

ARCHIVED REPORT

For data and forecasts on current programs please visit

www.forecastinternational.com or call +1 203.426.0800

McDonnell Douglas/Boeing DC-9/ MD-80 Series

Outlook

- Largest remaining fleets to be retired by 2020
- Cargo conversions may push past 2020
- ADS-B Out upgrades required for fleets operating past deadline
- Limited comms and navigation upgrades expected past 2020

Note: Icons indicate area(s) of current and potential retrofit/modernization activity



Orientation

Description. Twin-engine, short/medium-range, narrowbody commercial transport.

Current Status. The DC-9 and MD-80 are no longer in production.

Total Produced. A total of 979 DC-9 and 1,191 MD-80 series aircraft were produced.

Application. Short/medium-range commercial transport that accommodates roughly 90-172 passengers depending on variant and customer specification.

Price Range. Estimated used aircraft prices: MD-82, \$1-\$5 million; MD-83, \$4-\$11 million; MD-88 \$2-\$4 million.



Boeing MD-80

Source: Boeing

McDonnell Douglas/Boeing DC-9/ MD-80 Series**Contractors****Prime**

Boeing	http://www.boeing.com , 100 N Riverside, Chicago, IL 60606 United States, Tel: + 1 (312) 544-2000, Fax: + 1 (312) 544-2082, Prime
---------------	--

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

(MD-81/82/83/87/88)

	Metric	U.S.
Dimensions		
Length overall	45.05/45.05/45.05/ 39.70/45.05 m	147.83/147.83/147.83/ 130.50/147.83 ft
Height	9.02/9.02/9.02/9.30/ 9.02 m	29.60/29.60/29.60/30.50/ 29.60 ft
Wingspan	32.86 m	107.83 ft
Weight		
Operating weight empty	35,329/35,369/36,145/ 33,237/35,369 kg	77,888/77,976/79,686/ 73,274/77,976 lb
Max takeoff weight	63,500/67,800/72,570/ 63,500/67,800 kg	140,000/149,500/160,000/ 140,000/149,500 lb
Performance		
Maximum range, depending on variant	2,897-4,635 km	1,562-2,499 nm
Propulsion		
MD-81		
Two Pratt & Whitney JT8D-209 turbofans		
Thrust (each)	85.6 kN	19,250 lbst
MD-82		
Two Pratt & Whitney JT8D-217/217A turbofans		
Thrust (each)	92.75 kN	20,850 lbst
MD-83		
Two Pratt & Whitney JT8D-219 turbofans		
Thrust (each)	96.5 kN	21,700 lbst
MD-87 (a)		
Two Pratt & Whitney JT8D-217C turbofans		
Thrust (each)	92.75 kN	20,850 lbst
MD-88		
Two Pratt & Whitney JT8D-219 turbofans		
Thrust (each)	96.5 kN	21,700 lbst
(a) Other -200 engines are optional.		

McDonnell Douglas/Boeing DC-9/ MD-80 Series

Program Review

Background. Preliminary design work on the McDonnell Douglas Model 2086 began in 1962, and construction of the first DC-9 airframe began in March 1964. A prototype flew in February 1965, with certification and initial deliveries of the DC-9-10 taking place in November and December 1965, respectively.

The DC-9 was produced in five major variants prior to redesignation as the stretched MD-80 series. The original DC-9-10 had a maximum seating capacity of 105 passengers. Subsequently, McDonnell Douglas

developed stretched versions with increased passenger capacity up to a maximum of 172 seats.

Many of the early DC-9 series aircraft are still active in the world's airlines. Several modernization efforts can be expected, usually to improve performance or to convert the aircraft from one type of service to another.

To indicate the MD-80 was a new series of aircraft, McDonnell Douglas dropped the "DC-9" nomenclature shortly after announcing the DC-9-80.

Variants

DC-9-10. Basic variant. Initial flight in February 1965.

DC-9-20. Designed for operation in hot climate and/or high-altitude conditions. Up to 90 passengers. Powered by JT8D-9 engines rated at 64.5 kN (14,500 lbst) each. First flight in September 1968.

