/NSIGHTS

Fuel Price Uncertainty & Structural Evolution of Aircraft Market Warrant Consideration of New Fleet Strategies

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Situational Overview

- Wide fluctuations in oil prices over the past decade have rendered traditional fleet strategies suboptimal for many carriers.
- The bow wave of new generation aircraft types developed for mainstream market applications entering into service over the course of this decade do not represent game changers in network utility.
- This stands in contrast to previous aircraft technology rollover cycles, during which older generation aircraft types became economically obsolete due principally to shortfalls in performance capability relative to competing newer generation types.
- A substantial shift in ownership of the global aircraft fleet to operating lessors over the past 25 years is deepening the supply of current generation aircraft available in the secondary market.
- The structural evolution of the aircraft market noted above warrants examination of new fleet strategies—and the wide fluctuations in fuel prices recently experienced now makes this a strategic priority.

Introduction

This paper represents the first in a series that discusses the opportunity for commercial airlines to enhance economic value through the adoption of more dynamic fleet strategies. Today, many large commercial airlines tend to follow a "cradle to grave" fleet strategy that includes one or more of the following foundational elements:

- Acquiring new aircraft for growth and replacement needs, principally through the OEM channel;
- Evaluating lease/buy decisions principally on the basis of cost of financing considerations; and
- Retiring aircraft not otherwise deemed surplus in accordance with an established fleet retirement policy, typically after several major maintenance cycles.

The first of these three elements is illustrated in Exhibits 1a and 1b below. These diagrams show the relationship between size of airline and the proportion of airlines' fleets sourced through the lessor channel that are either new aircraft or used aircraft. As clearly shown, while a reasonable proportion of both smaller and larger carriers' fleets are represented by new aircraft sourced through lessors, the proportion of fleets represented by used aircraft sourced through lessors is fairly minimal for larger airlines.

Our research—developed using proprietary analytical tools and supported by client engagements—indicates that the aforementioned "cradle to grave" approach to fleet strategy will often need to be modified in order to maximize enterprise value. For purposes hereof, this is defined as a fleet structure that maximizes the expected net present value of future cash flows for the airline, taking into account variations in the expected revenue generating power and operating cost characteristics of individual fleet types under alternative fleet structure combinations.

Exhibit 1a: Proportion of Fleets Leased New by Airline Size

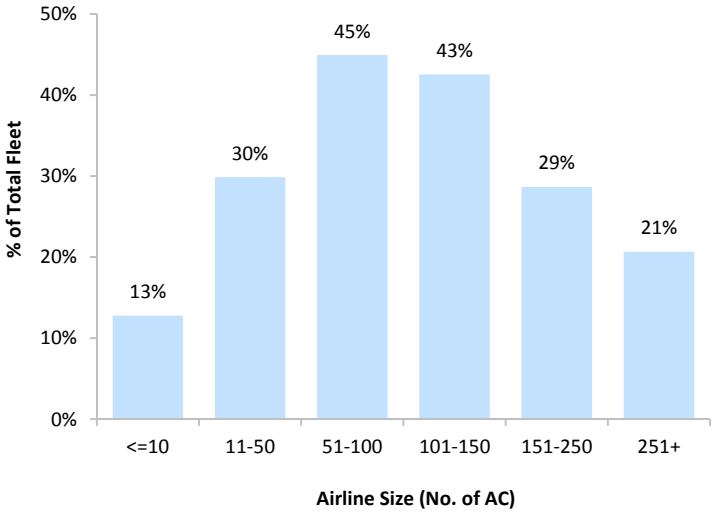
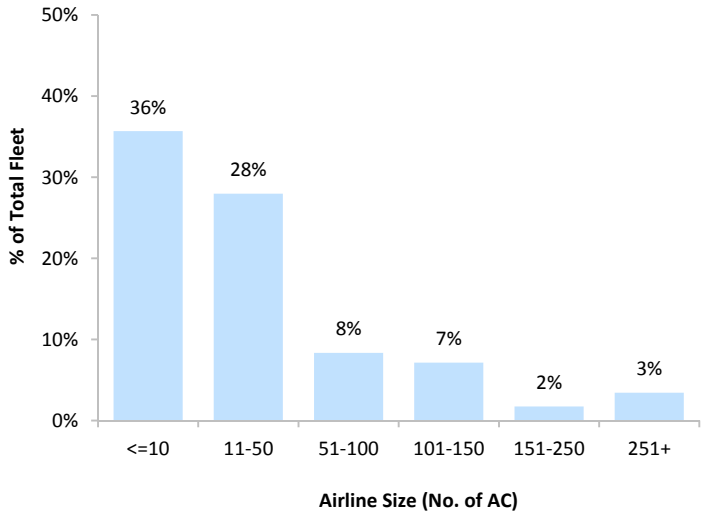


