Bloomberg Intelligence

Global Aerospace Covid-19 Outlook

BI Aerospace & Defense, Global Dashboard


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1. Covid-19 Outlook: Global Aerospace

(Bloomberg Intelligence) -- THESIS: Coronavirus has significantly degraded business conditions for aircraft manufacturers, suppliers and engine makers in 2020 as the extreme decline in travel demand likely leads to lower production rates and less aftermarket maintenance work. Profit and cash flow at Airbus and Boeing will be pressured by a lower build rate, even with six years of backlog for their most profitable, narrow-body planes. Wide-bodies are in worst shape, oversupplied before Covid-19 choked off international travel amid quarantines. Engine and parts makers must contend with reduced demand for new aircraft components and high-margin aftermarket parts, as cash-strapped airlines fighting to survive delay all but necessary maintenance.

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Lessor profits will be depressed as some airlines return aircraft, some fail and few need additional lift. (04/02/20)

Key Topics

Revenue: Virus Lowers Airbus, Boeing Builds

Boeing, Airbus 2020 Builds Miss Targets, Airlines Defer on Virus

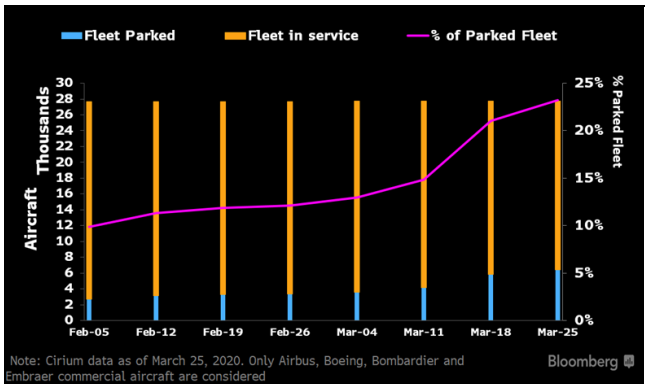
Revenue at Boeing, Airbus and Embraer will be lower than expected in 2020 as Covid-19 crushes air-travel demand and airlines put off new-aircraft deliveries as they manage cash and struggle to survive. The rebound in production rates will likely lengthen as slower economic growth due to social-distancing prolongs airline recoveries. (03/30/20)

2. Excess Airline Capacity on Virus Fears

Airframers' delivery plans will be lowered in 2020 as coronavirus batters demand for flying and airlines park planes, keeping fleets in surplus into 2021. Though it's still early, most European and U.S. airlines have cut capacity by more than 70% as we approach April, and this will likely persist into at least May. Past that, even if the market begins to recover, the ramp-up in demand takes time as customers get comfortable with flying in the era of Covid-19.

Airlines will be strapped for cash after significantly curtailing flights, and that cash crunch will be larger the longer there is an extreme decline in capacity, hurting the ability and desire to take new aircraft. Given the depth of airline cuts and the breadth of carriers affected, it's hard to see how manufacturers deliver much more than 50% of planned 2020 output. (03/30/20)

Parked Aircraft



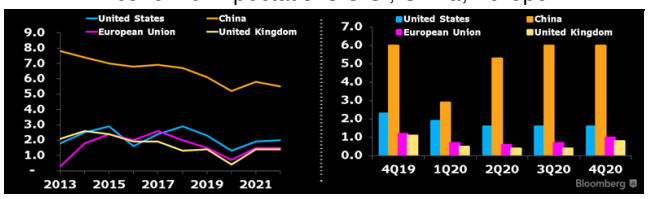
Source: Cirium, Bloomberg Intelligence

3. Recession a Blow to Airbus, Boeing Deliveries

The economic impacts of Covid-19 are intense as social distancing has throttled activity extensively in the world's largest markets, which will have a punishing effect on airlines once virus concerns fade. It's likely that the economic damage will push Europe -- and possibly the U.S. -- into recession and significantly slow Chinese growth, putting a second hit on travel demand and slowing its recovery. This subsequent damage to demand will likely extend the recovery period for airline earnings, depressing demand for new aircraft from Boeing and Airbus and prolonging the rebound in shipments.

The extent to which Covid-19 has spread seems to indicate no major economy will be spared, making it harder to find markets that need additional airplanes after a decade of rising production rates. (03/30/20)

Economic Expectations U.S., China, Europe



Source: Bloomberg Intelligence

4. Coronavirus Affects Most Narrow-Body Markets

Narrow-body deliveries should miss stated rates in 2020, in our view. Airbus will have difficulty delivering its target of 60 aircraft a month. Boeing has no guidance, so it could ramp up builds more slowly or flex workers to ready its inventory of 400 parked 737 Max aircraft. Cirium's data show 324 Boeing planes scheduled to be delivered in 2020, likely coming from both parked aircraft and new builds. Over one-third of the aircraft listed to be delivered in Cirium's database are going to Southwest, United, Ryanair, SpiceJet and American, all hard-pressed right now.

