

## AERO: Forecasting Long-Term Aircraft Demand

Sector Rating: Commercial Aerospace, Overweight

Company Name	Rating	Price	FY EPS		FY P/E	
		05/31/16	2016E	2017E	2016	2017
<b>Commercial Aerospace</b>						
AerCap Holdings N.V. (AER)	1	\$39.09	\$5.95	\$6.50	6.6x	6.0x
Aircastle Ltd. (AYR)	2	21.14	1.75	2.15	12.1x	9.8x
Esterline Technologies Corp. (ESL)	2	67.41	4.45	5.55	15.2x	12.2x
Fly Leasing Ltd (FLY)	1	11.42	1.30	1.95	8.8x	5.9x
LMI Aerospace, Inc. (LMIA)	2	8.42	0.10	0.65	84.2x	13.0x
Rockwell Collins, Inc. (COL)	1	88.40	5.50	5.90	16.1x	15.0x
Spirit AeroSystems Holdings, Inc. (SPR)	1	46.78	4.45	4.70	10.5x	10.0x
The Boeing Company (BA)	2	126.15	8.30	9.50	15.2x	13.3x
Triumph Group, Inc. (TGI)	1 V	37.73	5.27A	4.90	7.2x	7.7x
United Technologies Corporation (UTX)	1	100.58	6.55	7.00	15.4x	14.4x

Source: Company data and Wells Fargo Securities, LLC estimates 1= Outperform, 2 = Market Perform, 3 = Underperform, V = Volatile,  
 \* = Company is on the Priority Stock List NA = Not Available, NC = No Change, NE = No Estimate, NM = Not Meaningful

- **Summary.** We present a *basic* model for forecasting new aircraft demand that is available to clients upon request. The purpose of this model is to show the sensitivities of new deliveries to assumptions for aircraft retirements, economic growth, etc. *We are not making a big macro call on the OEMs' projected production rates*, which appear to be within a reasonable range of possible outcomes--but we do think they require higher average GDP growth and aircraft removal (replacement) rates.
- **Higher Rates Sustainable.** Aircraft deliveries have historically been cyclical, yet Boeing and Airbus have had flat-to-rising deliveries for twelve years--and both forecast higher near-term deliveries. The bottom line is that the OEMs' forecasts can be reasonable in our view, assuming aircraft retirement levels and/or traffic growth are above historical rates. Therefore, we expect higher deliveries over the next several years, but think it is unlikely that the full 35-40% A320/737 production increase currently envisioned by the OEMs will be achieved by 2020.
- **Key Inputs.** Our long-term aircraft demand model shows the sensitivity based on various factors. At the core, demand for planes is driven by GDP growth (leading to traffic growth) plus airplanes removed from service (whether parked, retired, etc.). Aircraft size, utilization, and speed also affect the number of new airplanes needed.
- **Narrowbodies.** Based on near-term traffic growth estimates and the historical 3.6% annual removal rate, 2016-17 delivery projections are clearly supported. In theory, to bring deliveries into balance would require aircraft removal rates of only 2.4% this year and 3.4% in 2017. While the monthly delivery rate increases over the next several years, it does not quite reach the OEM-forecasted 117 per month (57 for Boeing + 60 for Airbus).
- **Widebodies.** Widebody delivery estimates appear to be at greater risk than narrowbodies. If annual removal rates stayed at the 5%+ level as in 2015, it could bring the requirements closer to the production rate announcement, but it would require a sustainable retirement rate well above the historical 3.6% level. We think widebody concerns are broadly recognized.

Please see page 7 for rating definitions, important disclosures and required analyst certifications  
 All estimates/forecasts are as of 06/01/16 unless otherwise stated.

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Together we'll go far



**Summary.** The longevity and predictability of the commercial aerospace cycle is a common discussion for aerospace investors. Aircraft deliveries have historically been cyclical, yet Boeing and Airbus have had flat-to-rising deliveries for twelve years--and both forecast meaningfully higher deliveries in the coming years. As a result, we are often asked what could cause this upward trend to reverse (or at least be less robust).

