Financing terms for new aircraft have become so competitive that the A320 and 737-800 could displace the MD-80 with a rare similarity in ASM costs between new and old aircraft. Despite this, MD-80 operators have few complaints about the aircraft and it has a limited secondary market, making it hard to justify replacement.

MD-80: the indispensable workhorse?

Like the DC-9, the MD-80 is regarded as an aircraft that is hard to replace on the basis of economics and operating performance. The MD-80 is reliable, has the efficiencies of a two-man flight crew and twin engines that are compliant with Stage 3 noise rules and durable.

It is often hard for new aircraft with high acquisition costs to have lower operating costs and offer advantages over fully depreciated or partially financed older types. And despite the oldest MD-80s being more than 20 years old, their position seems solid.

The A320 and 737NG families have received much publicity about their family flexibility and flight crew and spare parts commonality. How close can they come to providing airlines with a case for replacement?

MD-80 in operation

Like all other McDonnell Douglas types, the MD-80 has been manufactured in large numbers, but operated by only a small number of airlines.

A total of 1,156 were built between 1980 and 1999. The majority of these (825 aircraft) are operated by just 10 airlines. These fleets include Alaska (34), Alitalia (90), American (277), Continental (68), Delta (120), Finnair (20), SAS (75), TWA (91) and USAirways (24).

Other smaller fleets are operated by Reno Air, Iberia, AOM, Air Liberté, Spanair and several Chinese operators.

There are four basic MD-80 variants. The MD-81, -82 and -83/-88 account for 1,082 of the aircraft built and all have the same seat capacity – about 143 in a typical two-class configuration.

These three variants were launched in ascending order and had overlapping production runs. There were 94 MD-81s produced between 1980 and 1994, 566 -82s between 1981and 1997 and 422 -83s/-88s between 1985 and 1999.

The smaller MD-87 has 117 seats and only 74 were manufactured.

The MD-80 family is powered by various models of the JT8D-200. The MD-81 is powered by the -209 variant, the -82 by the -217, -217A and -217C models and the MD-83 by the -219 engine. The basic difference between the three major MD-80 models, besides period of manufacture, is gross weight, fuel volume and operating range.

All three models are compliant with Stage 3 noise rules, but the heaviest -83 has only marginal compliance. This is explained by the -219 being rated at a high thrust rating. This issue could affect the MD-80's re-marketability if Stage 4 noise rules are not agreed on. There is unlikely to be difficulty, however, in developing a hushkit for the aircraft.

The MD-80 is mainly used on US domestic and trans-European routes. Average flight time is about 100 minutes, while annual utilisation is about 2,600 flight hours (FH) and 1,550 flight cycles (FC). This flight time is equivalent to an average route length of 550–600nm.

MD-80's future

The MD-80's fate is in the hands of the major US and European airlines that use it. The economics of replacing the MD-80 is largely influenced by the residual value of MD-80s on the used market.

The high acquisition costs of the A320 and 737NG families will be the largest obstacle an MD-80 operator has to overcome if it considers fleet replacement. The higher the re-sale values of MD-80s in the used market, the easier it is for an operator to make a case for replacement, since the net acquisition cost of new aircraft will be reduced. Owned and completely depreciated MD-80s will be hard to replace, especially while they continue to be free from structural and noise compliance problems.

Unlike many types, there has yet to be a major market established for a substantial number of used MD-80s. The aircraft's advantages are its reliability and Stage 3 compliance. Theoretically, this makes it a good investment case for airlines that buy used aircraft. Carriers such as Spirit, Midwest Express, TWA and Air Liberté acquire the MD-80 for these very reasons.

The market for secondary passenger aircraft is not large enough on its own to take several hundred aircraft from major

Although airlines such as Alitalia and SAS have ordered A320s and A321s, they have no plans to replace their large MD-80 fleets. New aircraft have been ordered to supplement narrowbody fleets.

airlines. The alternative is freight conversion. The MD-80 is at a disadvantage, however, because of its fuselage cross-section. The MD-80 cannot use the same containers as the common 727/737/757, being narrow in comparison.

There are more than 500 727S in service. Most are expected to retire in the next 20 years *(see Where will all the new freighters come from?, Aircraft Commerce, January/February 2000, page 40)* while it is predicted that about 900 aircraft of a similar size will be required to replace them and satisfy growth. This demand can easily be satisfied by a large fleet of 737-300/-400s and 757s, without the existence of used MD-80s. The MD-80 is therefore unlikely to be in demand from freight operators because of its narrower fuselage.

MD-80 market activity

So far there has been relatively little MD-80 aftermarket activity. Only a few of the type's major operators have disposed of a small number of aircraft. Examples are ex-Finnair aircraft, which are now operated by AOM. Swissair and Austrian are the only primary MD-80 operators to have disposed of their fleets. TWA bought several ex-Austrian aircraft and Edelweiss and Crossair use some of Swissair's fleet.

Nine of the other 10 major operators have still not begun to dispose of MD-80s. SAS, for example, which has one of the oldest fleets, does not have any plans to replace its MD-80s. It has, however, recently ordered A321s to supplement its fleet. Alitalia is in the same position. Although Finnair has A320/21s on order, it has not yet decided whether to use them as DC-9-50 or MD-80 replacements.

