



White Paper

# Making the Case for a Middle of the Market Aircraft

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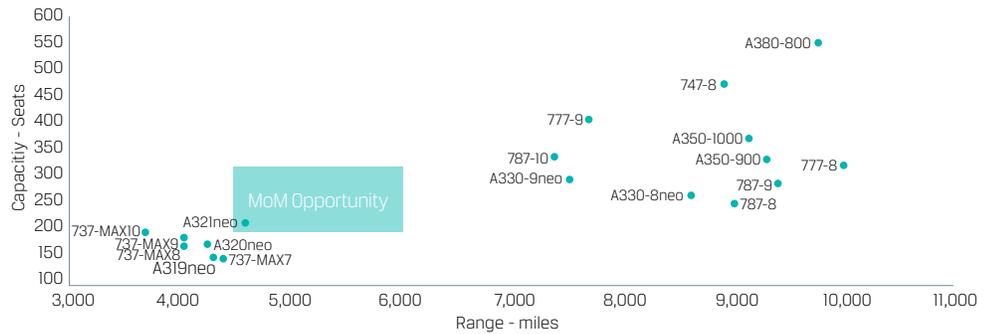
Aircraft and engine design and technology have been pushing the edge of what has been possible in the world of commercial aviation. The Boeing 787 and Airbus A350, along with the re-engined Boeing 737 and Airbus A320, have opened up new markets that were not economically feasible in the past. Routes such as Boston-Tokyo, the recently announced revival of Singapore-Newark, and Norwegian's Europe-North America network are possible today in large part due to the innovative design, material advancement, and operating capability of new technology aircraft.

As new markets are opened at the edges of aircraft capacity and flight ranges, ICF believes there is a market in the middle ripe for a new aircraft that would provide operators with similar opportunities that the 787/A350/737MAX/A320neo provided but in a seat class category that bridges the gap between current production single aisle aircraft and smaller widebodies. Developments in the midsize space promise similarly exciting opportunities.





CAPACITY AND RANGE OF NEW TECHNOLOGY AIRCRAFT



Source: ICF analysis.

Defining the Middle of the Market Aircraft

The definition for the Middle of the Market (MoM) aircraft is somewhat fluid, given the diversity of opinion expressed by airline executives, aircraft lessors, manufacturers, and other stakeholders. One simple way to define the future MoM aircraft is as an aircraft targeted to replace the current Boeing 757 capability with some growth up to 270 seats and range capability up to 5,500 miles. Another way to define the MoM aircraft is an aircraft that fills the gap between the maximum range and capacity capabilities of the 737 MAX 10/A321neo and the larger 787-8/A330-8neo types. Further research indicates that U.S. and European carriers desire 4,500-5,500 miles of range at a capacity of around 240 seats, while Asian operators are seeking a lower range option in a higher density configuration of up to 300 seats.

After significant analysis across its diverse practice areas, ICF believes that a good MoM aircraft, sometimes referred to as the New Midsize Aircraft (NMA), should be capable of transporting 175-270 passengers with a range of up to 5,500 miles, and powered with two engines providing 40,000-45,000 pounds of thrust. ICF believes the list price of such an aircraft will be in the range of \$130-160 million. (Airlines will generally pay much less than list price.)

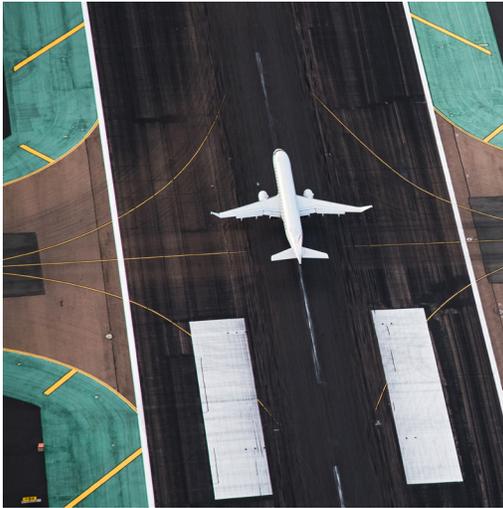
Making the Case for the MoM Aircraft

The business case for or against the MoM aircraft is often debated with vigor. Opponents state that Airbus' and Boeing's current offering can sufficiently cover most markets that a future MoM aircraft would serve.