Airbus shows 555 deliveries total, with the best prospects for 77 going to various airlines in China, though Cirium reports a 60% decline in daily hours and usage per aircraft in that country in late March. Cirium shows about 17 Boeings to China in 2020. (03/30/20)

Expected 2020 Narrow-Body Deliveries

Airlines	Boeing 737 Max Family	Airlines	Airbus A320 Family
Total	324	Total	555
Southwest Airlines	42	IndiGo	32
United Airlines	20	Delta Air Lines	27
Ryanair	20	Frontier Airlines	17
SpiceJet	16	Azul	16
American Airlines	13	Pegasus	16
Smartwings	10	American Airlines	15
Turkish Airlines	9	Lufthansa	15
Air Canada	9	Spring Airlines	15
flydubai	9	China Eastern Airlines	14
China Southern Airlines	7	Wizz Air	14
VietJet Air	6	China Southern Airlines	13
Avolon	6	JetBlue Airways	13
Alaska Airlines	6	AirAsia	12
GOL	6	GoAir	12
Pobeda	6	Spirit Airlines	12
AerCap	5	Turkish Airlines	11
GECAS	5	Qatar Airways	10
Aerolineas Argentinas	5	TAP Air Portugal	10
Caribbean Airlines	5	S7 Airlines	9
SunExpress	5	Loong Air	9
Ural Airlines	5	Middle East Airlines	9
Air China	4	Volaris	9
Air Europa	4	Air China	8
S7 Airlines	4	Gulf Air	8
WestJet	4	SWISS	8
LOT Polish Airlines	4	EasyJet	8
Oman Air	4	Egyptair	8
Shanghai Airlines	4	VivaAerobus	8
TUIfly	4	Vueling Airlines	8
Norwegian Air Sweden	3	VietJet Air	7
Shenzhen Airlines	3	AerCap	7
Aviation Capital Group	3	British Airways	7
Boeing	3	Vistara	7
CDB Aviation	3	SAS	7
Copa Airlines	3	HK Express	7
Lucky Air	3	Sichuan Airlines	7
SilkAir	3	Chinese Airlines	13
Other	53	Other	125

Cirium data as of 3/26/20

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5. Wide-Body Deliveries Hurt Most on Restrictions

Wide-body aircraft are likely to be much more interrupted as governments control access across borders longer to limit the spread of the coronavirus. Qatar Airways has the largest number in the 2020 delivery book that could be delivered, with more potentially pulled forward. We could also see deliveries continuing or being advanced for freight operators FedEx and UPS. The most important airliners to Boeing and Airbus -- the 787 and A350 -- don't have a primary freight function, and the airlines scheduled to take them, including United, American, ANA, Delta, IAG subsidiaries and others, will likely defer deliveries as they wait for borders to reopen and demand to improve.

Even China, which should be first to emerge from the virus, probably won't want many wide-bodies given global restrictions. (03/30/20)

Expected Wide-Body Deliveries 2020

Airline	747	767	777	787	Boeing Widebodies	A330	A350	A380	Airbus Widebodies	Total Widebodies
Grand Total	6	31	31	141	209	24	85	4	113	322
Qatar Airways				6	6		15		15	21
FedEx		15	5		20					20
China Southern Airlines			3	5	8		6		6	14
British Airways			4	6	10		4		4	14
United Airlines			1	12	13					13
Turkish Airlines			1	6	7		5		5	12
American Airlines				12	12					12
Singapore Airlines				3	3		8		8	11
United States Air Force		11			11					11
ANA-All Nippon Airways				9	9			1	1	10
Aeroflot Russian Airlines			2		2		7		7	9
Air Europa				9	9					9
Delta Air Lines						5	2		7	7
China Eastern Airlines							6		6	6
Iberia							6		6	6
UPS Airlines	5	1			6					6
All Others	1	4	15	73	93	19	26	3	48	141

Cirium Data as of 3/27/20 Bloomberg

6. Deliveries Fall for Regional Aircraft Makers

Regional aircraft makers Embraer, Bombardier and ATR face the same challenges as Boeing and Airbus, with customers looking to defer aircraft until at least 2021, hurting deliveries and revenue in 2020. The largest customers for these smaller commercial jets are U.S. regional airlines, which are likely to fly a lot less this year. Over the medium term, we believe U.S. mainline carriers, such as United, American and Delta, will want more regional flying because lower traffic makes smaller aircraft more desirable for many markets.

