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McDonnell Douglas DC/KC-10/MD-11 Series

Outlook

- Number of cargo conversions has decreased significantly
- Remaining DC-10 and MD-11 aircraft are limited to CNS/ATM modification to carry them through retirement
- USAF Mode 5 and CNS/ATM projects are progressing

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



Orientation

Description. The DC-10 is a widebody trijet commercial transport accommodating a crew of three plus 255-380 passengers. The KC-10A Extender is a long-range military tanker/cargo aircraft derived from the DC-10-30F transport.

Current Status. DC-10/KC-10 production ended in 1988. MD-11 production ended in 2000.

Total Produced. A total of 386 DC-10s were produced, plus 60 KC-10s. A total of 200 MD-11s were produced.

Application. DC-10/MD-11: commercial passenger / cargo transport. KC-10: military tanker/cargo transport.

Price Range. Estimated prices on the used aircraft market: DC-10-10, \$1-\$2 million; DC-10-30, \$1-\$5 million; DC-10-40, \$1-\$6 million; MD-11, \$10-\$15 million.

Contractors

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Boeing

<http://www.boeing.com>, 100 N Riverside, Chicago, IL 60606 United States,
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Technical Data

(DC-10-30)

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Length overall	55.50 m	182.04 ft
Height overall	17.70 m	58.06 ft
Wingspan	50.40 m	165.31 ft
Wing area, gross	367.7 sq m	3,958.0 sq ft
Weight		
Basic weight empty	121,198 kg	267,197 lb
Max payload	48,330 kg	106,550 lb
Max fuel weight		
Standard	111,387 kg	245,566 lb
With small auxiliary tank	116,049 kg	255,844 lb
With large auxiliary tank	121,467 kg	267,790 lb
Max TOW	259,450-263,085 kg	572,000-580,000 lb
Max zero-fuel weight	166,922 kg	368,000 lb
Performance (a)		
Never-exceed speed	Mach 0.95	Mach 0.95
Max level speed (b)	Mach 0.88	Mach 0.88
Service ceiling (c)	10,180 m	33,400 ft
Range		
With max fuel, no payload	12,055 km	6,504 nm
With max payload at max Zero-fuel weight	7,413 km	4,000 nm
Propulsion		
Three General Electric CF6-50A turbofans		
Thrust (each)	218.0 kN	49,000 lbst
or		
Three General Electric CF6-50C turbofans		
Thrust (each)	226.8 kN	51,000 lbst
or		
Three General Electric CF6-50C1 or CF6-50C2 turbofans		
Thrust (each)	233.5 kN	52,500 lbst
or		
Three General Electric CF6-50C2B turbofans		
Thrust (each)	235.7 kN	53,000 lbst

(a) At maximum TOW unless otherwise noted.

(b) At 7,620 meters (25,000 ft).

(c) At 249,475 kilograms (550,000 lb) AUW.

Program Review

Background. The DC-10 transport was the result of an American Airlines request in 1966 for a new 250-passenger twinjet for medium-range routes. Both McDonnell Douglas and Lockheed developed aircraft for this requirement, but in the process, the range capability and maximum gross weight increased, and power was raised with the addition of a third engine. Initial orders came during 1968, with American as the

first customer, and within a few years it appeared that the DC-10 was to achieve a larger market share than its TriStar competitor. This favorable position enjoyed by McDonnell Douglas enabled the company to push ahead with additional variants. A pair of long-range versions and a convertible passenger/cargo variant were subsequently developed, and Douglas further increased the line's appeal through a range of powerplant options.

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Variants

DC-10-10. This is the basic short-/medium-range model, typically configured for 255-270 passengers in mixed-class layout. The aircraft is powered by GE CF6-6 series turbofans, has a maximum takeoff weight of 185,970-206,385 kilograms (410,000-455,000 lb) depending on version, and has a range (with maximum payload at maximum zero-fuel weight) of 4,355 kilometers (2,350 nm).