DC-9-30. Improved version featuring increased wingspan and longer fuselage compared to DC-9-10. Was available with several engine options. U.S. military DC-9-30 designations include C-9A, C-9B, and VC-9C.

DC-9-40. Similar to Series 30 but with increased fuel capacity and longer fuselage. Also available with various engine options.

DC-9-50. Stretched version of Series 30. Featured high-density seating for up to 139 passengers. First flight in December 1974.

MD-81. The first of the MD-80 series, originally known as the DC-9 Super 80. It is powered by a pair of JT8D-209s. It entered airline service in October 1980. The aircraft seats up to 172 passengers. As are all MD-80 series transports, the MD-81 is equipped and approved for two-pilot operation.

MD-82. Announced in April 1979, this is the hot/high version powered by JT8D-217 engines. The aircraft entered airline service in August 1981 at a certificated

weight of 66,680 kilograms (147,000 lb). A second version, fitted with -217A powerplants and certificated at a higher maximum gross weight (67,800 kg/149,500 lb), became available in the fall of 1982.

MD-83. Launched in January 1983, this is the long-range (4,747-km/2,562-nm) variant powered by JT8D-219 engines. Alaska Airlines received the first MD-83 in February 1985. Two 2,195-liter (580-gal) fuel tanks are incorporated into the aircraft's cargo compartment; other modifications include a strengthened landing gear and some refinements to the wing structure and skin. The higher-thrust engines are 2 percent more fuel efficient than the -217As.

MD-87. Essentially a replacement for the DC-9-30, the MD-87 features a fuselage shortened by more than 5 meters and seats 130-139 passengers. Power is provided by JT8D-217C engines, which offer 2 percent lower fuel consumption than -217A turbofans. The aircraft takes off at 63,500 kilograms. Following its first flight in 1986, the MD-87 entered airline service in November 1987.

MD-88. This is basically an MD-82 fitted with uprated JT8D-219 engines (which also power the MD-83), incorporating more advanced avionics and cockpit instrumentation. Delta placed orders and options for 30 and 50, respectively, in January 1986, and took initial deliveries in 1987.

Funding

The U.S. Air Force once maintained a budget line item for C-9 modifications, but this item was last funded in FY05, and no future funding is anticipated at this time.

McDonnell Douglas/Boeing DC-9/ MD-80 Series

Milestones

Month	Year	Major Development
	1962	Preliminary design of Model 2086
Feb	1965	Prototype first flight
Nov	1965	DC-9-10 certificated
Oct	1979	MD-81 first flight
Sep	1980	Initial delivery of MD-81 (Swissair)
Jan	1981	MD-82 first flight
	1982	Initial MD-82 deliveries
Jan	1983	MD-83 launched
Feb	1985	Initial MD-83 deliveries
Oct	1987	Initial MD-87 deliveries
Jun	1987	First Chinese-assembled MD-82 flown
Aug	1987	MD-88 first flight
Dec	1987	MD-88 certificated
Dec	1999	Final MD-80 delivered
Q3	2011	AEI conversions certificated
	2018	Projected retirement of Allegiant fleet
	2019	Projected retirement of American Airlines fleet
	2020	Projected retirement of Delta fleet

