ASPEN/PITKIN COUNTY AIRPORT

ASE FUTURE AIR SERVICE PLANNING STUDY

PHASE I

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SECTION 1. INTRODUCTION

Pitkin County and its partners have worked tirelessly to promote and sustain commercial air service to meet the needs of both residents and visitors of the Roaring Fork Valley. Ongoing efforts include continued attention to air service improvement and planning for a new commercial service terminal. As the details of these efforts become clearer, uncertainty arises with regard to which aircraft can effectively provide commercial service to Aspen/Pitkin County Airport (ASE) in the future. Currently, a single commercial aircraft type flies into ASE – the Bombardier CRJ-700. As the practical useful life of that aircraft comes to an end, it is possible that the next generation of regional jets may not be able fly into ASE due to existing operational restrictions.

The intent of this study is to review and identify aircraft types in relation to ASE's future air service viability. **Industry trends indicate that current aircraft capable of serving ASE are in high demand** and short supply but new aircraft such as the Bombardier CSeries, Embraer E175-E2 and Mitsubishi Regional Jet (MRJ) are on the horizon and coming into service in greater numbers. The CSeries is expected to enter service in 2014, the Embraer E-175-E2 in 2018, and the Mitsubishi MRJ in 2017. This next generation of regional aircraft that are being developed will likely have the performance ability to operate at ASE and will be further reviewed for operational compatibility as they come into service in the U.S.

This phase of the study is intended to provide insight on relevant industry trends related to regional aircraft and manufacturer operational information that can be used to guide future air service improvement efforts to ensure the long-term viability of ASE to meet the needs of the community over the next decade. Phase 1 goals are focused on three key areas:

1. Aviation industry trends
2. The changing technology of future regional jet aircraft that may be capable of serving ASE
3. Actions that should be considered to sustain future air service

This phase of the study is primarily focused on relevant industry trends and identifying potential regional jet aircraft that could provide commercial service to ASE in the future if deemed capable given ASE's unique operational characteristics including the above mean sea level altitude, runway length, surrounding terrain, and pilot training requirements. In addition to the physical constraints of the airport, the regional jet aircraft identified in this study will be evaluated for compliance with the County-imposed operational restrictions on the airport.

Regional jet aircraft research was conducted with manufacturers and airlines (where possible) to assess operational compatibility knowing that each airline often imposes different operating range limitations than the manufacturer suggested range. The most recent regional jet industry activities along with a review of high-potential future air service opportunities are considered. This overview provides discussions and findings to be used for assessing the consideration of future regional jet aircraft types at ASE.

SECTION 2. INDUSTRY TRENDS

To assess the risks to the long-term viability of commercial service at ASE, it is important to understand changes occurring locally, and those within the U.S. aviation industry as a whole as national trends often impact local markets. Local trends and development at competing airports have an obvious effect on the use of the airport, especially with regard to air service. U.S. trends also have an effect on aviation demand especially with regard to fleet changes (i.e. where the industry is headed in terms of the aircraft types in service). The following subsections provide some discussion of these dynamics.

LOCAL AVIATION TRENDS

Certain trends at ASE are worth noting. For example, **Table 2.1** shows scheduled airline service for the month of January from 2004 through 2014. The highest service levels at ASE during the month of January were experienced in 2012 with 181 weekly departures and 12,142 weekly seats. Recently restored Atlanta and Minneapolis service has lifted capacity in 2014 to offset losses associated with the discontinuation of Delta Air Lines' Salt Lake City, Frontier Airlines' Denver, and US Airways' Phoenix services.

TABLE 2.1 ASE SCHEDULED AIRLINE SERVICE

DESTINATION	AIRLINE	FLIGHTS PER WEEK - MONTH OF JANUARY										
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Atlanta, GA (ATL)	DL						7	7				7
Chicago-O'Hare, IL (ORD)	UA				14	22	17	24	29	22	24	25
Dallas/Fort Worth, TX (DFW)	AA									7	7	7
Denver, CO (DEN)	F9						26	29	28	28		
	UA	77	80	82	98	98	78	76	75	67	63	65
Houston, TX (IAH)	UA								7	15	8	11
Los Angeles, CA (LAX)	AA									7	7	7
	UA	7	7	7	9	14	19	20	21	28	23	24
Memphis, TN (MEM)	NW	1	2	1								
Minneapolis/St. Paul, MN (MSP)	DL/NW	16	16	16								1
Phoenix, AZ (PHX)	HP/US	7	7	6	6	7						
Salt Lake City, UT (SLC)	DL				22	21	8	8				
San Francisco, CA (SFO)	UA				4	4	4	7	13	7	8	10

TABLE 2.1 ASE SCHEDULED AIRLINE SERVICE

DESTINATION	AIRLINE	FLIGHTS PER WEEK - MONTH OF JANUARY										
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Weekly flights		**108**	**112**	**112**	**153**	**166**	**159**	**171**	**173**	**181**	**140**	**157**
Weekly seats		**8,467**	**8,392**	**8,360**	**9,195**	**10,021**	**10,526**	**11,578**	**11,642**	**12,142**	**9,212**	**10,326**

Note: AA = American Airlines; DL = Delta Air Lines; F9 = Frontier Airlines; HP = America West (merged with US in 2005); NW = Northwest Airlines (merged with DL in 2008); UA = United Airlines; US = US Airways

Historically, ASE has had commercial service on regional aircraft with seating capacity exceeding the CRJ-700 and more in line with the next generation of regional jets that will be put into service in the coming years. As **Table 2.2** indicates, ASE has accommodated regional jet aircraft with as many as 100 seats (BAe-146). Though scheduled service records are not included past 1990, **Table 2.2** shows that the BAe-146 did not operate in the U.S. past 2006 but served ASE for over a decade.

TABLE 2.2 ASE - AIRCRAFT IN USE

AIRCRAFT TYPE	OPERATING CARRIER(S)	SEATING CAPACITY	AVERAGE DAILY DEPARTURES - JANUARY												
			1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014
BAe-146-200	TriStar*	100				0									
BAe-146-300	United	90-92								10	10				
	US Airways	90-98		14	16	11	14								
	Air Wisconsin	89-90						13	11						
BAe-146-100	Aspen	86	11												
	Business Express	70				2									
Dash 8 – Q400	Frontier	74											4	4	
Avro RJ-85	Northwest	69					2			2	2				
	Mesaba	69						2	2						
CRJ-700	American	64												2	2
	Delta	65-70										2	2		1
	United	66										14	17	19	20
Convair CV-580	Aspen	50	5												
Dash 8 – Q100	America West	37								1	1				
	United	37								1	2	2			
	US Airways	37										1			
Total			**17**	**14**	**16**	**13**	**16**	**15**	**12**	**14**	**15**	**20**	**23**	**24**	**23**

*Source: Diio Mi; *TriStar served ASE-LAX with x flights/week in 1996*

Airline Fine-Tuning
To manage this period of extreme volatility, air carriers have fine-tuned their business models with the aim of minimizing financial losses by lowering operating costs, eliminating unprofitable routes and grounding older, less fuel efficient aircraft.

NATIONAL AVIATION TRENDS

Each year the FAA publishes the *FAA Aerospace Forecasts*. The forecasts provide guidance on national trends that may impact local air service development efforts. The current edition of this annual forecast is *FAA Aerospace Forecasts-Fiscal Years 2013-2033*. The following are relevant excerpts from this document:

- Since the beginning of the century, the commercial air carrier industry has suffered several major shocks that have led to reduced demand for air travel. These shocks include the terror attacks of September 11, skyrocketing prices for fuel, debt restructuring in Europe and the U.S., and a global recession.
- To manage this period of extreme volatility, air carriers have fine-tuned their business models with the aim of minimizing financial losses by lowering operating costs, eliminating unprofitable routes and grounding older, less fuel efficient aircraft. To increase operating revenues, carriers have initiated new services that customers are willing to purchase. Carriers have also started charging separately for services that were historically bundled in the price of a ticket.
- The capacity discipline exhibited by carriers and their focus on additional revenue streams bolstered the industry to profitability in 2012 for the third consecutive year. Going into the next decade, there is cautious optimism that the industry has been transformed from that of a boom-to-bust cycle to one of sustainable profits.
- The 2013 FAA forecast calls for U.S. carrier passenger growth over the next 20 years to average 2.2 percent per year.
- System capacity in available seat miles (ASMs) – the overall yardstick for how busy aviation is both domestically and internationally – is projected to shrink by 0.1 percent this year after posting a 0.1 percent increase in 2012; it will then grow at an average annual rate of 2.9 percent through 2033.
- In the domestic market, capacity growth hovers around zero for the second year in a row. Domestic capacity is projected to grow at an average annual rate of 2.1 percent for the remainder of the forecast period.
- For the regional carriers, domestic capacity growth is also projected to be flat in 2013 after declining 4.3 percent in 2012.
- Domestic enplanements in 2013 will decrease 0.1 percent, and then grow at an average annual rate of 2.0 percent for the remainder of the forecast.

As stated previously, national trends often impact local air service efforts to retain and attract the levels of service needed by a community. It is also important to look beyond the macro industry trends and look at each carrier specifically as this remains a very volatile time in the industry due to economic uncertainty. Airlines take many factors into consideration when making

Large Scale Change
The industry has also gone through a large scale change in onboard service amenities and is in the process of phasing out smaller regional jets.

capacity and route decisions including fleet availability and ultimately decide which aircraft types fly which routes. Airline service capabilities are highly dependent on longer lead time factors (e.g. airport infrastructure, fleet size and composition, crew training) and are slow to adjust quickly to shorter term market demand changes.

It is the intent of this section of the report to provide insight into several of those market considerations. This outlook can also be useful in assuring that long lead-time airport infrastructure needs are attuned to air service and market demand needs.

Almost all airlines kept capacity in check in 2013 to increase load factors and generate higher revenue on remaining seats. Frontier Airlines cut capacity by as much as 20 percent year-over-year (reference **Table 2.3**) with some non-ASE compatible niche carriers like Spirit Airlines growing. The airlines serving ASE have kept capacity nearly flat and indications are to expect the same trend going forward.

TABLE 2.3 U.S. DOMESTIC SCHEDULES 2013 VERSUS 2012

	FLIGHTS PER DAY		SEATS PER DEPARTURE		ASM (BILLIONS)	
AIRLIINE	2013	YOY % CHANGE	2013	YOY % CHANGE	2013	YOY % CHANGE
Delta	4,720	(2)	103	3	139	2
United	4,612	(2)	82	0	136	0
Southwest	3,575	(4)	140	3	128	1
American	2,971	3	99	(2)	101	0
US Airways	2,902	(1)	93	3	71	4
SUBTOTAL	**18,779**	**(1)**	**103**	**1**	**574**	**1**
JetBlue	661	5	131	(1)	36	5
Alaska	746	4	115	1	31	7
Spirit	219	16	161	2	12	24
Virgin America	156	4	141	(1)	12	(2)
Hawaiian	199	(3)	148	1	10	4
Frontier	222	(30)	142	13	10	(20)
Allegiant	128	1	169	11	8	17
Sun Country	36	28	140	(4)	2	21
SUBTOTAL	**2,367**	**0**	**134**	**2**	**121**	**5**

Source: Diio Mi Schedule

Beyond the limitations on growth, the industry has also gone through large scale changes in onboard service amenities and is **in the process of phasing out smaller regional jets**. Many carriers "unbundled" services that used to be free. Checked baggage fees, paying for food and drink onboard, fuel surcharges, and other fees are designed to keep the airline's fare competitive with the low-cost carriers yet, at the same time, bring in a new stream of ancillary revenue to help offset cost

increases and lagging ticket revenues. Airlines are also continuing efforts to lower costs. With fuel costs rising significantly beginning in 2008, fuel management programs and other process efficiencies including keeping airport costs in check help lower costs.

The outlook is for more of the same as airlines wait for sustained economic improvement and stabilized energy prices. Look for the airlines to potentially cut capacity depending on fuel prices and the economy and be aggressive in moving underperforming service into new routes or stronger performing routes. Cost cutting and fuel saving programs continue to be at the top of every airline's agenda.

SECTION 3. REGIONAL JET TRENDS

This section reviews existing aircraft operating at ASE and regional jet aircraft that are and will be operating in the U.S. ASE operational limitations as well as individual airline operations limitations are reviewed.

REGIONAL AIRCRAFT

The most widely-flown regional aircraft operating in the U.S. today are manufactured by Bombardier of Canada and Embraer of Brazil. Japanese, Chinese and Russian aircraft manufacturers have recently been trying to establish their niche in the global regional aircraft market with their respective models, the MRJ-70/90, COMAC ARJ21 and Sukhoi Superjet 100. Mitsubishi has recently won orders from two U.S. regional passenger airlines, Trans States Airlines and SkyWest Airlines. So far, the Chinese COMAC and Russian Sukhoi have not been as successful as Mitsubishi in entering the U.S. market, and it is unlikely that these aircraft manufacturers will find a U.S. buyer.

Though not compatible with the ASE market, 50-seat regional jets were introduced in the US in the early 1990's. The rise in fuel costs since their introduction has made 50-seat regional jets uneconomical to operate. This has resulted in airlines replacing 50-seat and smaller regional jets with 70-seat and larger regional jets with demand for these larger aircraft far exceeding availability. Delta Air Lines is taking much more aggressive measures to eliminate 50-seat regional jets than other carriers. In response to this situation, carriers are trimming frequency, eliminating service, and only very selectively increasing service in markets. Individual carrier's strategy will vary on how each airline will handle the transition from 50-seat regional jets to 70-seat regional jets but **this transition has placed the larger regional jets such as the CRJ-700 in greater demand**.

Reduction in the Regional Jet Fleet
As carriers reduce the 50-seat or smaller regional jet fleet, demand for larger regional jets will increase.

Fifty-seat regional jets were initially introduced in 1992 with the Bombardier CRJ-100. Since then, over 3,200 Bombardier and Embraer regional jets have been delivered through 2011. Production of 50-seat jets has been suspended at both manufacturers. In 2012, American Airlines, Delta Air Lines, United Airlines and US Airways operated an average of 60 percent of their regional fleet with 50-seat or smaller aircraft (**Table 3.1**) with over 6,700 daily departures to 299 airports. As a percentage of total regional jet aircraft, American's fleet has the highest percentage of smaller regional aircraft; however, Delta and United have the highest number of aircraft. What is significant for ASE is that with nearly 60 percent of the U.S. regional jet fleet being phased out, demand for larger regional jets is increasing, thus increasing the demand for the CRJ-700 in markets other than ASE.

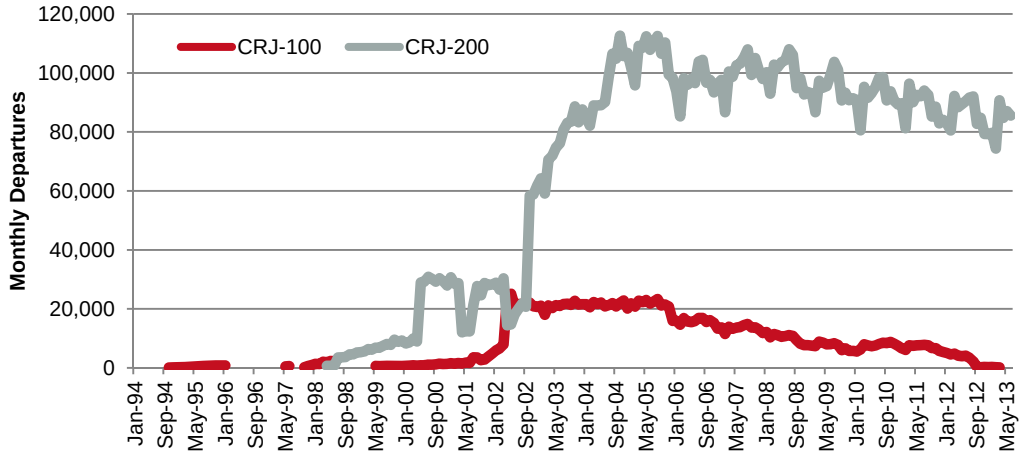
TABLE 3.1 2012 REGIONAL JET FLEETS

AIRLINE	TOTAL REGIONAL AIRCRAFT	50-SEAT OR LESS	50-SEAT % OF TOTAL
American	294	212	72%
Delta	616	366	59%
United	566	345	61%
US Airways	302	135	45%
Top 4	**1,778**	**1,058**	**60%**

Source: Airline 10-K; Diio Mi

Many of the oldest 50-seat or smaller regional jets have reached their 15-17 year lifecycle and are being phased out. Bombardier CRJs have life-limiting parts which preclude them from flying past a certain age based on the number of cycles or hours. There is currently no replacement for the 50-seat or smaller regional jet on the horizon. **Orders have shifted to the larger regional jets as the manufacturers are currently targeting new narrow-body aircraft and larger regional jets**. Internal forecasts show little demand for aircraft below 70 seats. Though the first generation of Bombardier regional jets introduced in the early 1990s were incapable of efficiently serving the ASE market, it is worth noting (**Exhibit 3.1**, next page) that these aircraft have begun to be phased out and are being replaced by the CRJ-700. Scheduled flights for this fleet type peaked in 2004, a decade after initially coming in to service, with 25 percent fewer flights today. Indications from the manufacturer are that the CRJ-700s useful flying cycle should be similar to the 50-seat CRJ-100 and CRJ-200.

EXHIBIT 3.1 HISTORICAL MONTHLY DEPARTURES FOR CRJ-100 AND CRJ-200 IN THE U.S.



As 70-seat aircraft are phased in to replace aging 50-seat aircraft, in general, market frequencies will likely decline to keep capacity neutral. Adverse 50-seat regional jet economics may cause cancellation of service in some markets that could subsequently be reinstated as additional 70-seat regional jets become available. This market shift away from the first generation of smaller regional jets is an important industry trend for ASE as it **indicates the CRJ-700 is in high demand and will be approaching its limited flying cycle sometime in the next decade**.

ASE Operational Limitations

A runway extension was completed at ASE in November 2011 extending the runway by 1,000 feet (current runway length is now 8,006 feet). The now completed runway improvements enable CRJ-700 aircraft to operate into and out of ASE without payload restrictions to most destinations (though longer distance flights such as Atlanta are expected to incur some weight restrictions). Beyond the CRJ-700, other regional aircraft currently or expected to be operating in the U.S. may be capable of operating in ASE but that ability is dependent on the following factors:

- Type of engines employed
- Distance of the route flown
- Adjustments for the altitude of ASE
- Runway length requirements
- Surrounding terrain
- Any individual safety operating limitations each airline may impose

Beyond the CRJ-700
Other regional aircraft currently or expected to be operating in the U.S. may be capable of operating in ASE.

Further analysis by individual operators may be needed to determine operational compatibility of new aircraft types in the ASE market.

Beyond aircraft operational limitations, an airport limitation exists that restricts the next generation of regional aircraft from serving ASE. According to Regulation 10.08.080 of the Pitkin County Code, "no aircraft having a tip-to-tip wingspan in excess of ninety-five (95) feet shall operate at the Aspen/Pitkin County Airport." This limitation restricts larger mainline aircraft (like the Boeing 737 and Airbus 319) from operating at ASE but also restricts next generation regional aircraft like the Bombardier CSeries and the Mitsubishi regional jet from potentially operating at ASE due to exceeding the wingspan limitation.

As **Table 3.2** indicates (Boeing and Airbus are included for comparison purposes only and are considered "mainline" aircraft, not regional jets), the next generation of regional jets such as the Bombardier CSeries and the Mitsubishi regional jet exceed the current operational restrictions thereby potentially limiting ASE's ability to retain and recruit air service in the future.

TABLE 3.2 AIRCRAFT TECHNICAL SPECIFICATIONS

AIRCRAFT TYPE	WINGSPAN		MAX LW (LBS)	ASE PERFORMANCE CAPABLE	MEETS/DOES NOT MEET CURRENT OPERATIONAL RESTRICTIONS
	FEET/ INCHES	METERS			
Current Regional Aircraft					
CRJ-700	76' 3"	23.2	67,000	Yes	Meets
Q-400	93' 3"	28.4	62,000	Yes	Meets
CRJ-900	81' 7"	24.9	73,500	No	Meets
CJR-1000	85' 11"	26.2	81,500	No	Meets
E-170	85' 4"	26	72,312	No	Meets
E-175	85' 4"	26	74,957	No	Meets
E-190	94' 3"	28.7	94,799	No	Meets
E-195	94' 3"	28.7	99,208	No	Meets
Future Regional Aircraft					
E175-E2	101' 8"	31	86,201	TBD	Does Not Meet
E190-E2	110' 7"	33.7	107,431	TBD	Does Not Meet
E195-E2	110' 7"	33.7	116,911	TBD	Does Not Meet
MRJ-70 Standard	95' 9"	29.2	79,807	TBD	Does Not Meet
MRJ-90 Standard	95' 9"	29.2	83,776	TBD	Does Not Meet
CS100 Base	115' 1"	35.1	110,000	Yes	Does Not Meet
CS300 Base	115' 1"	35.1	121,500	Yes	Does Not Meet
Comparison Non-Regional Aircraft					
Airbus A319	111' 11"	34.1	138,000	N/A	Does Not Meet
Boeing 737-700	117 '5"	35.7	128,928	N/A	Does Not Meet
Boeing 717	93' 5"	28.5	100,000	N/A	Does Not Meet

Source: Manufacturers

In addition to the operational limitations listed above, individual operators often restrict the distances flown on different aircraft taking into consideration other factors like customer perception (e.g. passengers don't like to fly on smaller jets beyond a certain distance or amount of time) and safety margins (**Table 3.3**).

TABLE 3.3 AIRCRAFT MAXIMUM SCHEDULED DISTANCES

AIRLINE/AIRCRAFT	MARKET	MAX RANGE (FLOWN BY AIRLINE)	MANUFACTURER RANGE (NM)	COMMENT
Alaska CRJ-700	LGB-SEA	965 miles (839 nautical miles)	1,434	Well below the manufacturer suggested maximum range
Alaska Q400	FAT-SEA	748 miles (650 nautical miles)	1,362	Turboprop not flow greater than 748 miles in the U.S.
Delta CRJ-700	DTW-MTY	1,481 miles (1,287 nautical miles)	1,434	Close to the manufacturer suggested maximum range
Delta CRJ-900	GDL-SLC	1,486 miles (1,291 nautical miles)	1,350	Close to the manufacturer suggested maximum range
Delta E-170 / E-175	IAH-LGA	1,416 miles (1,230 nautical miles)	1,800	Well below the manufacturer suggested maximum range
United CRJ-700	AUS-SFO	1,504 miles (1,307 nautical miles)	1,434	Close to the manufacturer suggested maximum range
United Q400	EWR-MYR	550 miles (478 nautical miles)	1,362	Turboprop not flow greater than 748 miles in the U.S.
United E-170	IAH-YUL	1,584 miles (1,376 nautical miles)	1,800	Below the manufacturer suggested maximum range
US Airways E-170 /175	DFW-PHL	1,302 miles (1,131 nautical miles)	1,800	Well below the manufacturer suggested maximum range
US Airways E-190	PHL-SAT	1,495 miles (1,299 nautical miles)	1,800	Well below the manufacturer suggested maximum range
US Airways CRJ-700	CLT-MCI	809 miles (703 nautical miles)	1,434	Well below the manufacturer suggested maximum range
US Airways CRJ-900	DSM-PHX	1,149 miles (998 nautical miles)	1,350	Below the manufacturer suggested maximum range

As **Table 3.3** above indicates, actual flown distances are below the manufacturer suggested maximum operating ranges, indicating the need for individual airline assessments of actual operating abilities in ASE. This is important because longer distance markets from ASE like New York may be in range of the manufacturer suggested maximum distance but below the actual operating distance of any given airline.

Nearly all of the U.S. major airline pilot contracts limit the amount of regional jet flying that can be outsourced by setting limits known as "scope clauses." Other than Alaska Airlines, major airline pilot scope clauses currently require aircraft certified in the U.S. with an MTOW exceeding 86,000 lbs. to be flown by the major airlines' pilots, not by their regional partners. U.S. mainline pilots are reluctant to loosen these limitations to protect their member's jobs but have done so in the past if forced to under bankruptcy proceedings or if receiving some benefit in exchange such as pay raises. Mainline pilot agreements become amendable at Delta Air Lines in 2015, at United Airlines in 2017 and at American Airlines in 2019 (US Airways pilot contract is already amendable and may be renegotiated alongside American pilots if the carriers merge).