Long-Haul Statistics of the Airbus A320 and Boeing 737 Families		
	A320	737
Longest route	BAH-CDG	PTY-MVD
Distance	3,000 miles	3,384 miles
Seats	136	155
Operator	Gulf Air	COPA
Frequency (annually)	364 flights	637 flights
Number of routes above 2,500 miles <sup>1</sup>	77	166

<sup>1</sup>Includes only scheduled commercial airline operation with more than 100 frequencies annually. Source: ICF analysis based on IATA PaxIS July 2017 data.





The two prime manufacturers differ on the need for new aircraft in this market segment. Airbus contends that it already has a dominant position at both ends of the market with its A320neo and A330neo offerings. Boeing is constrained in terms of developing a new derivative aircraft from existing products by the range, payload, and operating limitations inherent in a stretched 737 product, while facing challenges in terms of high unit price and operating economics should it choose to shrink its 787 aircraft.

Airlines are currently utilizing a variety of 737, A320, 757, 767, and A330 aircraft on MoM mission profiles, as depicted in the table on the previous page. Larger aircraft, such as the 767 and A330, are able to accomplish the mission profile, but with a significant cost disadvantage. Narrowbodies, such as the 737, 757, and A320, are able to accomplish a similar mission with a number of limitations, primarily on capacity and range. For example, Gulf Air uses a low density Airbus A320 aircraft to fly from its hub in Bahrain to Paris-Charles De Gaulle Airport. Meanwhile, COPA uses a 737-800 to complete a 7-hour flight from its hub at Panama City to Montevideo in Uruguay. Both of these routes push the edge of the performance of their respective airframes, thus requiring special considerations and operating parameters in order to complete their intended mission.

### Current Aircraft Design Limitations

While the current offerings can complete most of the proposed missions of the MoM aircraft, the greatest drivers behind the demand for this MoM aircraft are operating efficiency and economic effectiveness. The 737 and A320 are already at their design limits.

#### 1. Current Age and Fleet Size

One driver behind the demand for a MoM aircraft is the current age and fleet size of the 757, the aircraft closest in terms of capability to the MoM. As the table below shows, the average age of serviceable 757 aircraft is nearly 23 years. As a result, many of the current in service aircraft are likely to be replaced in the near future.

Quick Facts: Boeing 757	
Active + Parked	816 aircraft
Average Age	22.6 years
Longest Route	RDU-CDG – 4,052 miles
Largest Passenger Operators	Delta – 136 aircraft United – 85 aircraft American – 61 aircraft

Source: ICF analysis based on CAPA Fleets and IATA PaxIS July 2017 data.

#### 2. Take-Off Performance

Take-off capability is an important differentiator in what will make a truly successful MoM aircraft. The 757 Series is generally able to take off at full maximum takeoff weight (MTOW) under Hot and High Conditions with considerably shorter runway requirements than the 737 and A320 families.



The 757 owes its high-performance take-off capability to a relatively lightly loaded wing area and powerful engines. Wing loading and engine thrust capability limit any further stretches to the 737/A320. Both would require carefully integrated new wings and engines, as well as major modifications to the airframe and landing gear to meet capability requirements of a future MoM aircraft. The extent of these modifications will narrow the cost gap between a new clean sheet design and a stretch design, thus making a new MoM aircraft design a more likely option.

### 3. Costs

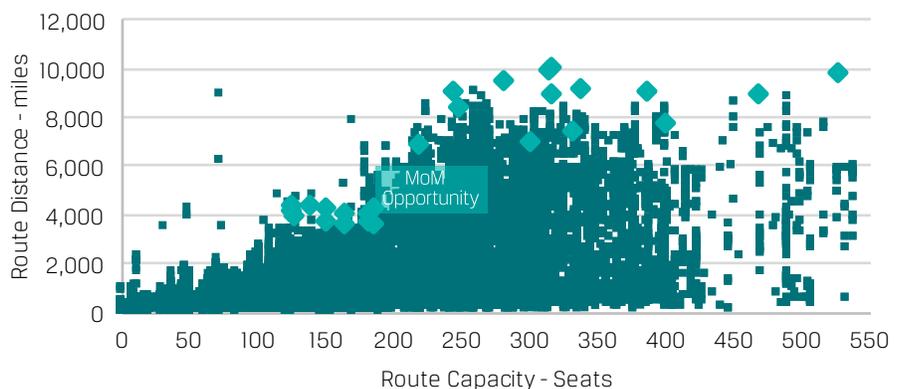
As aircraft manufacturers explore options to fulfill the MoM category demands, significant consideration must be given to both acquisition costs and operating costs.