Worldwide Distribution/Inventories

Country	Operator	Designation	Quantity	Average Age
AFGHANISTAN	Kam Air	MD-82	1	30.00
AFGHANISTAN	Kam Air	MD-83	2	30.00
AFGHANISTAN	Kam Air	MD-87	1	27.00
ALBANIA	Star Airways	MD-82	1	31.00
ANGOLA	Air Gemini Lda	DC-9-32	2	45.00
ANGOLA	ServisAir	MD-82	3	26.00
ARGENTINA	Andes Lineas Aereas	MD-83	5	28.60
ARGENTINA	Austral Lineas Aereas	MD-88	1	25.00
ARMENIA	Ararat International Airlines	MD-82	1	24.00
BANGLADESH	United Airways	MD-83	3	27.33
BULGARIA	Bulgarian Air Charter	MD-82	6	28.83
BULGARIA	Hemus Air	MD-82	1	31.00
BURKINA FASO	Air Burkina	MD-87	2	28.00
CHAD	Chad Air Force	MD-87	1	28.00
CHINA, PEOPLE'S REPUBLIC OF	China Southern Airlines	MD-82	3	30.00
COLOMBIA	Aerorepublica SA	MD-81	1	38.00
COLOMBIA	Inter-Intercontinental de Aviacion (Colombia)	DC-9-14	1	52.00
COLOMBIA	Lineas Aereas Suramericanas	DC-9-15F	1	51.00
CONGO, DEMOCRATIC REPUBLIC OF	Wimbi Dira Airways - WDA	DC-9-32	1	42.00
CONGO, REPUBLIC OF	Fly Congo	MD-82	2	34.50
COSTA RICA	Aeronaves de America SA	DC-9-33RC	1	50.00
DENMARK	DAT-Danish Air Transport	MD-83	1	28.00

McDonnell Douglas/Boeing DC-9/ MD-80 Series

Country	Operator	Designation	Quantity	Average Age
EGYPT	Air Leisure	MD-83	1	29.00
EGYPT	Air Memphis	DC-9-31	1	39.00
EGYPT	AMC Airlines	MD-83	1	22.00
GEORGIA	Sky Georgia (Georgian National Airlines)	DC-9-51	1	43.00
GHANA	Antrak Air Ghana Ltd	DC-9-51	1	41.00
GREECE	Sky Wings Airlines	MD-83	1	29.00
GUATEMALA	Tikal Jets Airlines	DC-9-51	1	37.00
INDONESIA	Airfast Indonesia	MD-82	2	28.00
INDONESIA	Lion Air	MD-82	2	36.50
INDONESIA	Wings Air	MD-82	1	34.00
IRAN	ATA Airline (Iran)	MD-82	1	28.00
IRAN	ATA Airline (Iran)	MD-83	8	22.88
IRAN	Caspian Airlines	MD-82	1	24.00
IRAN	Caspian Airlines	MD-83	5	24.60
IRAN	Iran Air Tours Company	MD-82	5	27.60
IRAN	Kish Air	MD-81	1	29.00
IRAN	Kish Air	MD-82	5	24.00
IRAN	Kish Air	MD-83	2	29.00
IRAN	Taban Air	MD-82	2	26.00
IRAN	Taban Air	MD-88	2	21.00
IRAN	Taftan Air Lines Ltd	MD-83	1	23.00
IRAN	Zagros Airlines	MD-82	6	29.83
IRAN	Zagros Airlines	MD-83	3	28.33
ITALY	Meridiana Fly	MD-82	4	28.25
ITALY	Mistral Air	DC-9-32	1	42.00
KENYA	African Express Airways (K) Ltd	DC-9-32	2	50.50
KENYA	African Express Airways (K) Ltd	MD-82	1	34.00
KENYA	Astral Aviation Ltd	DC-9-34CF	2	42.00
KENYA	Fly540	DC-9-14	1	53.00
KENYA	Pan African Airways	DC-9-32	1	50.00
KUWAIT	Gryphon Airlines	MD-82	1	35.00
KUWAIT	Gryphon Airlines	MD-87	1	28.00
LATVIA	Air Baltic Corporation AS	MD-87	1	27.00
LIBYA	Air One Nine	DC-9-32	1	51.00
MALI	Air Mali	MD-87	3	28.00
MEXICO	Aeromexico	MD-87	1	31.00
MEXICO	Aeronaves TSM SA de CV	DC-9-15F	1	51.00
MEXICO	Aeronaves TSM SA de CV	DC-9-32F	2	50.50
MEXICO	Aeronaves TSM SA de CV	DC-9-33F	1	49.00
MEXICO	Aeronaves TSM SA de CV	DC-9-33RC	1	49.00
MEXICO	Aeronaves TSM SA de CV	MD-82	1	25.00
MEXICO	Aeronaves TSM SA de CV	MD-83	1	26.00
MYANMAR	Myanmar Airways International - MAI	MD-82	1	33.00