DC-10-15. Basically a DC-10-10, the -15 uses CF6-50C2F engines of 206.8 kN (46,500 lbf), flat-rated for "hot and high" (ambient temperature to 30°C and high elevation) operations. The options offered on the -10 were standard equipment on the -15. Mexicana and Aeromexico ordered -15s.

DC-10-20. See DC-10-40, below.

DC-10-30. The standard long-range version, this was the line's breadwinner. (See **Technical Data**, above.) Landing gear was augmented by the addition of a dual-wheel bogie unit mounted on the fuselage centerline between the four-wheel bogie main units.

DC-10-30ER. A development of the -30, this extended-range model has CF6-50C2B engines of 240.2 kN (54,000 lbf), a maximum takeoff weight of 263,085 kilograms (580,000 lb), additional fuel capacity, and a maximum range of 10,620 kilometers (5,730 nm). Swissair ordered two -30ERs and kits to convert two of its operational DC-10s to the -30ER configuration. Finnair ordered one to inaugurate Helsinki-Tokyo service in the spring of 1983.

DC-10-30CF. Similar to the basic -30 and -40, the -30CF convertible freighter variant features overnight conversion to an all-cargo configuration. Payload can be 380 passengers or 64,860 kilograms (143,000 lb) of cargo over full intercontinental range; higher cargo loads to 70,626 kilograms (155,700 lb) are possible on domestic transcontinental distances.

DC-10-30F. The -30F freighter differs from the -30CF version in not having those features that allow

conversion to all-passenger configuration. Maximum takeoff weight is 263,085 kilograms (580,000 lb); payload capability is 80,282 kilograms (176,992 lb) over intercontinental range. Deliveries of the -30F began in 1986. The aircraft is powered by the GE CF6-50C2.

DC-10-40. This is the alternate long-range variant, powered by Pratt & Whitney JT9Ds. The first 22, ordered by Northwest Airlines, used the JT9D-20 engine, and were designated DC-10-20. Japan Airlines ordered the JT9D-59A for its DC-10-40s, and received the first of these in 1976. With the -59 engine, weights, capacities, and range are about the same as those of the DC-10-30.

MD-11. Announced at the 1985 Paris Air Show, this successor to the DC-10 incorporates a 5.64-meter (18.5-ft) fuselage stretch and has a standard maximum takeoff weight of 273,314 kilograms (602,555 lb) and a design range (with 298 passengers and with FAA international reserves) of 12,633 kilometers (6,821 nm). The aircraft also features a two-man flight deck and the addition of winglets. Customers could select either GE CF6-80C2 or Pratt & Whitney PW4460 engines.

Aside from the baseline passenger version, Boeing also marketed combi, freighter, and extended-range models. MD-11 certification and initial deliveries occurred in 1990.

KC-10A Extender. The KC-10A tanker/cargo aircraft is derived from the commercial DC-10-30CF. It has a boom operator's station, an aerial refueling boom, a hose and drogue, military avionics, and body fuel cells in the lower cargo compartments. As a tanker, the aircraft can deliver more than 90,719 kilograms (200,000 lb) of fuel to another aircraft more than 3,540 kilometers (1,910 nm) from home base and return. As a cargo aircraft, it can deliver up to 77,112 kilograms (170,000 lb) of cargo more than 6,920 kilometers (3,730 nm).

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Funding

The U.S. Air Force maintains a line item in its procurement budget for KC-10 modifications.

U.S. FUNDING

	FY13	FY13	FY14	FY14	FY15	FY15	FY16	FY16
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	(Req) <u>QTY</u>	(Req) <u>AMT</u>
KC-10 Mods	-	8.6	-	48.2	-	77.5	-	5.6
KC-10 RDT&E (PE#0401219F)	-	18.5	-	-	-	2.7	-	1.8
Total	-	27.1	-	48.2	-	80.2	-	7.4

All \$ are in millions.

