

**TURKISH
AVIATION
ACADEMY**



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Introduction to Fleet Planning
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Network, Fleet and Schedule
Strategic Planning
Module 4: 10 March 2014

Lecture Outline

- **World Airline Fleets**
 - Commercial Aircraft Manufacturers
 - Airline Fleet Sizes, Average Seats and Age
- **Passenger Aircraft Market Categories**
 - Evolution of aircraft types by size and range
 - Overview of current commercial aircraft types
 - Narrow-body jet aircraft
 - Wide-body jet aircraft
- **Aircraft Orders and Fleet Plans**
 - Current orders by region, type and manufacturer
 - Focus on emerging global carriers
 - Turkish Airlines: Orders and fleet outlook

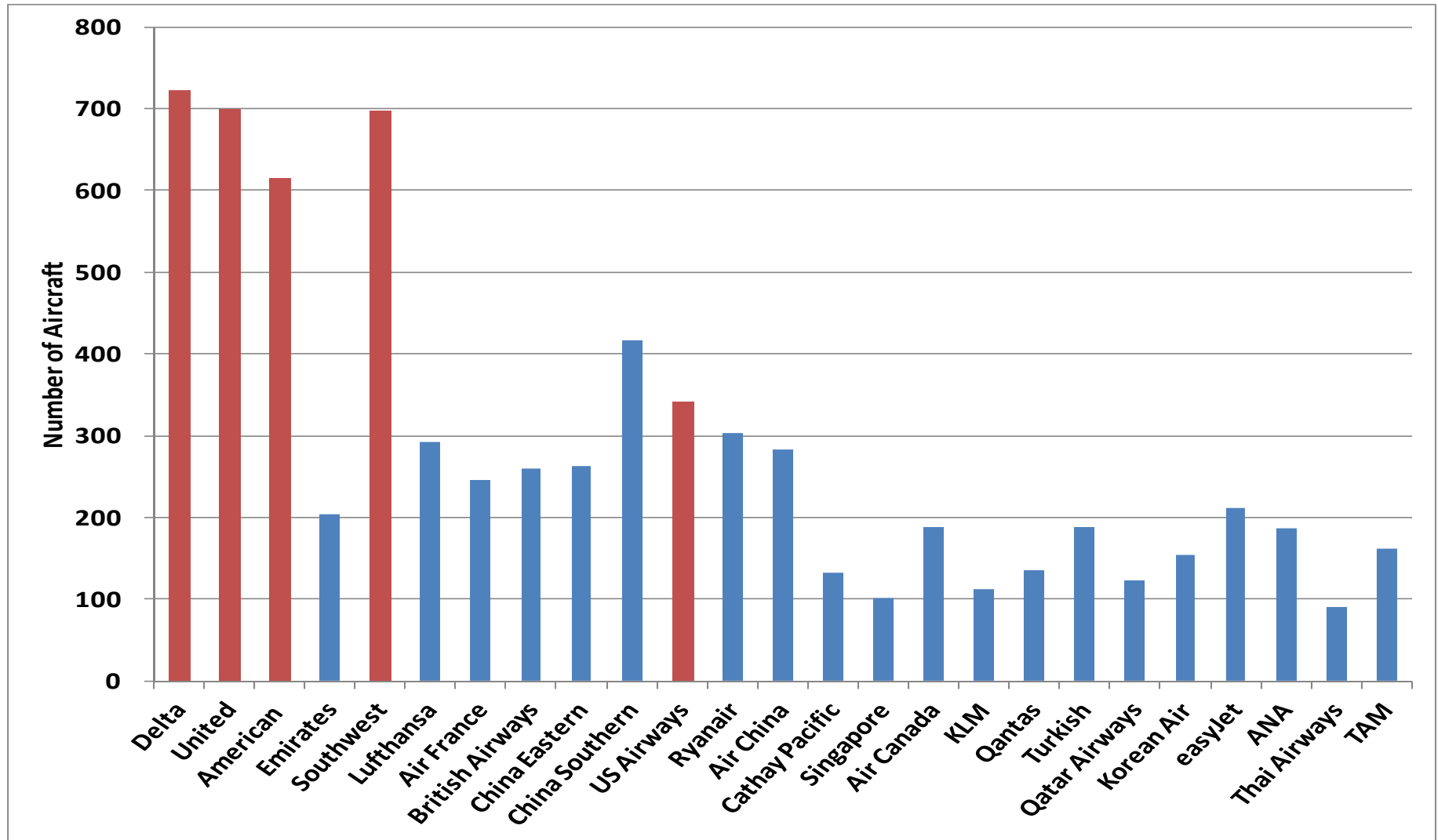
FLEET PLANNING

- **Fleet composition is a long-term strategic decision**
 - Fleet is the total number of aircraft that an airline operates, as well as the specific aircraft types that comprise the total fleet.
 - Each aircraft type has different technical performance characteristics (e.g., payload capacity and “range”)
 - Affects financial position, operating costs, and especially the ability to serve specific routes.
- **Large capital investment with a long-term horizon:**
 - US \$50-60 million for narrow-body 150-seat airplane
 - \$180+ million for mid-size (230 seats) long-range Boeing 787
 - \$300+ million for largest Airbus A380 (500-600 seats)
 - Depreciation impacts on balance sheet last 10-15 years
 - Some aircraft have been operated economically for 30+ years