We believe scope clauses in pilot contracts, which regulate the size and number of aircraft that can be flown for mainline airlines, could be lifted during current contract negotiations, spurring even more demand for regionals. (03/30/20)

Regional Aircraft Backlog

	ATR	Bombardier CRJ900	Embraer E175	Embraer E190	Embraer E195	Total
Total	228	18	178	22	137	583
Republic Airways			100			100
Azul	5				61	66
Nordic Aviation Capital	37					37
AerCap					30	30
FedEx	30					30
SkyWest Airlines			26			26
IndiGo	25					25
KLM Cityhopper					21	21
Mesa Airlines			20			20
Unannounced commercial customer	2		15			17
Lion Air	16					16
Air Peace					13	13
Aircastle				5	7	12
Envoy Air			11			11
Avianca Argentina	10					10
Silver Airways	10					10
Helvetic Airways				9		9
Jazz		9				9
All Others	93	9	6	8	5	121

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Costs: Scale Economies Fall With Build Rates

Aerospace Manufacturers Costs Rise as Production Rates Fall

Costs for aerospace manufacturers will rise as build rates fall on fewer airplane deliveries and less maintenance. The extreme decline in air traffic and severe cash crunch at airlines will lead to deferrals of new aircraft and maintenance. After interruptions this year, we expect delivery rates to be lowered in 2021, hurting economies of scale. (04/09/20)

7. Economy of Scale Fades, Inefficiencies Rise

Aerospace manufacturers such as Boeing, Airbus, Embraer, General Electric, Spirit Aerosystems, Raytheon Technologies, Safran and MTU will certainly pay higher costs in 2020 as lower volume hurts economies of scale. We expect new-aircraft delivery rates will suffer significantly in 2Q-3Q -- with 2Q likely near zero -- as the coronavirus effects spread globally, crushing air-travel demand and putting airlines in survival mode. Airlines will defer as much as possible as they focus on retaining cash, which will hurt manufacturers' ability to deliver planes and suppliers to follow suit on components.

The shutdown of factories due to illness -- or even the specter of infection -- will also make it difficult to deliver aircraft or components at anywhere near expected build rates. (04/09/20)

Airbus and Boeing Planned Production Rates

Airbus						Boeing						
Announced	Effective	A320	A330	A350	A380	Announced	Effective	737	767	777	787	747
Jan 2012	2012	42	9.5	-	2	Dec 2014	Sep 2015	-	-	-	-	1.3
Feb 2011	2Q 2013	-	10	-	-	-	2015	-	1.5	-	-	-
						June 2015	Mar 2016	-	-	-	-	1
July 2014	Nov 2015	-	-	5	-	Sep 2015	1Q 2016	-	2	-	-	-
Oct 2014	4Q 2015	-	9	-	-	Jan 2016	Mid 2016	-	-	-	12	-
2010	Jan 2016	A320 neo enters service										
Feb 2015	Q1 2016	-	6	-	-	Jan 2016	Sep 2016	-	-	-	-	0.5
Feb 2014	Spring 2016	46	-	-	-	Jan 2016	Jan 2017	-	-	7	-	-
Feb 2015	Q2 2017	50	-	-	-	Oct 2013	3Q 2017	47	-	-	-	-
Feb 2016	H2 2017	-	7	Cancelled		Dec 2016	Aug 2017	-	-	5	-	-
July 2016	2018					Sep 2015	Late 2017	-	2.5	-	-	-
	Late 2018	A330 neo enters service										
Feb 2015	Jan 2019	-	4	10	-	May 2016	Jan-18	-	-	3.5 (2)	-	-
July 2017	Jan 2019				0.66	Oct 2014	2018	52	-	-	-	-
Oct 2015	Mid 2019	60	-	-	-	Jan 2016	2019	57	-	-	-	-
Jan 2020	Immediately		3.33	9-10		Oct-17	2019	-	-	-	14	-
Latest Rate		60	3.33	9-10	0.66	Latest Rate		0 (1)	3	3 (2)	12	0.5
May 2015	2021	63 (1)	-	-	-	Apr-18	2020	-	3	-	-	-
						Oct-19	2020	-	-	3 (2)	12	-
						Jan-20	2021	57(?)	-	-	10	-
						Jan-20	2023	-	-	-	12	-
						Oct-19	2021	777X Enters Service				

(1) With increases of 1 to 2 a year after 2021 discussed on Q419 earnings call

(1) Temporary cut from 52 to 42 on April 5th, 2019 then to 0 December 16, 2019
(2) effective rate in transition to the 777X

Notes: A320 and 737 include each manufacturer's family of narrowbody aircraft

Source: Boeing, Airbus, Compiled by Bloomberg Intelligence

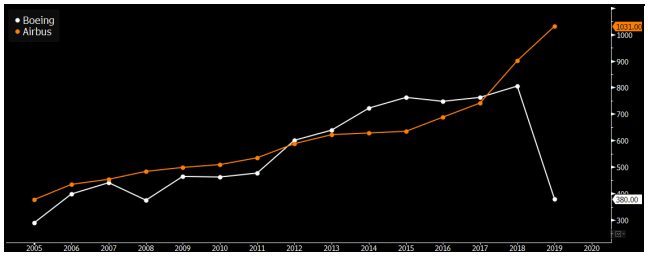
Source: Bloomberg Intelligence

8. Production Cuts in 2021; Investments Stranded

Build rates at Airbus, Boeing and Embraer likely will decrease over the medium term due to the effects of Covid-19 on global airlines, trimming margin and cash generation gains seen at aerospace manufacturers over the past decade. It's likely a number of airlines will fail and even more see significant degradation in financials, hurting the ability or desire to take additional aircraft. We expect this reduced demand to lead to production-rate declines well below the targeted 60 a month at Airbus and 57 at Boeing.