McDonnell Douglas/Boeing DC-9/ MD-80 Series

Country	Operator	Designation	Quantity	Average Age
NETHERLANDS ANTILLES	InselAir	MD-82	3	30.67
NETHERLANDS ANTILLES	InselAir	MD-83	1	28.00
NIGERIA	DANA - Dornier Aviation Nigeria AIEP Ltd	MD-83	2	28.00
NIGERIA	Dana Air	MD-83	3	27.00
PHILIPPINES	Spirit of Manila Airlines	MD-83	1	28.00
PHILIPPINES	Swiftair Inc	MD-83	1	29.00
ROMANIA	JetranAir	MD-82	5	35.20
ROMANIA	Medallion Air	MD-83	1	27.00
SERBIA/MONTENEGRO	Air Serbia (Jat Airways)	DC-9-32	1	45.00
SLOVENIA	Adria Airways	MD-82	1	37.00
SOUTH AFRICA	Phoebus Apollo Aviation (Pty) Ltd	DC-9-32	2	49.50
SOUTH AFRICA	Phoebus Apollo Aviation (Pty) Ltd	DC-9-34CF	1	42.00
SOUTH AFRICA	SAFAIR Pty Ltd	MD-82	9	33.89
SPAIN	Bravo Airlines	MD-83	3	27.33
SPAIN	Pronair Airlines	MD-87	1	28.00
SPAIN	Swiftair SA	MD-82	1	25.00
SPAIN	Swiftair SA	MD-83	2	27.50
SWEDEN	Air Sweden	MD-81	1	38.00
SWEDEN	Air Sweden	MD-82	1	33.00
SWEDEN	SAS	MD-81	1	28.00
SWEDEN	SAS	MD-82	4	28.00
SWEDEN	SAS	MD-87	2	27.00
TAIWAN, R.O.C.	Far Eastern Air Transport Corp - FAT	MD-82	2	23.00
TAIWAN, R.O.C.	Far Eastern Air Transport Corp - FAT	MD-83	3	22.33
THAILAND	Orient Thai Airlines	MD-82	3	30.67
THAILAND	Orient Thai Airlines	MD-83	1	36.00
TURKEY	Onur Air	MD-88	1	21.00
UKRAINE	Bravo Airways (Aviakompania Bravo)	MD-83	2	29.50
UKRAINE	Bukovyna Airlines	MD-82	3	26.67
UKRAINE	Khors Aircompany	MD-82	3	26.33
UKRAINE	Khors Aircompany	MD-83	1	32.00
UKRAINE	Khors Aircompany	MD-88	2	21.00
UKRAINE	Um Air	DC-9-51	1	42.00
UKRAINE	Wind Rose Aviation Company	MD-82	1	33.00
UNITED ARAB EMIRATES	Daallo Airlines	DC-9-32	1	51.00
UNITED ARAB EMIRATES	Eastern Skyjets	DC-9-32	1	37.00
UNITED KINGDOM	DHL Air	DC-9-31	1	47.00
UNITED KINGDOM	DHL Air	DC-9-32	1	50.00
UNITED KINGDOM	ExecuJet UK	MD-87	1	26.00