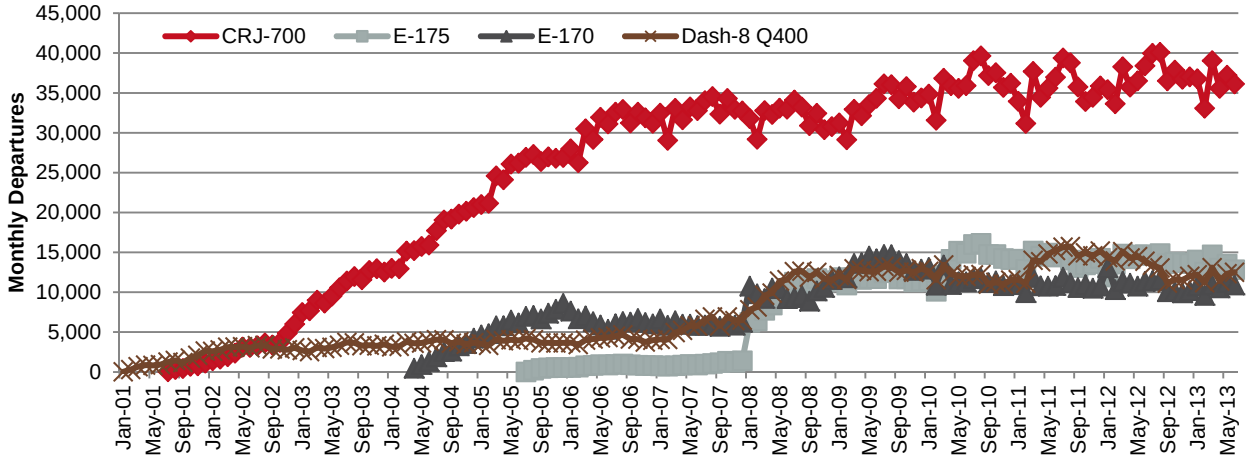
The manufacturers of these aircraft are hoping that these limitations will be relaxed in future negotiations but if not, may recertify the aircraft to MTOW limits that apply to each customer. Below are the current U.S. regional airline next generation aircraft orders:

Declining CRJ-700 Operations
Over 50 percent of U.S. CRJ-700 deliveries occurred by 2004. With an anticipated 20-year useful life cycle, it is expected that the majority of CRJ-700 operations will begin to significantly decline in the coming decade, by 2024.

- Republic Airways has placed an order for 40 CS300 jets (the North American launch customer) which are scheduled for delivery beginning in the second quarter of 2015
- Trans States has placed an order for 50 MRJ90 aircraft with deliveries to begin in 2016
- SkyWest has placed firm orders for 100 MRJ90LR and 100 Embraer 175-E2 with deliveries expected to begin in 2017 and 2020, respectively.
- All U.S. regional airlines will be monitoring major airline pilot agreements for any improved developments.

The current generation CRJ-700 first came into service in the U.S. in 2001 with scheduled operations peaking recently and future orders declining. As of June 2013, there were 14 unfilled orders for CRJ-700 aircraft (317 deliveries against 331 total orders), 41 unfilled orders for CRJ-900 aircraft (265 deliveries against 306 orders), and 36 unfilled orders for CRJ-1000 aircraft (34 deliveries against 70 orders) totaling 91 unfilled orders for Bombardiers regional jets. One of the largest recent orders came from Delta Air Lines, with an order of 40 CRJ-900s in December 2012, *a move away from the CRJ-700*. As **Exhibit 3.2** indicates, the majority of CRJ-700 operations in the U.S. occurred by 2005.

EXHIBIT 3.2 HISTORICAL MONTHLY DEPARTURES FOR CRJ-700, E-175, AND DASH 8 Q400 IN THE U.S.



Analysis in **Table 3.4**, next page, indicates that **over 50 percent of U.S. CRJ-700 deliveries occurred by 2004. With an anticipated 20-year useful life cycle, it is expected that the majority of CRJ-700 operations will begin to significantly decline in the coming decade, by 2024.**

With the CRJ-700 and Q-400 (turboprop) as the only viable aircraft with the ability to serve ASE mostly unrestricted today, ASE's future air service recruitment and retention efforts may be limited over the next decade. Though the CRJ-700 is technically still in production and expected to be in service for the foreseeable future, recent aircraft order trends indicate that other aircraft such as the E-175 E2 and MRJ are coming into the pipeline in greater numbers. This next generation of regional jet aircraft should be considered as viable replacements to the CRJ-700 and Q-400 in operation today.

TABLE 3.4 BOMBARDIER U.S. REGIONAL JET DELIVERIES

CALENDAR YEAR	CRJ 100/200/440	CRJ 700	CRJ 705	CRJ 900	CRJ 1000	TOTAL
1993	12					12
1994	12					12
1995	11					11
1996	23					23
1997	15					15
1998	42					42
1999	51					51
2000	55					55
2001	76	10				86
2002	99	35				134
2003	127	42		10		179
2004	89	52		15		156
2005	34	47		13		94
2006	0	25		11		36
2007	0	2		40		42
2008	0	2		47		49
2009	0	22		11		33
2010	0	19		3		22
2011	0	13		3		16
2012	0	0		0		0
Total	**646**	**269**	**0**	**153**	**0**	**1,068**

CHANGING REGIONAL JET TECHNOLOGY

Bombardier, Embraer and other regional jet manufacturers are in the process of introducing a new generation of regional jet aircraft in the larger regional jet market. One of these next generation regional jets comes in the form of new Bombardier aircraft types, the CS100 and CS300, which currently are entering the production phase with the first deliveries to follow shortly. As of June 2013 there are up to 388 orders/commitments from 15 customers around the world for these new Bombardier aircraft types, including the U.S.-based launch customer Republic Airways.

It is worth noting that ASE previously had service in the 1990's on the BAE-146 aircraft which was equipped with 100 seats. Though these next-generation regional jets are similar in seating capacity size to previous aircraft that served ASE they are designed to be more fuel efficient (fewer carbon emissions per passenger carried) and have greater range capability. The new CSeries aircraft offers new advanced technology including advanced materials (allowing for up to 2,000 lbs in weight savings) and new engines allowing for superior field performance and range flexibility which requires a larger wingspan.

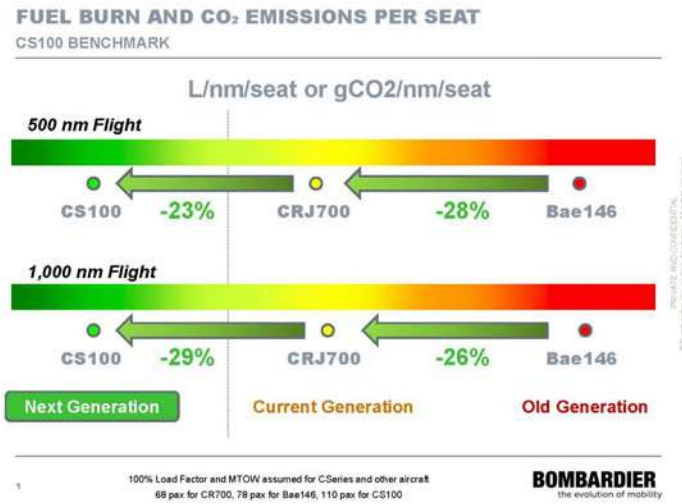
Additionally, these next generation aircraft will likely be equipped with winglets (or blended wings), which are beneficial for an aircraft in terms of reduced fuel consumption (resulting in lower emissions and operating costs). Less fuel needed would provide the airline the ability to carry more passengers and cargo which in turn would require fewer departures to handle the

same number of passengers, resulting in a lower carbon footprint. Winglets are capable of increasing take-off aerodynamic characteristics, which improve climb gradient (which could be a factor at airports like ASE located at high altitudes with shorter runways).

Bombardier advertises CSeries aircraft as a type with best-in-class airfield performance, capable of operating routes of increased range out of challenging airports, such as ASE. The CS100 should be able to deliver the following benefits for ASE:

- Lower per seat costs. The CS100 is expected to have a 23 percent lower operating cost per seat than a CRJ-700 70-seat regional jet, which should improve airline profitability.
- Expanded market reach with additional routes available for ASE passengers according to research provided by Bombardier. Reference the range maps in **Appendix A**. The CS100 and 300 can offer nonstop winter service out of ASE to practically anywhere in the U.S. including top markets such as New York and Boston; however, the CS300 would be restricted in summer operations.
- Lower environmental impact. In comparison to other aircraft types, the CS100 is expected to produce less noise in operation and will offer 28 percent lower CO2 emission in comparison to a 70-seat regional jet (up to 48 percent lower compared to the BAe-146). Reference **Exhibit 3.3**. The CS100 will offer a 45 percent reduction in CO2 emissions as compared to the BAe-146 over a 500nm flight, and 48 percent reduction over a 1,000 nm flight.
- Fewer departures for the same capacity. The aircraft can offer 39 percent fewer departures for the same level of capacity as can be offered by operating the CRJ700 70-seat regional jet.
- Higher comfort. The aircraft provides a more comfortable in-flight experience for passengers with seats, windows, storage bins, and aisle upsized.

EXHIBIT 3.3 EMISSIONS



Additional detail on the Bombardier CSeries is included in **Appendix A.**

SECTION 4. CONCLUSIONS & RECOMMENDATIONS

Airline operations at ASE are affected by multiple factors. These include altitude, runway length, temperature, and surrounding terrain which dictate take-off and landing criteria. Aircraft capabilities compatible with these factors limit the equipment and, in some cases, the airlines which can serve the market. The more types of aircraft that can serve the market, the greater the air service opportunities. Altitude, temperature and terrain are not subject to modification.

Even though the CRJ-700 serves ASE effectively today it has range limitations and is in high demand for use throughout the various airline networks limiting ASE's ongoing future air service recruitment efforts. Though the CRJ-700 is still in production and is expected to remain in service for years to come, eventually each fleet type runs its useful lifespan and is retired. Recent aircraft order trends indicate that other regional jet aircraft such as the Bombardier CSeries, Embraer 175-E2, and Mitsubishi MRJ will be coming into service in greater numbers, and ASE should be prepared to accommodate these replacement aircraft types.

Longer term air service development considerations suggest that it may be appropriate to review all options, if any, to secure future air service viability by revising local imposed operating restrictions. Such a review must take into consideration the needs of the community balanced with the realities of today's commercial air service opportunities. If improvements in these areas are operationally and economically feasible, a favorable impact on long-term air service may result.

Looking forward, the next generation of aircraft to replace the CRJ-700 and other aging regional jets includes the CSeries by Bombardier, the E175-E2 by Embraer, and the Mitsubishi MRJ-70/90. Each of these new regional jet types have improved operating characteristics achieved in part by expanding the size of the wing.

To remain a viable air service market in the future, limit risks and to accommodate changing regional jet specifications, it is recommended to proceed with Phase 2 of the *ASE Future Air Service Planning Study*. Phase 2 includes a review of the regulatory environment and assess the options available to accommodate the next generation of regional aircraft.

APPENDIX A. BOMBARDIER FUTURE OF REGIONAL SERVICE

The following pages include excerpts from the Bombardier The Future of The Regional Service at ASE report dated November 2013 that are relevant to the *ASE Future Air Service Planning Study*.

The Future of Regional Service At ASE

November 2013

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FORWARD-LOOKING STATEMENTS

This presentation includes forward-looking statements. Forward-looking statements generally can be identified by the use of forward-looking terminology such as “may”, “will”, “expect”, “intend”, “anticipate”, “plan”, “foresee”, “believe” or “continue”, the negative of these terms, variations of them or similar terminology. By their nature, forward-looking statements require Bombardier Inc. (the “Corporation”) to make assumptions and are subject to important known and unknown risks and uncertainties, which may cause the Corporation’s actual results in future periods to differ materially from forecasted results. While the Corporation considers its assumptions to be reasonable and appropriate based on information currently available, there is a risk that they may not be accurate. For additional information with respect to the assumptions underlying the forward-looking statements made in this presentation, please refer to the respective sections of the Corporation’s aerospace segment (“Aerospace”) and the Corporation’s transportation segment (“Transportation”) in the fiscal year 2012 MD&A.

Certain factors that could cause actual results to differ materially from those anticipated in the forward-looking statements, include risks associated with general economic conditions, risks associated with the Corporation’s business environment (such as risks associated with the financial condition of the airline industry), operational risks (such as risks related to developing new products and services; doing business with partners; product performance warranty and casualty claim losses; regulatory and legal proceedings; to the environment; dependence on certain customers and suppliers; human resources; fixed-price commitments and production and project execution), financing risks (such as risks related to liquidity and access to capital markets, certain restrictive debt covenants, financing support provided for the benefit of certain customers and reliance on government support) and market risks (such as risks related to foreign currency fluctuations, changing interest rates, decreases in residual value and increases in commodity prices.) For more details, see the Risks and Uncertainties section in the fiscal year 2012 MD&A. Readers are cautioned that the foregoing list of factors that may affect future growth, results and performance is not exhaustive and undue reliance should not be placed on forward-looking statements. The forward-looking statements set forth herein reflect the Corporation’s expectations as at the date of this presentation and are subject to change after such date. Unless otherwise required by applicable securities laws, the Corporation expressly disclaims any intention, and assumes no obligation to update or revise any forward-looking statements, whether as a result of new information, future events or otherwise.

BOMBARDIER COMMERCIAL AIRCRAFT PORTFOLIO

Optimized **short-haul** solution

Q-SERIES FAMILY

Optimized **regional network** solution

CRJ SERIES FAMILY

Optimized **100- to 149-seat market segment** solution

CSERIES FAMILY

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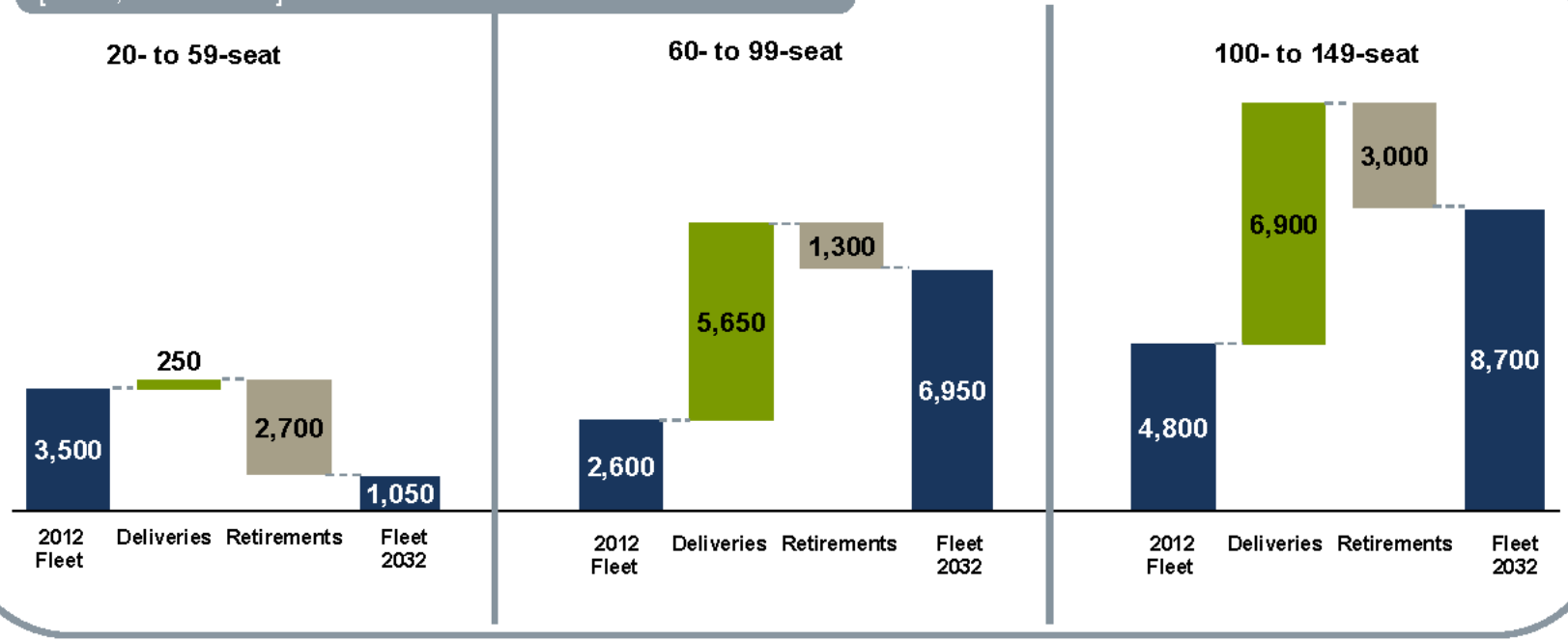
TREMENDOUS FLEET GROWTH
FOR 60-99 SEAT AND 100-149 SEAT AIRCRAFT CATEGORIES

20-Year Commercial Aircraft Fleet Forecast
[Units, 2012-2032]



Total	Fleet 2012	Deliveries	Retirements	Fleet 2032
20- to 149-seat	10,900	12,800	7,000	16,700

Demand will shift away from the 20- to 59-seat category

Source: Bombardier Commercial Aircraft Market Forecast 2013-2032

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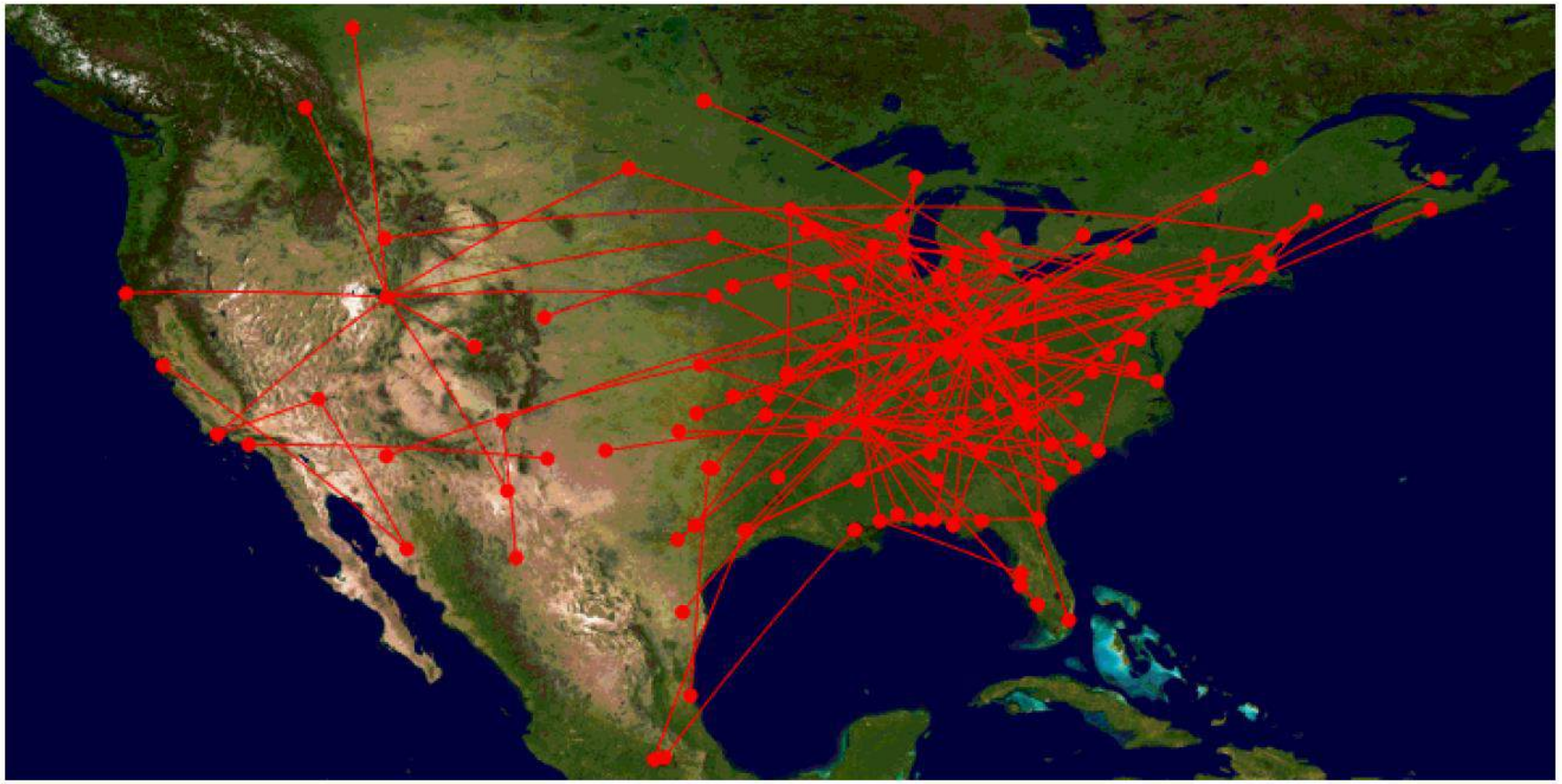
PREVIOUS 50-SEAT JET MARKETS