Commercial Aircraft Manufacturers

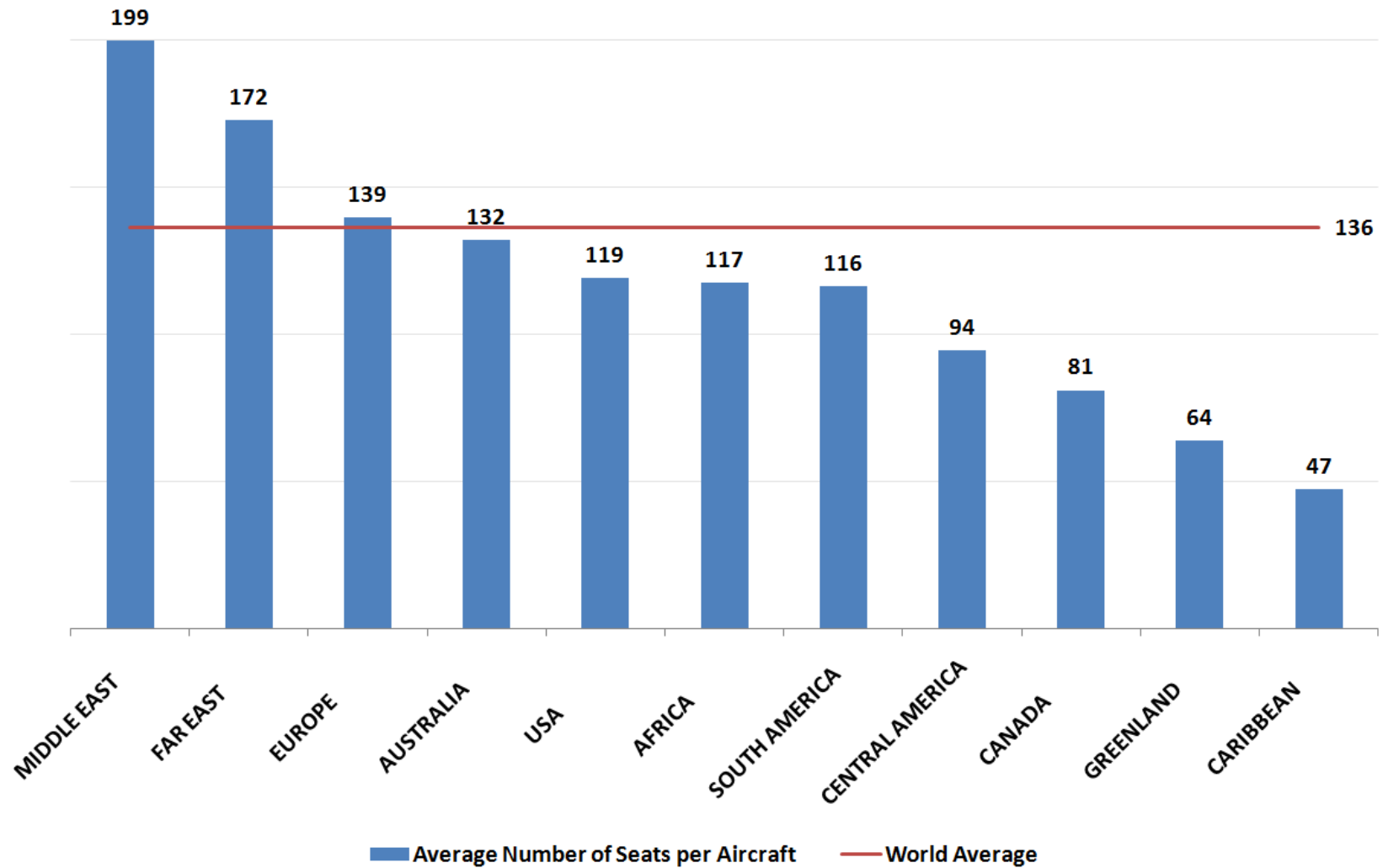
- **Boeing (USA)**
 - Largest producer of commercial (and military) aircraft
 - Acquired McDonnell-Douglas Aircraft in 1997
- **Airbus (Europe)**
 - Launched as a consortium owned by several European countries in 1967, now 80% owned by EADS
 - Has captured 50% market share of large jet aircraft
- **Embraer (Brazil)**
 - Developed small regional jets, now focusing on “E-jets” with 75-110 seats
- **Bombardier (Canada)**
 - Also shifting focus from 50-seat regional jets to larger “C-jets”