Most of our company-specific research is “bottoms up,” but with this report we are sharing a more macro-driven forecast to help investors understand the sensitivity of various factors for aircraft demand. While we are not making a big macro call on the original equipment manufacturers’ (OEMs’) projected production rates, the bottom line is that the recent above-trend passenger traffic supports a larger fleet, and the OEM forecasts can be reasonable given higher retirement levels and/or improved economic growth. Therefore, we expect higher deliveries over the next several years, but could see production rates not reaching the full output expected by the OEMs.

As an example, the monthly delivery rate increases over the next several years, but does not quite reach the OEM-forecasted 117 per month (57 for Boeing plus 60 for Airbus). In addition, if our traffic and production supply estimates are right, wide body delivery estimates require a sustainable retirement rate consistently above-historical levels to align supply with demand. We think wide body concerns are well-known.

*We can share this aircraft-demand model with investors that want to see the impact of various inputs.*

## **BASICS OF THE AIRCRAFT FLEET MODELS**

On the following pages we present two aircraft fleet models: one for narrowbodies and one for widebodies. The methodologies for assembling the two models are identical. We considered only *passenger* planes for this analysis, which is reasonable for narrowbodies (there are no in-production narrowbody freighter programs), but slightly problematic for widebodies given the ongoing 777F, 747F, and A330F programs. Still, based on *Ascend* data, only about 5% of all widebodies in the manufacturers’ firm backlog are for freighters--a relatively small consideration.

### **Section 1: GDP & Traffic**

Our forecast of world aircraft demand begins with estimates of world GDP growth. Over the past 25 years, global economic expansion has averaged 3.6%, with a range of (0.1%) (2009) to 5.7% (2007). Looking ahead, our baseline forecast calls for 3.0% growth in 2016 and 3.2% annually thereafter. This is in line with the long-term GDP growth rates assumed by Boeing (3.1%) and Airbus (3.2%) for their twenty-year forecasts.

Traffic growth--measured in revenue-passenger miles (RPMs)--has grown at an average annual pace of 5.3%. This is a 1.5x “beta” (multiplier) of GDP growth. Based on consensus estimates for 2016 GDP and traffic, that beta is currently closer to 2x; our model assumes a continuation of the 1.5x beta, resulting in 4.7% average traffic growth over the next 25 years. This too is in line with the long-term projections of Boeing (4.9%) and Airbus (4.6%).

### **Section 2: Traffic Growth → Fleet Growth**

The growth in the number of aircraft in the world fleet has historically been less than traffic (RPM) growth due to: (1) rising load factors (i.e., an increasing percentage of seats being filled); (2) more efficient aircraft utilization (i.e., more daily hours of flight time); (3) faster aircraft; and (4) an increasing average number of seats per plane.

Over the past 25 years these factors resulted in a sizable gap between average RPM growth (5.3%) and unit fleet size expansion (2.6%). *This was largely a result of vastly superior load factors in 2015 (about 80%) compared to 1991 (65%).* We believe that we could be approaching a low-80s “structural” limit in load factors. Therefore, going forward we expect a much narrower difference between projected traffic growth (4.7%) and fleet size growth (3.7%). This 3.7% estimate is consistent with Boeing’s (3.6%) and Airbus’s (3.7%) long-term projections.

### **Section 3: Deliveries & Removals**

For historical data we queried *Ascend* for annual deliveries and year-end in-service fleet totals; from this we imputed annual aircraft “removals.” These removals consist mostly of aircraft retirements, but would also include passenger aircraft that were converted to freighters; planes that transitioned between “stored” and “in

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service” (net); parked airplanes; and other events such as incidents that cause the plane to be removed from service.

For both narrowbodies and widebodies we found that over the past 25 years the average annual removal rate was 3.6% of the fleet. This seems reasonable based on a typical useful asset life of *around* 25 years. We believe that *near-term* delivery forecasts by Boeing and Airbus suggest a slightly lower narrowbody removal rate (2.5%-3.0%) but a somewhat higher removal rate for widebodies (5%). Given some of the anecdotal evidence we have witnessed (example: AerCap recently sold a 2006-vintage A340 widebody for part-out), we believe the assumption to continue 2015 trends falls within historical ranges. Longer term, our baseline model calls for a 3.5% retirement rate for narrowbodies and ~4% for widebodies.

Now having estimates for fleet growth (Section 2) and removals, we can back into new delivery estimates.