Rates in 2021 are likely to be much closer to 40 a month, with effects cascading through suppliers such as Safran, Raytheon, Spirit and Triumph. Costs to expand in recent years work against companies as excess capacity sits idle, denting margins. (04/09/20)

Airbus and Boeing Historical Build Rates



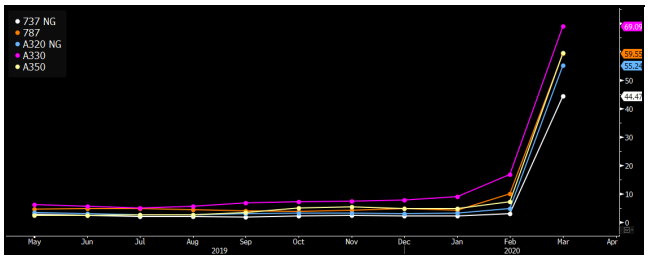
Source: Bloomberg Intelligence

9. Overhead Costs Rise as Throughput Falls

Supplier costs will rise as demand for spares and services falls on significantly less air travel and a greater number of older aircraft being torn down for parts, which hurts throughput and increases overhead. Strong profit and cash flow at component and engine suppliers including GE, Raytheon, MTU, Safran and Rolls-Royce over the past years have been largely driven by robust traffic trends, which in turned fueled maintenance work. We believe global traffic growth won't be back to 2019 levels until mid-2021 at best.

This decline in flying, combined with a rising supply of cheaper spare parts as aircraft are dismantled, will significantly impede the group. We believe these effects will only be partially offset by a decreasing volume of new parts, which typically earn lower margins. (04/09/20)

Parked Fleet End of March



Source: Bloomberg Intelligence

Supply Chain: Aerospace Suppliers Disrupted

Aerospace Supply Chain Rattled, Offset by Aircraft Deferrals

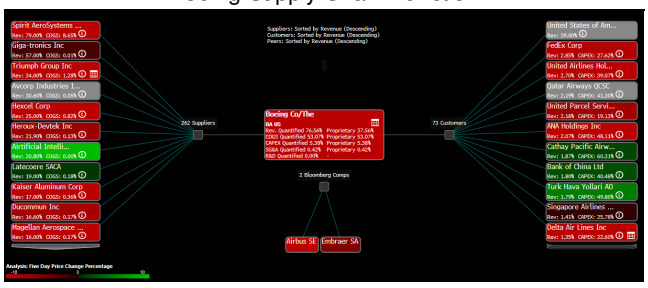
Aerospace supply chains will remain disrupted by Covid-19, mitigated in the near term by lower build rates as airlines defer aircraft. Longer term, difficulty replacing failed suppliers could have a multiyear ripple effect through the industry. (04/07/20)

10. Weak Supply-Chain Diversity Hurts Aerospace

Aerospace supply chains will be challenged by their global scope and a lack of redundancy. Much of the aerospace supply chain is single-source and geographically diverse, given small volume and rigorous standards, amplifying the effects of an interruption. Boeing and Airbus count on a handful of suppliers such Spirit Aerosystems, United Technologies, Safran, Honeywell, General Electric, Rolls-Royce and MTU for many of the components used to build aircraft. We expect interruptions in manufacturing to occur throughout the chain as the coronavirus forces factories to close for cleaning and to redefine work flow to keep employees safe.

The effects will be mitigated as airlines slow deliveries, shed capacity and preserve cash. Final-assembly plant closures also help reduce the need. (04/07/20)

Boeing Supply Chain Function



Source: Bloomberg Intelligence

11. Smaller Suppliers Crushed as Cash Flow Falls

The largest challenge in the global aerospace supply chain will be loss of smaller, less financially stable companies. These supply chains, especially for engine makers, are full of modestly sized shops that produce small-lot components. Many serve the automotive industry, too, and will likely see decreased demand from both sectors. Lacking the financial wherewithal to survive an extended downturn, a number of them will fail unless they get support from larger manufacturers or governments.

Some suppliers must manage stranded investments after spending to prepare for higher production rates that

may not happen for some time. In an extended downturn, these companies could fold, forcing higher-tier manufacturers to find new suppliers, which will take time and lead to interruptions and delays. (04/07/20)