LOST SERVICE IN 5 YEARS = 160 ROUTES



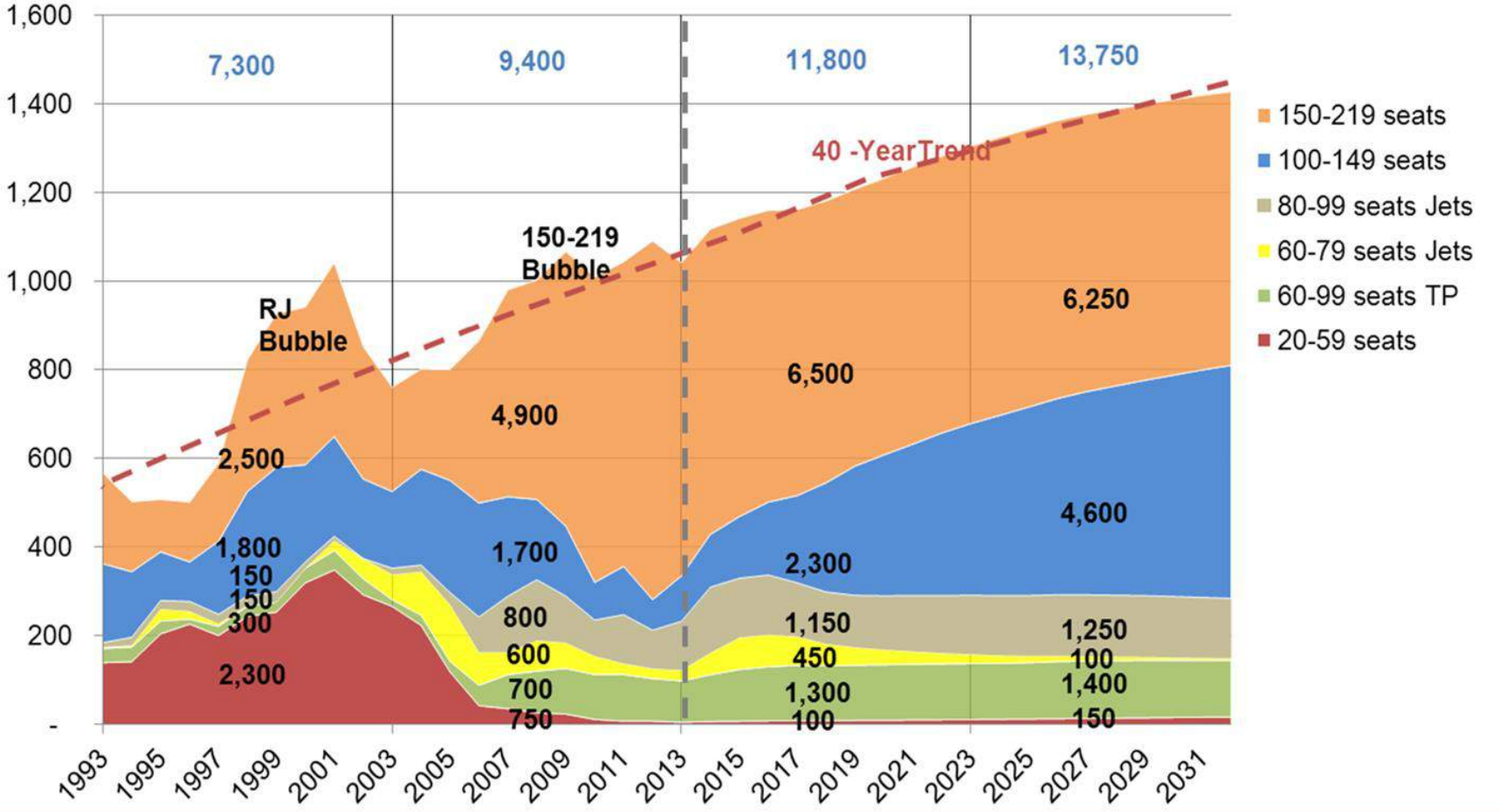
LOST ANNUAL DEPARTURES: ~170,000

LOST ANNUAL SEATS: ~8.5 MILLIONS

Based on Innovata Schedules for Year End 2013 vs 2009; BCA Analysis

GLOBAL COMMERCIAL AIRCRAFT DELIVERIES

20 TO 219 SEAT DELIVERIES IN UNITS [1993-2032]



6,900 deliveries in the 100-149 seat category over the next 20 years

Source: Fleet iNet, BCA Fleet Forecast Model

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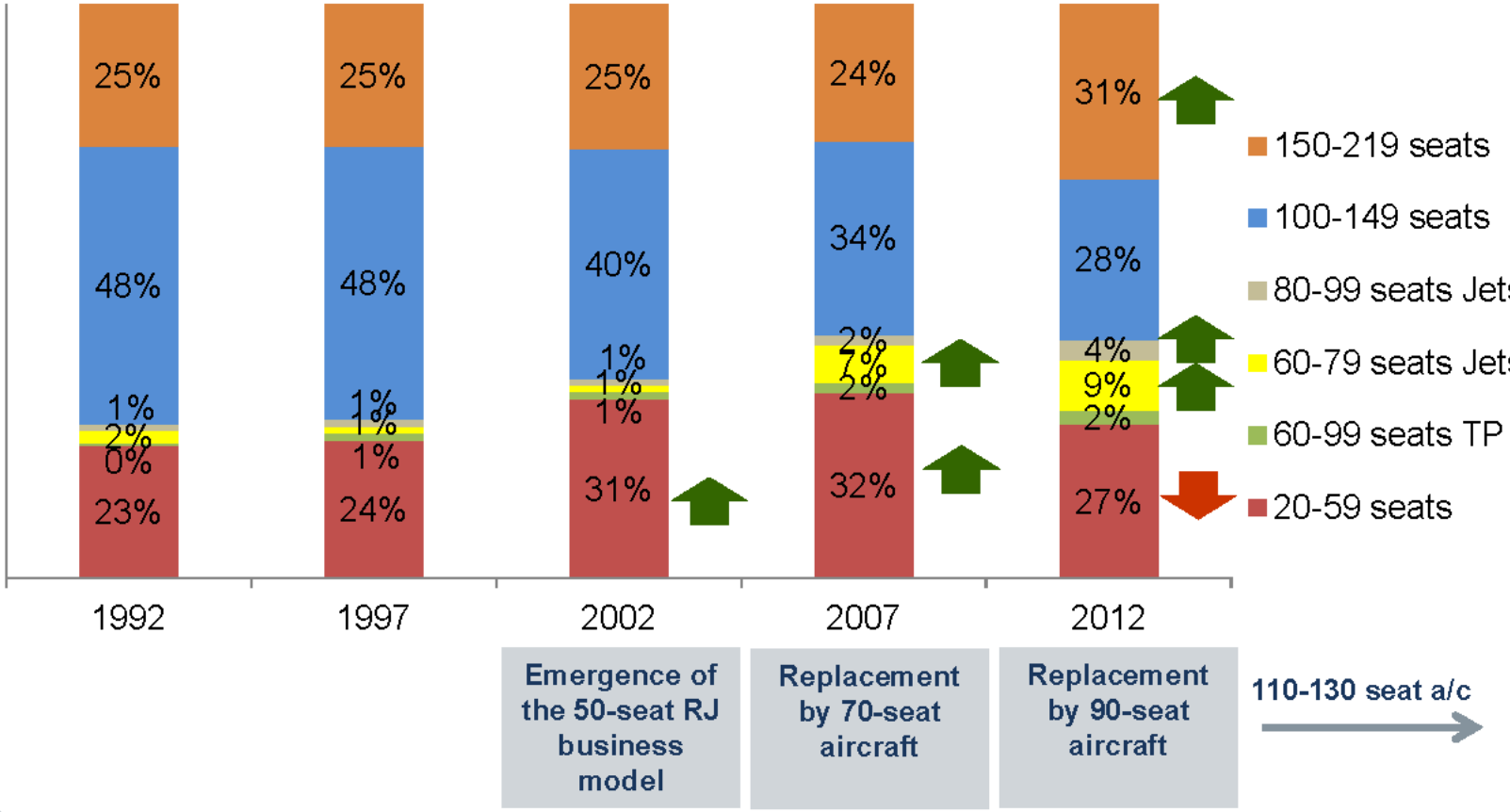
RECENT PURCHASING CYCLES HAVE SHOWN AN INCREASED INTEREST FOR LARGER REGIONAL JETS AND SMALL SINGLE-AISLE AIRCRAFT

Mix of Aircraft in the US
[%, All narrowbody aircraft, 1992-2012]



Source: Bombardier Commercial Aircraft Market Forecast 2013-2032

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CSERIES
100% NEW
AIRCRAFT
CS300
BOMBARDIER
CSERIES
BOMBARDIER
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ADVANCED TECHNOLOGY AIRCRAFT

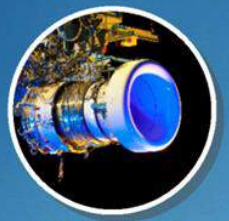
CLEAN SHEET TO ENSURE OPTIMAL INTEGRATION

Advanced Flight Deck
FBW with Side Sticks

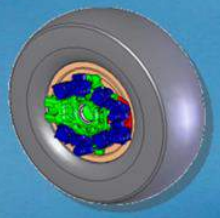
Best-In-Class
Cabin Comfort
and Flexibility

Superior Field Performance
& Range Flexibility

Advanced Materials
> 2,000 lb. weight savings



Pratt & Whitney
PurePower®
PW1500G Engine



Electric
Brakes

Integrated Avionics &
Optimized Systems

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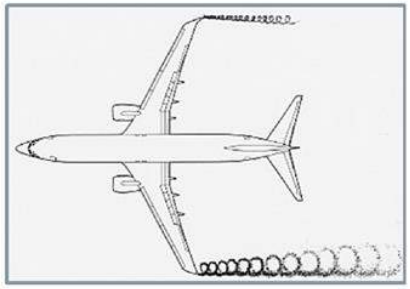
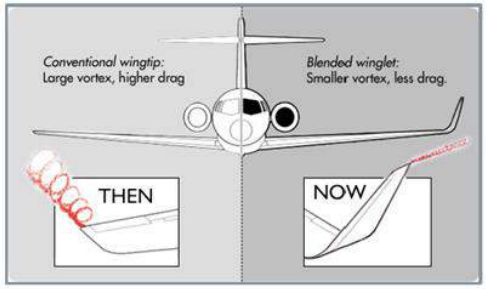
WINGLETS 101

HOW THEY BENEFIT PERFORMANCE

Winglets act as obstacles to wingtip vortices and reduce their strength, therefore reducing induced drag. Winglets also divert vortices away from the wingtip, reducing the fraction of the wing affected by the vortex downwash.





WINGLETS :

- Reduce induced drag and produce lift
- Increase the lift-to-drag (L/D) ratio
- Improve the overall efficiency of the wing

As opposed to “End-plates” which would simply block vortex and only reduce induced drag (no extra lift)

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BENEFITS OF WINGLETS IS WELL UNDERSTOOD

BOMBARDIER IS THE PIONEER OF WINGLET APPLICATIONS

REDUCED FUEL BURN (BETWEEN 2% TO 5%)

INCREASED PAYLOAD-RANGE CAPABILITIES

IMPROVED LANDING PERFORMANCE

IMPROVED TAKEOFF PERFORMANCE

REDUCED NOISE (VIA REDUCED THRUST)

REDUCED EMISSIONS (VIA REDUCED THRUST)

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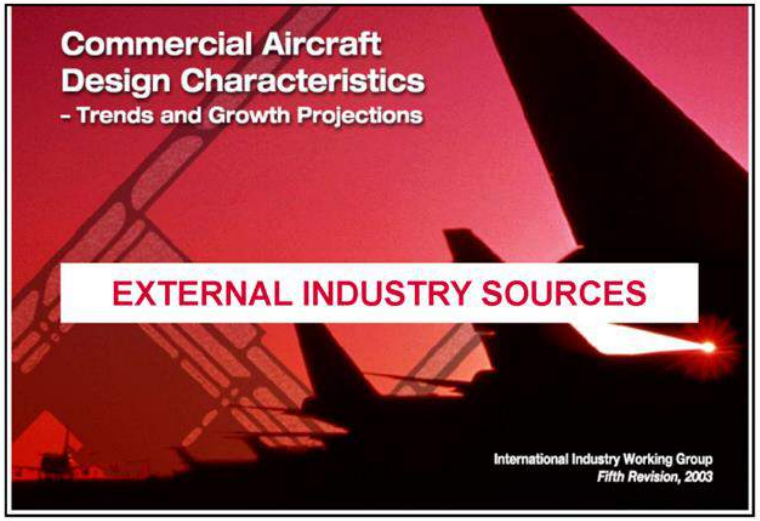
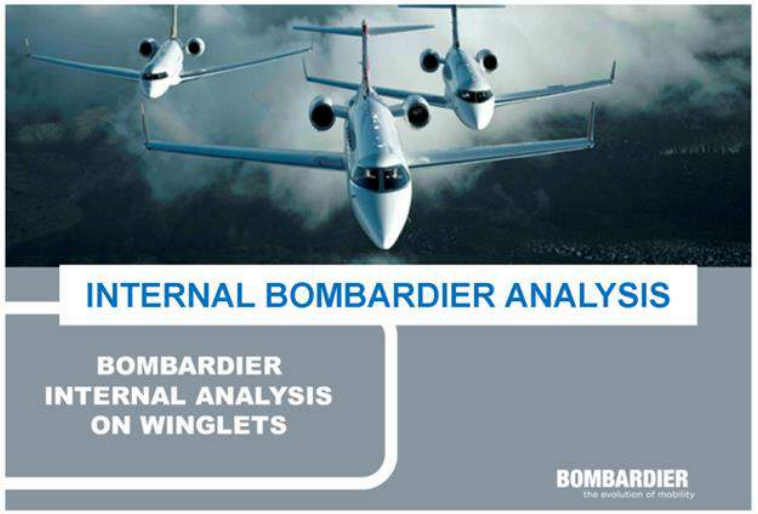
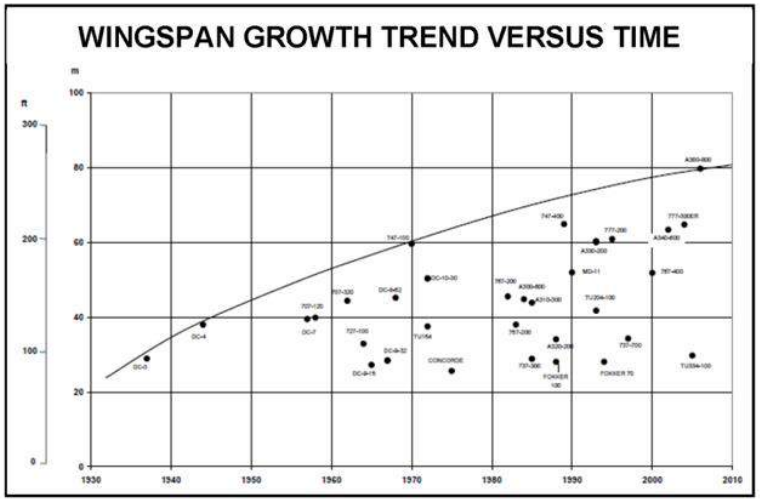
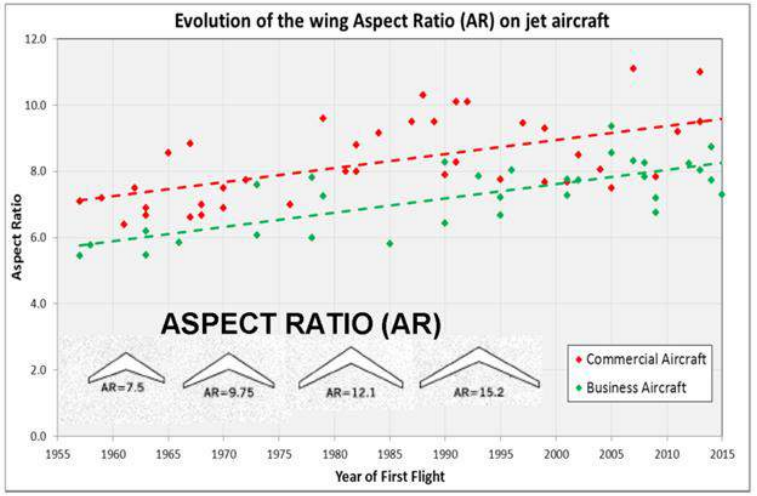
WINGSPAN OF NEW AIRCRAFT INCREASE WITH TIME

A TREND SEEN IN VARIOUS CATEGORIES AND WELL DOCUMENTED









* Aspect ratio illustrations taken from Evolution of the Airliners, Ray Whitford, Crowood 2007.

WINGSPAN OF NEW AIRCRAFT INCREASE WITH TIME

NEW GENERATION AIRCRAFT

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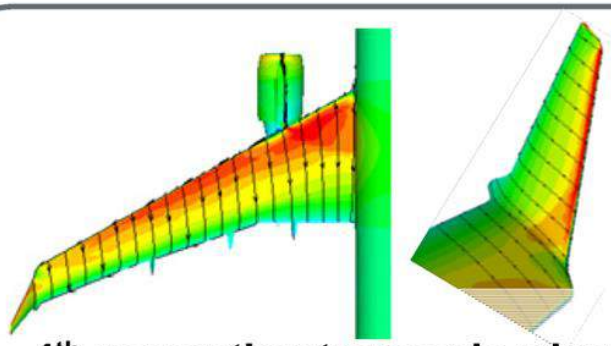
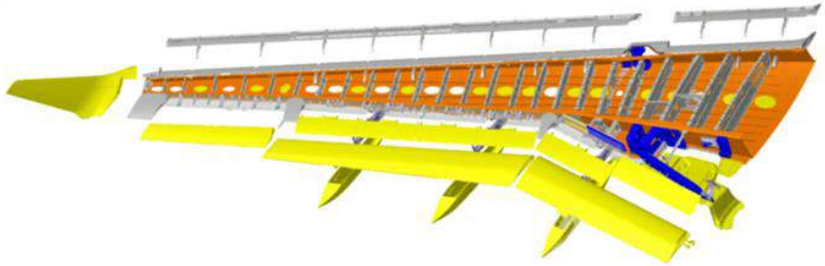
CSERIES WING AND WINGLET DESIGN & MANUFACTURE

NEW TECHNOLOGY AND TOOLS ENABLING HIGHER ASPECT RATIO



4th generation transonic wing; the result of highly skilled aero dynamists



Composite wing using Resin Transfer Infusion (RTI) process

CSeries wing; the result of our 40 years experience in composite

All our jet aircraft have winglet since our Learjet 28 (1977)

UNMATCHED FUEL EFFICIENCY

THROUGH WELL BALANCED TECHNOLOGY COMBINATION

Optimal Aircraft Integration

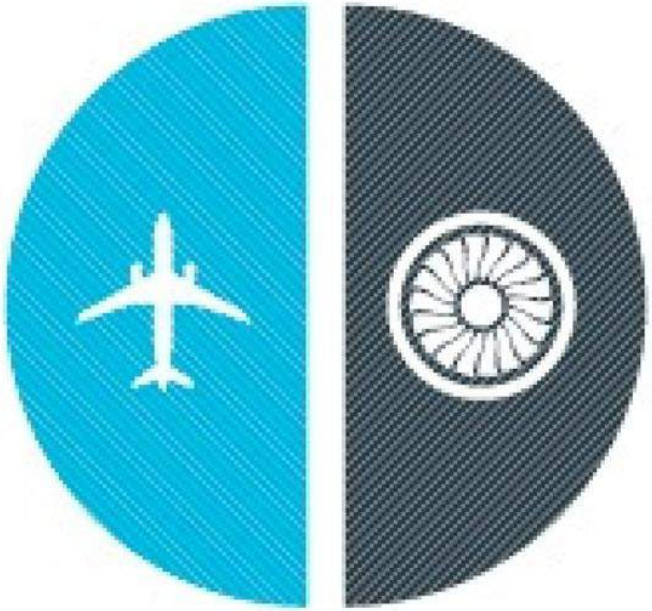
Lighter Aircraft by up to 12,000lbs (50 pax)

State-of-the-Art Aerodynamics

+

Game Changing Engine

PurePower® PW1500G



20% Fuel Burn Advantage

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WIDEBODY COMFORT WITH A SINGLE AISLE AIRCRAFT

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CS100 at ASE

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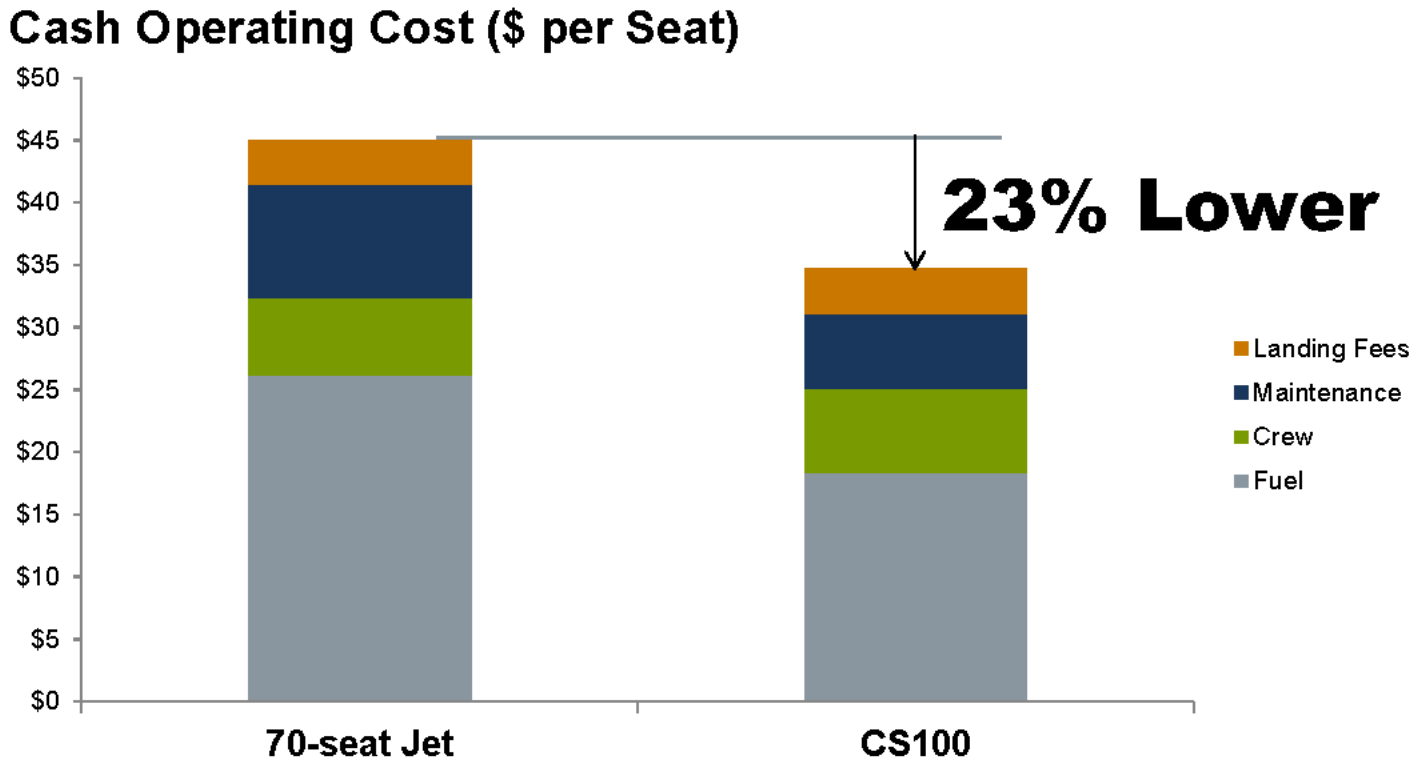
CS100 IS AN EFFICIENT AIRCRAFT FROM AN OPERATING COST PERSPECTIVE



350 nm sector; Fuel at $3.20/USG; Typical North America cost assumptions; 70-seat jet costs based on averaging CRJ700 and E170 costs

FROM ASE THE CS100 OFFERS EXCELLENT RANGE

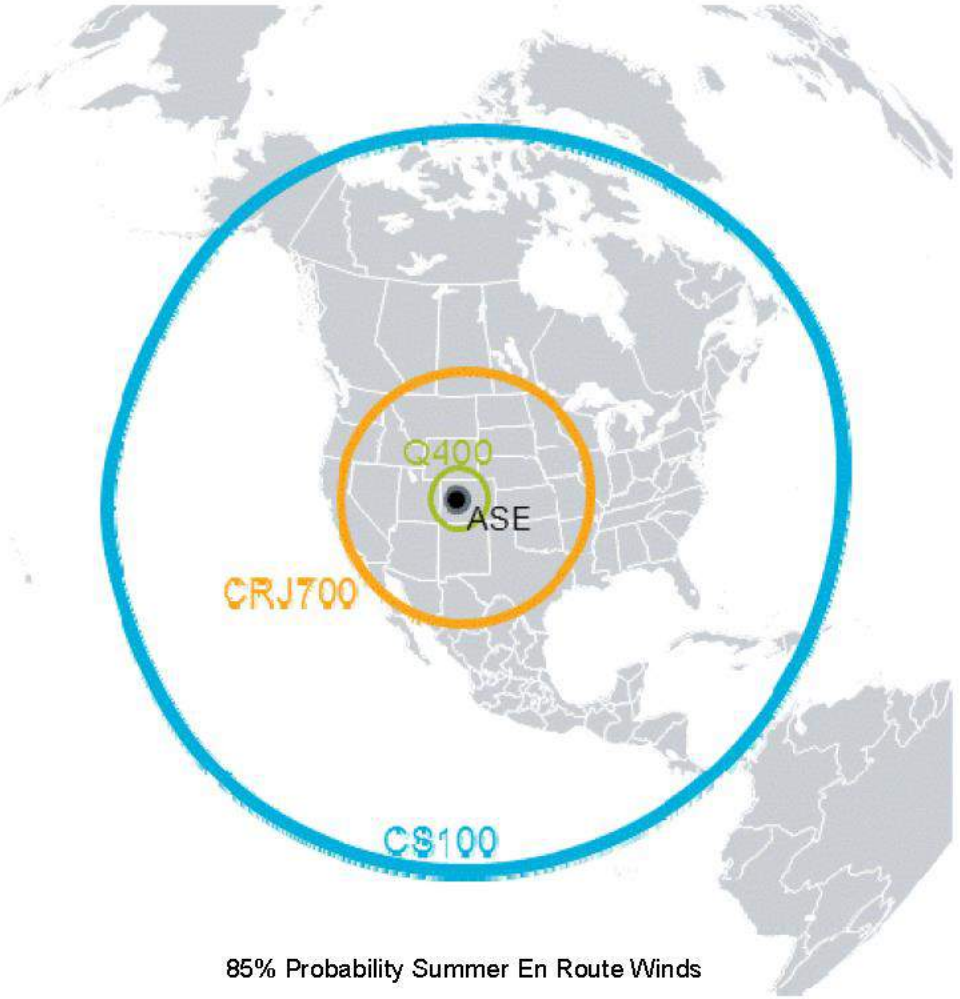
SUMMER RANGE

Q400	**74 Pax**	**178 nm***
CRJ700	**66 Pax**	**755nm***
CS100	**108 Pax**	**2,340 nm***

*Still-Air Range

Standard Performance Assumptions:

- 225 lb per Pax
- Typical dual class OWE
- 100 nm Alternate
- 45 min Hold @ 10,000 ft
- En-Route Temperature: ISA
- 5% Flight Fuel Reserve
- 15 min. Taxi
- ASE at ISA+23C



85% Probability Summer En Route Winds

Notes: Information purposes only – actual performance will depend on airline-specified procedures and assumptions

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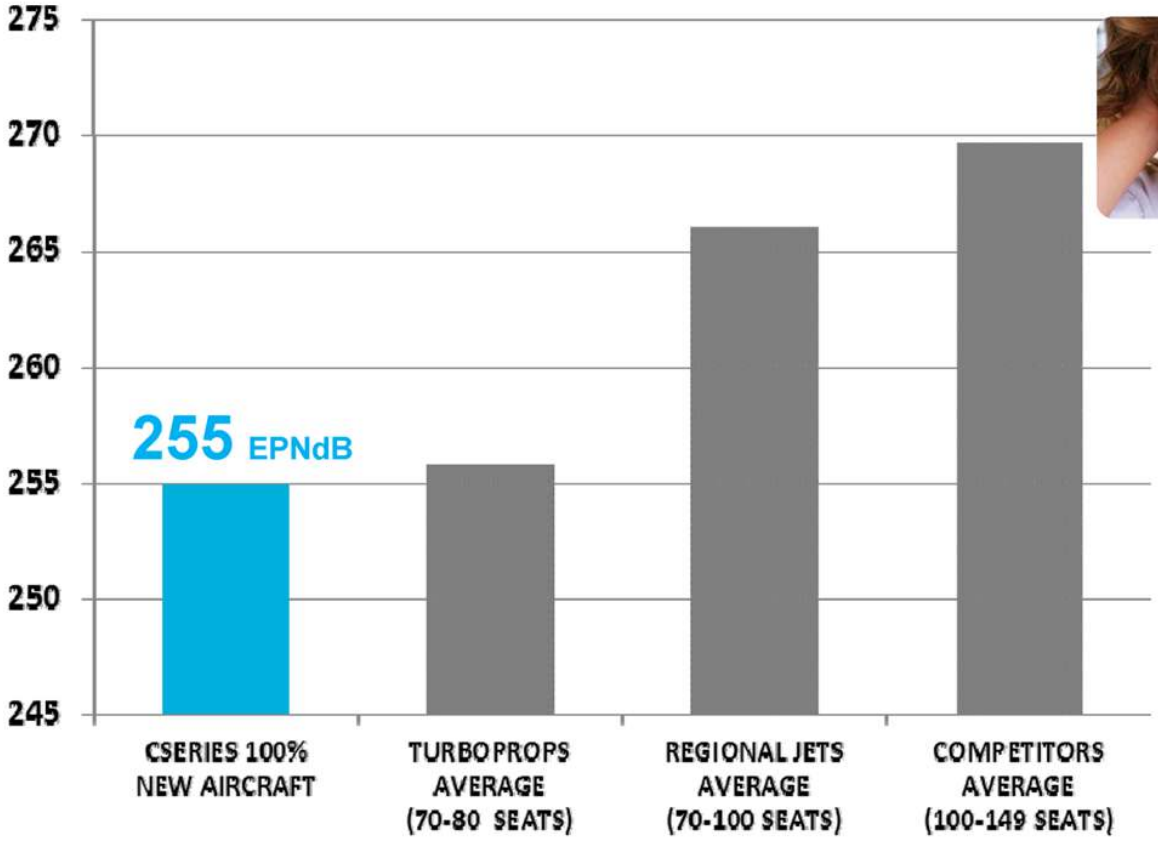
THE QUIETEST COMMERCIAL AIRCRAFT IN-PRODUCTION

Effective Perceived Noise in Decibels (EPNdB)



*Compared to in-production aircraft in its class. 255 EPNdB based on a CS100 aircraft variant.

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THE QUIETEST COMMERCIAL AIRCRAFT IN-PRODUCTION

MAIDEN FLIGHT OF CSERIES AIRCRAFT, SEPTEMBER 16, 2013

"The aircraft exceeded our expectations, and truly is a **Whisperjet**"

Mr. Robert Deluce,
CEO, Porter Airlines

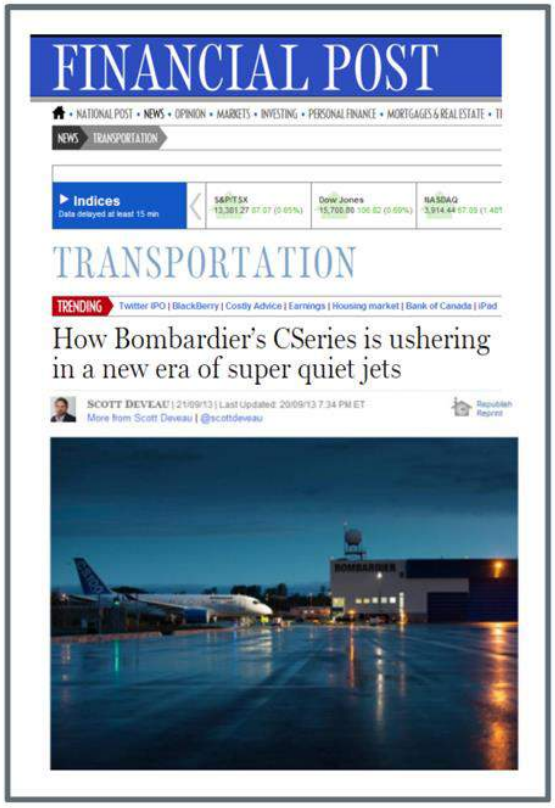
"**I could hardly hear it**, so it looks promising. It's going to be an environmental revolution"

Mr. Trygve Gjertsen, SVP
Braathens Aviation

"It was **very quiet**, which is great. We have a lot of data and we feel pretty confident that it will be good"

Mr. Nico Buchholz, SVP Corporate Fleet, Lufthansa

Comment seen on Twitter
"SO QUIET, CRICKETS WERE LOUDER!!!"



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NEWS TRANSPORTATION

Indices
Data delayed at least 15 min

S&P/TSX 13,381.27 87.07 (0.65%) | Dow Jones 15,700.80 106.82 (0.69%) | NASDAQ 3,914.44 67.09 (1.40)

TRANSPORTATION

TRENDING Twitter IPO | BlackBerry | Costly Advice | Earnings | Housing market | Bank of Canada | iPad

How Bombardier's CSeries is ushering in a new era of super quiet jets

SCOTT DEVEAU | 21/09/13 | Last Updated: 20/09/13 7:34 PM ET
More from Scott Deveau | @scottdeveau

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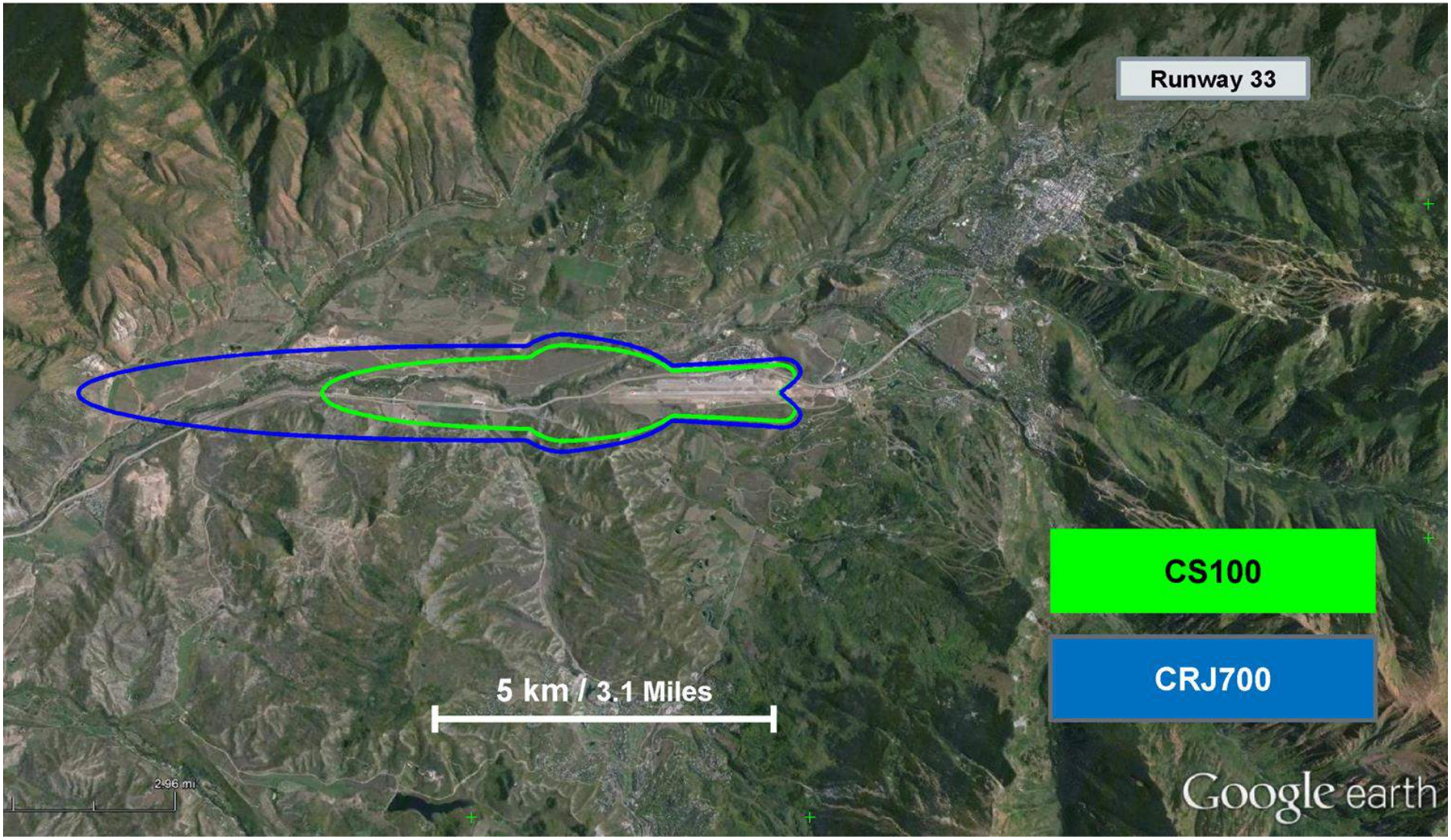
TAKEOFF NOISE FOOTPRINT

ASPEN–PITKIN COUNTY AIRPORT, COLORADO (ASE)



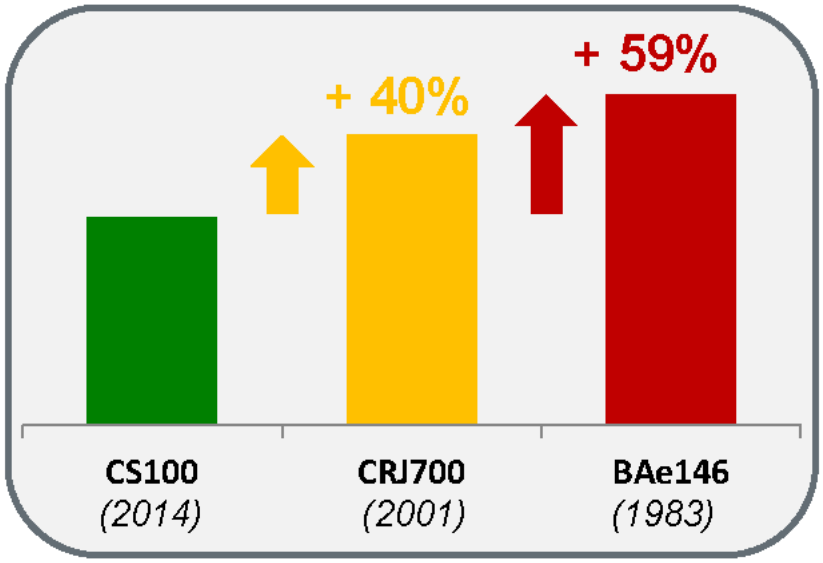
CS100 MTOW: 129,000 lb; TOT: 23,300 lbf; 1000 FT Altitude Engine Power Cutback to 1.2% OEI Climb Gradient;

CRJ700 MTOW: 75,000 lb; TOT: 12,680 lbf; 1000 FT Altitude Engine Power Cutback to 1.2% OEI Climb Gradient;

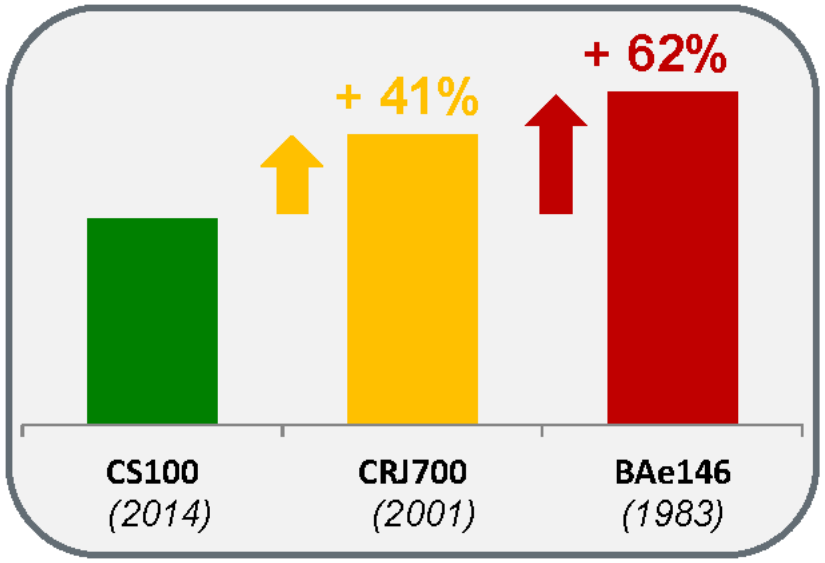
FUEL BURN AND CO_2 EMISSIONS PER SEAT

BENCHMARK CS100 VS PREVIOUS COMMERCIAL JETS AT ASPEN

L/nm/seat or gCO2/nm/seat



500 nm



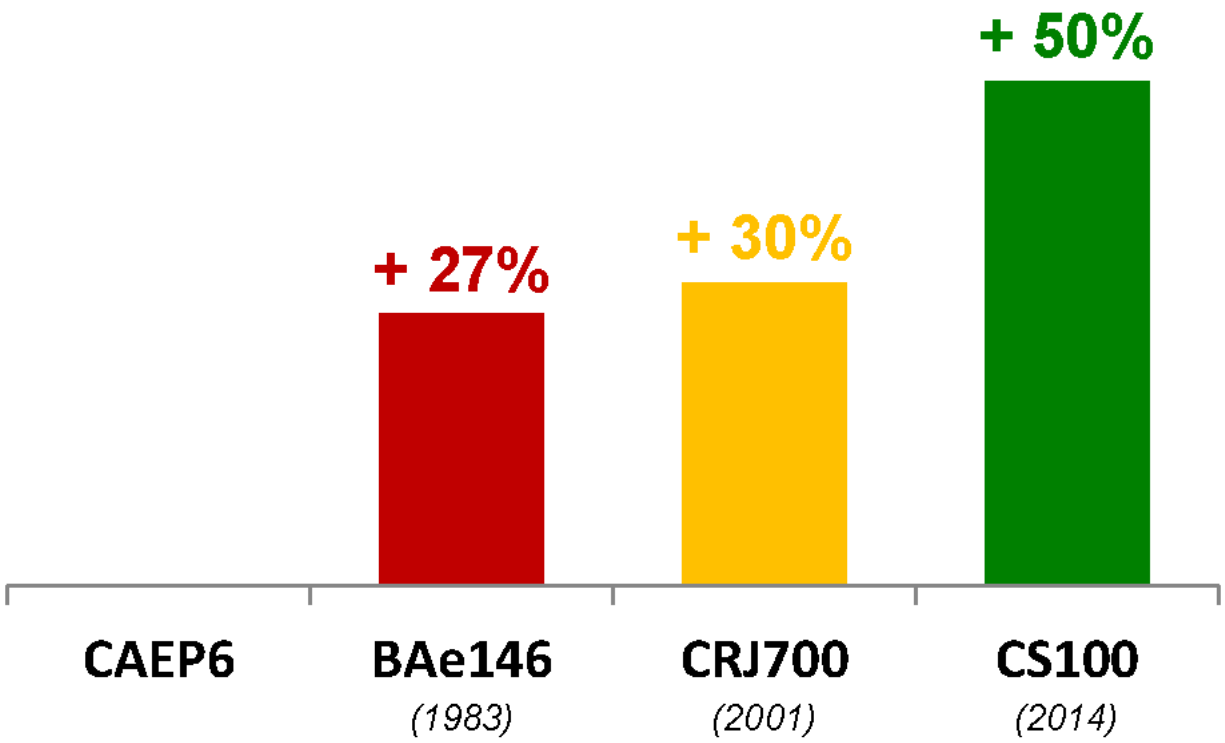
1,000 nm

100% Load Factor and MTOW assumed for CSeries and other aircraft

66 pax for CR700, 98 pax for BAe146, 108 pax for CS100

NO_x EMISSIONS

BENCHMARK CS100 VS PREVIOUS COMMERCIAL JETS AT ASPEN



100% Load Factor and MTOW assumed for CSeries and other aircraft

Engines Thrust Ratings: PW1521G for CS100, CF34-8C5 for CRJ700, ALF 502L for Bae146

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UNMATCHED FLEXIBILITY OF THE CSERIES AIRCRAFT IDEAL FOR LIGHT FOOTPRINT OPERATIONS

Unmatched flexibility

- Best-in-class airfield performance
- Increased range capability out of challenging airports

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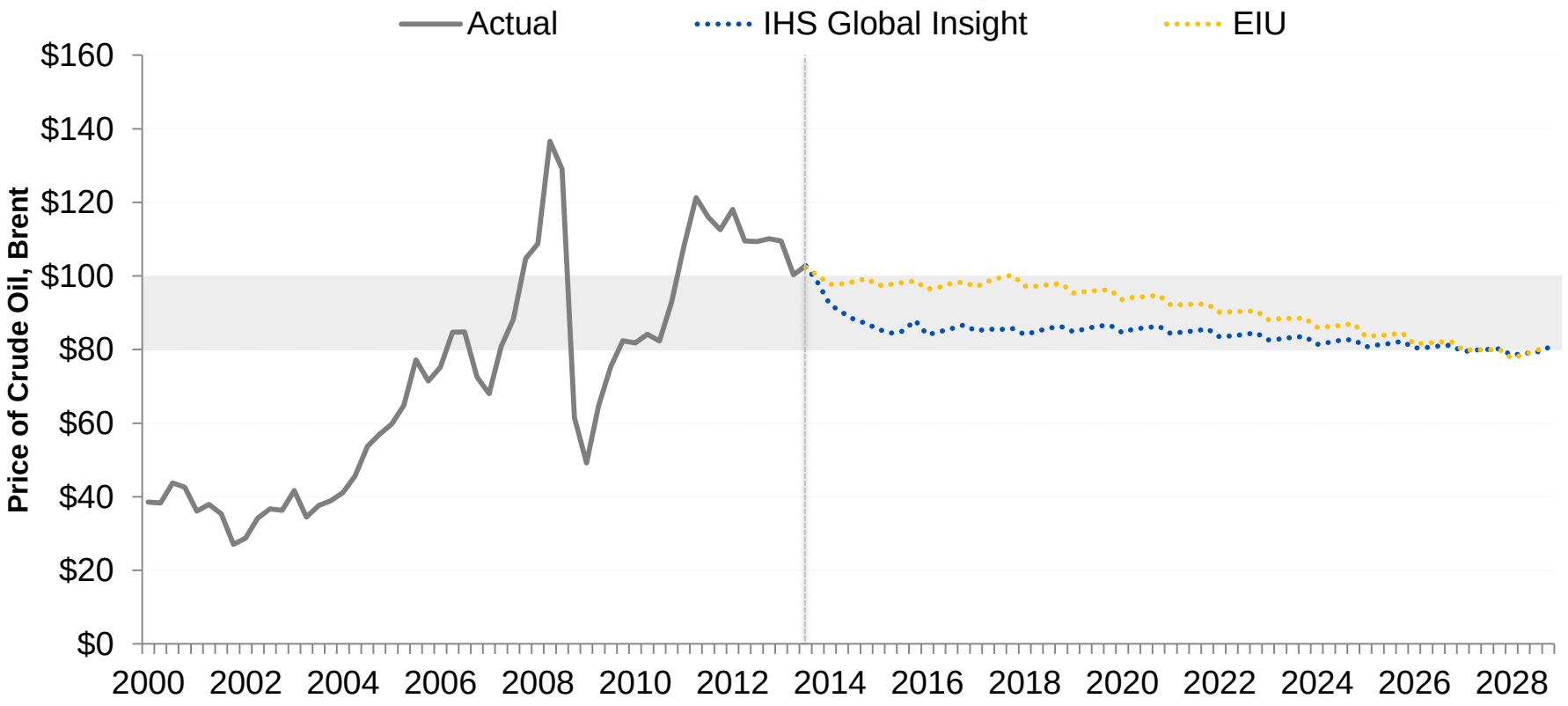
APPENDIX B. EMBRAER GLOBAL AIRLINE FLEET TREND

The following pages include excerpts from the Embraer Global Airline Fleet Trend and Demand Forecast dated 2013 that are relevant to the ASE *Future Air Service Planning Study*.