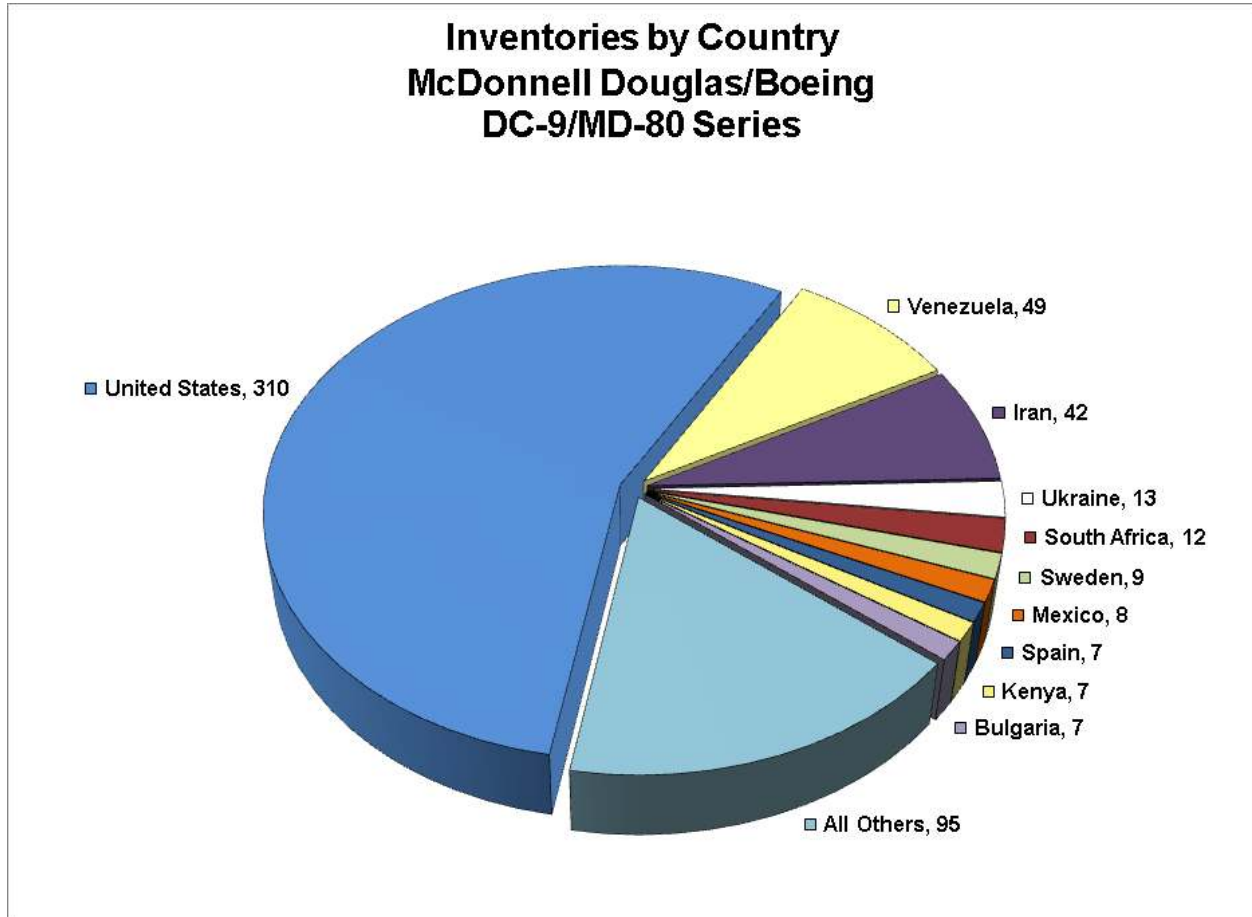
McDonnell Douglas/Boeing DC-9/ MD-80 Series