Airline Fleets 2012 – US Airline Fleets are Substantially Larger

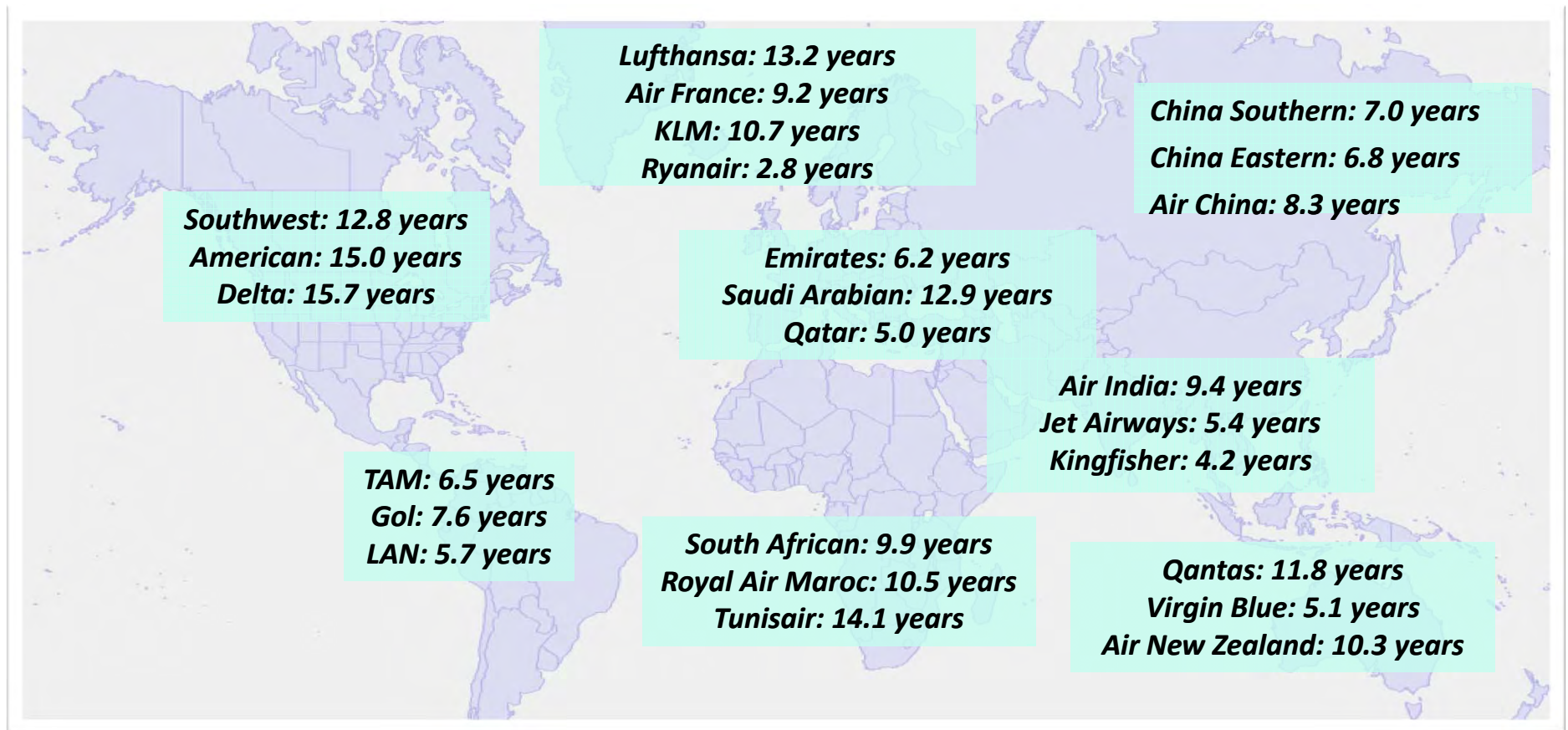


Source: Airline Business Top 200 Airlines Traffic 2012

Average Aircraft Size by Region



Average World Wide Fleet Ages



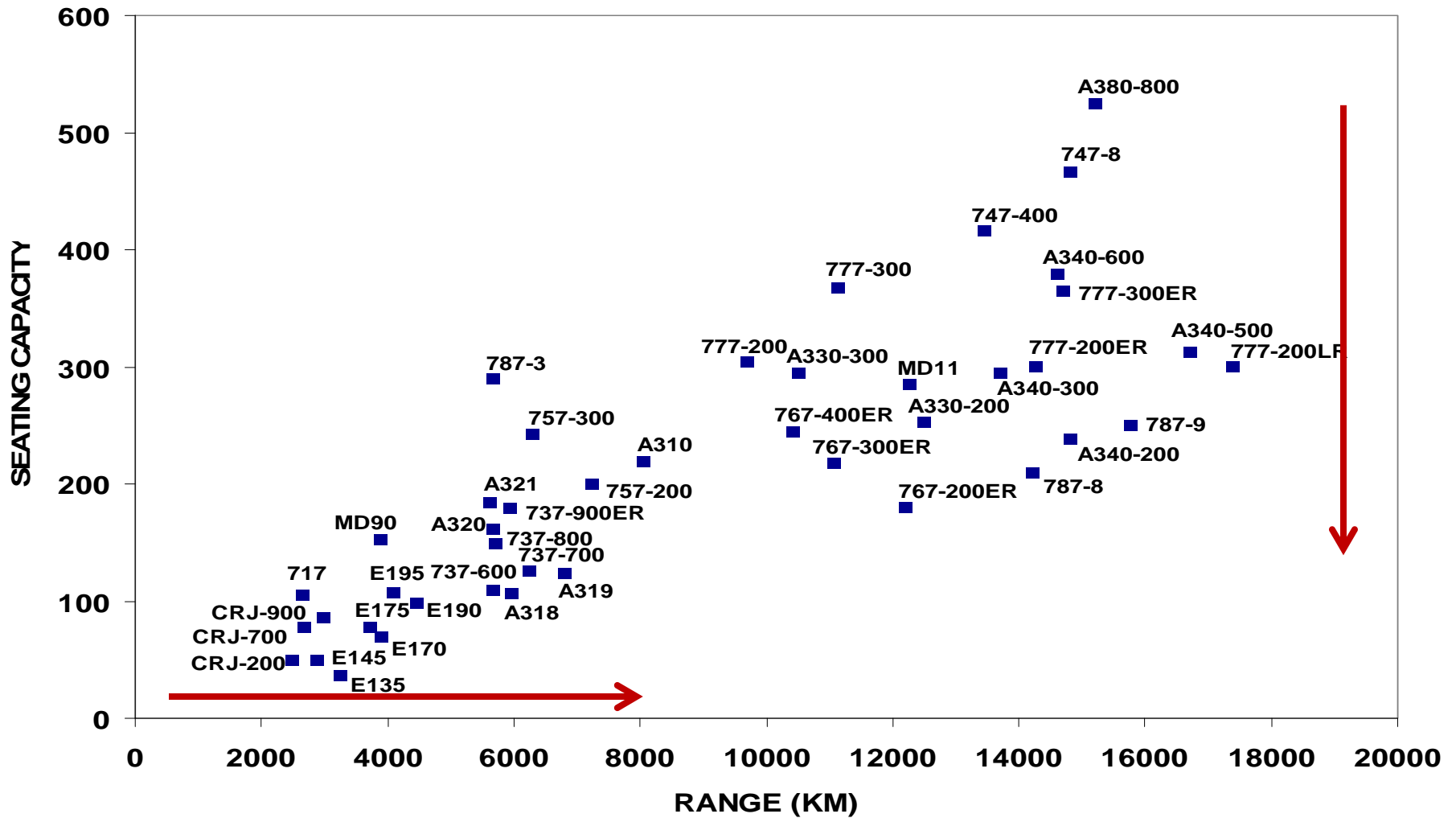
Courtesy: Kamala Shetty, MIT

Data Source: OAG - Oct. 2010

Passenger Aircraft Categories

- **Commercial aircraft are most commonly defined by their range and size:**
 - The “range” is the maximum distance that it can fly without stopping for additional fuel, while still carrying a reasonable payload of passengers and/or cargo.
 - The “size” of an aircraft can be represented by measures such as its weight, its seating or cargo capacity, as indicators of the amount of payload that it can carry.
- **Broad categories such as “small, short-haul” or “large, long-haul” aircraft can include several different aircraft types by different manufacturers.**
 - Aircraft with similar capabilities are regarded as “competitors” in the airline’s fleet planning decisions.