*The key insight – albeit not a new one – is that new delivery forecasts are highly sensitive to the removal-rate assumption.* We note the wide historical range for the annual removal rate: between 1% and 9% for both narrowbodies and widebodies. With an in-service narrowbody fleet of about 14,000 aircraft, a mere 0.5% change in this assumption represents 70 airplanes – or over 7% of our 2016 737/A320 forecast.

**2020E & Sensitivities.** During 2019 Boeing plans to increase 737 production to 57/mo, while Airbus expects to raise A320 production to 60/mo. This means that in 2020 [assuming: (1) 737/A320 rates stay flat; (2) there are only 11-11.5 months of actual production in any given year; (3) there are still ~15 non-passenger 737s built annually; and (4) Bombardier is delivering ~100 CSeries], the OEMs are forecasting around 1,400 new narrow body deliveries.

By contrast, the macro model we show below projects only about 1,100 deliveries. This suggests that, while deliveries are likely to be higher than 2015A’s 965, the full extent of the OEMs’ planned increases may not be realized without some combination of much higher GDP/traffic growth, and/or aircraft removal (replacement) rate.

What would it take to bridge that potential ~300 narrowbody unit difference in 2020?

- (1) a 5.5% annual aircraft removal rates (instead of the current 3.6% baseline estimate); or
- (2) a 6.4% annual traffic growth rate (instead of the current 5.2% baseline estimate); or
- (3) Some combination of (1) and (2) above.

Another way to think of this is how changing fundamental assumptions would change those forecasted 2020 deliveries. If we were to hold the other variables constant...

- (1) Every 0.1% of additional annual 2016-2020 GDP growth translates into 30 additional narrowbody and 9 additional widebodies in 2020;
- (2) Every 0.1x increase in the GDP-to-traffic growth multiplier (“RPM beta”) adds 63 narrowbody and 19 widebody deliveries in 2020;
- (3) Every 0.1% increase in the aircraft removal rate adds 16 narrowbody and 4 widebody deliveries in 2020. Given how the model functions, only the removal rate change in 2020 (i.e., not the cumulative 2016-2020 changes) affects this calculation; this is because removal-rate increases in prior years are offset by higher then-year deliveries.