Milestones

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1966	Initial DC-10 design studies
Feb	1968	First airline (American Airlines) order
Aug	1970	DC-10-10 first flight
Jul	1971	DC-10-10 certification and initial deliveries
Oct	1972	DC-10-20 certificated
Nov	1972	DC-10-30 certificated; -20 and -30 deliveries begin
	1977	McDonnell Douglas awarded initial KC-10 development/production contract
Mar	1981	First KC-10A delivered
Dec	1986	MD-11 program launched
Jan	1990	MD-11 first flight
Nov	1990	MD-11 certificated
Oct	2000	MD-11 production ceased
Nov	2014	KLM operates world's last MD-11 passenger flight

Worldwide Distribution/Inventories

<u>Country</u>	<u>Operator</u>	<u>Designation</u>	<u>Quantity</u>	<u>Average Age</u>
BOLIVIA	TAB Airlines	DC-10-10F	1	43
BOLIVIA	TAB Airlines	DC-10-30CF	1	41
BOLIVIA	TAB Airlines	MD-10	1	27
CANADA	Kelowna Flightcraft Group	DC-10-30	1	41
CANADA	Kelowna Flightcraft Group	DC-10-30F	4	41
CHINA, PEOPLE'S REPUBLIC OF	China Cargo Airlines	MD-11F	1	21
ETHIOPIA	Ethiopian Airlines	MD-11ER	1	18
ETHIOPIA	Ethiopian Airlines	MD-11F	1	17
FINLAND	Finnair	DC-10-30	1	41
FINLAND	Finnair	MD-11ER	1	21
FINLAND	Finnair	MD-11F	1	22
FINLAND	Nordic Global Airlines	MD11F	1	24

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Country	Operator	Designation	Quantity	Average Age
GERMANY	Lufthansa Cargo	MD-11F	17	18
IRAQ	Iraqi Airways	DC-10-10	1	35
IRELAND	Omega Air Ltd	DC-10-40	1	35
NETHERLANDS	KLM – Royal Dutch Airlines	MD-11	4	20
NETHERLANDS	Martinair Holland	MD-11Combi	1	17
NETHERLANDS	Martinair Holland	MD-11F	5	21
NETHERLANDS	Netherlands Air Force	DC-10-30CF	2	40
PERU	Cielos del Peru	DC-10-30CF	1	35
RUSSIA	Aeroflot Russian Airlines	MD-11F	3	22
SAUDI ARABIA	Saudi Arabia Air Force	MD-11	2	21
SAUDI ARABIA	Saudi Arabian Royal Flight	MD-11	1	22
SAUDI ARABIA	Saudia (Saudi Arabian Airlines)	MD-11F	4	18
SWITZERLAND	United Aviation Services	DC-10-10	1	43
TAIWAN, R.O.C.	Eva Air	MD-11	1	20
TAIWAN, R.O.C.	Eva Air	MD-11F	6	18
UNITED KINGDOM	Avient Aviation Pty Ltd	DC-10-30	1	37
UNITED KINGDOM	Avient Aviation Pty Ltd	MD-11F	1	23
UNITED STATES	10 Tanker Air Carriers	DC-10-10	1	41
UNITED STATES	10 Tanker Air Carriers	DC-10-30	2	40
UNITED STATES	Aero Controls Inc	DC-10-10	1	42
UNITED STATES	Bank of Utah	DC-10-30	1	37
UNITED STATES	Boeing Aircraft Holding Co	MD-11F	1	17
UNITED STATES	Boeing Capital Corporation	MD-11	1	19
UNITED STATES	Centurion Air Cargo	MD-11F	3	24
UNITED STATES	FedEx	MD-10	58	36
UNITED STATES	FedEx	MD-11	3	24
UNITED STATES	FedEx	MD-11ER	2	19
UNITED STATES	FedEx	MD-11F	39	21
UNITED STATES	GECAS – GE Capital Corp	MD-11F	1	21
UNITED STATES	Memphis Group, The	DC-10-10	1	39
UNITED STATES	Omni Air International	DC-10-30	1	40
UNITED STATES	Sky Lease Cargo	MD-11F	8	22
UNITED STATES	United States Air Force	KC-10A	59	30
UNITED STATES	UPS Airlines (United Parcel Service)	MD-11	2	23
UNITED STATES	UPS Airlines (United Parcel Service)	MD-11F	36	21
UNITED STATES	Wells Fargo	DC-10-40D	1	35
UNITED STATES	Wilmington Trust	DC-10-30F	1	27