Airbus and Boeing Production Rates

Airbus						Boeing						
Announced	Effective	A320	A330	A350	A380	Announced	Effective	737	767	777	787	747
Jan 2012	2012	42	9.5	-	2	Dec 2014	Sep 2015	-	-	-	-	1.3
Feb 2011	2Q 2013	-	10	-	-	-	2015	-	1.5	-	-	-
						June 2015	Mar 2016	-	-	-	-	1
July 2014	Nov 2015	-	-	5	-	Sep 2015	1Q 2016	-	2	-	-	-
Oct 2014	4Q 2015	-	9	-	-	Jan 2016	Mid 2016	-	-	-	12	-
2010	Jan 2016	A320 neo enters service										
Feb 2015	Q1 2016	-	6	-	-	Jan 2016	Sep 2016	-	-	-	-	0.5
Feb 2014	Spring 2016	46	-	-	-	Jan 2016	Jan 2017	-	-	7	-	-
Feb 2015	Q2 2017	50	-	-	-	Oct 2013	3Q 2017	47	-	-	-	-
Feb 2016	H2 2017	-	7	Cancelled		Dec 2016	Aug 2017	-	-	5	-	-
July 2016	2018				1	Sep 2015	Late 2017	-	2.5	-	-	-
	Late 2018	A330 neo enters service										
Feb 2015	Jan 2019	-	4	10	-	May 2016	Jan-18	-	-	3.5 (2)	-	-
July 2017	Jan 2019				0.66	Oct 2014	2018	52	-	-	-	-
Oct 2015	Mid 2019	60	-	-	-	Jan 2016	2019	57	-	-	-	-
						Oct-17	2019	-	-	-	14	-
Latest Rate		60	4	10	0.66	Latest Rate		42 (1)	2.5	3.5 (2)	14	0.5
May 2015	2021	63	-	-	-	Apr-18	2020	-	3	-	-	-
						Oct-19	2020	57	-	3 (2)	12	-
						Oct-19	2021	777X Enters Service				
						(1) Temporary cut to 42 from 52 announced on April 5th, 2019						
						(2) effective rate in transition to the 777X						

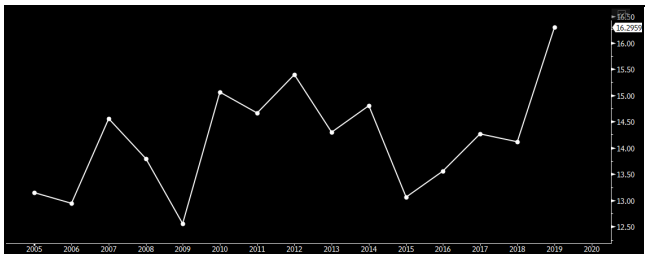
Source: Bloomberg Intelligence

12. High Standards Slow New Aerospace Suppliers

Aviation manufacturing requires high standards and certification, slowing the entrance of suppliers and lengthening the recovery time from downturn-induced failures. Tight manufacturing tolerances typically require investment in expensive machine tools and trained operators. Products are built to demanding specifications amid stringent regulatory oversight, which creates a barrier to entry and thwarts competition. It will likely take several years to return to production rates seen just before this downturn.

Diminished build rates likely equate to lower returns on investments in machine tooling and could lead to increased cost of components, hurting profitability up the supply chain. (04/07/20)

Supplier Ebitda Margins



Source: Bloomberg Intelligence

Lessors, ABS Roiled on Excess Aircraft

Aviation Lessors, Banks See Profit Fall on Less Aircraft Demand

Aircraft Lessors and aviation bankers will see lower profit and revenue in 2020 as a surplus of aircraft reduces new deliveries and financings, while existing customers have difficulty paying bills, leading to idle assets, forbearance and repossessions. The largest public lessors are Air Lease, Aercap and BOC Aviation. (04/02/20)

13. Returns, Repossessions, Forbearance to Clip Returns

Profit for aircraft lessors and lenders will fall in 2020 as failing airlines, aircraft returns and lower lease rates reduce revenue and boost nonperforming assets. Even the strongest global airlines are cutting flights to survive

extreme demand declines caused by the pandemic and we don't expect airlines to be flying at 80% of 2019 levels by year-end. Less flying will increase the number of aircraft coming off lease, reduce demand for new ones, and encourage forbearance, lease holidays and reduced lease rates. Failing airlines will compound the drag as lessors and bankers repossess aircraft. Aircraft asset-backed securities (ABS) will suffer as nonperforming assets decrease deal cash flow. We don't expect new ABS deals until demand improves significantly, hurting lessors' ability to manage portfolio concentration and risk. (04/02/20)

Air Lease, BOC Aviation and Aercap Performance

Source: Bloomberg Intelligence

Wide-Bodies Most Impacted by Virus

Wide-Body Aircraft Hit Harder by Coronavirus Than Narrow-Bodies

The coronavirus will likely hit wide-body aircraft significantly more than narrow-bodies, given a supply glut for the former, and our expectations for international travel to remain restricted longer than domestic flights as countries try to contain the virus' re-emergence. The Boeing 777 and Airbus A330 face the greatest pressure. (04/06/20)

14. Wide-Body Orders Crushed by Coronavirus

Wide-bodies are likely to garner very few orders in 2020 and we wouldn't be surprised to see a negative book-to-bill as airlines cancel orders and production rates fall. Covid-19 has hurt twin-aisle aircraft even more than single-aisle given heavier restrictions on overseas flights, and we see intra-country quarantine requirements as last to be lifted. Compounding the challenge, prior to the pandemic, order books were suffering on oversupply, which was seen in weak long-haul fares. We expect slowing global GDP will continue to depress long-haul travel after the pandemic, which may be worse and linger longer in the developing world. Longer-range narrow-bodies such as the Airbus A321 and Boeing Max-9 likely will continue to take market share from wide-bodies, especially as demand shrinks in many markets. (04/06/20)