 - For example, the Airbus A320 and Boeing 737-800 are competing aircraft types, as they are both new generation aircraft with approximately 150 seats with similar range capabilities.

Commercial Aircraft by Size and Range



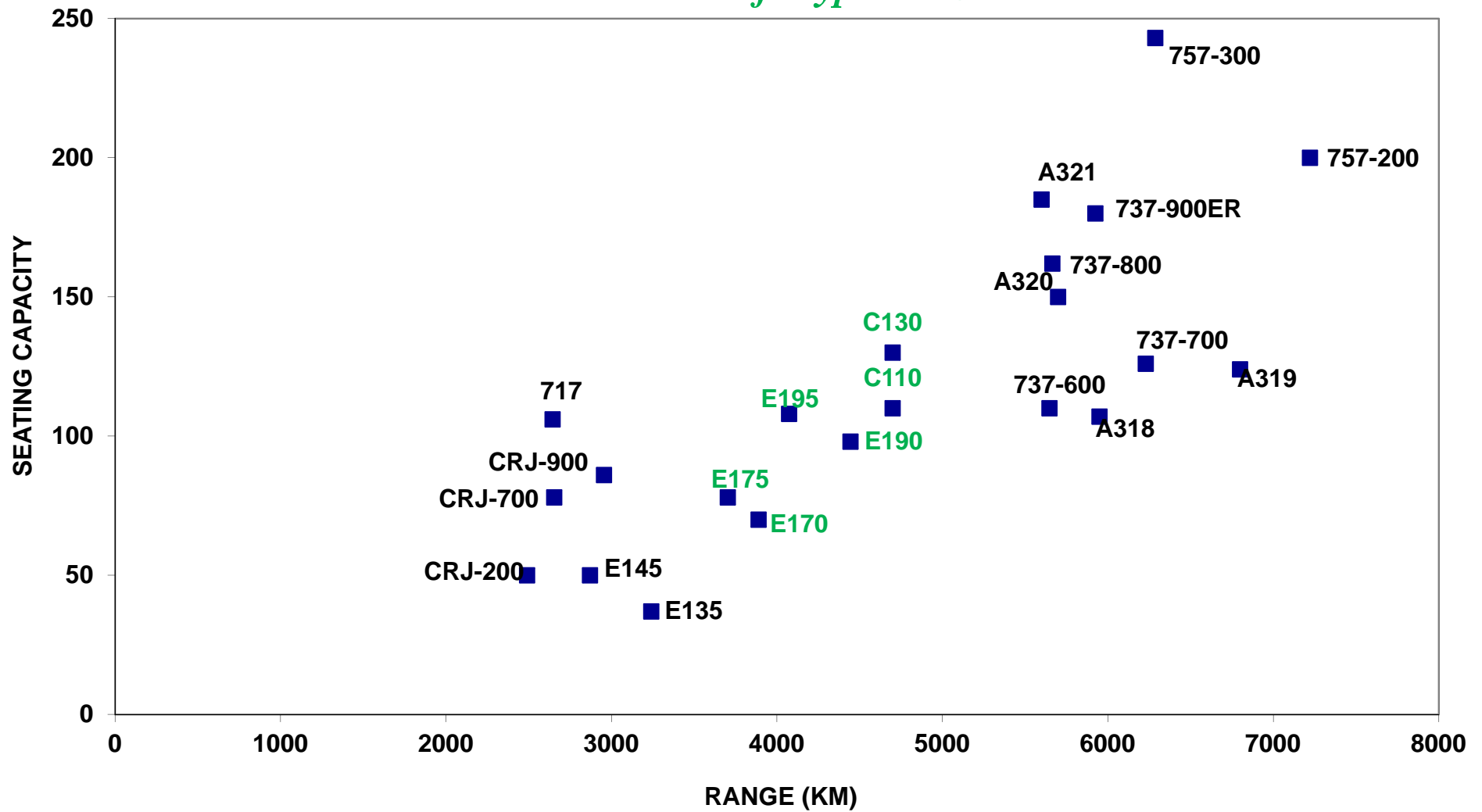
Adapted from: Belobaba et al (2009)

Aircraft Categories - Trends

- **Historically, largest aircraft were designed for routes with the longest flight distances.**
 - Relationship between aircraft size and range was almost linear.
 - Airlines wishing to serve a very long-haul non-stop route had to acquire the Boeing 747.
- **Airlines now have a much wider choice of products by range and capacity in each category:**
 - Range of new aircraft in the “small” category (100-150 seats) has increased dramatically.
 - US transcontinental routes are now being flown with Boeing 737 and Airbus 320 series aircraft.
 - Sizes of new “long-range” aircraft have decreased substantially.
 - Airlines even now serve certain low-demand long-haul non-stop international routes with Boeing 757 (180 seats) e.g., Newark to Lisbon, and Los Angeles to Maui.