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Country	Operator	Designation	Quantity	Average Age
UNITED STATES	World Airways Inc	DC-10-30	1	41
UNITED STATES	World Airways Inc	MD-11F	1	25
VENEZUELA	SBA Airlines (Santa Barbara Airlines)	DC-10-30	1	42

Identified Retrofit & Modernization Contractors

Airframe

Alenia Aermacchi	http://www.aleniaaermacchi.it , Via Ing. Paolo Foresio, Venegono Superiore, 21040 Italy, Tel: + 39 0331 813111, Fax: + 39 0331 827595, Email: communication@alenia.it (Passenger-to-Freighter Conversions)
Boeing Defense, Space & Security, Military Aircraft, Mobility Division	http://www.boeing.com/defense/ , 2401 E Wardlow Rd, Long Beach, CA 90807 United States, Tel: + 1 (562) 593-5511 (Aerial Refueling Tanker Conversions)
Erickson Air-Crane	http://www.ericksonaircrane.com , 5550 SW Macadam Ave, Suite 200, Portland, OR 97239 United States, Tel: + 1 (503) 505-5800 (Firefighting Conversion)
KLM Engineering & Maintenance	http://www.klm-engineering-maintenance.com , Postbus 7700, Schiphol-East, 1117 ZL Netherlands, Tel: + 31 203041880, Fax: + 31 203041889, Email: infoTD@td.klm.com (Aerial Refueling Tanker Conversions)
Singapore Technologies Aviation Services Co Pte Ltd	http://www.staero.aero/sasco.html , 8 Changi North Way, Singapore, 499611 Singapore, Tel: + 65 65450988, Fax: + 65 65456757, Email: stephenl@stengg.com (Passenger-to-Freighter Conversions)

Electronics

Boeing	http://www.boeing.com , 100 N Riverside, Chicago, IL 60606 United States, Tel: + 1 (312) 544-2000, Fax: + 1 (312) 544-2082 (MD-10 Conversion)
GE Aviation Systems	http://www.geaviation.com/military/systems/avionics/ , 1 Neumann Way, Cincinnati, OH 45215 United States (CNS/ATM Upgrade)
L-3 Communications - Integrated Systems	http://www2.l-3com.com/is/ , 10001 Jack Finney Blvd, Greenville, TX 75402 United States, Tel: + 1 (903) 455-3450, Fax: + 1 (903) 457-4413 (CNS/ATM Upgrade)
Rockwell Collins	http://www.rockwellcollins.com , 3200 E Renner Rd, Richardson, TX 75083 United States, Tel: + 1 (214) 705-0000, Fax: + 1 (214) 705-3398, Email: collins@rockwellcollins.com

Opportunities

Interest in DC-10 cargo conversions has waned, and it is possible that no more DC-10s will be converted beyond those that were part of the FedEx MD-10. Even these converted aircraft will be replaced by 50 Boeing 767s from FY18-FY23. MD-11 conversion has dwindled, and the number of available unconverted MD-11 passenger aircraft is rapidly fading. It is possible that all remaining MD-11 passenger aircraft will eventually be converted to a freighter configuration or otherwise retired.

Fuel consumption remains a great concern to operators worldwide, and even if efficiency upgrade programs, such as winglet and engine modifications, should materialize, airlines are expected to increasingly favor newer-build aircraft that were designed with fuel efficiency in mind.

The USAF intends to keep flying KC-10s through 2045, or the end of their service lives. The Air Force currently

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flies 59 aircraft, though the active fleet will shrink in the coming decades.

AIRFRAME

Cargo Conversion. Alenia Aeronavali, a division of Alenia Aeronautica, provides DC-10 passenger-to-freighter conversions under license from Boeing. Aeronavali also performs similar conversions for the MD-11. The company has converted at least 40 DC-10s and MD-11s and provided all 264 large cargo doors for DC-10 and MD-11 cargo aircraft. In addition, the company performs the DC-10 to MD-10 conversions under subcontract from Boeing.