**TABLE 1. PASSENGER NARROWBODY FLEET MODEL**

	GDP & TRAFFIC			TRAFFIC GROWTH ---> FLEET GROWTH					DELIVERIES & REMOVALS				Narrowbody Fleet (yr-end)
	World GDP	RPM Beta	RPM Growth*	Load Factor*	Utilization hours/day	Speed (mph)	Seats/ plane	Fleet Growth	New Deliveries	Removals	Removal Rate	Planes Added (net)	
1990	3.4%		7.0%	66.4				4.6%	492	194	3.0%	298	6,748
1991	2.6%		(3.3)%	65.3				1.6%	595	490	7.3%	105	6,853
1992	2.3%		12.9%	66.1				5.4%	573	201	2.9%	372	7,225
1993	2.1%		2.5%	65.6				2.0%	384	237	3.3%	147	7,372
1994	3.3%		8.5%	67.5				2.2%	282	123	1.7%	159	7,531
1995	3.3%		11.1%	67.9				1.3%	223	122	1.6%	101	7,632
1996	3.9%		8.1%	69.1				1.2%	225	133	1.7%	92	7,724
1997	4.1%		4.7%	69.8				1.8%	343	206	2.7%	137	7,861
1998	2.5%		3.3%	69.4				4.0%	537	219	2.8%	318	8,179
1999	3.6%		4.8%	69.7				2.3%	633	446	5.5%	187	8,366
2000	4.8%		8.6%	71.5				4.2%	591	237	2.8%	354	8,720
2001	2.5%		(2.8)%	69.9				(2.0)%	631	808	9.3%	(177)	8,543
2002	2.9%		0.0%	71.5				3.5%	495	195	2.3%	300	8,843
2003	4.3%		1.1%	71.7				1.9%	425	260	2.9%	165	9,008
2004	5.4%		14.4%	73.7				3.9%	450	96	1.1%	354	9,362
2005	4.9%		7.0%	74.9				2.0%	510	324	3.5%	186	9,548
2006	5.5%		5.9%	75.7				3.7%	622	266	2.8%	356	9,904
2007	5.7%		7.0%	76.6				4.9%	683	196	2.0%	487	10,391
2008	3.0%		1.7%	75.9				(2.1)%	665	883	8.5%	(218)	10,173
2009	(0.1)%		(1.6)%	75.9				3.2%	755	426	4.2%	329	10,502
2010	5.4%		8.2%	78.0				4.1%	751	323	3.1%	428	10,930
2011	4.2%		7.4%	78.4				3.8%	771	356	3.3%	415	11,345
2012	3.5%		5.2%	78.6				2.6%	850	558	4.9%	292	11,637
2013	3.3%		5.6%	79.0				4.4%	913	405	3.5%	508	12,145
2014	3.4%		5.9%					4.2%	952	437	3.6%	515	12,660
2015	3.1%							5.8%	965	233	1.8%	732	13,392
<b>25yr avg</b>	<b>3.6%</b>	<b>1.5x</b>	<b>5.3%</b>					<b>2.8%</b>			<b>3.6%</b>		
2016e	3.0%	2.0x	6.0%	80.1	9.02	351	162	4.6%	1,093	482	3.6%	611	14,003
2017e	3.2%	1.7x	5.4%	80.2	9.03	351	163	4.0%	1,067	504	3.6%	563	14,565
2018e	3.2%	1.5x	4.8%	80.3	9.05	352	165	3.4%	1,019	524	3.6%	495	15,060
2019e	3.2%	1.5x	4.8%	80.4	9.06	352	166	3.4%	1,055	542	3.6%	513	15,573
2020e	3.2%	1.5x	4.8%	80.5	9.08	353	168	3.4%	1,092	561	3.6%	532	16,104
2021e	3.2%	1.5x	4.8%	80.6	9.09	353	169	3.4%	1,131	580	3.6%	551	16,656
2022e	3.2%	1.5x	4.8%	80.7	9.11	354	171	3.4%	1,171	600	3.6%	572	17,227
2023e	3.2%	1.5x	4.8%	80.8	9.12	354	172	3.4%	1,213	620	3.6%	593	17,820
2024e	3.2%	1.5x	4.8%	80.9	9.14	355	174	3.4%	1,256	642	3.6%	615	18,435
2025e	3.2%	1.5x	4.8%	81.0	9.15	355	175	3.5%	1,301	664	3.6%	637	19,072
2026e	3.2%	1.5x	4.8%	81.1	9.17	356	177	3.5%	1,348	687	3.6%	661	19,733
2027e	3.2%	1.5x	4.8%	81.2	9.18	356	178	3.5%	1,396	710	3.6%	685	20,418
2028e	3.2%	1.4x	4.5%	81.3	9.20	357	180	3.2%	1,381	735	3.6%	646	21,065
2029e	3.2%	1.4x	4.5%	81.4	9.21	357	181	3.2%	1,427	758	3.6%	669	21,733
2030e	3.2%	1.4x	4.5%	81.5	9.23	358	183	3.2%	1,474	782	3.6%	691	22,425
2031e	3.2%	1.4x	4.5%	81.6	9.24	358	184	3.2%	1,522	807	3.6%	715	23,140
2032e	3.2%	1.4x	4.5%	81.7	9.26	359	186	3.2%	1,573	833	3.6%	740	23,879
2033e	3.2%	1.4x	4.5%	81.8	9.27	359	187	3.2%	1,625	860	3.6%	765	24,644
2034e	3.2%	1.4x	4.5%	81.9	9.29	360	189	3.2%	1,679	887	3.6%	791	25,436
2035e	3.2%	1.4x	4.5%	82.0	9.30	360	190	3.2%	1,734	916	3.6%	819	26,254
2036e	3.2%	1.4x	4.5%	82.1	9.32	361	192	3.2%	1,792	945	3.6%	847	27,101
2037e	3.2%	1.4x	4.5%	82.2	9.33	361	193	3.2%	1,852	976	3.6%	876	27,977
2038e	3.2%	1.4x	4.5%	82.3	9.35	362	195	3.2%	1,913	1,007	3.6%	906	28,883
2039e	3.2%	1.4x	4.5%	82.4	9.36	362	196	3.2%	1,977	1,040	3.6%	938	29,821
2040e	3.2%	1.4x	4.5%	82.5	9.38	363	198	3.3%	2,043	1,074	3.6%	970	30,791
<b>25yr avg</b>	<b>3.2%</b>	<b>1.5x</b>	<b>4.7%</b>					<b>3.4%</b>			<b>3.6%</b>		