Narrow-body Jet Aircraft

Newest Aircraft Types in Green



Adapted from: Belobaba et al (2009)

Bombardier CRJ 100/200/700



Embraer E175/E190



Boeing 737-600/700/800/900



Airbus 320 Family (318/319/320/321)

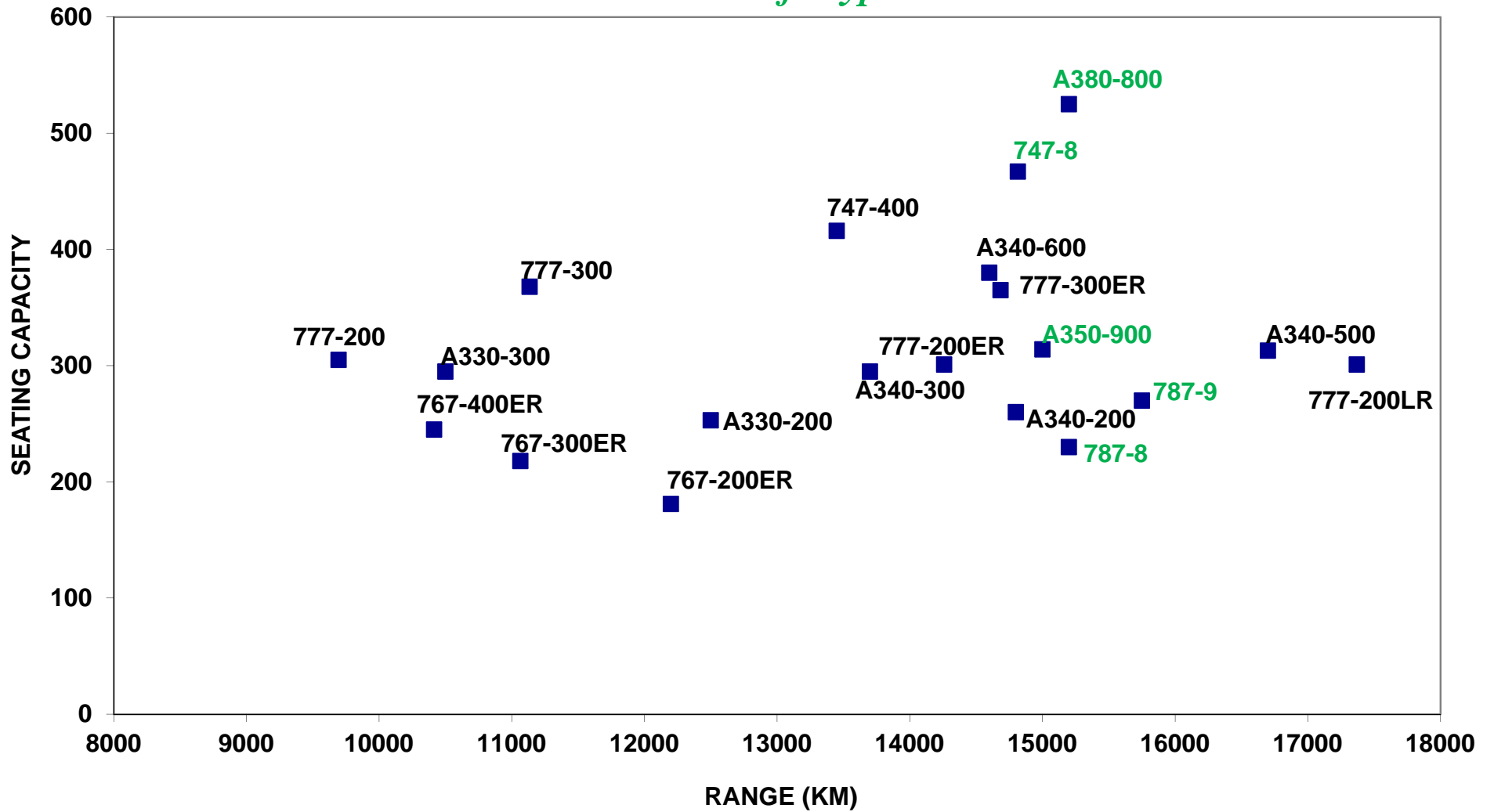


Boeing 757-200/300



Wide-body Jet Aircraft

Newest Aircraft Types in Green



Adapted from: Belobaba et al (2009)