Aeronavali's DC-10 cargo conversion takes three to five months to complete. The conversion includes a 3.55-meter x 2.64-meter cargo door, a strengthened floor and wing center-section, and reconfigured electrical and hydraulic systems. The company's MD-11 conversion takes 75 days to complete.

In February 2000, ST Aviation Services Co signed an agreement with Boeing to perform passenger-to-freighter conversions of DC-10s and MD-11s. SASCO performs the conversions in Singapore. The company is a subsidiary of Singapore Technologies Aerospace.

In May 1999, Israel Aircraft Industries (now Israel Aerospace Industries) signed an agreement with Boeing for MD-11 freighter conversions. IAI has converted at least five MD-11s into freighters for Boeing.

In May 2007, Finnair sold two MD-11s to Aeroflot, the latter firm announcing intentions to convert these to cargo aircraft. In August 2007, Aeroflot signed with Boeing and SASCO to have the aircraft converted beginning in November 2008.

Cargoitalia has accepted three MD-11 Boeing Converted Freighter (BCF) aircraft, including one as part of a long-term lease from Boeing. AV Cargo has ordered two. Boeing has converted more than 100 MD-11s as part of the BCF program, which includes a flight deck and cargo handling upgrade.

KLM has retired its passenger MD-11 fleet, and Air Algérie has expressed a desire to lease at least two of these aircraft after they have been converted to the MD-11F cargo configuration. Air Algérie has also spoken to Ethiopian Airlines about acquiring MD-11 freighters, though it's unknown if these two procurements are competing or complementary options.

Aerial Refueling Tanker Conversion. A market that may develop for DC-10 modifications is the conversion of the aircraft to an aerial refueling tanker configuration, perhaps modeled after the KC-10.

In 1992, the Dutch Ministry of Defense purchased two used DC-10-30CFs from Martinair for about

\$98.8 million, including tax. These aircraft were then converted to a tanker/transport configuration designated KDC-10. In early 1993, the U.S. Air Force awarded McDonnell Douglas a \$32 million contract to begin design work and the conversion of the two aircraft for the Royal Netherlands Air Force in support of the Foreign Military Sales program. McDonnell Douglas completed a price proposal, leading to definitization of the full contract, which the company estimated to have a value of more than \$100 million over two and a half years.

In November 1993, KLM Engineering & Maintenance (a division of KLM Royal Dutch Airlines) was awarded a subcontract worth approximately \$7 million by McDonnell Douglas to perform the conversion work on the two DC-10s.

In November 2004, the Royal Netherlands Air Force took delivery of a third used DC-10-30CF. The aircraft was to be used for passenger and/or cargo transport. It would be modified to the same configuration as the Air Force's two existing KDC-10s but without the in-flight refueling equipment. Its first operational flight following modification was scheduled for early 2006. Acquisition of this third DC-10 enabled the service's two KDC-10s to more frequently be utilized in their primary role as tankers.

Global Airtanker Service has developed a DC-10 converted tanker, which it also calls the KDC-10. GAS is a joint venture of Omega Air (Dublin, Ireland) and Evergreen International Aviation (McMinnville, Oregon, USA).

The GAS KDC-10 is equipped with two Flight Refuelling FR MK32-900 wing-mounted hose-and-drogue pods capable of 400 gal/min each, one Flight Refuelling FR 300 fuselage-mounted centerline hose drum unit capable of 500 gal/min, and an optional centerline boom capable of 900 gal/min.

GAS parent company Omega Air offers military aerial refueling services on a turnkey commercial basis, including aircraft, flight crew, and maintenance personnel. The one KDC-10 that Omega Air operates is configured without a centerline boom.

The KDC-10 conversion is also available for order.

Firefighting Conversion. 10 Tanker Air Carrier LLC, Victorville, California, has developed a firefighting DC-10. The company is a joint venture of Cargo Conversions LLC, San Carlos, California, and Omni Air International, Tulsa, Oklahoma.