Exhibit 1b: Proportion of Fleets Leased Used by Airline Size



Source: SkyWorks analysis, based on data from Ascend Fleets from Flightglobal as of Jan 15, 2016.
Note: Used aircraft placements identified based upon aircraft having different original operator; data controlled for mergers & acquisitions.

The main drivers of this are the competitiveness of current generation aircraft offerings from a network utility standpoint, as well as the dramatic increase in ownership of the world aircraft fleet by operating lessors—and a need for business strategies that enable airlines to better cope with a high degree of uncertainty in the long-term outlook for the price of jet fuel. In addressing this topic, this paper will principally focus upon factors that are creating a business case for sourcing aircraft from the secondary market, while lease/buy and retirement policies will be addressed in a subsequent publication.

Competitiveness of Current Generation Aircraft Offerings from Network Utility Standpoint

An important aspect of the current evolution of the commercial aircraft market is that many newer and future generation aircraft types have payload/range characteristics substantively similar to previous generation aircraft. Historically, new aircraft programs often offered improved network utility through significantly increased payload/range capability, as well as improved time in revenue service through increases in long-term dispatch reliability, extended airframe maintenance intervals, and longer engine on-wing times.

Through improvements in network utility, the launch of new aircraft programs such as the 737NG and 777 represented "game changers" for the industry. Aircraft types such as these supported an ability to modernize fleets into fewer fleet types while simultaneously improving operating efficiency. For instance, in the domestic US market, many airlines are able to deploy the 737NG not only on routes previously served by the 737 Classic but also on transcontinental routes previously served by larger aircraft. In the twin-aisle segment, the 777 delivered twin-engine operating efficiency on routes previously dominated by older generation four-engine aircraft.

Large-step changes in network utility often allowed the network to rule aircraft fleet selection and trumped ownership cost considerations. This can be evidenced by the residual value performance of previous generation aircraft types that were limited in performance capability (and, in some instances, capacity) relative to competing newer generation offerings—one such example being the 737 Classic. In spite of rapidly declining ownership costs during the 2000's, the aircraft was still deemed economically uncompetitive by many network carriers.

Looking ahead, the single-aisle space will see some new aircraft types that are differentiators from a network utility standpoint, but the mainstream segment of the single-aisle aircraft market, driven primarily by re-engine initiatives and cabin enhancements, will not see significant changes in network performance characteristics or capacity between current generation and newer generation offerings.

The situation in the twin-aisle segment is fairly similar with certain mainstream types such as the 777-300ER offering performance capabilities on par with (or in some cases exceeding) newer and future generation offerings—holding aside aircraft tailored for the ultra-long range segment such as the 777-8X and A350-900ULR. An added dynamic to be factored into the long-haul segment is the fact that the vast majority of twin-aisle aircraft operations performed today, as well as a majority of the growth projected by the OEM's over the next 20 years, is not on long-haul routes (defined here as routes over 6,000 nm).

This will drive significant future aircraft demand for twin-aisle aircraft that do not serve a critical mass of long-haul routes. This demand will be driven by the sheer size of non-long-haul markets that, depending on size of the airline, will warrant the need for aircraft types offering maximum efficiency on medium-haul routes. This is evidenced by the fact that both Airbus and Boeing are developing new twin-aisle offerings tailored to the medium-haul segment.