\* Traffic (RPM - Revenue Passenger Mile) growth and load factors are for all aircraft (not only narrowbodies).  
Ascend criteria: Aircraft Status - In Service; Aircraft Usage - Passenger; Aircraft Type List - Narrowbody (All excluding regional jet types)  
Sources: Bloomberg, Airline Monitor, Ascend (www.ascendworldwide.com), and Wells Fargo Securities, LLC estimates

TABLE 2. PASSENGER WIDEBODY FLEET MODEL

	GDP & TRAFFIC			TRAFFIC GROWTH ---> FLEET GROWTH				DELIVERIES & REMOVALS				Widebody Fleet (yr-end)	
	World GDP	RPM Beta	RPM Growth*	Load Factor*	Utilization hours/day	Speed (mph)	Seats/ plane	Fleet Growth	New Deliveries	Removals	Removal Rate		Planes Added (net)
1990	3.4%		7.0%	66.4				-68.8%	162	47	0.7%	115	2,013
1991	2.6%		(3.3)%	65.3				5.2%	177	73	3.6%	104	2,117
1992	2.3%		12.9%	66.1				6.8%	199	54	2.6%	145	2,262
1993	2.1%		2.5%	65.6				4.9%	187	76	3.4%	111	2,373
1994	3.3%		8.5%	67.5				2.8%	133	67	2.8%	66	2,439
1995	3.3%		11.1%	67.9				4.0%	121	24	1.0%	97	2,536
1996	3.9%		8.1%	69.1				3.2%	136	56	2.2%	80	2,616
1997	4.1%		4.7%	69.8				3.9%	178	77	2.9%	101	2,717
1998	2.5%		3.3%	69.4				2.3%	192	130	4.8%	62	2,779
1999	3.6%		4.8%	69.7				2.5%	212	142	5.1%	70	2,849
2000	4.8%		8.6%	71.5				2.7%	170	93	3.3%	77	2,926
2001	2.5%		(2.8)%	69.9				(3.8)%	168	279	9.5%	(111)	2,815
2002	2.9%		0.0%	71.5				2.2%	140	78	2.8%	62	2,877
2003	4.3%		1.1%	71.7				(1.4)%	122	161	5.6%	(39)	2,838
2004	5.4%		14.4%	73.7				3.8%	122	13	0.5%	109	2,947
2005	4.9%		7.0%	74.9				1.3%	127	89	3.0%	38	2,985
2006	5.5%		5.9%	75.7				1.4%	158	115	3.9%	43	3,028
2007	5.7%		7.0%	76.6				3.4%	167	63	2.1%	104	3,132
2008	3.0%		1.7%	75.9				(0.3)%	156	164	5.2%	(8)	3,124
2009	(0.1)%		(1.6)%	75.9				0.7%	155	133	4.3%	22	3,146
2010	5.4%		8.2%	78.0				2.7%	144	58	1.8%	86	3,232
2011	4.2%		7.4%	78.4				3.5%	176	63	1.9%	113	3,345
2012	3.5%		5.2%	78.6				2.6%	231	143	4.3%	88	3,433
2013	3.3%		5.6%	79.0				4.2%	272	127	3.7%	145	3,578