Boeing 767- 200/300/400



Airbus 330 /340 Family



Boeing 787



Boeing 777



Boeing 747-400



Airbus 380



New Aircraft



Airbus A350



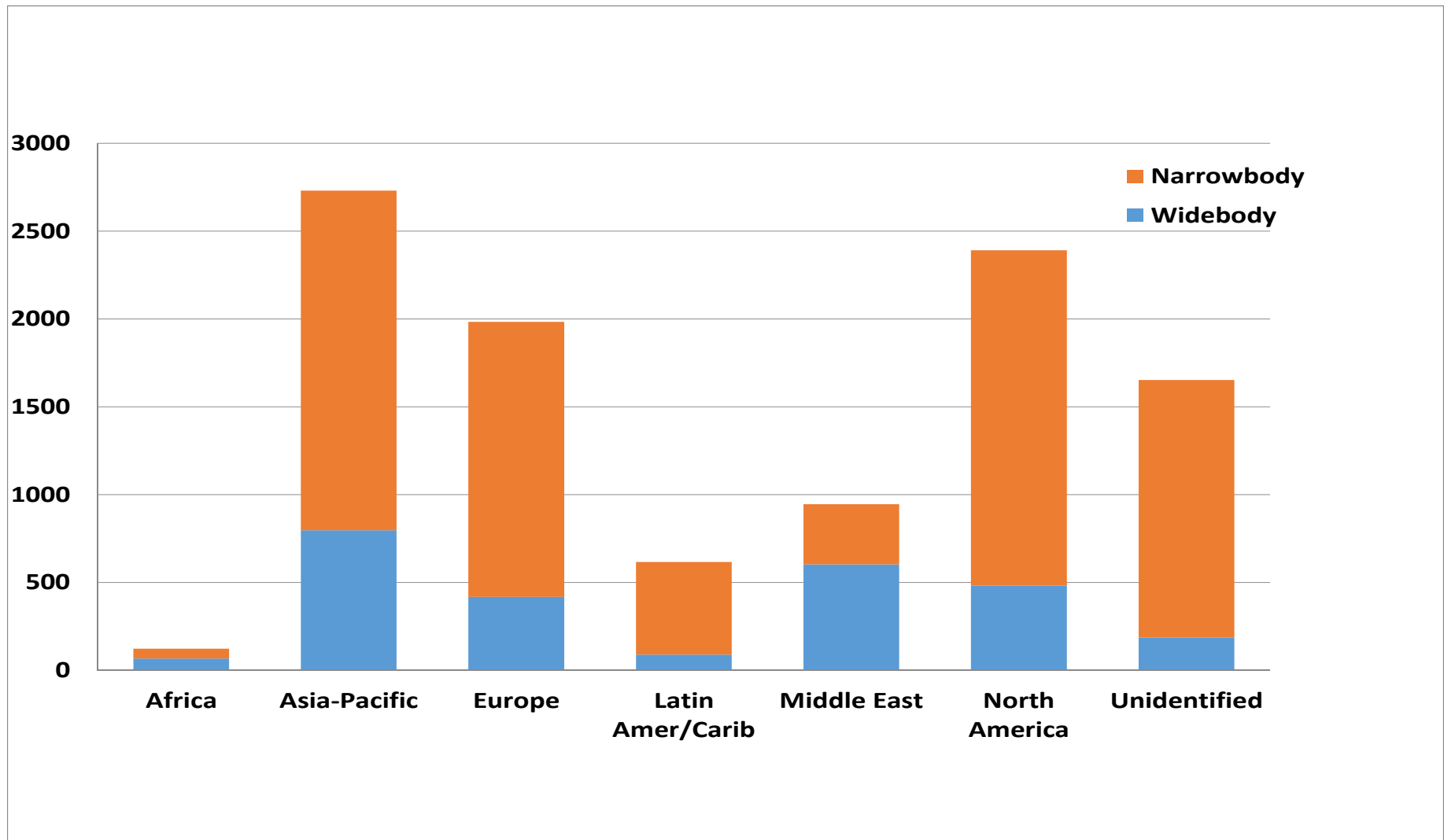
Airbus A380



Boeing 787

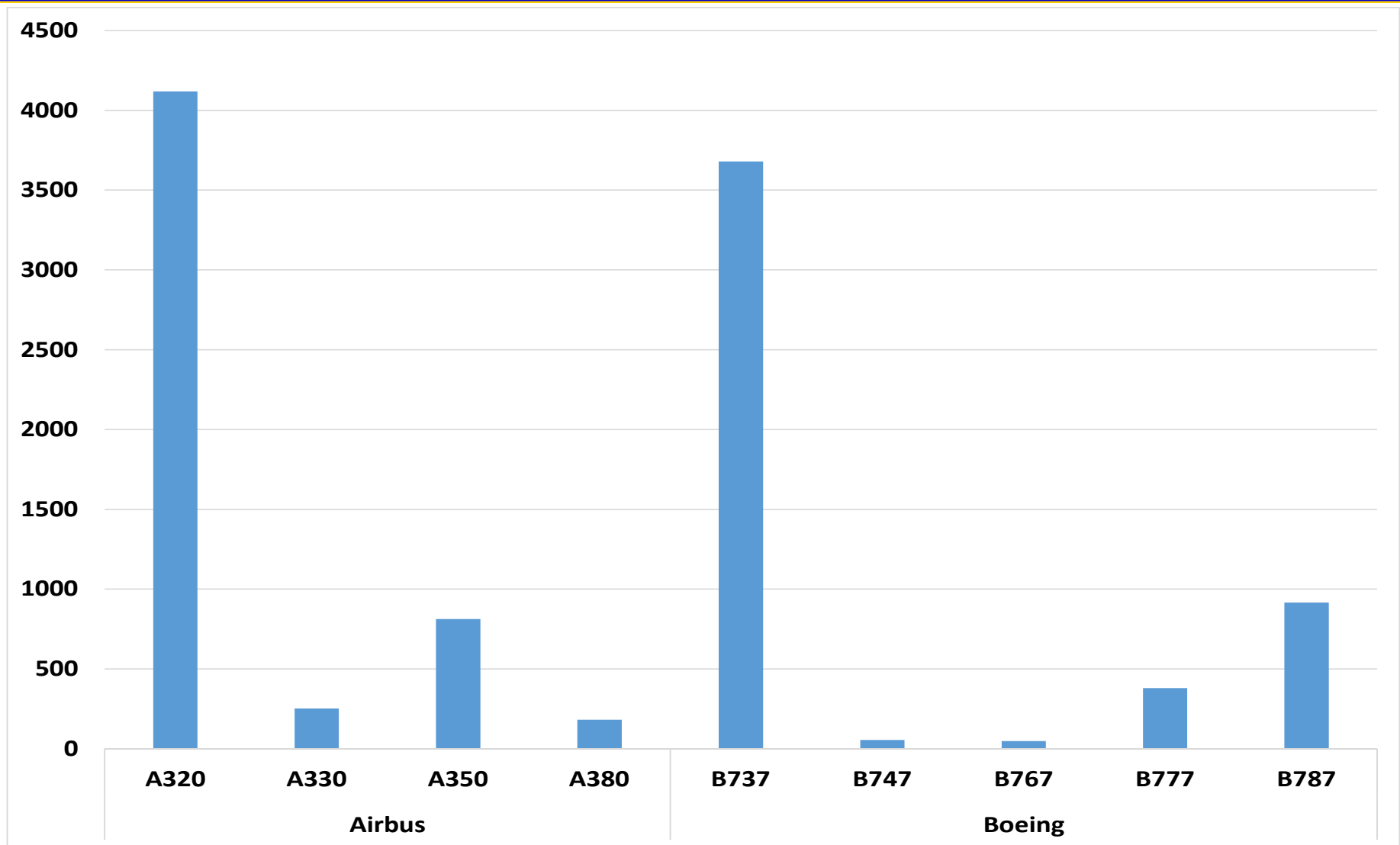