Oil Price History

Real Price (2012 US$/Barrel)

EMBRAER
Commercial Aviation



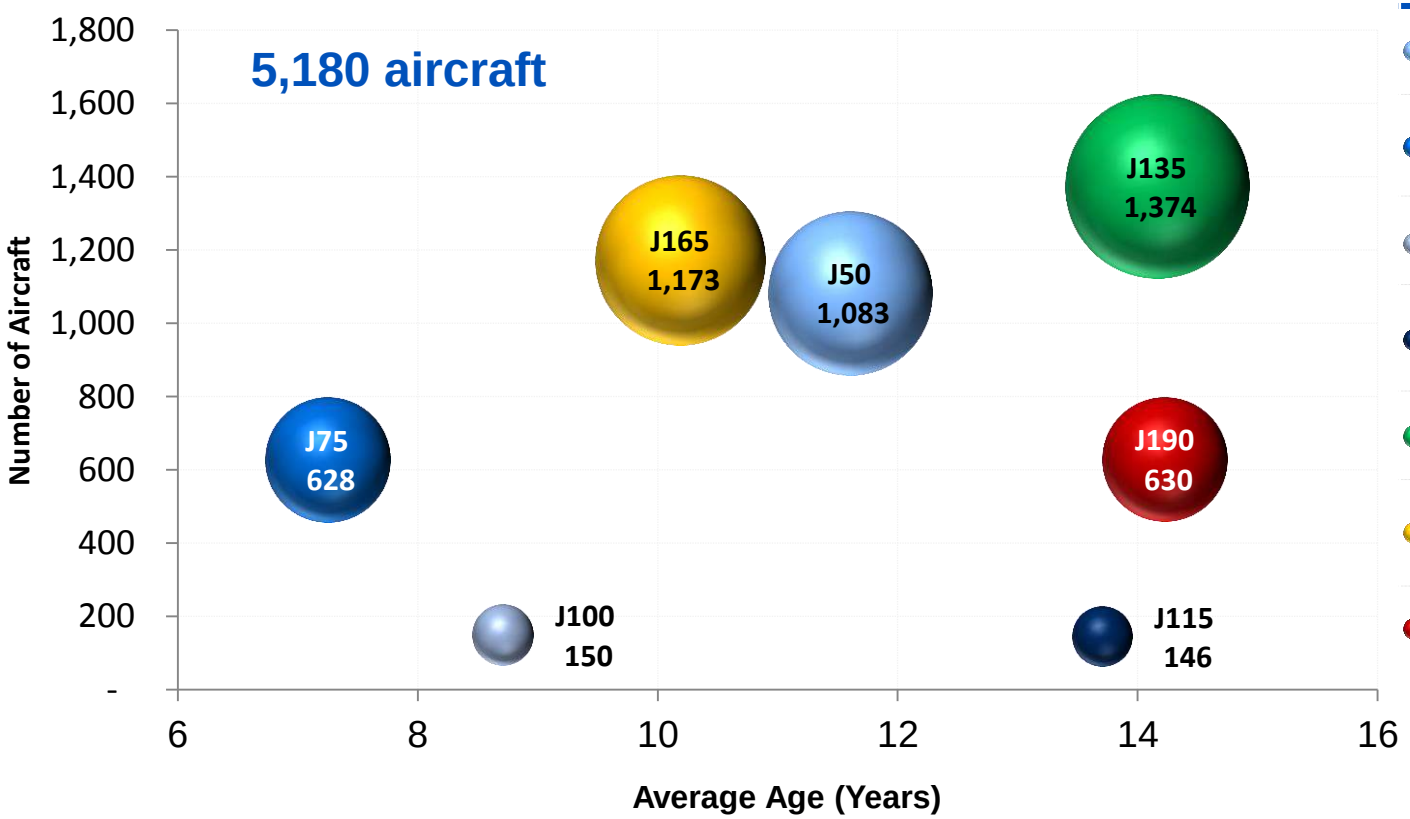
Crude oil prices are expected to be between US$ 80-100 per bbl

Source: EIA, IHS Global Insight, EIU (Sep/2013)

Fleet in Service

North America, Single Aisle Jets

EMBRAER
Commercial Aviation



Backlog	
J50	0
J75	395
J100	25
J115	0
J135	236
J165	707
J190	584

Jet 70-130 market drivers →

Natural growth from J50

Replacement of current fleet

Right-sizing of low load factor NB flights

Scheduled Airline, Active in Service and Backlog
Source: OAG (Sep/2013)

2013: Market Confidence on E-Jets

EMBRAER Commercial Aviation

Customer	Firm Orders
Republic (American Eagle)	**47 E175**
United Airlines	**30 E175**
Austral Líneas Aéreas	**2 E190**
Air Costa	**1 E190**
SkyWest Airlines	**40 E175** **100 E175-E2**
Conviasa	**7 E190**
Japan Airlines	**4 E170**
ILFC	**25 E190-E2** **25 E195-E2**
Aurigny Air Services	**1 E195**
Belavia	**2 E195**
284 Firm Orders	

Source: Embraer (Oct/13)

E-Jets

Diversified Customer Base

EMBRAER
Commercial Aviation

64 Airlines from 45 Countries

Oct/2013

E-Jets Improvements - 2014

EMBRAER
Commercial Aviation

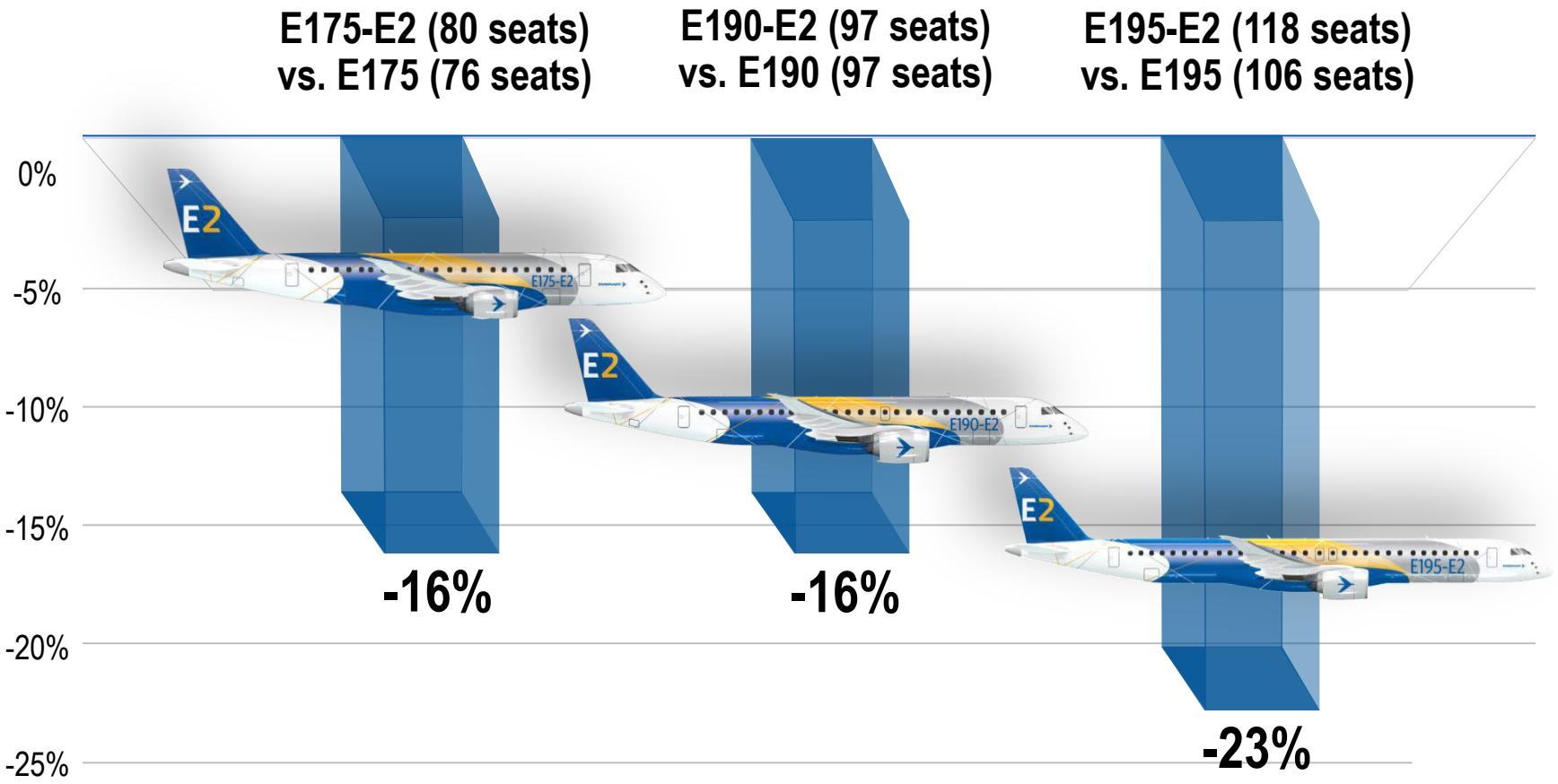
Currently being flight tested

All improvements are retrofittable, except the E175 wingtip

E2 Fuel Burn Improvements

EMBRAER Commercial Aviation

Fuel Burn per Seat

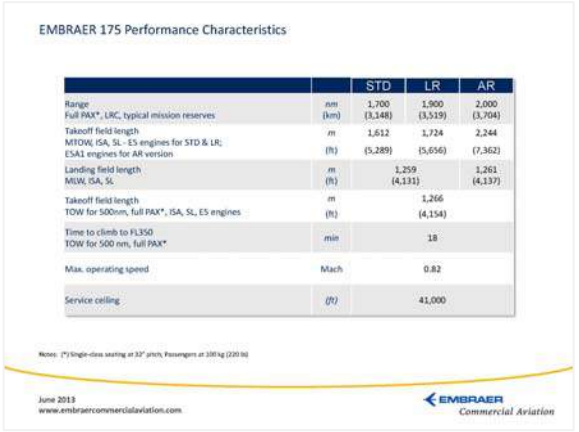


E-JETS E2 THE SECOND GENERATION

600 nm sector; Dual Class Configuration

APPENDIX C. AIRCRAFT SPECIFICATIONS

The following pages include performance specifications on several aircraft: the Embraer 175, the MRJ70 and MRJ90, the Bombardier Winglet, the Bombardier CS100 and the E-Jets E2.



EMBRAER 175 Performance Characteristics

		STD	LR	AR
Range Full PAX*, LRC, typical mission reserves	nm (km)	1,700 (3,148)	1,900 (3,519)	2,000 (3,704)
Takeoff field length MTOW, ISA, SL - E5 engines for STD & LR; ESA1 engines for AR version	m (ft)	1,612 (5,289)	1,724 (5,656)	2,244 (7,362)
Landing field length MLW, ISA, SL	m (ft)	1,259 (4,131)		1,261 (4,137)
Takeoff field length TOW for 500nm, full PAX*, ISA, SL, E5 engines	m (ft)	1,266 (4,154)		
Time to climb to FL350 TOW for 500 nm, full PAX*	min	18		
Max. operating speed	Mach	0.82		
Service ceiling	(ft)	41,000		

Notes: (*) Single-class seating at 32" pitch, Passengers at 100 kg (220 lb)

June 2013
www.embraercommercialaviation.com

EMBRAER Commercial Aviation

EMBRAER 175 Performance Characteristics

		STD	LR	AR
Range Full PAX*, LRC, typical mission reserves	*nm* (km)	1,700 (3,148)	1,900 (3,519)	2,000 (3,704)
Takeoff field length MTOW, ISA, SL - E5 engines for STD & LR; E5A1 engines for AR version	*m* (ft)	1,612 (5,289)	1,724 (5,656)	2,244 (7,362)
Landing field length MLW, ISA, SL	*m* (ft)	1,259 (4,131)		1,261 (4,137)
Takeoff field length TOW for 500nm, full PAX*, ISA, SL, E5 engines	*m* (ft)	1,266 (4,154)		
Time to climb to FL350 TOW for 500 nm, full PAX*	*min*	18		
Max. operating speed	Mach	0.82		
Service ceiling	*(ft)*	41,000		

Notes: (*) Single-class seating at 32” pitch; Passengers at 100 kg (220 lb)

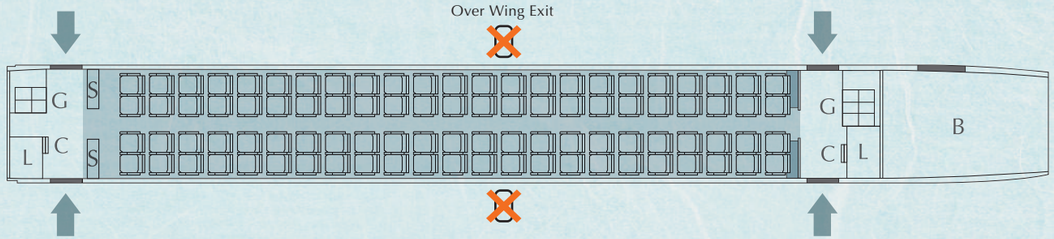
MRJ Family

The MRJ family consists of the MRJ90 (90 seat class) and the MRJ70 (70 seat class).
These aircraft have common wings, empennage, engines, and systems.
In addition, they have commonalities in pilot type rating, maintenance program, and spare parts.

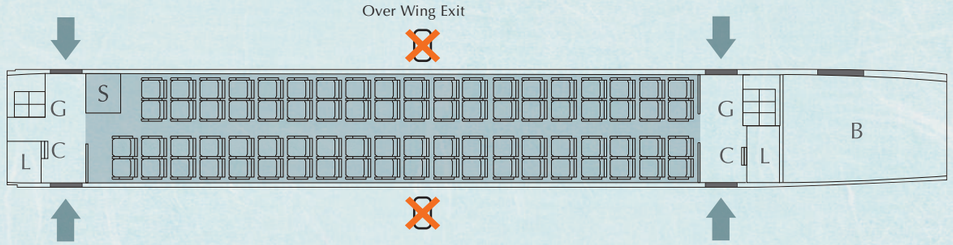
Interior Arrangement

Service and entry door are located on the front and rear of the fuselage.
The MRJ can flexibly accommodate a diverse array of passenger cabin layouts
since there is no emergency exit door over the wing.

MRJ90 Single-Class, 92Y (29" pitch)



MRJ70 Single-Class, 78Y (29" pitch)



B : Baggage	S : Stowage
L : Lavatory	C : Cabin Attendant
G : Galley	

Principal Characteristics

MRJ90

		MRJ90STD	MRJ90ER	MRJ90LR
Passengers		92 (Typical single class)		
External Dimensions (L×W×H)	m (ft)	35.8 × 29.2 × 10.5 (117.4 × 95.9 × 34.4)		
Engine Thrust	kN (lbf)	78.2 (17,600) × 2		
Maximum Takeoff Weight	kg (lb)	39,600 (87,303)	40,995 (90,378)	42,800 (94,358)
Maximum Landing Weight	kg (lb)	38,000 (83,776)	38,000 (83,776)	38,000 (83,776)
Range (@Full Passenger Payload)	km (nm)	1,670 (900)	2,400 (1,290)	3,310 (1,780)
Maximum Operating Mach Number		M 0.78	M 0.78	M 0.78
Takeoff Field Length (MTOW, SL, ISA)	m (ft)	1,490 (4,890)	1,600 (5,250)	1,740 (5,710)
Landing Field Length (MLW, Dry)	m (ft)	1,480 (4,860)	1,480 (4,860)	1,480 (4,860)

MRJ70

		MRJ70STD	MRJ70ER	MRJ70LR
Passengers		78 (Typical single class)		
External Dimensions (L×W×H)	m (ft)	33.4 × 29.2 × 10.5 (109.6 × 95.9 × 34.4)		
Engine Thrust	kN (lbf)	69.3 (15,600) × 2		
Maximum Takeoff Weight	kg (lb)	36,850 (81,240)	38,995 (85,969)	40,200 (88,626)
Maximum Landing Weight	kg (lb)	36,200 (79,807)	36,200 (79,807)	36,200 (79,807)
Range (@Full Passenger Payload)	km (nm)	1,530 (820)	2,730 (1,470)	3,380 (1,820)
Maximum Operating Mach Number		M 0.78	M 0.78	M 0.78
Takeoff Field Length (MTOW, SL, ISA)	m (ft)	1,450 (4,760)	1,620 (5,320)	1,720 (5,650)
Landing Field Length (MLW, Dry)	m (ft)	1,430 (4,700)	1,430 (4,700)	1,430 (4,700)

A GENERAL TREND TO INCREASE WINGSPAN WITH TIME

Aircraft design is always a compromise between multiple constraints with dissimilar behaviors.

Depending on the context, some constraints will have more authority on the design.

Wingspan seems to constantly increase through the Jet history.

This can be catched by comparing the wing Aspect Ratio (AR) which is the wingspan squared over the wing area.

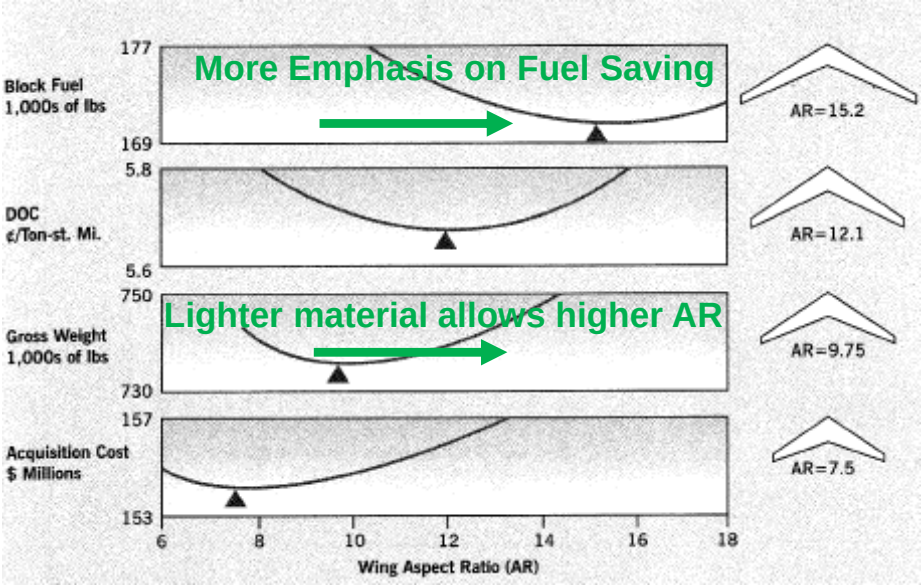
Basically the Aspect Ratio is driven by:

- Structural Weight (Increases with AR)
- Induced Drag (Decreases with AR)
- Ground Clearance

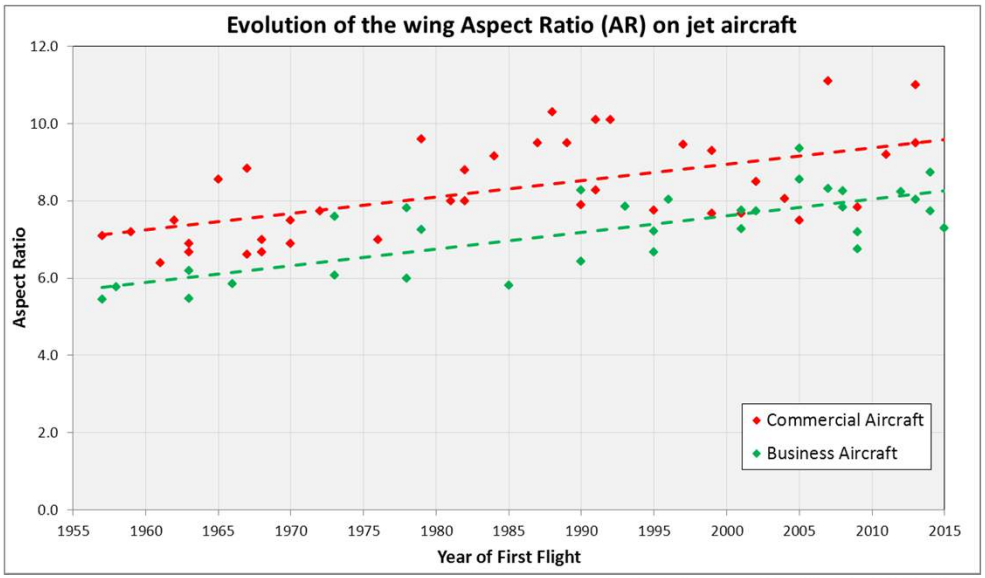
The world has changed since the 60's…

- Fuel price constantly increases
- New technology and lighter materials

This context motivates an increase in wing AR.



*** Taken from Evolution of the Airliners, Ray Whitford, Crowood 2007.**

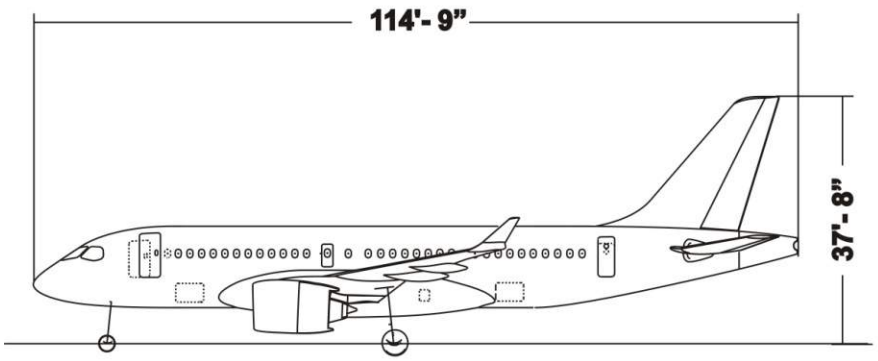


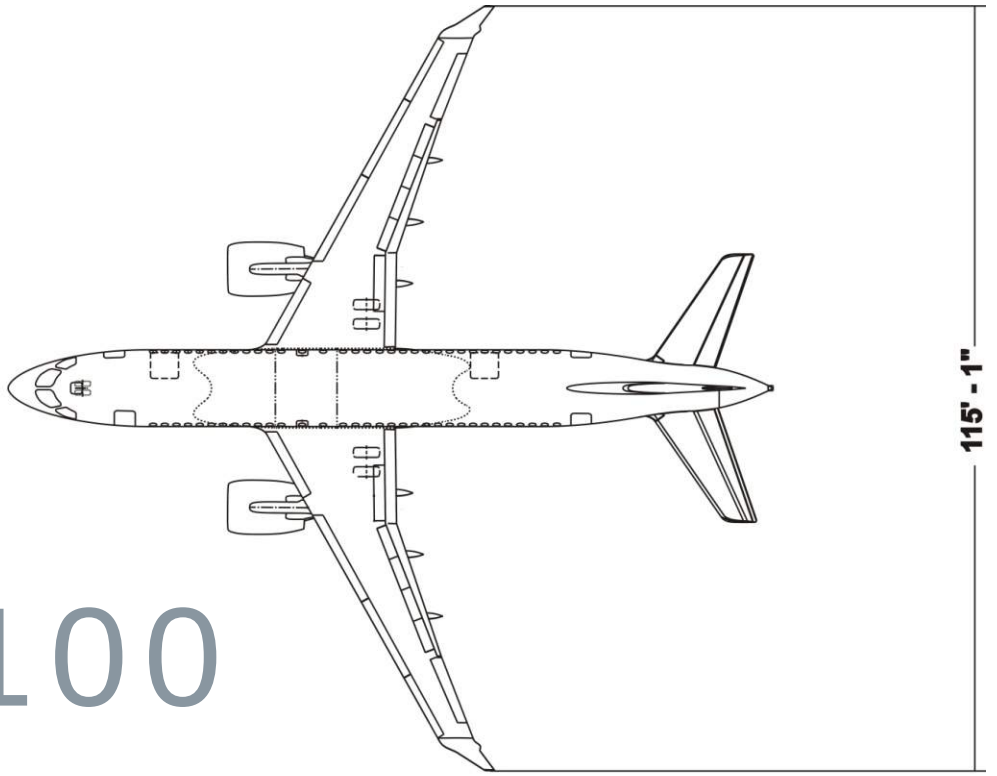
Use of winglets can be an efficient way to limit the wingspan increase.