2014	3.4%		5.9%	<i>rough estimates</i>				4.4%	329	173	4.8%	156	3,734
2015	3.1%		6.4%	80.0	11.00	450	300	3.5%	345	214	5.7%	131	3,865
25yr avg	3.6%	1.5x	5.3%					2.6%			3.6%		
2016e	3.0%	2.0x	6.0%	80.2	11.02	451	302	4.8%	378	193	5.0%	185	4,050
2017e	3.2%	1.7x	5.4%	80.3	11.04	452	303	4.4%	379	202	5.0%	177	4,227
2018e	3.2%	1.5x	4.8%	80.4	11.06	453	305	3.7%	369	211	5.0%	158	4,385
2019e	3.2%	1.5x	4.8%	80.5	11.08	454	306	3.7%	383	219	5.0%	164	4,549
2020e	3.2%	1.5x	4.8%	80.6	11.10	455	308	3.7%	398	227	5.0%	170	4,719
2021e	3.2%	1.5x	4.8%	80.7	11.12	456	309	3.7%	366	189	4.0%	177	4,896
2022e	3.2%	1.5x	4.8%	80.8	11.14	457	311	3.8%	379	196	4.0%	184	5,079
2023e	3.2%	1.5x	4.8%	80.9	11.16	458	312	3.8%	394	203	4.0%	191	5,270
2024e	3.2%	1.5x	4.8%	81.0	11.18	459	314	3.8%	409	211	4.0%	198	5,468
2025e	3.2%	1.5x	4.8%	81.1	11.20	460	315	3.8%	424	219	4.0%	206	5,674
2026e	3.2%	1.5x	4.8%	81.2	11.22	461	317	3.8%	440	227	4.0%	214	5,887
2027e	3.2%	1.5x	4.8%	81.3	11.24	462	318	3.8%	457	235	4.0%	222	6,109
2028e	3.2%	1.4x	4.5%	81.4	11.26	463	320	3.5%	455	244	4.0%	211	6,320
2029e	3.2%	1.4x	4.5%	81.5	11.28	464	321	3.5%	471	253	4.0%	218	6,538
2030e	3.2%	1.4x	4.5%	81.6	11.30	465	323	3.5%	488	262	4.0%	226	6,765
2031e	3.2%	1.4x	4.5%	81.7	11.32	466	324	3.5%	505	271	4.0%	234	6,999
2032e	3.2%	1.4x	4.5%	81.8	11.34	467	326	3.5%	523	280	4.0%	243	7,241
2033e	3.2%	1.4x	4.5%	81.9	11.36	468	327	3.5%	541	290	4.0%	251	7,493
2034e	3.2%	1.4x	4.5%	82.0	11.38	469	329	3.5%	560	300	4.0%	260	7,753
2035e	3.2%	1.4x	4.5%	82.1	11.40	470	330	3.5%	580	310	4.0%	269	8,022
2036e	3.2%	1.4x	4.5%	82.2	11.42	471	332	3.5%	600	321	4.0%	279	8,301
2037e	3.2%	1.4x	4.5%	82.3	11.44	472	333	3.5%	621	332	4.0%	289	8,590
2038e	3.2%	1.4x	4.5%	82.4	11.46	473	335	3.5%	643	344	4.0%	299	8,890
2039e	3.2%	1.4x	4.5%	82.5	11.48	474	336	3.5%	666	356	4.0%	310	9,200
2040e	3.2%	1.4x	4.5%	82.6	11.50	475	338	3.5%	689	368	4.0%	321	9,521
25yr avg	3.2%	1.5x	4.7%					3.7%			4.2%		