Wide-Body Book-to-Bill for 2019 (YTD)

	Airbus	Boeing (1)
Wide-Body Aircraft Net Orders YTD	51	107
Wide-Body Aircraft Deliveries YTD	147	224
Wide-Body Aircraft Book-to-Bill	0.3	0.5
Total Net Orders Year-to-Date	718	56
Total Deliveries Year-to-Date	725	345
Expected 2019 Deliveries	860	368
Expected Deliveries in January 2019	880 - 890	895 -905

Data as of December 11th, 2019. Data from companies websites (1) ASC 606 Changes are not considered

Source: Bloomberg Intelligence

15. Boeing 787, Airbus A350 Likely See Rate Cuts

The 787 and A350 were being built above sales rates before the coronavirus and despite adjustments to Boeing's 787 production rate, we believe there's high potential for cuts for both. Of particular concern is the concentration at struggling Emirates, which is dependent on long-haul flights. India is an important market for Emirates, making the airline vulnerable should the virus significantly affect the country. Further concentrations at Lufthansa, United, Singapore and American, which are preserving cash to survive the downturn, increase the likelihood for deferrals and rate cuts.

The 787 and A350 are the most produced wide-bodies at Boeing and Airbus, and while margins are below that of the narrow-bodies, the size of the order book and build rates could bring strong margins and cash flow. (04/06/20)

Orders for 787, A350 by Operators

Operators	787-10	787-9	787-8	A350-1000	A350-900	Grand Total	Share
Emirates Airline		30			50	80	7.3%
United Airlines	2	10			45	57	5.2
Qatar Airways		23		27		50	4.5
Etihad Airways	22	11		16		49	4.4
Singapore Airlines	29				19	48	4.4
Lufthansa		20			27	47	4.3
American Airlines		25	21			46	4.2
Air France - KLM	10	1			34	45	4.1
International Airlines Group (IAG)	12			13	18	43	3.9
Turkish Airlines		14			25	39	3.5
Korean Air	20	10				30	2.7
Japan Airlines				13	13	26	2.4
Unannounced commercial customer	12	16	7			35	3.2
Other Operators	38	175	21	65	209	508	46.1
Grand Total	145	335	49	134	440	1,103	

Only firm orders are considered.
Cirium data as of April 3, 2020.

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16. Boeing 777, Airbus A330 Smallest Backlog

Airbus and Boeing's most profitable wide-bodies, the A330 and 777, entered 2020 short on orders and running the largest risk of a rate cut. We expect the coronavirus pandemic to add to that difficulty. Both programs contribute close to double-digit profitability, yet are waning. Boeing adjusted its monthly build rate on the 777 to three, from 3 1/2 as it transitions to the 777x. Both the size and concentration to Middle East carriers makes us believe a further cut is likely with no strong bounceback on the horizon.

The A330 has five years of backlog, though we would characterize 40% of it from AirAsia X (78) and Iran Air (36) at risk. AirAsia X is managing weak profitability and has just parked the majority of its fleet after not taking an airplane in four years. Iran Air can’t take deliveries due to renewed U.S. sanctions. (04/06/20)

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Latest Rate		60	3.33	9-10	0.66	Latest Rate		0 (1)	3	3 (2)	12	0.5
May 2015	2021	63 (1)	-	-	-	Apr-18	2020	-	3	-	-	-
						Oct-19	2020	-	-	3 (2)	12	-
						Jan-20	2021	57(?)	-	-	10	-
						Jan-20	2023	-	-	-	12	-
						Oct-19	2021	777X Enters Service				

(1) With increases of 1 to 2 a year after 2021 discussed on Q419 earnings call

(1) Temporary cut from 52 to 42 on April 5th, 2019 then to 0 December 16, 2019
(2) effective rate in transition to the 777X

Notes: A320 and 737 include each manufacturer's family of narrowbody aircraft

Source: Boeing, Airbus, Compiled by Bloomberg Intelligence

Source: Bloomberg Intelligence

17. Boeing 777, Airbus A350 Largest Survivors

The number of markets served by the new, larger 777 is rapidly diminishing, which could continue for years, due to Covid-19. We expect shrinking air-travel demand and slower growth as economies recover from the pandemic. This will cut the average size needed for a long-haul airplane. Also, the concentration of 777s at Emirates and Qatar is a challenge as the aircraft serve long-haul fliers between India, Southwest Asia and Europe, regions likely to be hampered by travel restrictions for at least the rest of 2020. About 54% of Boeing's 777 backlog is to Gulf carriers, with almost 32% at Emirates.

