

**Fuel Consumption Analysis of the
Boeing 767-200ER and Airbus 330-200
in Commercial Service when operated
at High Take-off Gross Weight with
Oil at \$100 and \$125 per Barrel**

Prepared for:

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1.0 Summary

The Boeing 767-200ER and the Airbus 330-200 are twin-aisle airline transport aircraft designed for long range, international flights. Both have about the same range, but the A 330 is larger and heavier than the B 767-200ER. For this reason, the A 330-200 consumes more fuel for a given trip and payload than the B 767-200ER. With the cost of oil at \$100 and projected to rise higher, this difference in fuel consumption has a very significant financial impact.

To determine this impact, an analysis was accomplished, using published data, to calculate the additional fuel consumption and the resulting extra cost incurred by a fleet of 179 Airbus 330-200 when compared with the Boeing 767-200ER where both fly similar commercial mission profiles, both fly 750 hours per year over a 40 year service life and both are operated at or near their maximum take-off gross weight.

A previous analysis (documented in a report entitled “Fuel Consumption Analysis of the Boeing 767-200ER and Airbus 330-200 in Commercial Service when operated at High Take-off Gross Weight” dated November 12, 2007) established that:

- The Airbus 330-200 consumes about 24% more fuel than the B 767-200ER. This results in the A 330-200 consuming 2.24 billion gallons more fuel for the projected fleet of 179 aircraft over a 40 year service life at 750 hours per year
- The projected annual percentage increase in fuel cost per gallon based on the trend established over the last 21 years is 5.69% per year. This includes the impact of inflation as projected by OMB.

Two fuel cost levels were used in this analysis. One with oil at \$100 per barrel and one with oil at \$125 per barrel. Taking into account the estimated cost of refining, transportation, storage, handling and uplift into the aircraft results in the following estimated cost per gallon.

- Total cost per Gallon \$3.11 @ \$100/Barrel \$3.71 @ \$125/Barrel

Using these factors, the extra fuel required by a fleet of 179 A 330-200 over the projected 40-year service life costs between \$25.0 and \$29.8 Billion more than with the same size fleet of B 767-200ER aircraft, as shown below:

Total Fuel Cost (179 Aircraft) -- \$ Billion				
	Oil \$/Barrel	B 767-200	A 330-200	Difference with A 330-200
- 750 Hrs/Yr & 40 Yrs	\$ 100	\$103.0	\$128.0	\$ 25.0
- 750 Hrs/Yr & 40 Yrs	\$ 125	\$122.7	\$152.5	\$ 29.8

2.0 Introduction

The Boeing 767-200ER and the Airbus 330-200 are both twin-aisle airline transport aircraft designed for long range, international flights. Both aircraft have about the same range capability, but the A 330 is the larger and heavier of the two aircraft, as shown in the following table.

	A 330-202		B 767-200ER	
	CF6-80E1		CF6-80C2	
Max Range	6,600	NM	6,750	NM
Max TOGW	513,765	Lbs	395,000	Lbs
Max Landing Weight	396,000		284,801	
Wt Empty (OWE)	265,700		184,000	
Useful Load	248,065		211,000	
Passengers				
- 3 class cabin	253		181	
- 2 class cabin	293		224	
Overall Length	192.9	Ft	156.1	Ft
Wingspan	197.8		159.2	
Fuselage Diameter	18.5		16.5	

The increased size and weight of the Airbus 330-200 will cause it to consume more fuel for a given trip and payload than the Boeing 767-200ER.

An analysis documented in a previous report (“Fuel Consumption Analysis of the Boeing 767-200ER and Airbus 330-200 in Commercial Service when operated at High Take-off Gross Weight”, dated November 12, 2007) established the following:

- The additional fuel consumption for a 179-aircraft fleet of A 330-200 when compared with the B 767-200ER where both fly similar commercial mission profiles, both fly 750 hours per year and both are operated at their maximum take-off gross weight at the start of each mission profile and/or their maximum landing weight at the conclusion of each mission profile is shown in the following table.

Total Fuel Consumption (750 Hrs/Yr & 40 Years)

	B 767-200ER		A 330-202	
Average per Hour	1,722	Gallon	2,139	Gallon
Total 750 Hours/Yr	1,291,135		1,604,344	
Difference per Year			313,210	
Total 40 Years	51,645,390		64,173,774	
Difference for 40 Years (1 Aircraft)			12,528,384	
Difference for 40 Years (179 Aircraft)			2,242,580,721	

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- The projected annual percentage increase in fuel cost per gallon based on the trend established over the last 21 years is 5.69% per year. This includes the impact of inflation as projected by OMB.
- The cost of fuel for airline operations includes the cost of the fuel (Jet A) plus the cost of storage, quality control and uplift into the aircraft. The cost of the fuel including the cost of the oil plus the cost of transportation, refining, overhead and profit for the refiner is discussed in the next section. The cost of storage, handling and uplift into the aircraft was analyzed in the referenced study and is estimated to be \$0.32 per gallon.