BOMBARDIER
the evolution of mobility

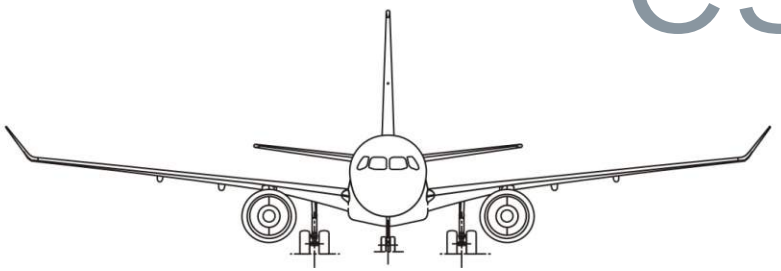
EXTERNAL DIMENSIONS

CS100





CS100



BOMBARDIER
l'évolution de la mobilité

E-Jets E2 Characteristics

October 2013

EMBRAER
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E-Jets E2 – Characteristics

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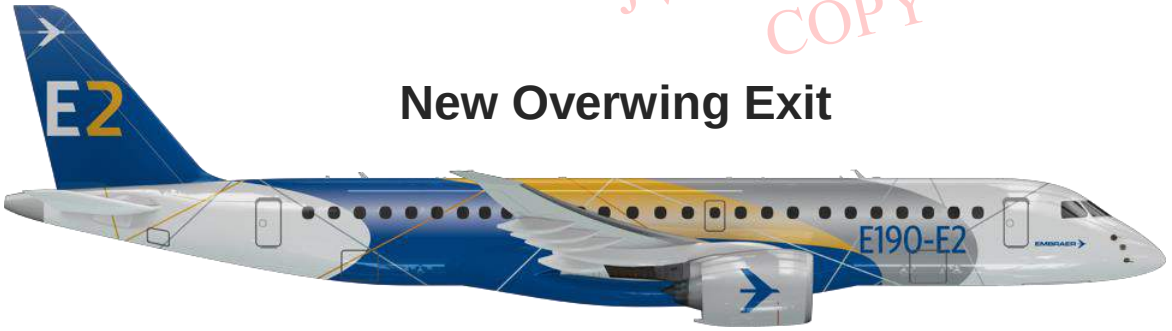
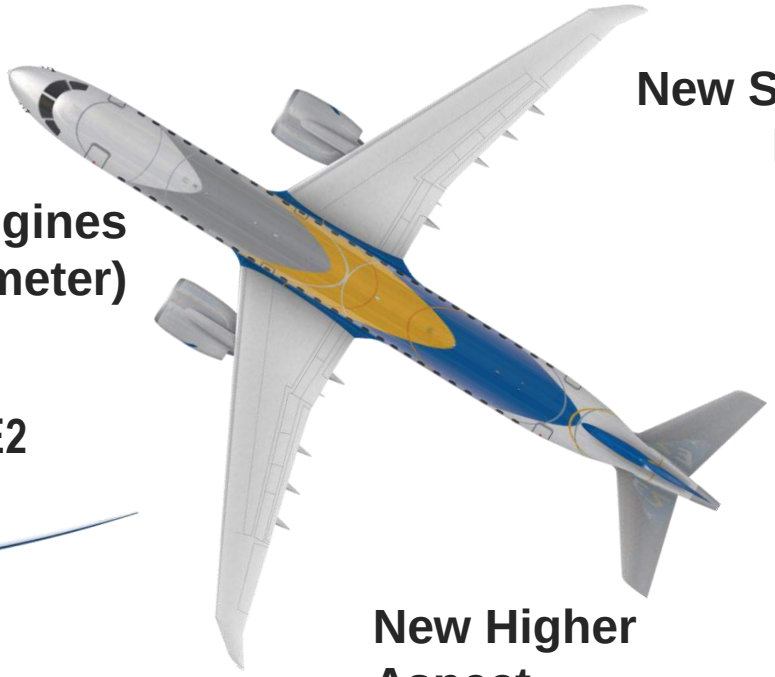


New Overwing Exit

New Landing Gears
4th Generation Fly-by-Wire
Improved Avionics
New Interior



New Stubs & Pylons

New Engines (larger fan diameter)

E175-E2 **E190-E2/E195-E2**

Optimized Wing/Engine

New Higher Aspect Ratio Wing

E-JETS E2 THE SECOND GENERATION

E-Jets E2: Main Changes

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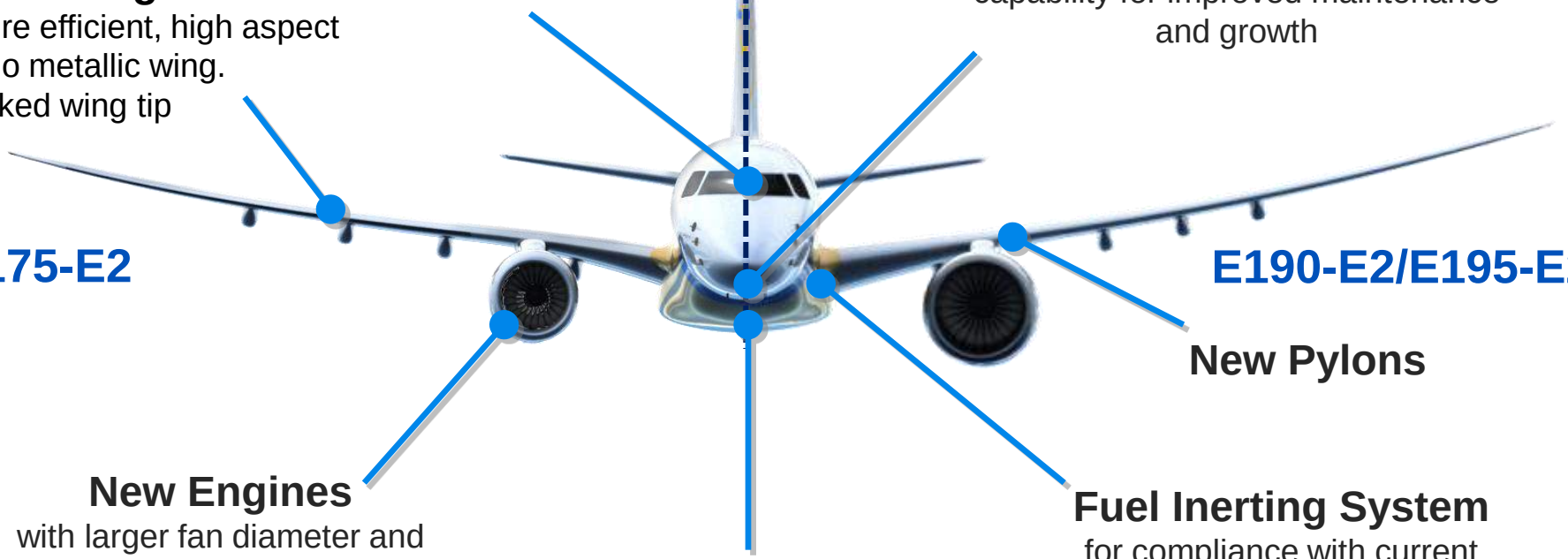
Improved Avionics
with 4 larger 13”x10” displays and touchscreen controls MCDUs

Electrical Distribution
with increased capacity, reduced weight/volume and field loadable capability for improved maintenance and growth

New Wing
more efficient, high aspect ratio metallic wing.
Raked wing tip



E175-E2

E190-E2/E195-E2

New Pylons

New Engines
with larger fan diameter and improved fuel efficiency

Fuel Inerting System
for compliance with current certification requirements

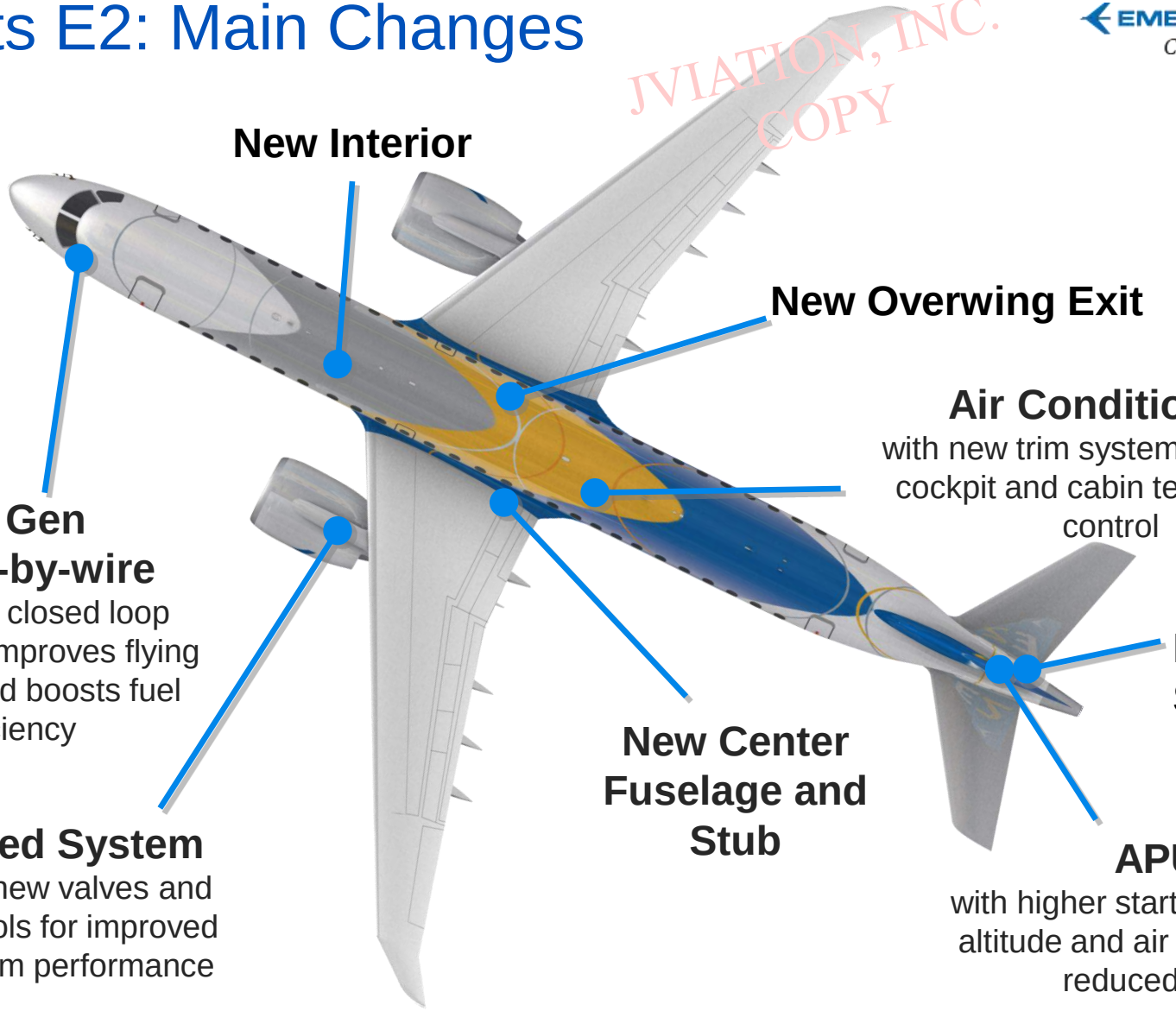
Main Landing Gear
Enabling larger engines and with doors for improved fuel efficiency

Optimized Wing/Engine: dedicated wing and engine for E175-E2 and E190-E2/195-E2

E-JETS E2 THE SECOND GENERATION

E-Jets E2: Main Changes

EMBRAER Commercial Aviation



New Interior

New Overwing Exit

Air Conditioning
with new trim system to improve cockpit and cabin temperature control

4th Gen Full fly-by-wire
with digital closed loop control that improves flying qualities and boosts fuel efficiency

New Stabilisers

New Center Fuselage and Stub

Bleed System
with new valves and controls for improved system performance

APU
with higher starting/operation altitude and air inlet door for reduced drag

Evolution in other systems: Flight Controls, Hydraulics, Steering and Ice Protection

E-JETS E2 THE SECOND GENERATION

Family Evolution

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Typical Seating

130
120
110
100
90
80
70

+ 3 rows

118 pax DC
132 pax SC

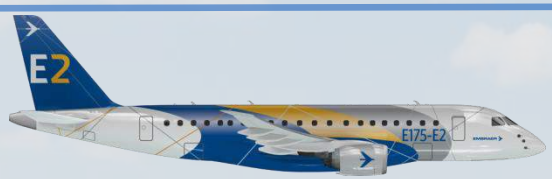
20%

same

97 pax DC
106 pax SC

20%

+ 1 row



80 pax DC
88 pax SC

E190-E2/E195-E2: Views

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Commercial Aviation

E190-E2

11.0 m (36ft 1in)

36.2 m (118ft 11in)

Current E190: 36.2 m (118ft 10in)

33.7 m (110ft 7in)

Current E190/E195: 28.72 m (94ft 3in)

higher aspect ratio wing → higher fuel efficiency

no change to ICAO Airport Reference Code (C)

E195-E2

10.9 m (35ft 10in)

41.5 m (136ft 2in)

Current E195: 38.65 m (126ft 10in)

E-JETS E2 THE SECOND GENERATION

E175-E2: Views

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Commercial Aviation

9.98 m
(32ft 8in)

32.3 m (106 ft)

current E175: 31.7 m (103ft 11in)

31 m (101ft 8in)

current E175: 26 m (85ft 4in)
E175+: 28.7 m (94ft 2in)

higher aspect ratio wing → higher fuel efficiency

no change to ICAO Airport Reference Code (C)

E-JETS E2 THE SECOND GENERATION

MLW and Payload

EMBRAER Commercial Aviation

		E175-E2	E190-E2	E195-E2
MLW	**kg**	**39,100**	**48,730**	**53,030**
	lb	86,201	107,431	116,911
Payload	**kg**	**10,310**	**13,080**	**15,150**
	lb	22,730	28,836	33,400

E-JETS E2 THE SECOND GENERATION

Noise Benefit

EMBRAER
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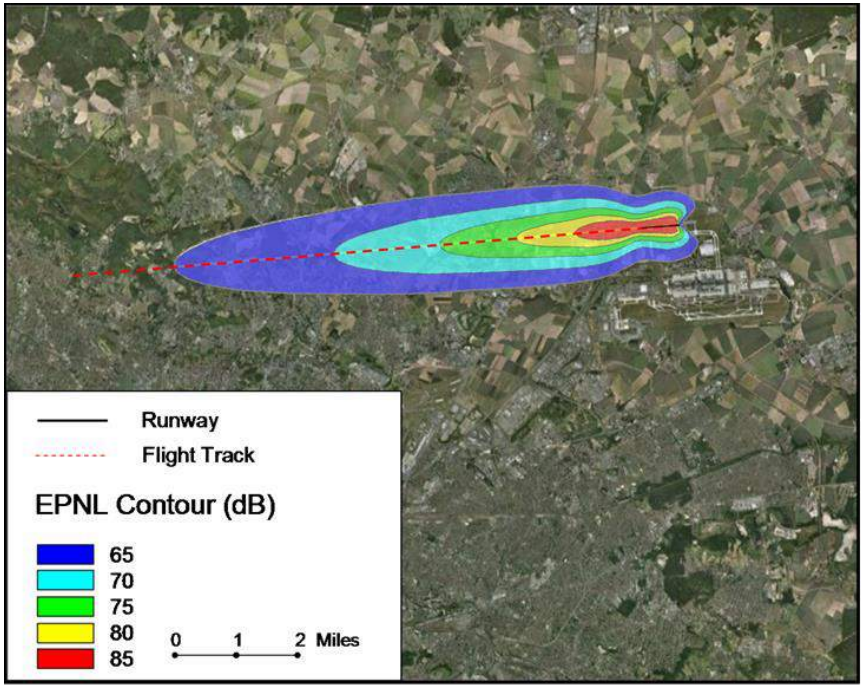
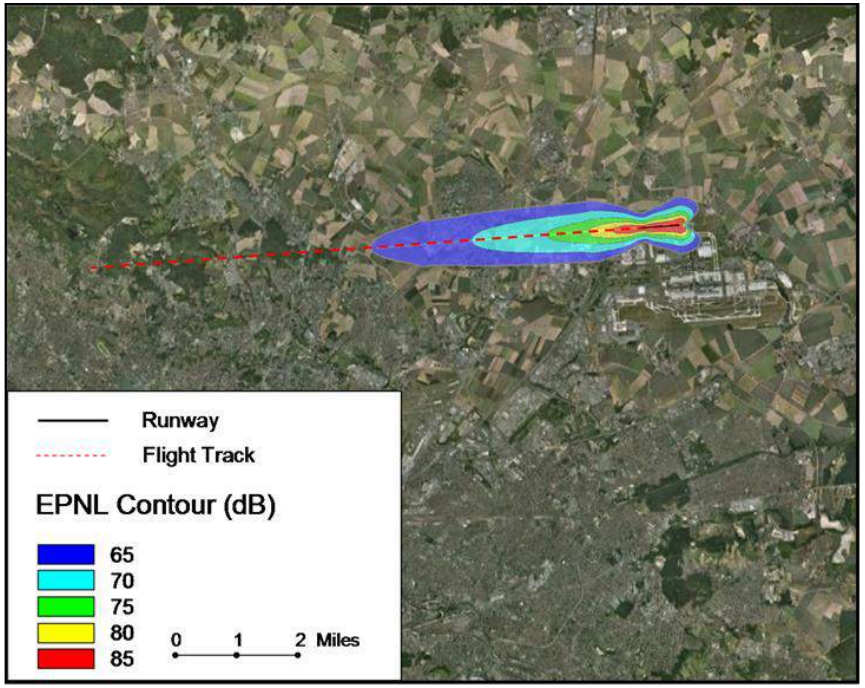
Opportunity for additional 2-3% reduction in aircraft cash operating cost via lower noise fees, direct flight tracks and curfew extensions

65% Reduction in Noise Contour – Paris (Charles de Gaulle)



E190



E190-E2

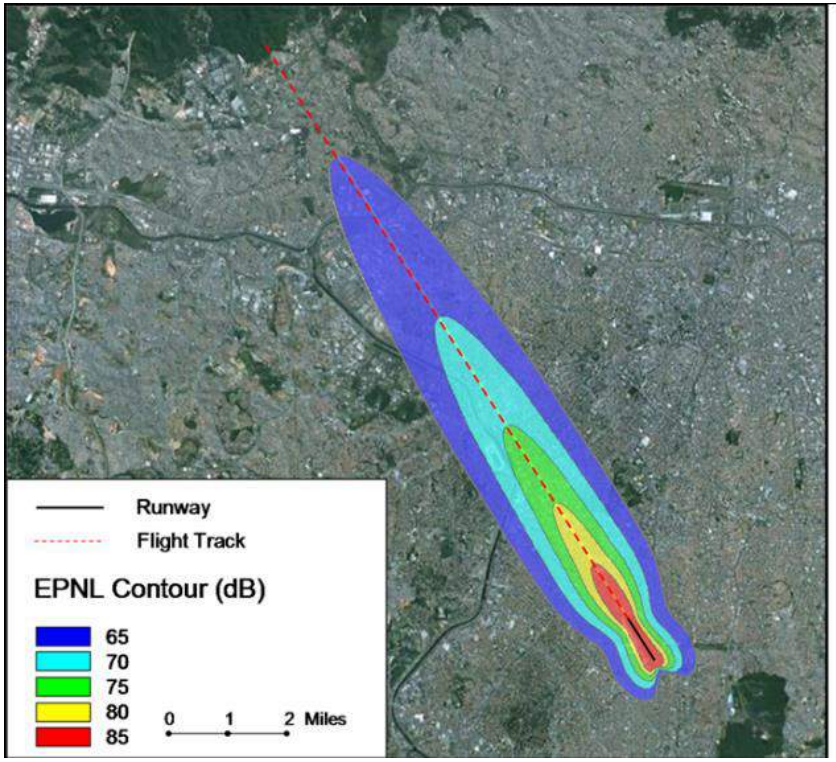
E-JETS E2
THE SECOND GENERATION

Noise Benefit

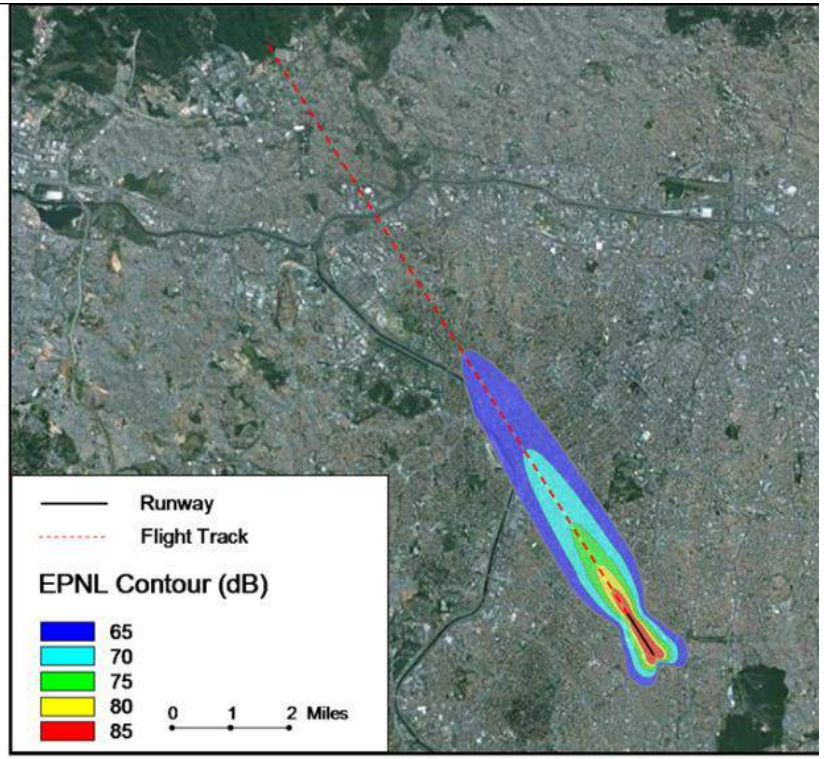
EMBRAER
Commercial Aviation

Opportunity for additional 2-3% reduction in aircraft cash operating cost via lower noise fees, direct flight tracks and curfew extensions

65% Reduction in Noise Contour – Sao Paulo (Congonhas airport)



E190



E190-E2

E-JETS E2 THE SECOND GENERATION

Noise Levels

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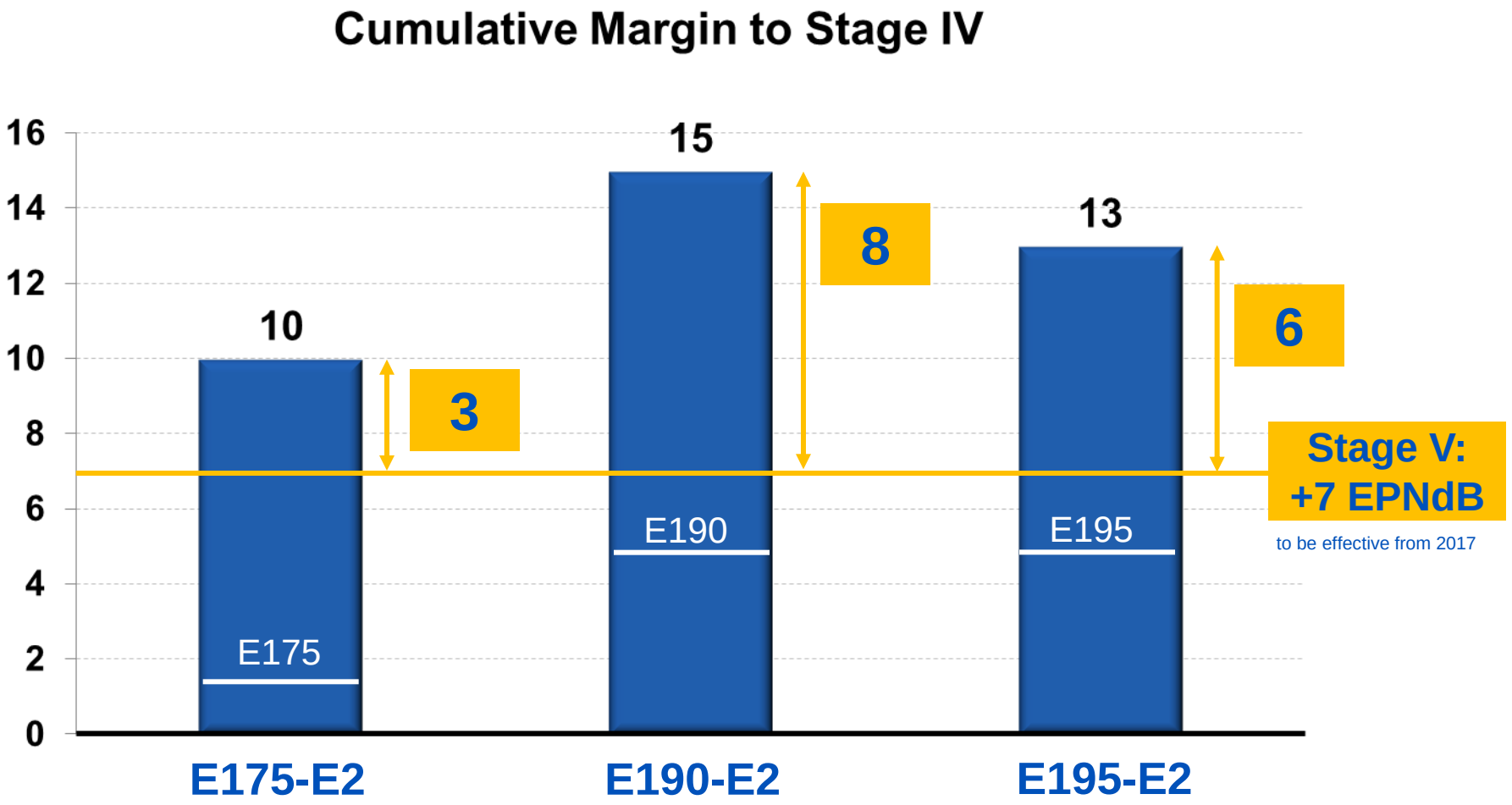

E-JETS E2 THE SECOND GENERATION

Emissions

EMBRAER
Commercial Aviation

	Margin to CAEP/8 limit		
Emissions Parameter	**E175–E2**	**E190-E2**	**E195-E2**
UHC	100%	100%	100%
CO	73%	80%	82%
NOx	38%	42%	39%
Smoke	89%	94%	92%

E-JETS E2 THE SECOND GENERATION

APPENDIX D. RELATED INDUSTRY ARTICLES

The following pages include published articles on several of the aircraft discussed in this report to provide additional information.


Embraer Launches NextGen E-Jets With Strong Support

Embraer Launches NextGen E-Jets With Strong Support

AIN AIR TRANSPORT PERSPECTIVE » JUNE 24, 2013

by **GREGORY POLEK**

June 24, 2013, 1:03 PM

The second generation of Embraer's E-Jet series of narrowbody airliners was officially launched and named E2 during last week's Paris Air Show. Seven launch customers rallied for the christening party, supporting the Brazilian airframer with approximately $17.8 billion worth of orders and commitments for up to 365 of the twinjets.