We expect the pandemic to hasten parking of the A380 and 747 passenger aircraft. The 777 and A350 are likely to survive yet fewer will be flown. (04/06/20)

Gulf Carriers' Order Books

	777	787	A330	A350	Total
United Arab Emirates	140	63		66	269
Emirates Airline	115	30		50	195
Etihad Airways	25	33		16	74
Qatar	65	23		27	115
Qatar Airways	65	23		27	115
Iran			36	16	52
Iran Air			36	16	52
Other Middle East Countries		29	50	36	115
Grand Total	205	115	50	129	499
Percentage of Backlog	55%	22%	15%	22%	28%

Only firm orders are considered. "Other Middle East Countries" includes Kuwait, Iraq, Israel, Lebanon, Oman, Saudi Arabia, and Yemen.

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18. Airbus A350 Could Gain on Chinese Backlog

The trade dispute and slowing GDP growth were hurting Boeing's Chinese wide-body orders before the pandemic and could give the Airbus A350 an advantage as travel restrictions unwind. China had the virus first and could lead the way out, though we are still concerned international flights will be restricted much longer than domestic as governments protect against reinfection. Chinese carriers have significantly more orders for the A350 than Boeing's 787 and 777, a relationship significantly different in other regions. The region's 777 order book could be at risk for deferral or cancellation as Cathay Pacific and Hong Kong Airlines were struggling amid unrest before the pandemic.

The A330 runs similar risks with a large order to financially struggling Hong Kong airlines and no large order book at other carriers. (04/06/20)

Chinese Wide-Body Orders

Operators	777	787	A330	A350	Total
Cathay Pacific	21			12	33
Air China		1	2	20	23
China Southern Airlines	3	5		14	22
China Eastern Airlines				13	13
Hong Kong Airlines	6		4		10
Sichuan Airlines				10	10
Ruili Airlines		6			6
Hainan Airlines		4	1	1	6
Others		18	6	1	25
Total	30	34	13	71	148
Percentage of Backlog	8%	6.4%	4%	12.4%	8.2%
Unknown Country	10	35	44		89
With Unknown Country	10.6	13%	17.4%	12.4%	13.1%

Only aircraft on firm order are considered.
Cirium data as of April 3, 2020.

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Engine-Makers Profit Dims on Cash Crunch

Engine-Makers' Profits Fall as Virus Dents High-Margin Spares

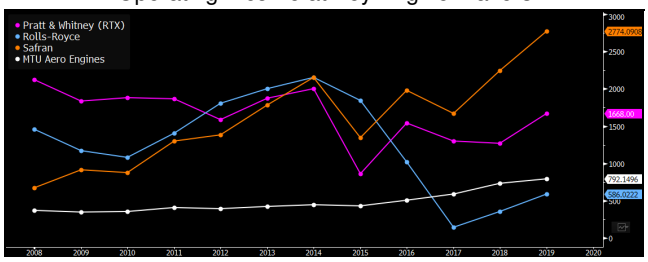
Engine-makers' strong results will fall victim to the coronavirus as airlines conserve cash in a fight for survival. Large numbers of aircraft are being parked as demand falls significantly, while airlines will cancel repairs and use planes that don't need maintenance. We expect surplus airplanes to be torn down for usable spare parts. (04/15/20)

19. Engine Makers See About-Face as Travel Falls

Engine makers will be hurt significantly by falling air traffic as a result of the coronavirus. Rising profit and operating margin at General Electric's engine business, Raytheon Technologies' (formerly United Technologies) Pratt and Whitney division, Rolls-Royce, Safran and MTU have been driven in large part by healthy airline capacity growth over the past four years, as carriers flew everything they had. Then the 737 Max grounding left many airlines flying older planes. With the extreme decline in demand and airlines fighting for survival, they'll defer maintenance and park aircraft.

As these aircraft exit fleets, they'll likely be torn down for usable parts, hurting the manufacturers even more. (04/15/20)

Operating Income at Key Engine Makers



Source: Bloomberg Intelligence

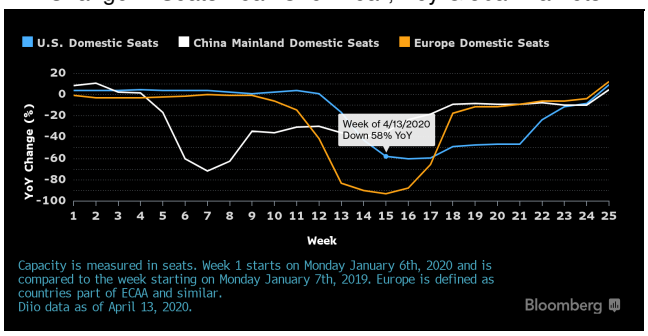
20. Spare-Parts Business Declines on Parked Fleet

We expect spare parts and maintenance demand to fall more than 50% in the short run as airlines have parked significant portions of their fleets amid the precipitous decline in flying. With airlines intensely protecting cash, demand for overhaul work and spare parts will tumble. We expect carriers will put aircraft needing heavy maintenance back in the hangar for now, which won't be difficult as Europe has parked over 80% of its fleet and

the U.S. 40%. We expect the U.S. number to grow. Engine manufacturers with maintenance businesses, such as MTU, and airlines with significant outside repair work, including Lufthansa, will see results hurt -- albeit less due to lower margins -- from reduced shop visits.