The DC-10 tanker is capable of dropping up to 45,600 liters (12,000 U.S. gal) of water or fire retardant in eight seconds. Fully loaded, operational radius is

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925 kilometers (500 nm) at 310 knots. Without water or retardant, the tanker has a 5,550-kilometer (3,000-nm) ferry range at Mach 0.72-0.74.

Erickson Air-Crane developed the firefighting tank system. Engineering support was provided by Aircraft Technical Service.

10 Tanker has converted one DC-10-10 and three DC-10-30s to the tanker configuration. One converted DC-10-30 was recently retired and was replaced with a new converted DC-10-30 model. Certification from the U.S. Federal Aviation Administration (FAA) was awarded in March 2006.

To date, no further customers have emerged for the DC-10 tanker system. The aircraft does provide unique opportunities for firefighting. Given its extremely large load capabilities and low aircraft acquisition cost, there may be a market for a few more sales. Erickson Air-Crane might find another buyer for its system, or 10 Tanker could act as a mediating agent in brokering a sale. Still, it is unclear if any additional DC-10 tankers will be produced. For now, we are not forecasting any new conversions.

Life Extension Modification. As the global fleet continues to age, many aircraft will be retired in favor of newer and more modern analogs, but those that remain active will eventually need structural modifications to ensure safe and reliable operation at reasonable maintenance costs. These programs will be detailed individually as they materialize.

ELECTRONICS

Mode 5 Upgrade. The USAF intends to upgrade its KC-10 fleet's identification friend or foe (IFF) system to the Mode 5 standard, enhancing anti-spoofing / exploitation capabilities and lowering the risk of misidentification and friendly fire incidents. The modification will include a Mode 5 crypto appliqué, a new IFF control panel, hardware modification to the APX-119 transponder, and other support changes.

Initial plans called for the full fleet to receive the upgrade beginning in FY14 at a cost of around \$10.9 million. Though the item has been absent in the presidential budget request since 2013, it has recently reappeared. IFF RDT&E funds are allocated through 2016. Procurement funds for Mode 5 and service life extension are allocated through 2020. Rockwell Collins was awarded the Mode 5 IFF engineering and manufacturing development (EMD) contract.

MD-10 Conversion. In September 1996, McDonnell Douglas and FedEx announced an agreement to convert FedEx DC-10s to a new freighter configuration called the MD-10. The two-phase project involved 89 aircraft.

FedEx also had options to convert an additional 29 DC-10s to the MD-10 configuration. However, in July 2001, the company decided that it would not exercise these options due to the then-weakening U.S. economy and decreasing demand for domestic express services. (The 29 aircraft are currently in storage.) In addition, FedEx said that, unless it could negotiate a reduction in the number, it would honor its contract with Boeing for the initial 89 conversions.

The first phase of the MD-10 program involves converting passenger-configured DC-10s to freighters. The second phase involves the installation of Boeing's new Advanced Common Flightdeck (ACF). This modification converts the three-crew DC-10 flight deck into a two-crew flight deck. The ACF is based on Honeywell's Versatile Integrated Avionics design, the VIA 2000. Honeywell provides most of the hardware and software for the ACF.

The baseline system is derived from the MD-11 flight deck, and features six flat-panel liquid crystal displays and improved system control functions. Triple VIA computers integrate the LCD electronics and related software.

Other major improvements are installed during the ACF conversions. These include aerodynamic drag reductions, a weather radar with predictive windshear detection, a Category IIIb autoflight system, and landing gear reliability improvements.

In 2003, Honeywell obtained FAA certification for its Pegasus flight management system (FMS) for use on the MD-11. It was to be included in the MD-10 upgrade.

The Pegasus FMS equips the aircraft for automatic dependent surveillance. In addition, the Pegasus FMS provides twice as much navigation database storage as the MD-11's existing FMS. The Pegasus FMS also provides quicker processing than the existing system.

The MD-10 also has GPS navigation capabilities, Future Air Navigation System compatibility, satellite communications, and an onboard maintenance terminal.

The initial flight of the first MD-10 occurred in April 1999. Certification by the FAA was achieved in May 2000. Initial delivery to FedEx occurred later that month.