Country	Operator	Designation	Quantity	Average Age
UNITED KINGDOM	Skyblue Airways (Atlantic Express)	DC-9-32	1	38.00
UNITED KINGDOM	Trident Aviation Lsg Services (Ireland)	MD-83	1	31.00
UNITED STATES	ABX Air	DC-9-33RC	1	49.00
UNITED STATES	Aircraft Guaranty Corp	MD-82	2	21.00
UNITED STATES	Allegiant Air	MD-81	1	32.00
UNITED STATES	Allegiant Air	MD-83	35	28.89
UNITED STATES	Allegiant Air	MD-87	5	29.20
UNITED STATES	Allegiant Air	MD-88	3	29.00
UNITED STATES	American Airlines	MD-82	48	28.44
UNITED STATES	American Airlines	MD-83	43	21.02
UNITED STATES	Ameristar Air Cargo	DC-9-15F	3	51.00
UNITED STATES	Ameristar Air Cargo	DC-9-15RC	1	51.00
UNITED STATES	Amtec Jet Inc	DC-9-21	2	49.50
UNITED STATES	Astar Air Cargo	DC-9-32	1	50.00
UNITED STATES	Astar Air Cargo	DC-9-41	2	43.50
UNITED STATES	Aviation Capital Group	MD-83	1	27.00
UNITED STATES	Aviation Systems International Inc	DC-9-31	1	50.00
UNITED STATES	Bank of Utah	MD-87	1	29.00
UNITED STATES	Boeing Capital Corporation	MD-82	1	33.00
UNITED STATES	Clay Lacy Aviation	DC-9-14	1	52.00
UNITED STATES	Corporate Aviation Services Inc	MD-87	1	29.00
UNITED STATES	Delta Air Lines	DC-9-31	1	51.00
UNITED STATES	Delta Air Lines	MD-88	107	27.87
UNITED STATES	Erickson-Air Crane	MD-87	3	27.00
UNITED STATES	Everts Air Alaska	DC-9-32F	1	51.00
UNITED STATES	Everts Air Alaska	DC-9-33CF	1	48.00
UNITED STATES	Everts Air Alaska	DC-9-33F	1	49.00
UNITED STATES	Everts Air Alaska	DC-9-33RC	1	49.00
UNITED STATES	Everts Air Alaska	MD-82	1	31.00
UNITED STATES	Everts Air Alaska	MD-83	1	26.00
UNITED STATES	Falcon Air Express	MD-83	6	28.50
UNITED STATES	Finova Capital Corporation	MD-81	1	37.00
UNITED STATES	GECAS - GE Capital Corp	MD-83	1	26.00
UNITED STATES	Jet Midwest	DC-9-32	4	47.25
UNITED STATES	Jet Midwest	MD-83	2	27.00
UNITED STATES	Kalitta Charters	DC-9-15RC	2	51.00
UNITED STATES	Kalitta Charters	DC-9-33CF	1	50.00
UNITED STATES	KEB Aircraft	MD-87	1	29.00
UNITED STATES	OK Aviation Inc	DC-9-31	1	51.00
UNITED STATES	Olympia Aviation	MD-81	1	37.00
UNITED STATES	Perris Valley Aviation Service	DC-9-21	1	49.00
UNITED STATES	Republic Financial Corp	DC-9-32	1	39.00
UNITED STATES	United States Marines	C-9B	2	42.50

McDonnell Douglas/Boeing DC-9/ MD-80 Series

Country	Operator	Designation	Quantity	Average Age
UNITED STATES	USA Jet Airlines	DC-9-15	1	51.00
UNITED STATES	USA Jet Airlines	DC-9-15F	2	51.00
UNITED STATES	USA Jet Airlines	DC-9-32F	2	46.00
UNITED STATES	USA Jet Airlines	DC-9-34	1	38.00
UNITED STATES	USA Jet Airlines	MD-83	2	28.50
UNITED STATES	Wells Fargo	MD-83	2	31.00
UNITED STATES	World Atlantic Airways (Caribbean Sun Airlines)	MD-82	1	30.00
UNITED STATES	World Atlantic Airways (Caribbean Sun Airlines)	MD-83	5	26.80
VENEZUELA	Aeropostal Alas de Venezuela CA	DC-9-21	2	49.00
VENEZUELA	Aeropostal Alas de Venezuela CA	DC-9-31	1	49.00
VENEZUELA	Aeropostal Alas de Venezuela CA	DC-9-32	3	48.33
VENEZUELA	Aeropostal Alas de Venezuela CA	DC-9-34CF	1	41.00
VENEZUELA	Aeropostal Alas de Venezuela CA	DC-9-51	7	42.14
VENEZUELA	Aserca Airlines CA	DC-9-31	10	45.40
VENEZUELA	Aserca Airlines CA	DC-9-32	2	47.00
VENEZUELA	Aserca Airlines CA	MD-82	4	32.00
VENEZUELA	Aserca Airlines CA	MD-83	1	21.00
VENEZUELA	Avensa - Aerovias Venezolanas SA	DC-9-31	1	50.00
VENEZUELA	LASER - Linea Aerea de Servicio Ejecutivo Regional	DC-9-31	1	36.00
VENEZUELA	LASER - Linea Aerea de Servicio Ejecutivo Regional	DC-9-32	1	51.00
VENEZUELA	LASER - Linea Aerea de Servicio Ejecutivo Regional	MD-81	3	27.33
VENEZUELA	LASER-Linea Aerea de Servicio Ejecutivo Regional	MD-82	4	29.00
VENEZUELA	SBA Airlines (Santa Barbara Airlines)	DC-9-31	1	38.00
VENEZUELA	SBA Airlines (Santa Barbara Airlines)	MD-82	1	36.00
VENEZUELA	Servivensa-Servicios Avensa	DC-9-31	1	51.00
VENEZUELA	Servivensa-Servicios Avensa	DC-9-32	1	51.00
VENEZUELA	Servivensa-Servicios Avensa	DC-9-51	2	41.00
VENEZUELA	Venezolana - Linea Aerea de Venezuela RAV SA	MD-82	1	29.00
VENEZUELA	Venezolana - Linea Aerea de Venezuela RAV SA	MD-83	1	32.00