The table on the subsequent page summarizes publicly reported data concerning the capacity and range of various offerings under one of each manufacturer's specification and performance rules for the aircraft types displayed. It should be noted that there are numerous underlying assumptions and that the figures shown are not "apples to apples" between Airbus and Boeing nor necessarily representative of any particular carrier. Rather, the purpose of presenting this data is to illustrate that current generation offerings are generally comparable in performance to newer and future generation offerings.

Exhibit 2: Capacity / Range Summary for Key Commercial Aircraft Types

Type	Capacity	Range (nm)	Type	Capacity	Range (nm)
737-300	128	2,700	**787-8**	242	7,350
737-400	146	2,000	**787-9**	290	7,635
737-600	110	3,050	**787-10**	330	6,430
737-700	126	3,400	**A319-100**	124	3,700
737-800	162	3,100	**A319neo**	140	3,750
737-900ER	178	3,200	**A320-200**	150	3,300
737 MAX 7	126	3,800	**A320neo**	165	3,500
737 MAX 8	162	3,700	**A321-200**	185	3,200
737 MAX 9	178	3,600	**A321neo**	206	4,000
767-300ER	269	6,310	**A330-200**	247	7,250
777-200ER	313	7,065	**A330-300**	277	6,350
777-200LR	317	8,555	**A330-800neo**	257	7,500
777-300ER	396	7,370	**A330-900neo**	287	6,550
777-8X	375	8,700	**A350-900**	325	7,600
777-9X	425	7,600	**A350-1000**	366	7,950

Source: Airbus and Boeing websites (current/future production types); Airliners.net (out of production types).
Note: 2-class configuration assumed for all narrow-body aircraft; 2-class configuration assumed for all Boeing wide-body aircraft; Airbus capacity numbers based on industry typical configurations.

Dramatic Increase in Ownership of the World Aircraft Fleet by Operating Lessors

The aircraft operating leasing market has exhibited a dramatic increase in growth. According to Boeing Capital Corp., the percentage of the global aircraft fleet under operating leases has increased from approximately 12% in 1990 to just over 40% of the in-service fleet in 2014.

Historical data indicates a strong propensity for operating leases to influence long-term airline fleet planning in a manner that serves to increase the availability of aircraft in the secondary market. As illustrated in Exhibits 3a and 3b below, in examining popular single-aisle aircraft produced in the mid-1990s, approximately 70% of owned aircraft remained with the same operator after 15 years, whereas only 35% of leased aircraft remained with the same operator. With the steady increase in ownership of aircraft by operating lessors during the past 25 years, this pattern would suggest that the supply of aircraft available in the used aircraft market can be expected to continue to steadily grow.

Exhibit 3a: Operator Changes for Owned Aircraft as of 1996

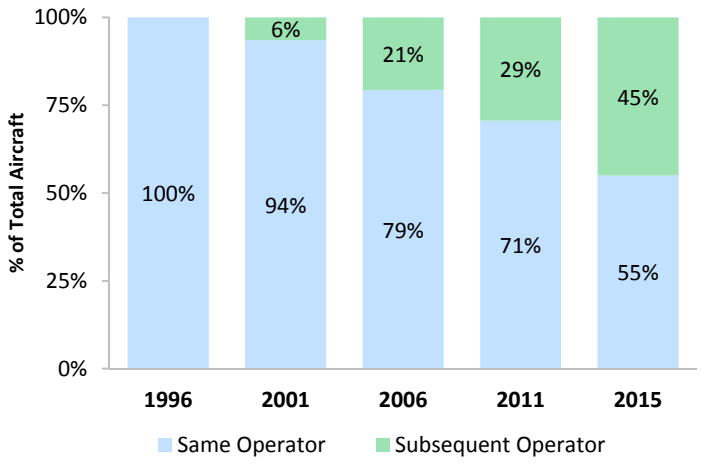
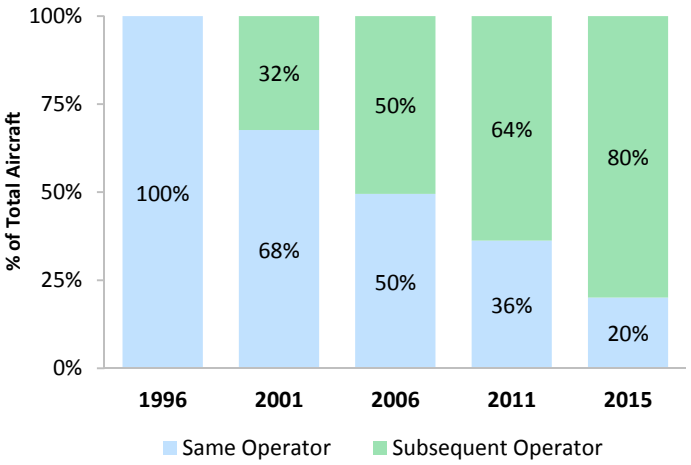