The main foundation for the upgraded 97- to 114-passenger E190-E2, the 144-seat E195-E2 and the 90-seat E175-E2 is the replacement of the General Electric CF34 engines with Pratt & Whitney's new PW1000G geared turbofan. Other improvements include a new wing with higher aspect ratio; improved avionics; full fly-by-wire flight controls; a new interior; and improved connectivity technology in the cabin.

First to enter service in 2018 will be the E190-E2. This will be followed in 2019 by the E195-E2, which will have three more rows of four-abreast seats than the existing E195. Finally, the E175-E2, with one more row of seats than the existing version, will reach the market in 2020. Embraer has opted not to include the 70-seat E170 in the E2 mix.

Another key program partner will be Honeywell, which is to equip the E2 with its Primus Epic 2 avionics suite. Embraer's decision to retain Honeywell in the cockpit put an end to speculation that the airframer might switch to another supplier in the wake of "teething" troubles it experienced in service with the existing E-Jets. In February, Embraer Commercial Aviation COO Luis Carlos Affonso acknowledged that the company had seriously considered a switch to Rockwell Collins or Garmin, but ultimately opted not to make the change on the grounds that it wanted to retain the technical commonality with the existing E-Jet cockpits.

Epic 2 borrows much of its architecture from the existing Epic suite, including the configuration of system boxes and data buses. The E2 E-Jets will benefit from a new flight management system that Embraer plans to integrate into production of the current E-Jets by 2015.

Embraer CEO Frederico Curado told a Paris press conference that the extra capacity for the E175-E2 and E195-E2 will come from a fuselage stretch rather than simply reconfiguring the interiors. The E190-E2 will retain its existing airframe dimensions. All three types will get new wings, with the E190-E2 and the E195-E2 having the same design. Anticipated fuel-burn improvements over the current models include a 16-percent advantage for the E175-E2 and the E190-E2, while the E195-E2 should consume

23 percent less jet-A. Embraer claims the E195-E2 will deliver better seat-mile costs than the substantially larger Airbus A320neo.

TAGS: E175 EMBRAER E-JET FAMILY E170 E2 PRATT & WHITNEY PW1000G E AIRBUS A320 FAMILY

FILED UNDER: AIR TRANSPORT AND CARGO AIRCRAFT

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In order to leave comments you will now need to be a registered user. This change in policy is to protect our site from an increased number of spam comments. Additionally, in the near future you will be able to better manage your AIN subscriptions via this registration system. If you already have an account, click here to log in. Otherwise, click here to register.

THIS MONTH | ALL TIME

Emirates Puts Its Stamp on 777X
OCTOBER 7, 2013, 3:20 PM

Rivet Joint Airworthiness Questioned by UK
OCTOBER 30, 2013, 4:42 PM

Airbus Secures Monumental A350 Order from JAL
OCTOBER 7, 2013, 3:33 PM

Gliders Might Improve Pilots' Upset Flying Skills
OCTOBER 7, 2013, 1:40 PM

Europe's Regional Airlines Soldier Through Political Quagmire
OCTOBER 7, 2013, 3:10 PM

Bizjets Used for Efficiency, Not Luxury, Survey Finds
OCTOBER 8, 2013, 3:00 PM

ICAO Agrees To Global Emissions Cap-and-Trade Scheme by 2020
OCTOBER 7, 2013, 3:25 PM

As Time Flies By, Learjet Celebrates 50 Years
OCTOBER 8, 2013, 3:15 PM

JSF Clocks 10,000 Hours as LRIP Contracts Are Signed
OCTOBER 11, 2013, 12:45 PM

FAA Files Show Avantair Had Long History of Issues
OCTOBER 8, 2013, 3:10 PM

World Airline News

Aircraft Stock Images and Color Photos. Framable Prints and Aviation Gifts. Slide Shows.

SkyWest signs a firm order for 100 new Embraer E175-E2 Second Generation jets

By Bruce Drum on June 17, 2013

(http://airlinersgallery.smugmug.com/Airlines-UnitedStates/SkyWest-Airlines/15966310_dLrcgT)

SkyWest Inc. (SkyWest Airlines (http://airlinersgallery.smugmug.com/Airlines-UnitedStates/SkyWest-Airlines/15966310_dLrcgT) and ExpressJet Airlines) (St. George) has signed a firm order for 100 Embraer E175-E2 aircraft, with another 100 Purchase Rights, bringing the total potential of the order to 200 aircraft. The announcement was made today at a press conference at the 50th International Paris Airshow. If all the orders are exercised, the contract has an estimated value, at list price, of $9.36 billion.

© SkyWest Airlines

(http://airlinersgallery.smugmug.com/Airlines-UnitedStates/SkyWest-Airlines/15966310_dLrcgT)

This new contract is in addition to SkyWest's previous order in May 2013 for up to 200 current generation E175 aircraft, and therefore the potential order of E-Jets at SkyWest may reach 400 aircraft.

As the first operator to order the E175-E2, SkyWest becomes the launch customer for that aircraft, one of three E-Jets E2 models. SkyWest is the largest regional airline group in the world. It is the parent company of SkyWest Airlines and ExpressJet Airlines, both of which have been long time operators of Embraer aircraft. More than 40 EMB-120 Brasilia turboprops continue to fly in the SkyWest Airlines network, primarily in the western states. ExpressJet Airlines operates 249 aircraft from the ERJ 145 family and has the largest ERJ fleet in the world.

The E-Jets E2 represent Embraer's commitment to continuously invest in the company's line of commercial jets and maintain its leadership in the 70 to 130 seats market. The three new airplanes (E175-E2, E190-E2, E195-E2) carry the designator "E2" which signifies generational changes in technology that have been incorporated in the design. Each of the three aircraft has the versatility for a range of single class, multi-class or high-density seat capacities to suit operator requirements with new 'look and feel' and improved comfort levels.

State-of-the-art engines in combination with new aerodynamically advanced wings, full fly-by-wire flight controls, and advancements in other systems will result in double-digit improvements in fuel burn, maintenance costs, emissions and external noise.

The first delivery of an E-Jets E2 (the E190-E2) is planned for the first semester of 2018. The E195-E2 is slated to enter service in 2019 and the E175-E2 in 2020. Over 950 E-Jets have been delivered to date. Currently, 65 customers from 47 countries have added Embraer E-Jets to their fleets.

Pratt & Whitney will provide exclusive power for up to 100 firm plus 100 purchase right Embraer Second Generation E-Jets for an order announced today by Embraer and SkyWest, Inc. Deliveriesare scheduled to begin in 2020. Pratt & Whitney is a division of United Technologies Corporation.

Each Embraer Second Generation E2 E-Jet will be powered by two PurePower engines. Pratt & Whitney has announced orders for more than 3,500 engines that include announced and unannounced firm orders, plus options. The PurePower family of engines uses an advanced gear system allowing the

engine's fan to operate at a different speed than the low-pressure compressor and turbine. The combination of the gear system and an all-new advanced core deliver the improvements in fuel efficiency, environmental emissions and noise.

Image: Embraer.

SkyWest Airlines:

(http://airlinersgallery.smugmug.com/photos/swfpopup.mg?AlbumID=15966310&AlbumKey=dLrcgT)

Posted in: ExpressJet Airlines, SkyWest Airlines | Tagged: Embraer, ExpressJet Airlines, Pratt and Whitney, SkyWest Airlines

The Flying Engineer ~ Technically and Operationally Commercial Aviation

Affordable Capacity: The definition of the Regional Jet Market.

28 *Monday* Oct 2013

POSTED BY THEFLYINGENGINEER IN GENERAL AVIATION INTEREST, MANUFACTURER

≈ **2 COMMENTS**

Tags

1000, *170*, *175*, *190*, *195*, *700*, *900*, *Bombardier*, *C*, *CRJ*, *CS100*, *CS300*, *Embraer*, *Jet*, *market*, *Regional*, *Series*, *Shift*, *trend*

Highlights: *The death of the 70 seat regional jet market, shifting market trends, and what airlines seem to trend on: affordable capacity.*

50 seat regional jets heralded a new way to travel. Comfort and speed were real reasons, and offering a jet to regional customers, as opposed to a turboprop aircraft, suddenly seemed very attractive. The Embraer ERJ 145, introduced in 1996, and the Bombardier CRJ 100/200, introduced in 1992, both extremely popular 50 seat airplanes, sold 708 airplanes and 935 airplanes, respectively.

Regional aviation only continued to grow, fuelled by more efficient jets that promised good operating economics. According to Bombardier's study in 1998, there was a growing requirement for larger aircraft in the fleets of the world's regional airlines. To keep up with the growth in mainline fleets, Bombardier felt that regional fleet must grow in both size and capacity. The company felt that if the regional fleet did not grown beyond 50 seats, the number of 50-seaters required to satisfy demand would quadruple.

Because of this growth, regional airplanes grew in capacity, to match demand. The CRJ 700, a 70 seat regional jet from Bombardier, was introduced in 2001, and the competing Embraer 170 was introduced to airline service in 2004. As airplanes grew in size, the operational costs per seat started to fall, further opening up regional aviation to larger airplanes while gradually declining the smaller regional jet market. The market shifted, and continues to shift towards larger sized regional jets.

The CRJ 100/200 is no longer in production. In 2008, the Embraer 145 had 733 firm orders, which slumped to 708 in 2009, and has remained at that figure, over 4 years till date. By 2011, all orders had been realised through deliveries. The 50 seat jet market effectively and statistically died many, many years ago.

The CRJ 700, when introduced, did exceedingly well. Between 2000 and 2010, the order book grew by 160%, to 344 firm orders. The Embraer 170, which had a late start, touched 194 firm orders in 2009. While these were fairly good figures, the market shift hadn't stopped.

The Embraer 190, and the CRJ 900 have seen the greatest sales growth. The E-190, when introduced in 2005 with JetBlue, had 185 firm orders. This has seen a fairly steady, and unparalleled growth to 560 in 2013: a growth of 200%. The CRJ1000 was Bombardier's answer to the E-190, but that entered service very late, almost 5 years later, in December 2010, but firm orders stand at only 70, as of July 2013. The CRJ1000 is not much of a competitor to the E-190; The longest range version of the jet, 1,622NM, falls short of the shortest range version of the E-190: E-190STD at 1800NM. The E-190AR has a range of 2400NM.

While there was such encouraging growth in sales of 100 seat airplanes, The CRJ700 stopped building orders after 2010. In fact, after 2010, 4 firm orders were lost, with the number lazily bouncing back to 347 in 2013. After 2009, The Embraer 170's firm orders only reduced, and hasn't recovered since. It's not the manufacturer. It's the market, and the 70 seat regional jet isn't favoured anymore. As of Sep 2013, there is a backlog of only 6 E-170, of which 2 are for Japan Airlines and 4 for ETA Star Aviation, India.

The 78-88 (80) seat E-175 is the next-best received aircraft. Orders for the type are nowhere close to that of its longer, 100 seat E-190, and had stagnated for more than 1 year in the period after 2011, at the level of the dead-market E-170. A sudden surge in orders, of 65% to 315 in 2013, is thanks to Skywest, which placed a large enough order for the type. The 90 seat CRJ900, has 306 firm orders in 2013, and witnessed a 380% surge in orders between 2005 and 2007.

A 2000NM range airplane with the ability to carry 100 passengers has been the hottest selling cake. Add another 16 to 24 seats and the offering, the E-195, isn't quite as attractive. Bombardier's response to the E-195 is the 125 CS100, and the unique, hitherto unmatched offering is the 135-160 seat CS300.

Proof that the market is shifting away from 70 seat jets is the fact that Embraer, that has moved forward with its plans to re-engine, significantly re-engineer and update the E-Jets to a "Second generation" of E2 jets, has the E-195-E2, the E-190-E2, and the E-175-E2, but no plans at all for the E-170-E2.

The market needs higher capacity airplanes for greater flexibility, provided that it doesn't come at the cost of economics and performance. With economically better performing or promising airplanes hitting the market, "affordable capacity" is the market demand.

And since the E-175-E2 is planned for a 2020 Entry into service (EIS): the last amongst all re-engined E-Jets, it's a sign of the 80 seat regional jetliner's grave being prepared, next.

**This section is part of a much bigger, comprehensive article on the C-Series by The Flying Engineer.*

thoughts on "Affordable Capacity: The definition of the Regional Jet Market."

1. *said:*Cyril Mathew Roy

   October 28, 2013 at 7:41 am

   Something to add to the above .

   The number of 50 seat regional jets grew in huge numbers in the 1990's and late 2000 has a lot to do with Pilot Union Negotiations at the Major Airlines in the US

   After the recession in early 1990 the airlines negotiated with Pilot Unions to raise the number of seats that their Regional Partners can carry .
   This was capped at 50 seats and hence the growth of the 50 seat jet market
   Until then most regionals had small turboprops with 40 seats or less

   After 9/11 and many airlines filed for bankruptcy the airlines negotiated again in exchange to prevent job cuts they asked the 50 seat limit to be raised

   This raised the limit to 76 seats and hence we saw the growth of the ERJ 170/175 and the CRJ 900

   REPLY

   - ***said:*theflyingengineer**

Larger regional jets to set trends on the MRO specialists' market

2013.03.26

Last week Embraer representatives spoke about their anticipation to significantly increase the sales rates of the company's 70- and 76-seat regional jets in the U.S. market. The expected spike in demand for larger jets can be attributed to the diminishing popularity of the traditional 50-seaters among airlines. Another manufacturer – Bombardier Aerospace – also forecasts a significant shift towards larger and more efficient regional jets around the world - the 60- to 99-seat jets segment alone will increase by over 270% during the upcoming 20 years. Such trend in the airlines market will directly impact the demand for the accordingly qualified MRO specialists, as well as the need to retrain the current generation of maintenance specialists.

The Brazilian producer Embraer anticipates that during the upcoming years the USA alone will require several hundreds of new regional jets. Frederico Curado, the company's CEO, has indicated that the reshaping of U.S. fleet will be the major source of the demand. At the same time, the Canadian giant Bombardier is also shifting their focus onto larger regional jets. In December 2012 a major U.S. carrier – Delta Air Lines – placed an order for forty CRJ900s with an option to acquire 30 additional aircraft. In February 2013 a Russian leasing company Ilyushin Finance Co. ordered 32 CS300s with an option for another dozen aircraft of the kind.

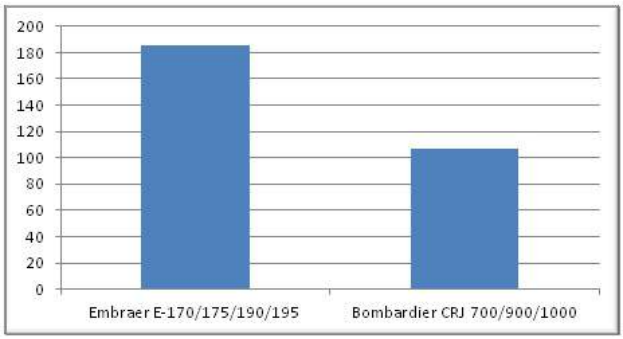


Table 1. E-170/175/190/195 and CRJ 700/900/1000 backlog as of 31 December, 2012

'U.S. airlines are actively looking for options to replace their 50-seaters. The development of regional aviation and the demand for constant fleet optimization drives carriers to replenish their fleets with newer generation aircraft. Similar trends can be observed outside North America as well. Europe is likely to sustain a strong demand for large regional jets. This also concerns the CIS region where several new E-Jets have already reached their operators. Furthermore, Russia has finally certified CRJ 700/900/1000 and E190/195. The potential of the Russian market in the upcoming 20 years is of somewhat several hundred of larger regional jets,' comments Dainius Sakalauskas, the Deputy Head of FL Technics Training.

Apart for Embraer and Bombardier, other manufacturers are also keen on cutting their slice of the expanding regional jet market. Already by the end of 2013 the Chinese Comac is set to deliver its first ARJ-21 one of the 300 ordered aircraft, mainly awaited to be delivered to Asian companies. Mitsubishi Aircraft Corporation is also planning to enter the regional jet market with its 70-90-seat MRJ, the first delivery of which is planned for 2015. Meanwhile, the Russian Sukhoi Holding is actively increasing the sales of its Sukhoi SuperJet 100. Apart from some operators in Russia and the CIS, SSJ100 has been already delivered to Sky Aviation (Indonesia) and Lao Central (Laos) with an upcoming delivery to Interjet (Mexico).

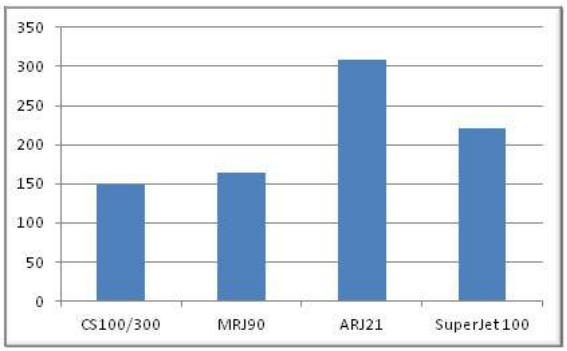


Table 2. MRJ, ARJ21, SSJ 100 and CS300 backlog

While shifting from smaller to larger regional jets, airlines are forcing natural changes in the employment market of aircraft technicians. Among those affected the in-house specialists and technical staff of third party MRO providers will be topping the list of the most sought after employees.

'Naturally, some of the current specialists will be able to support the re-fleeting processes. There a lot of various retraining programs which allow one to retrain, for example, from CRJ 200 to CRJ 900 type of aircraft within just a 2-month period. With theoretical courses to last about a month and the practical part – another several weeks, retraining comes as the most time-effective solution to meet the immediate needs. However, we must also address the pressing issue of retirement. Current generation of technicians cannot be tapped into forever. Along with the increasing number of aircraft orders, this forms a potential gap in the global market. It is highly important that the manufacturers of new aircraft types understand the need for a wider training network for the latest and upcoming regional jets. The lack of qualified maintenance personnel and/or possibilities to prepare adequately trained specialists would undoubtedly limit the development of a proper MRO network thus diminishing the competitiveness of new aircraft types,' concluded D. Sakalauskas.

InvestorCenter

United Embraces Bigger Regional Jets but Still Lags Delta

by Adam Levine-Weinberg, The Motley Fool May 23rd 2013

6:31PM

Updated May 23rd 2013 8:00PM

"Upgauging" -- replacing small airplanes with larger ones -- has become an important trend in the airline industry in the past five years. Airlines have found that larger aircraft usually have lower unit costs, which improves profitability. Fifty-seat regional jets have come in for particular scorn, as they have very high unit costs and provide a poor passenger experience.

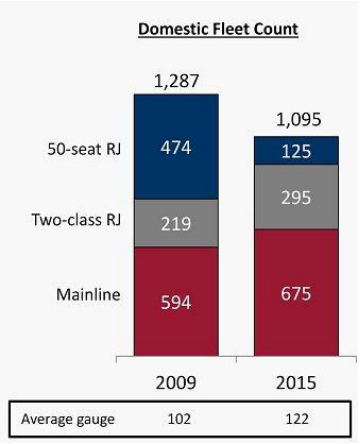
Historically, the popularity of 50-seat regional jets was driven by "scope clauses", agreements between airlines and their pilot unions that restricted the airlines from outsourcing flying on large regional jets. However, the most recent round of airline labor negotiations has led to relaxed scope clauses at **Delta Air Lines** , **United Continental** , and **AMR**.

Delta has been the leader in seeking to reduce its reliance on 50-seat (and smaller) aircraft. However, United has also drawn attention as it ordered 30 E175 76-seat planes from **Embraer** last month, and then agreed this week to add 40 more E175s operated by **SkyWest** . These two agreements pave the way for United to add 70 large regional jets over the next two years, while removing 100 or more 50-seat aircraft. Nevertheless, United will remain significantly behind Delta in terms of fleet restructuring, which will leave it with a higher cost structure and lower profitability.

Delta kills the 50-seat regional jet

Over the last year, Delta has introduced a fleet restructuring plan that will remove all but 125 of its 50-seat regional jets from service by 2015. The company was able to sublease 88 used **Boeing** 717s (seating 110 passengers) from **Southwest Airlines** at a great price, as Southwest wanted to return to flying only Boeing 737s.

In return for adding this additional "mainline" flying -- performed by Delta pilots and flight attendants -- Delta's pilot union agreed to allow the company to add more 76-seat regional jets. In December, Delta signed a firm order for 40 new Bombardier CRJ900s, with options for 30 more. If all the options are exercised, Delta will reach a maximum limit of 325 76-seat regional jets permitted by its pilot contract.



Delta Domestic Fleet Restructuring (Source: Delta 8-K, 12/12/12, slide 18)

As this figure shows, the Boeing 717s and CRJ900s ("Two-class RJ") being added to the fleet will replace flying currently done by 50-seat regional jets. Since the

updated fleet will feature larger planes, Delta will be able to produce the same amount of capacity despite having significantly fewer departures and a smaller fleet. This will lower the company's unit costs.

United follows, but at a distance

Today, United relies very heavily on small regional aircraft (50 seats or less), most of which are 50-seat regional jets. As of the end of 2013, United's regional fleet will consist of 389 aircraft with 50 or fewer seats, compared with just 185 large (i.e. more than 50 seats) turboprops and regional jets.

United's two recent orders will raise its large regional aircraft count to 255 by the end of 2015, which is the maximum permitted by its labor contract. Those additional 76-seat regional jets will allow United to cut back to 250-300 planes with 50 or fewer seats. However, that will still be more than double the size of Delta's small regional jet fleet, putting United at a cost disadvantage.

Can United catch up?

Given the highly competitive nature of the airline industry, having too many inefficient 50-seat aircraft could be a huge drag on profitability. United's pilot contract does allow the company to go beyond 255 large regional aircraft. The airline can add up to 70 more large regional aircraft (bringing the total to 325) if it also adds 88 small narrowbodies to be flown by United pilots. This language mimics Delta's fleet restructuring plan.

However, Delta's fleet restructuring was enabled by its deal with Southwest for used (i.e. cheap) Boeing 717s. United would most likely buy new Embraer 190/195 or Bombardier CSeries planes for $30 million-$40 million each if it decides to continue upgauging its domestic fleet. In other words, United will have to spend billions of dollars on capex to fully catch up with Delta in the race to get rid of 50-seat aircraft. Since United already has very high capex commitments through the end of the decade,

management may understandably shy away from additional fleet restructuring actions.

Who's the real winner?

While United is clearly following the same path as Delta toward "upgauging", it will have trouble matching Delta's 50-seat fleet reductions. Delta benefited from good timing, insofar as Southwest was looking to get rid of its Boeing 717s at the same time that Delta was thinking of adding planes of that size. United will either have to invest a significant amount of capital in small mainline aircraft or maintain its higher usage of 50-seat (and smaller) regional aircraft.

The real winners in all of this are Embraer and Bombardier, which have a near duopoly on the regional jet market. United's recent orders have done wonders for Embraer by helping it to rebuild its order backlog. Moreover, United's pilot contract paves the way for the company to add 100-seat aircraft from Embraer or Bombardier eventually. The obsolescence of the 50-seat regional jet should drive strong demand for replacements for the rest of the decade.

The article United Embraces Bigger Regional Jets but Still Lags Delta originally appeared on Fool.com.

Motley Fool contributor Adam Levine-Weinberg is short shares of United Continental Holdings and has the following options: Long Sep 2013 $33 Puts on United Continental Holdings. The Motley Fool recommends Embraer-Empresa Brasileira and Southwest Airlines. Try any of our Foolish newsletter services free for 30 days. We Fools may not all hold the same opinions, but we all believe that considering a diverse range of insights makes us better investors. The Motley Fool has a disclosure policy.

Flightglobal serious about aviation

Regional jet demand now centred on 90-plus seaters: report

By: Mary Kirby Philadelphia Oct 19, 2011

Demand in the regional jet market is now centred on the 90-seat and larger aircraft, as the heyday for 50-seats "and even the 70-seat jet market" has come and gone, predicts research firm Forecast International in its latest market report.

Irrespective of scope clauses in major airline pilot contracts, which generally bar the operation of 90-seaters by regional affiliates, the 90-plus seat passenger aircraft segment "will experience the most dynamic growth in the regional aircraft market", said Forecast International. It explained: "Independent regional carriers, low-fare airlines, and major network airlines will buy large regional jets in quantity. A combination of air traffic growth and the need for operating efficiency is dictating that carriers, when able, move to larger aircraft to accommodate rising passenger demand rather than fly smaller aircraft at greater frequencies. At the same time, many routes currently served by narrow body airliners can be more efficiently served by 90-125 seat regional jets."