The previous analysis assumed that the cost of oil would revert to the mean after the temporary spikes caused by hurricane Katrina, the war on terror, etc. It clearly has not and instead the cost of oil per barrel has steadily increased to well above \$100 per barrel (hitting \$106 on March 7). As a result the following analysis was done to determine the financial impact of the very high cost of oil on the additional fuel consumption of the A-330-200 over a 40-year life for a 179 aircraft fleet.

The following analysis examines this cost impact for two oil price levels - \$100 per barrel and \$125 per barrel.

3.0 Jet A Fuel Cost Analysis

The cost of Jet-A fuel is composed of three parts:

- Crude oil
- Refining costs
- Storage, handling and uplift into the aircraft

The cost of the crude oil to be used for this analysis is \$100 per barrel or \$125 per barrel. This translates into a cost per gallon as follows (42 gallons per barrel):

- \$2.38 per gallon (\$100 per barrel)
- \$2.98 per gallon (\$125 per barrel)

The cost to refine the oil was determined by subtracting the cost of the crude oil per gallon from the “spot price” per gallon for home heating fuel as obtained from NYMEX (NY Mercantile Exchange) recent prices. Home heating fuel was used because it is very similar in composition to Jet A and good historical are readily available. During a recent 10 day period in February the spot prices averaged about \$2.79 per gallon while crude oil averaged about \$100 per barrel (\$2.38 per gallon). This yields the following expense to refine one gallon of Jet-A:

- \$0.41 per gallon

The cost store, handle and pump the Jet-A into the aircraft was previously estimated at:

- \$0.32 per gallon

Adding these three cost elements yields the following cost per gallon for Jet-A

<i>Cost of Crude Oil</i>	<i>\$100 per Barrel</i>	<i>\$125 per Barrel</i>
• Crude oil	\$2.38 per Gallon	\$2.98 per Gallon
• Refining cost	\$0.41	\$0.41
• Storage, handling and uplift	\$0.32	\$0.32
• Total cost per Gallon	\$3.11	\$3.71

4.0 Additional Fuel Cost Analysis

The analysis documented in a previous report (“Fuel Consumption Analysis of the Boeing 767-200ER and Airbus 330-200 in Commercial Service when operated at High Take-off Gross Weight”, dated November 12, 2007) established the additional fuel consumed by a fleet of 179 A 330-200 when compared with the same size fleet of B 767-200ER. The analysis showed that the A 330-200 will consume about 24% more fuel than the B 767-200ER. This results in the A 330-200 consuming 2.24 billion gallons more for the projected fleet of 179 aircraft over the planned 40 year service life as shown below.

Total Fuel Consumption (750 Hrs/Yr & 40 Years)

	B 767-200ER		A 330-202	
Average per Hour	1,722	Gallon	2,139	Gallon
Total 750 Hours/Yr	1,291,135		1,604,344	
Difference per Year			313,210	
Total 40 Years	51,645,390		64,173,774	
Difference for 40 Years (1 Aircraft)			12,528,384	
Difference for 40 Years (179 Aircraft)			2,242,580,721	

This analysis assumed that both fly similar commercial mission profiles, both fly 750 hours per year and both are operated at their maximum take-off gross weight at the start of each mission profile and/or their maximum landing weight at the conclusion of each mission profile.

The cost of Jet-A fuel when oil is at \$100 or \$125 per barrel was discussed in section 3.0 and is as follows:

<i>Cost of Crude Oil</i>	<i>\$100 per Barrel</i>	<i>\$125 per Barrel</i>
• Total cost per Gallon	\$3.11	\$3.71

Applying the inflation factor discussed in section 2.0 to the cost per gallon of fuel means the cost of fuel will increase from a nominal \$3.11 or \$3.71 per gallon in 2008 to \$26.95 or \$32.11 forty years later. The impact of this on the fuel budget for a fleet of 179 aircraft flying 750 hours per year is as follows:

Oil at \$100 per Barrel

<i>Budget Summary (40 Yr)</i>	<i>B 767-200ER</i>	<i>A 330-200</i>
Fuel Budget (40 Years)	\$575,582,573	\$715,210,126
Difference (One Aircraft)		\$139,627,553
Difference (179 Aircraft)		\$ 24,993,332,016

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Oil at \$125 per Barrel

Budget Summary (40 Yr)	B 767-200ER	A 330-200
Fuel Budget (40 Years)	\$685,712,408	\$852,055,780
Difference (One Aircraft)		\$166,343,372
Difference (179 Aircraft)		\$ 29,775,463,505

This shows that when oil is between \$100 and \$125 per barrel, a fleet of 179 Airbus 330-200 aircraft will consume between \$25.0 and \$29.8 Billion more fuel than the same size Boeing 767-200ER fleet over the projected 40-year service life.