Exhibit 3b: Operator Fleet Changes for Leased Aircraft as of 1996



Source: SkyWorks analysis, based on data from Ascend Fleets from Flightglobal as of Jan 15, 2016.
Note: Limited to 1993-1996 vintage Airbus and Boeing single-aisle aircraft types.

The striking relationship between asset ownership and fleet planning is driven at least in part by aircraft ownership tending to lock an aircraft into an airline's fleet plan. Given that aircraft book values often exceed actual trading values of aircraft sold on an outright basis (i.e., not subject to a leaseback arrangement), especially in times of industry overcapacity when such fleet exits are most desirable, exiting out of owned aircraft becomes difficult without a willingness to incur material book losses. Added to this is the propensity of airlines that source aircraft through the OEM channel to often seek heavy LOPA customization, which creates an added friction cost in transitioning an aircraft to a subsequent operator. In addition, airlines are increasingly placed in a position where they are competing with operating lessors that offer a wide inventory of aircraft with stapled financing by virtue of being on a lessor's balance sheet.

A further influencing factor on the increase in used aircraft supply—one that goes hand in hand with and has helped support the rise of operating lessors—is the low cost carrier ("LCC") business model. The LCC share of all short-haul flying has risen from approximately 10% in 1994 to almost 30% in 2015 per the Boeing Current Market Outlook, 2015-2034. Certain prominent LCCs have had a propensity to systematically cycle aircraft out of their fleets at a relatively young age, often through using operating leases as a fleet planning tool, adding to the available supply of used aircraft.

Need for Business Strategies that Enable Airlines to Better Cope with Fuel Price Uncertainty

Fuel prices have imparted significant stress on fleet planning decisions during the past decade. Numerous airlines have found themselves going from one extreme to the other. On the one hand, many airlines elected to take significant book value impairments on less fuel-efficient aircraft well before the time they had originally intended to retire aircraft. In many instances they simultaneously placed long-dated orders at a time when oil prices were averaging around $100 per barrel, and the economic value being attributed to reductions in specific fuel consumption was high.

With limited changes in network utility and the capacity profile of many newer and future generation aircraft, increases in operating efficiency have underpinned the business case for many of the new aircraft orders placed in recent years. Absent a sudden, significant, and sustained rebound in oil prices, it is reasonable to expect that at least some of the orders previously placed by airlines will fail to deliver on all of the economic advantages that were expected once factoring in ownership costs. In addition, as OEM control over the aftermarket continues to be consolidated, this may be further compounded by the possibility of long-term escalation in maintenance costs exceeding maintenance cost escalation rates of current generation aircraft types.

The rise and subsequent fall in oil prices indicates that more dynamic fleet strategies are warranted. The development of such strategies should seek to identify one or more fleet structure alternatives that mitigate volatility in future earnings. This paper has indicated that structural evolution of the aircraft market itself warrants examination of new fleet strategies, but the wide fluctuations in fuel prices recently experienced now makes this a strategic priority. For instance, by expanding the pool of aircraft that are considered in a strategic aircraft sourcing campaign and through avoiding long dated commitments, it may be possible to achieve solutions that are more adaptable to a range of fuel price outcomes.