Improved efficiencies and longer ranges

Large Jet Aircraft Orders by Region (December 2013)



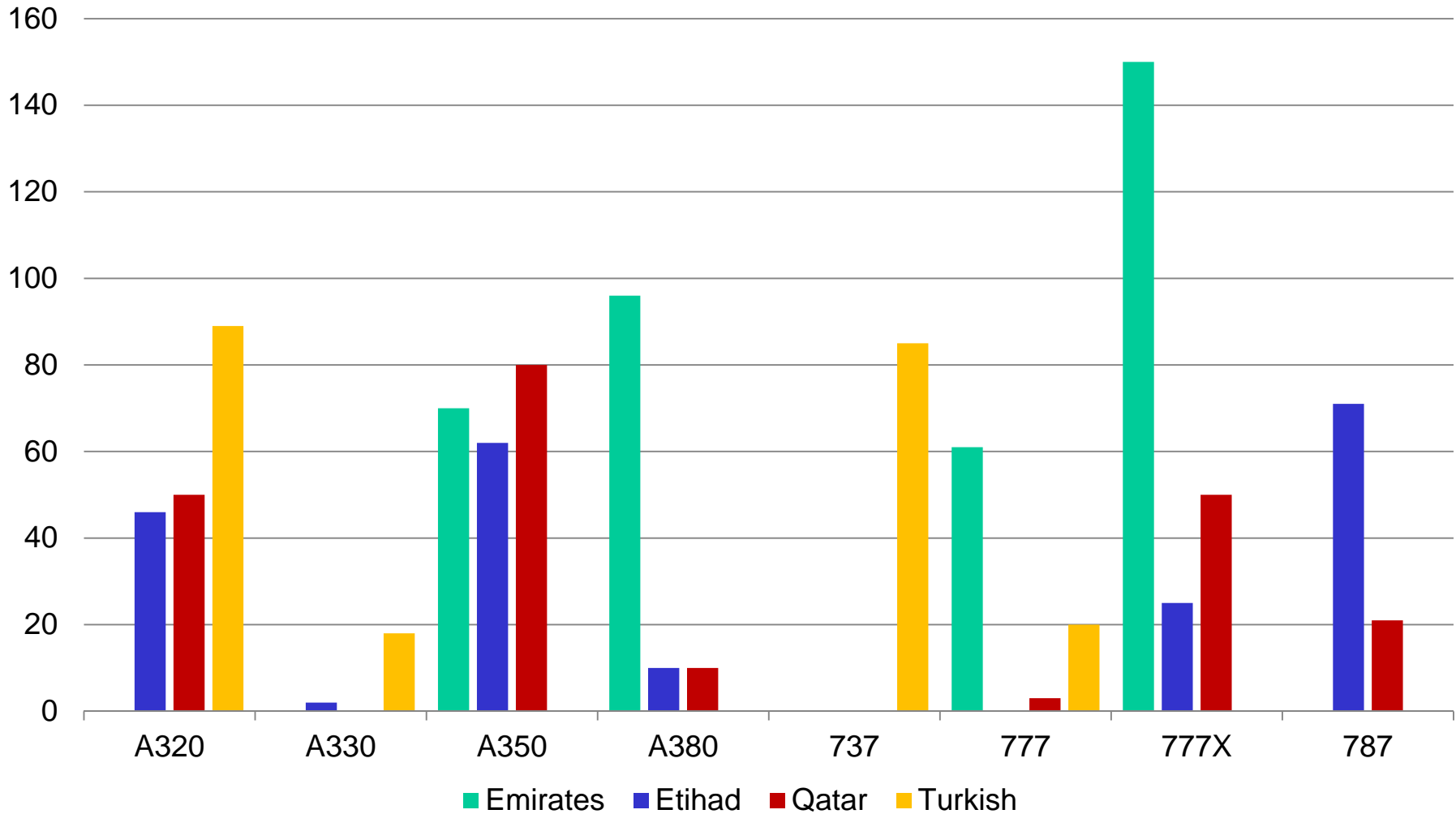
Sources: Manufacturer order and delivery schedules, airbus.com, boeing.com