\* Traffic (RPM - Revenue Passenger Mile) growth and load factors are for all aircraft (not only widebodies).  
Ascend criteria: Aircraft Status - In Service; Aircraft Usage - Passenger; Aircraft Type List - Widebody (All)  
Sources: Bloomberg, Airline Monitor, Ascend (www.ascendworldwide.com), and Wells Fargo Securities, LLC estimates

***Near-Term Narrowbody Estimates Appear Reasonable***

Using this model framework, we can assess whether our near-term Boeing and Airbus delivery estimates are reasonable. For Boeing, we forecast about 470 passenger 737 deliveries this year, ramping up to 610 in 2019 – a 9% CAGR. [Note: these estimates exclude about 15 annual P-8 (737 derivative) military deliveries]. For Airbus, we forecast this year’s 495 A320-family deliveries also growing to 610 in 2019 – a 7% CAGR. Also, we are including rough estimates of initial Bombardier CSeries deliveries. In all, we forecast 980 narrowbody additions this year, then rising at a 10% CAGR to 1,295 in 2019:

**Table 3. Near-Term Narrowbody Outlook**

	<b>2016E</b>	<b>2017E</b>	<b>2018E</b>	<b>2019E</b>
Narrowbody fleet (start of period)*	13,392	13,890	14,465	15,104
Traffic growth assumption	6.0%	5.4%	4.8%	4.8%
Fleet growth assumption^	4.9%	4.3%	3.7%	3.7%
Historical removal rate	3.6%	3.6%	3.6%	3.6%
Number of new deliveries required implied by model	1,138	1,097	1,056	1,103
Current delivery estimates:				
Boeing 737s	470	505	550	610
Airbus A320s	495	540	560	610
Bombardier CSeries	15	30	50	75
	980	1,075	1,160	1,295
Delivery estimates vs model	(158)	(22)	104	192
Difference as % of fleet	(1.2)%	(0.2)%	0.7%	1.3%
<b>Removal rate required to bring into balance</b>	<b>2.4%</b>	<b>3.4%</b>	<b>4.3%</b>	<b>4.9%</b>

\* 2017-19 based on historical removal rate (3.6%) and prior years' estimated deliveries

^ Assumes 1.1pct lower than traffic growth -- about in-line with Boeing's and Airbus's long-term forecasts.

Sources: *Airline Monitor*, *Ascend (www.ascendworldwide.com)*, and *Wells Fargo Securities, LLC estimates*

Table 3 above suggests that, based on near-term traffic growth estimates and the historical 3.6% annual removal rate, 2016-17 delivery projections are clearly supported. In theory, to bring the model in balance would require aircraft removal rates of only 2.4% this year and 3.4% in 2017.

In 2018-19 the outlook is slightly worse, as we reduce our traffic growth estimate to 4.8% (i.e., approximating the long-term market outlook) and the CSeries volume increases. In those years, this model suggests aircraft removals would need to be in the 4-5% range. This is **not** an unreasonable scenario in our view; recall that the historical range is 1-9%. Still, it suggests that a traffic downturn could result in lower delivery projections – assuming a higher removal rate (which is what we typically see when traffic softens) does not fully offset the traffic impact.

As a side note, our calculation for Boeing’s 2019 deliveries is that we assumed a half year at 52/month and half year at 57/month and then subtracted estimated P-8 deliveries. Should Boeing move to 57/month earlier in the year, it would require modestly higher removal rates.

**Near-Term Widebody Estimates Appear At Greater Risk Than Narrowbodies**

For Boeing, we forecast about 220 passenger widebody deliveries this year, but declining to 205 in 2019 as 787 increases are offset by 747/777 cuts. Our estimates exclude many 767/747/777s freighter deliveries. For Airbus, we forecast an A350-driven widebody ramp-up from ~135 units this year to ~250 in 2019. Airbus is currently deliveries fewer than three A350s/month; in 2018 it expects to be at 14/month (while the A330 remains at 7/mo).

**Table 4. Near-Term Widebody Outlook**

	2016E	2017E	2018E	2019E
Narrowbody fleet (start of period)*	3,865	4,081	4,319	4,553
Traffic growth assumption	6.0%	5.4%	4.8%	4.8%
Fleet growth assumption^	4.9%	4.3%	3.7%	3.7%
Historical removal rate	3.6%	3.6%	3.6%	3.6%
Number of new deliveries required implied by model	329	322	315	332
Current delivery estimates:				
Boeing 747s/767s/777s/787s	220	205	210	205
Airbus A330s/A350s/A380s	135	180	180	250
	355	385	390	455
Delivery estimates vs model	26	63	75	123
Difference as % of fleet	0.7%	1.5%	1.7%	2.7%
Removal rate required to bring into balance	4.3%	5.1%	5.3%	6.3%

\* 2017-19 based on historical removal rate (3.6%) and prior years' estimated deliveries

^ Assumes 1.1pct lower than traffic growth -- about in-line with Boeing's and Airbus's long-term forecasts.

Sources: Airline Monitor, Ascend ([www.ascendworldwide.com](http://www.ascendworldwide.com)), and Wells Fargo Securities, LLC estimates

Table 4 above suggests that wide body delivery estimates – which are mostly projections based on the manufacturers' stated monthly build rates – appear at greater risk than our narrow body forecasts. If annual removal rates stayed at the 5%+ level as in 2015, it could bring the requirements closer to the production rate announcement, but it would require a sustainable retirement rate well above the historical 3.6% level. In other words, if our traffic and production supply estimates are right, it would require a consistently above-average aircraft removal rate to align supply with demand.

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