Examining Alternative Aircraft Sourcing Strategies

We have been recommending that our clients explore a broadened approach to fleet sourcing for some time. SkyWorks has developed the SAAV® System to examine a wide range of aircraft sourcing alternatives as a component of a dynamic fleet asset management strategy. Such alternatives can often include two-stage sourcing strategies in which, by way of example, a current generation aircraft is leased in (or sold and leased back) on a short-term basis for replacement with a future generation aircraft at lease expiry.

While the optimal fleet strategy for a given airline will vary, and is impacted by such factors as an aircraft's utilization, yield/load factor, and hour-to-cycle ratio, one of the trends we are seeing due to expanding opportunities in the used aircraft market and falling fuel prices is that sourcing current generation aircraft for at least some portion of an airline's needs can often serve to maximize enterprise value. To illustrate this, we have assembled a demo airline fleet portfolio comprising 737-800 and A320-200 aircraft. Our portfolio assumes a fleet with a range of ages and applies typical aircraft revenue, operating cost, and financing assumptions. The analysis we have conducted examines the optimal replacement aircraft for each aircraft in the fleet amongst the following choices based on the objective of maximizing the net present value of cash flows over a 20 year period:

- New next generation aircraft either through an aircraft order or lease-in
- New current generation aircraft either through an aircraft order or lease-in
- Used current generation aircraft either through a purchase or lease-in

We have modeled a range of fuel price scenarios. Given current low fuel prices and widespread views that low fuel may only be a temporary phenomenon, we have established several scenarios that assume low average fuel prices for an initial period followed by high average fuel prices later on.

In addition, we have included scenarios under both low and high fuel price scenarios throughout the analysis period to establish the "edges of the envelope" for our analysis. In addition, the levels we have established do not represent cyclical lows or highs in fuel prices. More specifically, we have modeled the following scenarios:

- $3.00 per gallon throughout the analysis term
- $1.50 per gallon initially, followed by $3.00 per gallon after 2019
- $1.50 per gallon initially, followed by $3.00 per gallon after 2021
- $1.50 per gallon initially, followed by $3.00 per gallon after 2023
- $1.50 per gallon throughout the analysis term

Exhibits 4a and 4b below present the results of our analysis, by summarizing the optimal sourcing strategy for each of the two narrow-body aircraft fleets, based on replacing one of the fleet types in 2016 and the other in 2018.

As shown, the optimal approach for both aircraft types varies with the assumed fuel price scenario. The optimal scenarios feature a combination of aircraft other than in the instance of one of the two fleet types and where fuel is assumed at $3.00 throughout the 20-year analysis period. In addition, most of the optimal fleet structures feature the acquisition of used current generation aircraft for nearly half of the fleet.

The difference in net present value between each of the optimal scenarios and a strategy of pursuing only one profile of replacement aircraft is in the millions of dollars with the exception of the one scenario where 100% replacement by new next generation aircraft is indicated.

Of course, our analysis depends on aircraft availability and aircraft market assumptions, and if airlines broadly begin to widen their fleet acquisition strategies, this will impact the aircraft market which may in turn impact the specific outcomes indicated by our analysis. Further, as previously noted, we have applied generic assumptions in the analysis and so this is not a recommendation for any specific airline on the exact course to follow in a fleet replacement process.

Conclusion – Some Emerging Evidence That A Shift in Fleet Sourcing Strategies Is Underway

Some of the highest profit margin airlines in the world, including Delta Air Lines, amongst others, are carriers that prominently include the acquisition of aircraft from the secondary market. In addition, United reached agreement last year to lease-in used A319 aircraft and more recently IAG has reported that it sees second-hand A380s as an attractive opportunity. For some of these carriers, aircraft acquisition strategies which included the consideration of used aircraft were in place when oil prices were at substantially higher levels. While some of this is due to business models and structures that make certain airlines more naturally suitable to consider the operation of mature aircraft, it suggests that a closer look at the fleet replacement decision framework is warranted.