Many airlines, such as Air France, Delta, American and IAG, farm out some maintenance work. (04/15/20)

Change in Seats Year-Over-Year, Key Global Markets



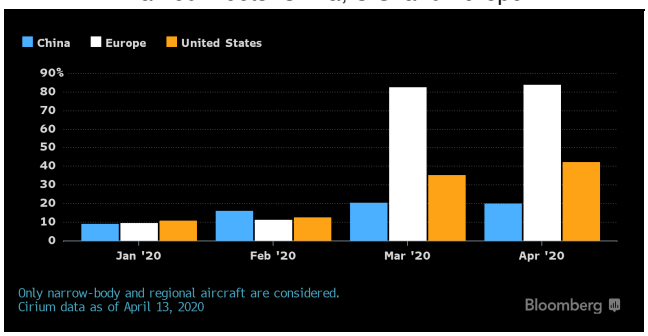
Source: Diio, Bloomberg Intelligence

21. Grounding Leads to Tear-Downs, Hurts Spare Parts

Aircraft tear-downs, which harvest usable parts, are likely to rise, squeezing new spare-part demand further and pressuring engine-makers' margins. Airlines will likely return planes to lessors and other financial interests due to much lower demand for flying, boosting the number of tear-downs. Carriers are also likely to cannibalize parked aircraft, maximizing the value of owned assets and reducing the purchase of new parts. The age of the average tear-down is likely to fall, especially as financial owners attempt to salvage returns through used-part sales.

The increase in used materials will hurt demand for new and overhauled components. Companies that make engines, landing gear and seats, such as Safran, and those that sell carbon brakes will see declining demand across the spectrum of offerings. (04/15/20)

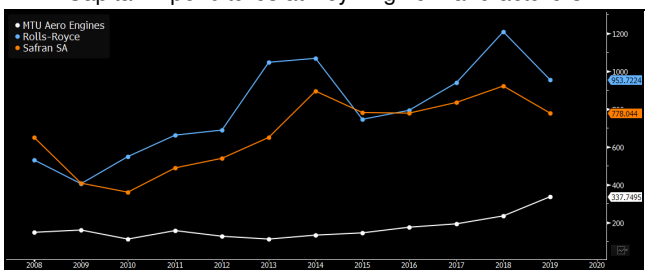
Parked Fleets: China, U.S. and Europe



22. Stranded Investment Drags on Profit Margins

As Boeing and Airbus lower production rates, new-engine manufacturers will build fewer loss-making powerplants that dilute profit and margins. All the engine manufacturers were recently investing to increase production capacity as airframers planned to boost output of narrow-bodies into the 60s and potentially beyond. Some of this investment was slowed in 2019 as the Boeing Max was grounded and bottlenecks were inconsequential. For the next several years, we expect deliveries well below targets of 57 a month at Boeing and 63 at Airbus. Recent investments will likely be stranded, hurting financial performance. (04/15/20)

Capital Expenditures at Key Engine Manufacturers



Source: Bloomberg Intelligence

23. Wide-Body Franchises Most Clipped by Virus

Spending on maintenance and spare parts for long-haul planes will be most damaged by Covid-19, as we see restrictions such as mandatory quarantines on international travel being lifted last. Reduced spending on wide-bodies will hurt Rolls-Royce, GE and United Technologies most. GE's pain will be offset by its strong position in narrow-bodies, which we see rebounding faster, though not without the pain of airline cash conservation and usable spare parts. United Technologies has several older aircraft powered by its engines, including 767s and 777s, and the business isn't well-supported by its relatively new narrow-body franchise as difficulties launching have led to a lot of warranty work.

Rolls-Royce has franchises other than aviation, though its engine business is sharply focused on wide-body power. (04/15/20)

Key Wide-Body Programs by Manufacturer

	In-Service Aircraft	Average Age	Stored Aircraft	Average Age
Engine Alliance (P&W, GE)				
A380	2	5	127	7
General Electric				
747	249	15	122	17
767	433	18	213	20
777	590	7	626	10
787	229	3	385	4
A300	79	24	24	29
A310	25	31	15	30
A330	77	10	226	11
DC-10	89	37	7	43
MD-11	67	26	13	23
Pratt & Whitney				
707	82	44	7	51
727	55	42	32	42
747	85	26	53	24
757	149	26	133	24
767	76	16	142	23
777	47	18	90	19
A300	101	22	8	22
A330	61	12	137	14
MD-11	38	26	4	28
Rolls-Royce	2,917	13		
747	19	21	33	23
757	266	26	201	23
777	35	18	153	19
787	155	4	201	4
A330	235	7	679	9
A340	18	14	84	14
A350	135	2	229	2
A380	4	11	107	7

Cirium data as of 4/14/2020 Bloomberg

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