For commercial success, operating costs—primarily fuel, crew, and maintenance costs—must be significantly less than that of current widebodies. In fact, uncompetitive operating and capital costs were the reason that aircraft such as the 787-3 and A330 Regional types (two recent manufacturer attempts to address the MoM segment) were largely unsuccessful.

A clean sheet design would be one that can meet both the technical and financial challenges of the MoM mission profile. Incorporating a common flight deck design with another aircraft (such as the 787 for Boeing, or either the A350, A330, or A320 family for Airbus) allows pilots, flight attendants, maintenance, and other personnel to be trained on a common platform and introduces unprecedented flexibility for operational management. This commonality is a significant advantage and is likely to be a factor in the success for any aircraft in this category.

### MoM Aircraft Offers Efficiency and New Market Growth

The chart below represents the seat capacity and distance of routes currently flown (in dark teal) and current new technology aircraft capability (in light teal). A large subsection of routes is served by aircraft that are much more capable than the route requires. This is generally an inefficient use of aircraft as manufacturers design aircraft to perform best in the upper range of their capabilities.



Source: ICF analysis based on IATA PaxIS July 2017 data.

A new MoM aircraft would not only replace aircraft operating inefficiently at well below their design capability but also stimulate new markets, likely in the 4,000-5,500 mile range, which cannot be served economically with present aircraft.

A new MoM aircraft is expected to open up new city pairs as represented in the table below, just as the 787/A350 did earlier in the decade. Such an example is shown in the map below, which illustrates new markets or those regaining service due to the introduction of the 787. The attractive economics of a new MoM aircraft are expected to stimulate growth in low cost long-haul service, potentially introducing new entrants to the industry.

Route Pair	Distance (miles)
Tokyo – Las Vegas	5,500
Barcelona – Beijing	5,476
Berlin – Bangkok	5,345
Miami – Stockholm	4,967
Newark – Kahlui	4,895
London – Goa	4,780
Dublin – Seattle	4,527
Cancun – Saõ Paulo	4,101

Source: ICF analysis based on IATA PaxIS July 2017 data.

**INTERNATIONAL SERVICES LAUNCHED WITH BOEING 787 AIRCRAFT FROM THE U.S.**



Source: ICF analysis based on OAG July 2016 data



## Looking Forward

At the 2017 Paris Air Show, Boeing shared some details of what may become its MoM aircraft. As expected, this aircraft will make heavy use of composite materials and will feature new engine technology. The most significant part of this new development, however, is the "hybrid" design of the fuselage, which will combine the comfort and boarding efficiency of a twin-aisle widebody aircraft with the economics of a single-aisle narrowbody aircraft.

Norwegian, already a beneficiary of expansion due to the 787 and 737 MAX, has expressed interest as a launch customer of the MoM aircraft. Market interest has been reiterated by many industry leaders. John Plueger, the Chief Executive Officer of Air Lease Corporation, stated at the ISTAT Americas 2017 Conference that the MoM aircraft "...could be the airplane that creates the next phase of growth for the low-cost carriers."

Interest is not limited to Low Cost Carriers. Speaking about Boeing's MoM aircraft concept, United Airlines Chief Financial Officer Andrew Levy said, "It has a lot of merit and, if they decide to launch it, we'd be very interested in considering it." Other major airlines, such as Alaska Airlines and Delta Airlines, have also indicated interest.

It is likely that Boeing will launch the first MoM aircraft design both as a defensive measure against the A321's order book dominance and to reassert leadership in the MoM category it once dominated after the simultaneous introduction of the 757 and the 767. Given its current development cycle commitments with the 737 MAX, 777X, and 787-10, Boeing will likely target entry into service of its new MoM aircraft around 2025. Concurrently, while Airbus has the engineering bandwidth to certify an aircraft earlier, it risks cannibalizing part of its very successful A321neo program. For that reason, Airbus has chosen to continue advertising the A321neo along the A330-8neo as the pair of aircraft best positioned to fulfill the mid-size aircraft market requirements.

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