In February 2002, Aeronavali was awarded a contract worth EUR83 million by Boeing for ACF installations on up to 52 FedEx DC-10s as part of the MD-10 program. This work was transferred from SR Technics Palmdale.

FedEx MD-10 modification work was completed in 2010.

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Boeing is marketing the MD-10 conversion to all current owners of DC-10s. No further major customers have emerged to date. Given this, we are not forecasting any MD-10 conversions for the immediate future.

Communication, Navigation, Surveillance/Air Traffic Management (CNS/ATM) Upgrade. In March 2006, the U.S. Air Force began soliciting proposals for the upgrade of 59 KC-10 tanker / transports.

In its current incarnation, the CNS/ATM upgrade will update the FMS and inertial navigation systems to meet 2015 CNS/ATM requirements and a host of other improvements. USAF KC-10s will receive either COTS or MOTS software and hardware to meet the following CNS/ATM requirements: Required Navigation Performance 4 (RNP-4), Basic Area Navigation (BRNAV), RNP-2 and -1, Precision-RNAV, time arrival for refuel rendezvous (within 30 seconds), Automatic Dependent Surveillance-Broadcast (ADS-B) Out, GPS, the selective availability anti-spoofing module, the satellite datalink for air traffic systems, command and control (C2) communications for flight in oceanic airspace (FL310-410), satellite voice for beyond line-of-sight pilot C2 operations, and very high-frequency datalink Mode 2 for LOS pilot C2 operations.

Rockwell Collins was awarded the CNS/AMT contract.

Installations ran from FY14 through FY15 at a cost of \$115.2 million, though given the history of the program, its total cost is significantly higher. Fifty-nine USAF KC-10s received the upgrade.

In June 2010, Boeing received a \$216 million contract to install a variation of the Cockpit Upgrade Program, which the Royal Netherlands Air Force had purchased. This upgrade is slightly more limited than originally envisioned, with a similarly reduced price of around one-third the estimated cost of the full CNS/ATM. It will still meet international requirements for global operation.

FedEx FMS. FedEx plans to install the MD-11 FMS to accommodate RNP on its MD-11 and MD-10 fleets. It will also pursue an aircraft interface device (AID) that will provide satellite connectivity and data to the crew during flight. FedEx will also have to comply with the FAA's FAR 91.225 that requires ADS-B equipment for operation in certain classes of airspace by 2020.

Future Avionics Upgrades. Over the coming years, the active fleet will require periodic modernization to adhere to current and new global aviation administration requirements, most notably the 2020 FAA deadline. Most of these mandates focus on communication and navigation systems to enhance safety and efficiency in airspace with heavy traffic, such as that surrounding major airports. As these programs materialize, they will be detailed individually.

FI's Opportunity Outlook

AIRFRAME													
		High Confidence					Good Confidence			Less Confidence			
Status	Thru 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total	
Estimated Potential Candidates	302	Life Extension Modification <> DC-10/KC-10/MD-11											
Planned/In Progress	0	0	0	0	0	0	0	0	0	0	0	0	
Speculative		0	0	0	0	0	0	5	5	7	10	9	

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ELECTRONICS													
		High Confidence					Good Confidence			Less Confidence			
Status		Thru 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Estimated Potential Candidates	59	Communication, Navigation, Surveillance/Air Traffic Management (CNS/ATM) Upgrade <> KC-10 <> United States <> Air Force											
Planned/In Progress		19	40	0	0	0	0	0	0	0	0	0	40
Speculative			0	0	0	0	0	0	0	0	0	0	0
Estimated Potential Candidates	0	Flight Management System (FMS) <> MD-11											
Planned/In Progress		0	0	24	23	0	0	0	0	0	0	0	47
Speculative			0	0	0	0	0	0	0	0	0	0	0
Estimated Potential Candidates	302	Future Avionics Upgrades <> DC-10/KC-10/MD-11											
Planned/In Progress		0	0	0	0	0	0	0	0	0	0	0	0
Speculative			0	0	0	0	0	20	20	20	20	20	100