Large Aircraft Orders by Manufacturer and Type (December 2013)



Data Source: Manufacturer websites – www.airbus.com, www.boeing.com

Emerging carriers have over 1000 aircraft on order; 74% are for wide-body aircraft



Turkish Airlines Fleet (2013)



Airbus A320:

- **A319: 14**
- **A320: 32**
- **A321: 32**



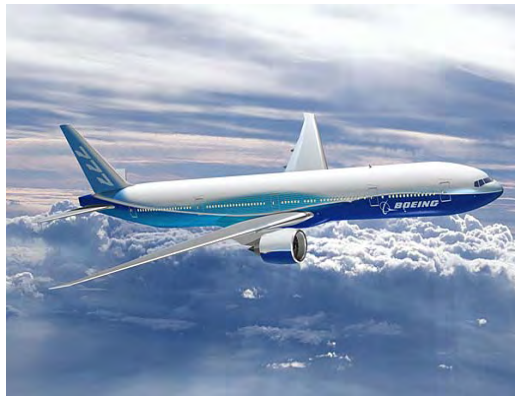
Airbus A330:

- **A330-200: 7**
- **A330-300: 10**



Airbus A340:

- **A340-300: 7**



Boeing 777:

- **777-300ER: 22**



Boeing 737:

- **737-400: 3**
- **737-700: 14**
- **737-800: 59**
- **737-900: 9**

Fleet Outlook (2012 - 2020): Turkish Airlines



Turkish Airlines



	In Service	On Order	2013	2014	2015	2016	2017	2018	2019	2020	Total	Seats
Airbus												
A320												
A319	14										14	132
A320	28	4			2		2				32	158
A321	32	30	3	3	4	4	4	4	4	4	62	185
A320Neo		57			7	10	10	10	10	10	57	190
A330												
200	7										7	262
300	10	17		6	6	5					27	289
A340												
300	7			-4	-3						0	270
Boeing												
737												
400	3		-3								0	150
700	14										14	124
800	59	30	7	7	8	8					89	161
900	9	6	2	2	2						15	151
MAX		50				8	8	8	8	8	40	170
777												
300ER	12	20		5	5	5	5				32	332
Total	195	106	9	19	31	40	29	22	22	22	389	

Fleet Forecast (2020): Turkish Airlines



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Airbus A320:

- **A319: 14**
- **A320: 32**
- **A321: 62**
- **A320Neo: 57**



Boeing 737:

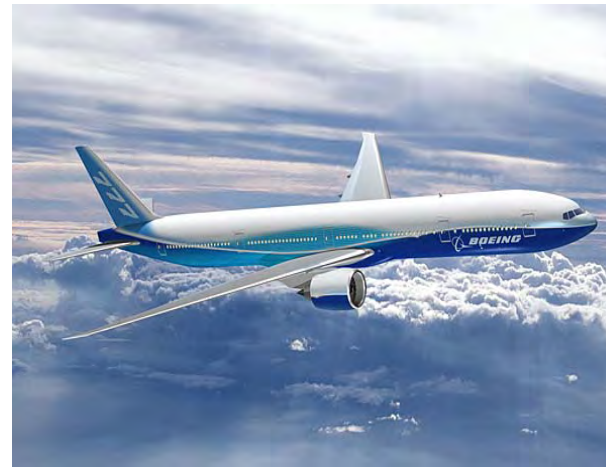
- **737-700: 14**
- **737-800: 89**
- **737-900: 15**
- **737-MAX: 40**



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Airbus A330:



- **A330-200: 7**
- **A330-300: 27**



Boeing 777:

- **777-300ER: 27**

Fleet Operating Outlook (2013 - 2020): Turkish Airlines

	Turkish Airlines											
Aircraft	Operating Performance			2012			2020			Change		
	Seats	Deps/Day	Avg. Stage Length	Fleet	Departures	ASMs	Fleet	Departures	ASMs	Departures	ASMs	
Airbus												
A319	132	5.6	870	14	28,616	3,286,261,440	14	28,616	3,286,261,440	0%		
A320	158	4.1	859	28	41,902	5,687,023,244	32	47,888	6,499,455,136	14%		
A321	185	4.3	1068	32	50,224	9,923,257,920	62	97,309	19,226,312,220	94%		
A320Neo	190	4.0	900				57	83,220	14,230,620,000			
A330-200	262	2.3	2712	7	5,877	4,175,511,816	7	5,877	4,175,511,816	0%		
A330-300	289	2.3	2455	10	8,395	5,956,210,525	27	22,667	16,081,768,418	170%		
A340-300	270	1.9	2953	7	4,855	3,870,541,395	0	0	0	-100%		
Boeing												
737-400	150	0.2	438	3	219	14,388,300	0	0	0	-100%		
737-700	124	3.4	511	14	17,374	1,100,886,136	14	17,374	1,100,886,136	0%		
737-800	161	4.6	818	59	99,061	13,046,135,578	89	149,431	19,679,763,838	51%		
737-900	151	4.2	2144	9	13,797	4,466,695,968	15	22,995	7,444,493,280	67%		
737-MAX	170	3.5	1000				50	63,875	23,314,375,000			
777-300ER	332	1.6	4579	12	7,008	10,653,757,824	35	20,440	31,073,460,320	192%		
Total				195	277,327	62,180,670,146	402	559,691	146,112,907,604	101.8%	135.0%	