McDonnell Douglas/Boeing DC-9/ MD-80 Series



Identified Retrofit & Modernization Contractors

Airframe

Aeronautical Engineers Inc	http://www.aeronautical-engineers.com , 7765 NW 54th St, Miami, FL 33166 United States, Tel: + 1 (305) 594-5802, Fax: + 1 (305) 594-5804, Email: sales@aeronautical-engineers.com (Cargo Conversion)
Commercial Jet	http://www.commercialjet.com , 100 Jet Services Way, Dothan, AL 36303 United States, Tel: + 1 (305) 341-5150 (MD-83SF Conversion)

Electronics

Gogo	http://www.gogoair.com , 1250 N Arlington Heights Rd, Ste 500, Itasca, IL 60143 United States, Tel: + 1 (630) 647-1400, Fax: + 1 (630) 285-0191, Email: sales@aircell.com (Gogo Wi-Fi)
-------------	---

McDonnell Douglas/Boeing DC-9/ MD-80 Series

Opportunities

Airframe

Cargo Conversion

The AEI cargo conversion model, the MD-80SF, was certificated during the third quarter of 2011, with eight deliveries following by the end of that year.

The AEI MD-80SF costs about \$3.5 million: around \$1 million for the aircraft and engines, \$2.2 million for the conversion, and the remainder for maintenance. According to AEI, the MD-80SF has the same payload – 46,000 pounds – as a 737-400SF but at less than half the price. It can take a payload of 21.1 tons or 12 pallets measuring 88 x 108 inches.

Conversion partners include Commercial Jet in Miami, Florida and Dothan, Alabama. AEI's Asian partner is Boeing Shanghai Aviation Services.

The pursuit of an MD-80 cargo carrier is risky in a market with more modern freighters like the 737. AEI has fallen short of its expected orders.

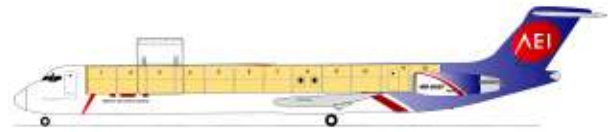
As of the end of 2016, AEI had converted seven MD-80s; demand had called for 100 conversions over 10 years. A stronger-than-expected demand for 737-400s may thus have had an impact on AEI conversions.

An MD-83 aircraft was delivered to Everts Air Cargo in April 2017. In June 2017, AEI announced two orders from Mexico's Aeronaves for two additional MD-83SF freighters. Modification of the first began in June, with an expected delivery in September from Commercial Jet's Miami, Florida, facility. Work on the second MD-83 was to begin on June 26, with redelivery scheduled for October from Commercial Jet's Dothan, Alabama, facility.

In November 2017, Aeronaves ordered an additional three MD-83SFs, all of which were expected to be delivered in 2018.

