	7.
2050 – 2100	7.	100M – over 100M			

The chart above depicts the rise in yearly aviation movements since the invention of the airplane compared with the rise in yearly container movements, broadly understood, at the world's top 100 cities and 100 ports. Every quarter century, results increase by a factor of ten. Container generations are one generation ahead of aircraft movement generations. London, and other top 100 cities too (Atlanta), fits nicely into the chart with its one million ATMs being registered yearly during the period 1975 – 2000 (if at the end), namely, Generation Four. Meanwhile, during the same quarter century, the harbours of the top 100 ports were handling one to ten million containers per year, i.e. Generation Five. For the quarter century 2000 – 2025, the top 100 port cities are handling between ten million and one hundred million containers per year, i.e. container Generation Six. Correspondingly, according to the chart, the top 100 aviation cities should be entering Generation Five. Mutatis mutandis, when the ports move into their seventh generation, the aviation cities should move into their Generation Six. The final column, that of mpa Planning, indicates the time frame for planning that particular Generation. For example, the years 1950 – 1975 should have seen the planning for the Fourth Aviation Generation (and they somewhat did) and the years 1975 – 2000 should have seen the planning for the Fifth Aviation Generation (they did not). The years 2000 – 2025 should constitute the planning phase for the Sixth Aviation Generation.

2. For those ports wishing to maintain their status in the top 100, it would behove them to implement capacity sufficient to handle 100 million containers a year, while planning for quantities beyond this mark. Generation 7 is on the horizon. And in point of fact, a mere eight ships a day of the newest generation (and surely not the last generation) of ships, loaded and unloaded in a 24-hour period, would see these kinds of seventh generation figures (18,000 containers per ship).

3. Should this chart prove applicable, it is fairly easy to see the congestion potential in London's airports. If your capacity remains as it is (6 runways), you will only be able to



accept one of ten slot applications. And starting in the year 2025, that figure will drop to only one of every hundred slot applications, i.e. one percent.

4. There is currently no planning in Britain for the challenges of either Generation Five or Generation Six. Planning for Generation Five, according to the chart, was meant to have taken place in the years 1975 – 2000. That is now forty years late. Implementation of Generation Five should have commenced in the year 2000. And for the now thirteen years after 2000, planning should have been in progress for Generation Six.

5. For Generations Four, Five and Six, I employ the metaphor of three different sized ships, the first one able to carry 1000 passengers, the second 10,000 passengers, and the third 100,000 passengers. The first ship arrived in London ready to take on passengers in 1975, the second in the year 2000, and the third will arrive in the year 2025. These ships set off on cruises with or without passengers. According to the laws of the sea, the number of lifeboats, however, determines the number of passengers that these are allowed to take on board. Unless the number of lifeboats increases by a factor of ten, the ships will sail proportionately empty and the losses proportionately great. If those holiday makers seeking a cruise cannot find tickets here because of the lack of lifeboat allotment, they will cruise elsewhere.

6. The only thing holding back the world's top ports from fulfilling the scenarios depicted in the chart is congestion and lack of capacity allotment. I maintain that the same holds true of the aviation generations as depicted in the chart. Via decongestion practices such results are not only achievable but inescapable. I am convinced that the Movements Generations Chart above best represents the demand forecasting and transportation accuracy we all seek.

7. A container is just an aircraft without wings.

8. Congestion is a major reason why freight goes by sea instead of by air.

9. It bears remembering that passenger traffic is only one segment of the three major aviation segments. Freight movements could replicate the number of passenger movements; and business aviation yet a third equal segment.

10. England exists from an era of one new runway every ten years into eras asking for ten runways every one year.

#### **IV. Competitive Maintenance**

“But Jeeves, everyone is asking the name of my tailor.”

“Doubtless to avoid him, Sir.” (P. G. Wodehouse)

1. Low cost carriers have indicated that sheer population is becoming the dominant factor in aviation.
2. Greater Asia is heading toward a population of six billion while Europe is perhaps one billion and North America 500 million. Asia not only enjoys the critical advantage of numbers, but can moreover use this to enjoy interior lines of communication. Europe and North America are not in the same league, even when combined. Asia is decoupling at an alarming rate. The best countermeasure that the West can offer is to decongest their airports and provide adequate capacity allotment with the all-important proper reserve.
3. It should be noted that Dubai and the other Gulf States are five degrees west of the Urals, and with Moscow and Istanbul now present new challenges to Western Europe.
4. England suddenly finds herself geographically speaking in a position akin to Dunkirk, being moved from the centre of the West to the far edge of Eurasia by the events of 1989. Sufficient infrastructure and more importantly generous reserve offer the best mitigation for geographical disadvantages.
5. England, however, still remains the English-speaking bridge between North America and all of Europe. Americans prefer to connect via the mother country. It is still upstream to North America. If capacity allotments are sufficient, it will retain its hegemony in this regard and can even increase in importance. I call this the notion of England as an airfaring nation.
6. Nothing impacts your competitive position more negatively than faulty prognoses.

## **V. Why the Bother**

“Some of the jury wrote it down ‘important’, and some ‘unimportant’. Alice could see this, as she was near enough to look over their slates; “But it doesn’t matter a bit,” she thought to herself.” (Lewis Carroll)

1. A case can be made that the exercise of demand forecasting in the case of aviation is thoroughly superfluous. If demand is as depicted in Generation Five and Generation Six, there is no need for prognostication. In 1940 if you had a clear understanding of war, you would know that the supply of the new miracle drug penicillin would never be sufficient to satisfy demand. Now, 75 years later, if you have an equally clear understanding of Asia, you will know that additional aviation infrastructure will hardly be able to outstrip demand. So the genuine question arises, why prognosticate at all, just build. Dunkirk was not calculated;

everything available was simply thrown at it. Resolve the backlog and then prognosticate. And let capacity do your forecasting.

2. Aviation infrastructure expansion may resemble the building of Noah's ark, but investigation will reveal that all proper additional allotment is full at opening, and even every improper allotment after a year or two.
3. It is a hard truth that England, as well as many an other country, does not possess the means to build and allot capacity to a degree that would outstrip demand.

## **VI. Conclusion**

“Don't invade China; don't invade Russia.” (Field Marshall Montgomery)

1. The above is an unexpanded version of the commentary that is available. The expanded paper in its entirety or selected portions of greater interest can be submitted upon request.
2. It is my intention to present as sharp a contrast as possible between the 1% put forward as a possible growth rate figure in the paper's methodology, and the 1% foreseen in the Generation Six scenario of slot applications which can be accepted should there be no infrastructure expansion. Aviation in England has reached a watershed and the intention of this report is to influence policy makers in the right direction of the two.