Exhibit 4a: Narrow-body Aircraft Type #1 Replacement Analysis

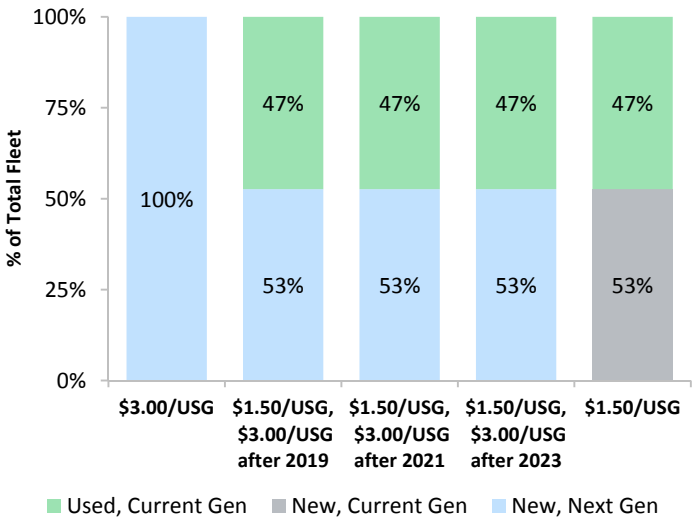
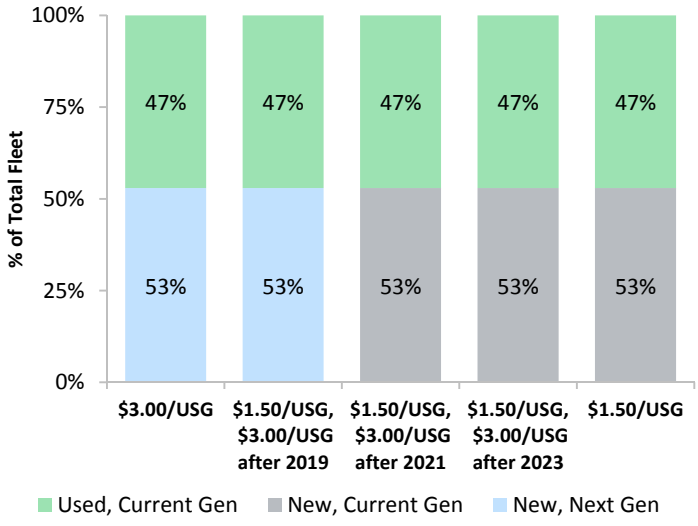


Exhibit 4b: Narrow-body Aircraft Type #2 Replacement Analysis



Source: SkyWorks analysis using SAAV® System.

SkyWorks' track record covers over 10% of the global commercial jet fleet

SkyWorks' Expertise: The Aircraft Investment Lifecycle

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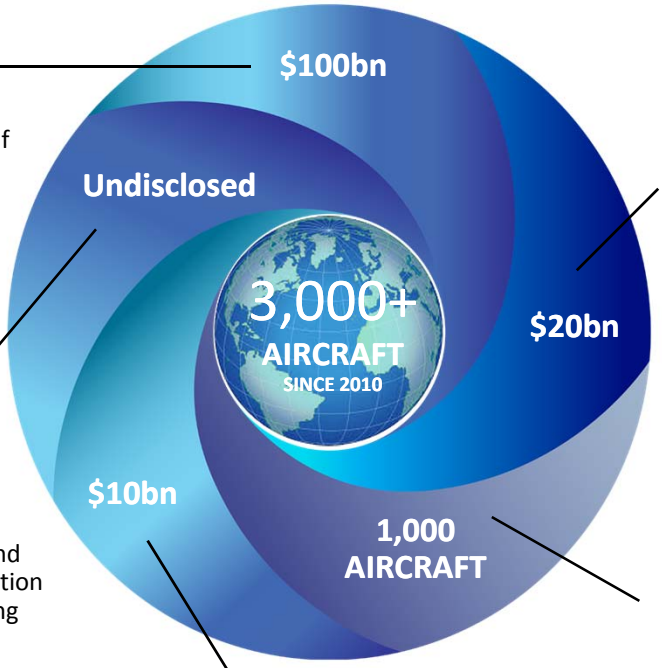
Experience with all major airframe manufacturers; landmark transactions on behalf of AerCap, American Airlines, ICBC Leasing, Japan Airlines, and Southwest Airlines



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