In March 2018, AEI received an order for two MD-83SF conversions for Everts Air Cargo. The first delivery was expected in August 2018, and the second in December 2018.

Much like MD-11 and 747 cargo conversions, the MD-80 conversions are winding down, and may see their last days in 2019-2020, although with the cargo market as strong as it is, conversions may get pushed out somewhat further.



MD-82SF

Source: AEI

Electronics

Wi-Fi

High-speed, low-cost, reliable Wi-Fi connectivity is increasingly an expected amenity on airline flights. Failure to provide this service may result in substantial competitive disadvantage.

Gogo markets an improved air-to-ground technology, the ATG4, that was planned to be retrofitted on Delta's MD-88 fleet. The 9.8-Mbps technology can be installed overnight, and includes hardware installations on the aircraft, along with four antennas for placement on the bottom of the plane.

The outfitting of a wireless Internet package is most likely the final upgrade for Delta's fleet – being done in order to make a tired aircraft feel more youthful and luxurious. Even so, with retirement slated for 2020, the expenditure and time may not be worth the upgrade.

Although there may be minor fleet upgrades to the new system, further Wi-Fi upgrades are unlikely because airlines plan to retire their MD-80 fleets by the end of the decade.



Gogo ATG4 Antenna

Source: Gogo

Future Avionics Upgrades

With some of the world's largest fleets undergoing retirement, avionics upgrades for passenger aircraft should come to a trickle, being performed solely on smaller fleets. Cargo fleets, however, will continue to see limited communications and navigation upgrades through at least the mid-2020s.

McDonnell Douglas/Boeing DC-9/ MD-80 Series

Forecast Rationale

Although the DC-9 is still widely popular with passengers due to its 18.5-inch economy seats and two-three layout, its popularity with airlines has been on the decline for quite some time, with operators citing problems such as low fuel efficiency. As a narrowbody, the MD-80 isn't the most appealing aircraft to cargo companies, and even at a time of relatively low fuel prices, the high cost associated with fuel inefficiency is pushing operators to rapidly retire the aircraft.

MD-80s in general are becoming increasingly unreliable, and retired planes will likely be cannibalized in order to repair those in operation, or scrapped completely.

Allegiant has scheduled its last MD-80 flight for November 2018. American Airlines, the world's largest

MD-80 operator, plans to retire its entire fleet by 2019, while Delta plans to retire its fleet by 2020.

It is still possible that some retired aircraft will be sold for cargo conversion, or to smaller airlines in the developing world. In 2018, Aeronautical Engineers is expected to deliver five MD-83SF cargo conversion aircraft.

An upswing in activity will be seen in 2019 as remaining fleets attempt to meet ADS-B Out requirements. With a limited worldwide fleet of DC-9 passenger aircraft, and a similarly modest cargo fleet, few upgrades are expected post-2020. And these will likely be limited to communication and navigation upgrades.

FI's Opportunity Outlook

AIRFRAME													
Status		Thru 2017	High Confidence				Good Confidence			Less Confidence			Total
Estimated Potential Candidates	500		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	
		Cargo Conversion <> DC-9/MD-80											
Planned/In Progress		10	5	0	0	0	0	0	0	0	0	0	5
Speculative			2	3	2	1	1	0	0	0	0	0	9
ELECTRONICS													
Status		Thru 2017	High Confidence				Good Confidence			Less Confidence			Total
Estimated Potential Candidates	500		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	
		Wi-Fi Upgrade <> DC-9/MD-80											
Planned/In Progress		0	0	0	0	0	0	0	0	0	0	0	0
Speculative			10	6	3	1	1	0	0	0	0	0	21
		Future Comms Upgrades <> DC-9/MD-80											
Planned/In Progress		0	0	0	0	0	0	0	0	0	0	0	0
Speculative			0	0	2	4	3	2	3	2	2	1	19
		Future Navigation Upgrades <> DC-9/MD-80											
Planned/In Progress		0	0	0	0	0	0	0	0	0	0	0	0
Speculative			0	0	2	4	3	2	3	2	2	1	19