It comes as little surprise to the industry that a glut of 50-seat jets - which populate the fleets of North American regional airlines - are expected to enter the used market over the next decade. "There is really no desire on the part of North America operators to fly them [50-seat jets]," said Forecast International senior aerospace analyst Ray Jaworowski in an interview with FlightglobalPro. But while replacement aircraft will likely include 70-seat aircraft, either jets and/or turboprops, a gradual shift to even larger aircraft - in the 90-plus seat range - will continue, he said.

The forecast presented in Forecast International's study indicates that 4,198 regional aircraft will be produced during the 2011-2020 time period. Of this amount, some 2,117 aircraft will be in the 76-130-seat range, while 1,667 units will be required in the 51-75-seat range, predicted the company.

Source:
http://www.flightglobal.com/news/articles/regional-jet-demand-now-centred-on-90-plus-seaters-report-363649/

The New York Times

April 9, 2013

Japan Re-Emerges in the Aerospace Arena With a New Jet

By HIROKO TABUCHI

TOKYO — As a small boy, Teruaki Kawai watched wide-eyed as American DC-3s took off and landed at a small airport across an inlet from his home on the Hiroshima coast.

Japan's golden era of aviation, which culminated with the feared and respected Mitsubishi Zero fighter planes, had ended a decade earlier along with World War II. Banned from making planes by American occupiers after the war, then allowed only to make parts for American military jets, Japan's aircraft industry was a shadow of its former self.

If all goes well this year, Mr. Kawai, now 65 and president of the Mitsubishi Aircraft Corporation, will preside over Japan's biggest aviation comeback since the war. In late 2013, the company plans the first flight of its Mitsubishi Regional Jet, a sleek, 90-seat commercial plane that is Japan's bid to break into the industry's big leagues after almost 70 years.

"For decades, we were confined to supplying parts for other passenger jets. But we're finally heading into new territory," Mr. Kawai said in a recent interview at Mitsubishi Aircraft's Tokyo office.

Mitsubishi's comeback was abetted in large part by Boeing's outsourcing more of its aircraft manufacture to overseas suppliers. As Boeing came to rely on foreign contractors, Japanese manufacturers moved in, designing and supplying some of the jet's most vital sections.

A full third of Boeing's new 787 Dreamliner is supplied by Japanese manufacturers, including Mitsubishi Aircraft's parent company, Mitsubishi Heavy Industries, which makes the jet's carbon-fiber composite main wings.

Even so, Boeing and Mitsubishi could not be further apart in their approach to jet-building. In contrast to the cutting-edge 787, Mitsubishi's regional jet uses only a little of the advanced carbon fiber that its parent company supplies to Boeing.

Neither does the regional jet use the volatile lithium-ion batteries that have become a major headache for Boeing, overheating on two planes in January and prompting American and Japanese safety regulators to ground the entire 787 fleet.

Mitsubishi's caution underscores the importance, to the company and to Japan, of getting the regional jet project off the ground in an industry where reputation for reliability is paramount. That is especially the case, experts say, for a country long absent from the business of making planes, save military jets under license from the United States, and a series of small private jets.

In the late 1950s and 1960s, Mitsubishi participated in a consortium to develop the YS-11 plane, a 60-seat turboprop airliner led and largely financed by the Japanese government, which was eager to restart the country's aviation industry.

Leading the YS-11's design was Teruo Tojo, one of the Mitsubishi Zero fighter's original engineers and the second son of Hideki Tojo, the Japanese wartime leader who was executed as a war criminal by the Allies. But with no experience in making civilian jets, Mr. Tojo and his team of engineers struggled with the YS-11's design.

Regulators in the United States who tested the plane said early versions of the aircraft rolled from side to side and leaked rainwater. Its air-conditioning systems broke down. Passengers complained its roaring twin engines were too loud. And despite generous state backing, soaring manufacturing costs crippled the consortium's finances. In 1973, barely 10 years after the YS-11's maiden flight, the consortium canceled the project. It built just 182 aircraft and sold its planes at a loss.

"We wanted to sell to the world, but on the ground, we felt we were chasing an impossible dream," Mr. Tojo, who eventually became vice president of Mitsubishi Heavy Industries and president of Mitsubishi Motors, reminisced in a 1990 interview with the Nikkei Sangyo Shimbun newspaper. "Who would buy a plane made in Japan?" Mr. Tojo passed away last year at the age of 98.

Burned by the YS-11 flop, Japan shifted its aviation strategy to supplying, and learning from, the largest aircraft makers of the time, of which the largest was Boeing. Japanese suppliers have played an increasingly bigger role in building Boeing aircraft, supplying 15 percent of the 767 jet, 21 percent of the 777, and 35 percent of the 787.

The Japanese government quickly became one of the largest financial backers of those projects, handing out billions of yen in subsidies to help Japanese suppliers develop technology and win lucrative contracts from Boeing. Though the government declines to reveal exact numbers, estimates by researchers at the State University of New York of how much Japan has handed out to 787 suppliers in subsidies and loans over the past decade are as high as $1.6 billion. .

Boeing, which is based in Chicago, outsources its parts manufacturing to pare its investment in research and development, design, manufacturing and also its work force. These Boeing contracts have kept tens of thousands of Japanese workers busy for years, and still account for about 40 percent of jobs in the industry. They also help keep Japanese companies on the forefront of crucial aeronautical technology.

And in a cozy quid pro quo, Japan's biggest airlines have for years bought their planes almost exclusively from Boeing — an unusual practice among global carriers, which tend to play Boeing off against its rival, Airbus, to negotiate better terms and prices.

"It's been a 'you scratch my back, and I'll scratch yours' kind of relationship that made both sides captive to each other," said Takanori Maema, an aeronautics expert and former engine designer at the IHI Corporation, another major Boeing supplier. "But all along, Japan always aspired to build its own plane."

At the same time, the Japanese government was ready to give passenger plane manufacturing another try, as it looked in the early 2000s for ways to bolster Japanese exports and revitalize the country's stagnant economy.

In 2003, it announced bold plans to finance the development of compact, fuel-efficient aircraft. By the mid-2000s, Mitsubishi executives were gearing up to develop a passenger jet. The company placed Mitsubishi Aircraft's new headquarters in its prewar offices in Nagoya, where engineers designed the Zero.

The Mitsubishi Regional Jet, announced in 2008, is conservative in its use of new technologies and materials. Mitsubishi drastically reduced its use of advanced carbon composite material, opting to use high-grade aluminum alloy wings after discovering that carbon fiber still did not deliver the weight savings that engineers had hoped for. (The weight savings from carbon composite materials are greater for the 787, a larger plane.)

After initially exploring the use of advanced lithium-ion batteries, Mitsubishi engineers also concluded that the technology was not tested enough to power a passenger jet, opting instead to use conventional cadmium nickel packs. ("It's too dangerous. The technology isn't mature enough for a plane like ours," Mr. Kawai said of lithium-ion batteries.)

Still, Mitsubishi's regional jet boasts about 20 percent in fuel savings compared to similar size Brazilian-built Embraer 190 jets. Much of the fuel economy comes from its use of new engines from the American manufacturer, Pratt & Whitney. The plane's wings are thinner and are more aerodynamic than those on similar models, also improving energy efficiency.

Mitsubishi says newly designed seats on the M.R.J. also offer wider seats than rival aircraft: 18.5 inches across compared with 17.3 inches on Canada's Bombardier's CRJ700 series.

The company has 165 firm orders to date for the $42 million jet, and it aims to secure as many as 5,000 orders over the next two decades — a goal some experts dismiss as unrealistic.

It faces well-established rivals like Bombardier and Embraer. The Russians and Chinese are also making inroads into plane-building. By bolstering its aviation credentials, Japan could also keep upstarts in South Korea, Taiwan and China from encroaching on its lucrative Boeing work, which analysts say contributes around a fifth of Mitsubishi's roughly $5.7 billion aeronautics business.

"As a boy, I didn't think that Japan would build a plane again," Mr. Kawai said. "But it's been over a half-century. It's high time for Japan to give it another go."

This article has been revised to reflect the following correction:

Correction: April 9, 2013

An earlier version of this article referred incorrectly to the DC-3 aircraft. It is propeller-driven; it is not a jet.

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SkyWest Completes MRJ Order, Adding 100 Options; Sticks With Larger Model

By Bradley Perrett, Andrew Compart
Source: Aviation Daily

December 14, 2012

SkyWest Inc. has finalized an order for 100 Mitsubishi Aircraft MRJ regional jets announced in June, adding options for a further 100, and sticking with its original plan to use the firm order for the larger MRJ90 aircraft—at least for now.

The MRJ90 holds 90 seats in a single class, compared with 70 for the MRJ70. That is significant for U.S. regional carriers, such as the SkyWest subsidiaries, which operate the vast majority of their flights for major carriers under their brand names. That is because scope clauses in the major carrier collective bargaining agreements with their pilots limit by aircraft size and number the amount of flying that can be outsourced to regional carriers.

When SkyWest placed its tentative order in June, Kraupp said the carrier would wait to see how scope clauses at its major airline partners and potential future partners take shape before deciding whether to stick with the MRJ90s. If United Airlines pilots approve their tentative contract when the votes are counted on Dec. 15, the new upper limits will have been established for Delta, United and American Airlines at 76 seats. The only major network carrier higher than that is US Airways, at 90, so the picture could change a bit if it merges with American.

Kraupp now says that, either way, the MRJ90 could be a good fit.

“The MRJ90 can be configured to 76 seats to comply with current scope limitations,” Kraupp told Aviation Week on Dec. 13. “Since the aircraft don’t deliver for a few years, we will see where scope clauses migrate to when making final determinations as to which aircraft to take and how many seats.”

Kraupp says SkyWest probably needs to decide by 2015 whether to switch its order to MRJ70 aircraft. As to which airlines SkyWest will be operating the MRJ for, he says only that “we will have an ongoing effort to offer the aircraft to all of the U.S. majors and see what their appetite is.”

As for its order, SkyWest and Mitsubishi say each batch of 100 aircraft is valued at $4.2 billion, presumably referring to catalog prices. Pratt & Whitney PW1200G geared-turbofans will power the MRJ.

In agreeing to unstated rights and obligations, the companies say they will “mutually position themselves for opportunities in the U.S. airline industry.”

The addition of options to the deal underscores SkyWest’s statement this year that that it might want more than 100 MRJs. The problem, however, is that Mitsubishi Aircraft, struggling with development delays, cannot deliver more than the first 100 this decade. If the options are taken up, the aircraft that they cover will be delivered from 2021.

The aircraft in the firm order will be delivered from 2017, as previously stated. The contract takes the MRJ order book to 165 units, almost three years of production at the maximum planned production rate of five units a month—and much longer when the ramp-up after first delivery is taken into account.

Seeking to offset the development delays, Mitsubishi Aircraft is looking for ways to reach full-rate MRJ production faster than its original, unstated schedule, and then to build faster than the planned rate of five a month.

First delivery to initial customer All Nippon Airways is due in late 2015 or early 2016, at least two years later than the target set when the program was launched in 2008. ANA has ordered 15 MRJs, and Trans States Airlines of the U.S. has ordered 50.

SkyWest Inc. owns SkyWest Airlines, based in St. George, Utah, and ExpressJet Airlines, based in Atlanta, Ga. They operate under the brands United Express, Delta Connection, American Eagle and US Airways Express. SkyWest Airlines also operates flights for Alaska Airlines.

Mitsubishi Aircraft is partly owned by Mitsubishi Heavy Industries, the prime contractor for the MRJ fuselage.

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Bombardier C Series

The **Bombardier CSeries** is a family of narrow-body, twin-engine, medium-rangejet airliners being developed by Canadian manufacturer Bombardier Aerospace. Models are the 110-seat **CS100**, and the 130-seat **CS300**. These were initially named C110 and C130, respectively.

Development

Bombardier C Series

Background

During the demise of Fokker, Bombardier considered purchasing the company in order to gain access to their Fokker 100 100-seat short-haul aircraft. They eventually decided against a purchase and ended discussions in February 1996.

The *Bombardier BRJX*, or "Bombardier Regional Jet eXpansion", was a project for a larger regional jet than the Canadair Regional Jet. Instead of 2-2 seating, the BRJX was to have a wider fuselage with 2-3 seating, and underwing engine pods. It was projected to seat 80 to 120 passengers, abutting the smallest narrow-body jetliners, like the 2-3 DC-9/MD-80/Boeing 717 or the 3-3 A318/737-500/737-600. The project was shelved by Bombardier in favour of stretching the CRJ700 into the CRJ900.

It was not long after that the 80-seat Embraer E-170 came to market, followed by the 110-seat E-195. Both models became bestsellers, and Bombardier had no product to compete with them at the "high end".

CSeries

In July 2004, Bombardier announced the development of the CSeries family of airliners to replace the cancelled BRJX project. The CSeries would be larger than the current Canadair Regional Jets, and capable of carrying 110 to 130 passengers. For the first time, Bombardier would be competing directly with the smallest size airliners from Boeing and Airbus. At the time, Bombardier expected the aircraft to be available by 2013.

In March 2005, Bombardier's board decided to promote the plane to airlines to gather advance orders. Two models were announced: the**C110** with layouts from 100-125 seats, and the **C130** with layouts from 120-145 seats. The CSeries would feature new, more fuel-efficient engines and a higher percentage of composite materials in its fuselage, a strategy similar to that used on the widebody Boeing 787 Dreamliner and Airbus A350.

The aircraft were designed to seat passengers in a 2-3 arrangement in coach and a 2-2 arrangement in business/first class, similar to the Boeing 717. With the 2-3 arrangement, 80% of the seats would be aisle or window seats, as opposed to 'middle' seats (seats set between two other passengers' seats). The aircraft would have under-wing turbofans. The CSeries' cross section was designed to give enhanced seating comfort for passengers, with features like broader seats and armrests for the middle passenger and larger windows at every seat to give every passenger the physical and psychological advantages of ample natural light.

In May 2005, Bombardier secured agreements with the Federal Government of Canada, the Provincial Government of Quebec, and the Government of the United Kingdom for support and loans for the CSeries project. The Canadian government has committed US$350 million in financing; the British government has committed US$300 million. The program will cost about $3.5 billion, and Bombardier will share the cost with suppliers and governments.

The fuselage will be built by China Aviation Industry Corp. I (AVIC I)' affiliate Shenyang Aircraft Corporation. Final assembly of the aircraft was to be at Mirabel Airport, Mirabel, outside Montreal, Quebec. Substantial portions of the aircraft were to be constructed at Bombardier facilities in Belfast, Northern Ireland.

On 31 January 2006, Bombardier announced it would not go forward with plans to develop the CSeries after it failed to secure any significant orders. Bombardier stated it would keep a small team of roughly 50 employees working on the CSeries marketing plan, and including other risk sharing partners in the program. With the CSeries on hold, Bombardier announced on 18 February 2006 that it would begin work on the 100-seat CRJ1000 regional jet.

Restarting programme

On 31 January 2007, Bombardier announced that work on the aircraft would continue.[9] In November 2007, Bombardier announced that the Pratt & Whitney Geared Turbofan (now PW1000G) would be the exclusive powerplant for the CSeries. On 22 February 2008, Bombardier Aerospace announced that its parent company's Board of Directors had granted it the authority to offer formal sales proposals of the CSeries family to airline customers.

On 13 July 2008, in a press conference on the eve of the opening of the Farnborough Airshow, Bombardier Aerospace announced the launch of the CSeries, with a letter of interest for 60 aircraft (including 30 options) from Lufthansa. The final assembly of the aircraft would be done at a new assembly facility to be built beside the existing one where the CRJ700 and CRJ900 are assembled in Mirabel, north of Montreal.[12] Ghafari Associates will work on redeveloping the Montreal manufacturing site to accommodate CSeries production. The CSeries aircraft will use the Rockwell Collins Pro Line Fusion avionics suite, an integrated cockpit system made up of 15 inch displays, with comprehensive navigation, communications, surveillance, engine indication and crew alerting system (EICAS), and aircraft maintenance systems.

The CSeries is designed for the 100- to 149-seat market category. This market is estimated by Bombardier at 19,333 aircraft, representing more than $250 billion revenue over the next 20 years. Bombardier expects to be able to capture up to half of this market with the CSeries, currently projected to enter service in 2013. First flight for the CSeries is expected in 2012. The CSeries would feature a five-abreast cabin with larger windows and overhead luggage bins.

Mongolian airline Eznis Airways has a letter of interest for seven CSeries. Qatar Airways had previously been in talks with Bombardier, but broke off talks after disagreeing on terms. An unnamed lessor was understood to be in talks for 40 aircraft. On 11 March 2009, Bombardier announced their first firm orders for the CSeries. Lufthansa, who originally had signed a letter of interest for 60 aircraft, firmed up an order for 30. The aircraft will be operated by Lufthansa subsidiary Swiss European Air Lines.

In March 2009, Bombardier also announced that the C110 and C130 were being redesignated the **CS100** and **CS300**, respectively. On 30 March 2009, Bombardier inked the second CSeries order, with airliner lessor Lease Corporation International (LCI) of Dublin, Ireland ordering 3 CS100s and 17 CS300s, becoming the launch customer of the latter. LCI also hold options for a further 20 aircraft.

Republic Airways Holdings ordered 40 CS300 aircraft with options for an additional 40 in February 2010.[23] In March 2010, easyJet stated that the company is having "ongoing discussions with Bombardier regarding CSeries.[24] In December 2009, United Airlines expressed interest in using the CS100 and CS300 for replacing the now retired 737-300 and 737-500 aircraft. But no plans or orders have been made by United Airlines as of December 2011.

On 1 June 2011 Braathens Leasing Limited in Sweden announced that they had placed a firm order for five CS100 and five CS300. It also took options on ten more aircraft. With this new deal, Bombardier has now secured 100 firm orders for the CSeries. On 7 June 2011, Bombardier announced that an unnamed airline had placed a firm order for three CSeries airplanes, with options for three more. On 20 June 2011, Bombardier announced it had secured a launch customer for the CS100 at the Paris Air Show. The undisclosed airline signed a firm order for 10 aircraft with an option for six more. On 21 June 2011, Korean Airannounced that they will purchase 10 CS300 plus an additional 10 options and 10 purchasing rights on CS300. On 24 June 2011, the last day of the Paris Show 2011, Bombardier reached a last minute deal with an undisclosed European carrier that will purchase 10 CS100. On 17 August 2011, at the MAKS Airshow, Bombardier announced a deal with Ilyushin Finance for up to 30 CSeries aircraft. Atlasjet announced plans on 15 November 2011 to purchase 10 CS300 aircraft with options for another plus five.
The CSeries programme has several major suppliers including, Shenyang Aircraft (centre fuselage), Alenia Aeronautica (horizontal and vertical stabilisers), Fokker Elmo (wiring and interconnection systems), Parker Hannifin (fuel and hydraulics systems), Goodrich (flap and slat actuation systems, as well as engine nacelles), and Rockwell Collins (avionics).Deliveries of the CS100 are expected to start in 2013, and CS300 deliveries are to follow a year later.

Design

The Bombardier CSeries aircraft contain features similar to those found in the Boeing 787 Dreamliner and the Airbus A350 aircraft. These include higher usage of composite materials, a lower cabin altitude and larger windows.
The CSeries cabin would also have large, rotating overhead storage bins, allowing each passenger to stow a sizeable carry-on bag on board. Compared to the cabins of current in-service narrowbody aircraft, the CSeries is to provide airlines with the highest overhead bin volume per passenger and a wider aisle that would allow for faster boarding and disembarkation of passengers.

The CSeries aircraft contain 70% advanced materials comprising 46% composite materials and 24% aluminium-lithium which allows for a 15% lower seat-mile cost and a significant reduction in maintenance costs. Computer software design tools were used on the project, including CATIA and HyperSizer, and similar technology employed in the Learjet 85.

In January 2010, JP Morgan released a report stating Bombardier are considering a 150-seat version of the CSeries. Bombardier called the report speculative, noting that the CSeries development program "is in the joint definition phase where we will be able to add greater product definition and that includes the ability to make changes before the final design is frozen".

Specifications

	CS100	CS100ER	CS300	CS300XT	CS300ER
Passengers	125 (1-class, dense)			145 (1-class, dense)	
	110 (1-class, standard)			130 (1-class, standard)	
	100 (2-class, mixed)			120 (2-class, mixed)	
Seat Pitch	30 in (76 cm) (1-class, dense)				
	32 in (81 cm) (1-class, standard)				
	36 in (91 cm) & 32 in (81 cm) (2-class, mixed)				
Seat Width	19 in (48 cm)				
Flight crew	2 (pilot, co-pilot)				
Length	34.9 m (115 ft)			38.0 m (124.7 ft)	
Wingspan	35.1 m (115 ft)				
Wing Area (net)	112.3 m^2 (1,209 sq ft)				
Tail height	11.5 m (38 ft)				
Cabin width	3.27 metres (129 in)				
Cabin height	2.13 metres (84 in)				
Fuselage max diameter	3.7 m (12 ft)				
Max takeoff weight	54,931 kg (121,100 lb)	58,151 kg (128,200 lb)		59,557 kg (131,300 lb)	63,095 kg (139,100 lb)
Max landing weight	50,576 kg (111,500 lb)			55,339 kg (122,000 lb)	
Cargo Volume	23.2 m^3 (820 cu ft)			30 m^3 (1,100 cu ft)	
Max range	4,074 km (2,200 nmi)	5,463 km (2,950 nmi)		4,074 km (2,200 nmi)	5,463 km (2,950 nmi)
Max cruise speed	Mach 0.82 (870 km/h, 470 kn, 541 mph)				
Typical cruise speed	Mach 0.78 (828 km/h, 447 kn, 514 mph)				

Take off run at MTOW	1,509 m (4,951 ft)	1,902 m (6,240 ft)	1,661 m (5,449 ft)	1,890 m (6,200 ft)
Landing field length	1,350 m (4,430 ft)	1,448 m (4,751 ft)		
Service ceiling	12,497 m (41,001 ft)			
Engines	2 x Pratt & Whitney PW1500G			
Thrust per Engine	93.4 kN (21,000 lbf)	103.6 kN (23,300 lbf)	93.4 kN (21,000 lbf)	103.6 kN (23,300 lbf)

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Bombardier opens green facility to produce innovative wings for CSeries

October 15, 2013
By Courtney Howard
Executive Editor

BELFAST, U.K., 15 Oct. 2013. U.K. Prime Minister, David Cameron officially opened Bombardier's new wing manufacturing and assembly facility in Belfast.

Bombardier's new 600,000-square-foot facility is producing the wings for the *CSeries* aircraft, which had its maiden flight last month. The wings are made using carbon-fibre composite technology developed by Bombardier engineers in Northern Ireland. This technology enables both material and aircraft weight savings, which contribute to reduced manufacturing cycle times and reduced fuel burn.

"We believe that our advanced composites process enables a step-change in the way aircraft wings are made. The benefits of weight reduction compared to conventional metal wings, and reduced inspection and maintenance activities, are making an important contribution to the *CSeries* aircraft's success. Bombardier's major investment in the *CSeries* aircraft programme continues to bring significant benefits to the 200 companies in our UK supply chain as well as to the Northern Ireland and wider UK economies," says Michael Ryan, vice president and general manager, Bombardier Aerospace, Belfast.

The new wing facility has been certified to Gold level in the Leadership in Energy and Environmental Design (LEED) rating system by the U.S. Green Building Council for improved environmental and health performance. The facility's sustainable initiatives include: building material selection, the extensive use of natural light, energy efficiency, water saving, and indoor environmental quality.

"The *CSeries* is setting new standards in the commercial aircraft marketplace with its unmatched environmental scorecard, and our employees' expertise and dedication are playing a key role in the success of the program. The prestigious LEED certification of our new Belfast facility also demonstrates that not only are we on the right track with our innovative and environmentally conscious products, we are also delivering on our commitments as a responsible corporate citizen," says Bombardier Inc. President and CEO Pierre Beaudoin.

Bombardier will create at least 250 more employment opportunities over the next 12 months, to cater for its expanding aircraft programs and component repair business. By the end of 2014, this will bring the projected workforce to approximately 6,250.

Bombardier also has added nearly 1,000 employees to its Northern Ireland workforce over the past two years.