TWA has recently expanded its MD-80 fleet with used aircraft, which are some of the youngest in its fleet. Although USAirways has a large number of outstanding firm orders and options for the A320 family, it has a large number of F.28s, DC-9s, 737-200s and 727s to replace before its MD-80s.

The most important MD-80 fleets in terms of numbers are American and Delta. That is, the more aircraft they put on the market, the lower values will fall. The retirement policy of these two carriers will thus have the largest influence on MD-80 values and the ease with which all operators will make an economic case for replacement.

American and Delta have both completed exclusive-supplier orders with Boeing. This includes orders for 737-800s by both carriers. Delta, however, only has 112 firm orders outstanding for the 737-800, which are scheduled for delivery up to 2007. "We will use these mainly to replace our fleet of 120 727-200s, the last of which will go in 2004," explains Dan McDonald, director of fleet planning at Delta. "We also have 60 options and a number of rolling options with no firm delivery dates. Our MD-88s have an average age of nine years. We plan to keep our fleet for the foreseeable future, and so will not begin to retire them probably for about another 10 years."

American has the largest fleet, with 277 aircraft. Although it has 737-800s on order, it has no plans to retire its MD-80s. American in fact sees the MD-80 as a workhorse and is happy with the aircraft having experienced no problems with them.

The past five years has seen the first used MD-80 transactions. French carriers AOM and Air Liberté and also Transwede, TWA, Spirit and Midwest Express, have taken advantage of aircraft becoming available.

AOM is no longer acquiring MD-80s and Europe is now virtually a non-existent market. This leaves mainly the US and South America.

Market values are currently good. The oldest MD-81/82s are still valued at $9–12 million. This compares to the original $17–19 million cost, 18–20 years ago. Mid-1980s MD-83s are estimated to be about $15 million.

Younger models should be easier to sell, although the MD-83 will carry the stigma of a small Stage 3 compliance margin, now Stage 4 noise is becoming an issue. The MD-83's narrow Stage 3 margin is in fact already causing it market problems, since it is not permitted to land at Frankfurt after 8pm.

MD-80 replacements

Although MDC launched the MD-87 to complement the MD-81/2/3/8 and to provide airlines with a family, the MD-80 in most cases is operated as a standalone aircraft. That is, airlines which required more or less seats than the MD-81/2/3's 143, acquired types such as the 757 and 737-300. Some airlines, however, also had DC-9s to complement their MD-80 fleets.

The A320 and 737NG families offer airlines with a range of seat numbers. The existence of these families therefore also makes the replacement of other types an issue.

The A320 and 737NG families, in relation to their seat numbers and revenue earning capacity, will therefore have to offer an overall economic advantage to both the MD-80 and other fleets operated by airlines.

The A320 has 150 seats, just seven more than the MD-80. The MD-81 has a range of only 1,550nm, and the MD-83/-88, 2,400nm. The A320 outperforms with 2,850nm.

The smaller A319 has 124 seats and so matches the size of the DC-9-50 and MD-87. The A319 has a 2,650nm range.

The A321 provides airlines with 185 seats and so flexibility for varying passenger loads throughout the network, as well as the capacity to absorb growth. This is preferable to acquiring a larger and heavier aircraft with no commonality to the A320.

The A318 has 107 seats and so can provide MD-80 operators with a fleet

Delta will not consider MD-80 replacement for another 10 years. It still has 120 older 727s to replace, and the last will be retired in 2004. Delta acknowledges the main problem with MD-80 retirement is that it will put large numbers on the market, and depress values.

range of 107–185 seats and thus a whole fleet replacement solution in this size range.

Another area where the A320 can get lower maintenance costs is through spares parts commonality across its family. This can reduce investment per aircraft in smaller fleets.

The A320 family also has cross-crew qualification (CCQ), while the MD-80 has no flightdeck commonality with any other type.

Aircraft in the A320 family can use the same simulator and pilots can fly each type with the same type rating. If airlines operating the MD-80 want their pilots to have multiple type ratings more training time will be required and several simulators will be needed.

An A320 family fleet will achieve more pilot flight hours per year and lower training costs compared to crews operating MD-80 and other fleets.

The A320 also has CCQ with larger Airbus types and so could reduce training costs and improve flight crew productivity even further.

So far the A320 family has won orders from Swissair, Austrian and Finnair as MD-80 and DC-9 replacements. Although USAirways has a large number of options for the A320 family outstanding, these are likely to replace its MD-80s.

The 737NG family offers three aircraft of similar sizes to the A320 family. The 160-seat 737-800 is the nearest to the MD-80's size, while the 737-700 and -900 have 128 and 177 seats, respectively.

The 737NG family has similar fuel burn and maintenance cost advantages as the A320 family. The 737NG family has ranges in excess of the MD-80's performance. The 737 can also offer similar advantages of spare parts commonality as the A320 family.

The 737NG family also has the same type rating, but not CCQ with larger Boeings. This implies the 737NG may not be able to offer the same efficiencies in flight crew utilisation as the A320. Airlines operating just A320 or 737NG family aircraft should have similar flight crew productivities and training costs.

The 737NG has so far won orders and options from Alaska, American and Delta for the -800. These firm orders are to replace older fleets and provide capacity for growth, while options could conceivably be converted to firm orders that will eventually replace MD-80s.

Replacement economics

While many airlines have no plans to replace their MD-80s, the aircraft's seat-mile costs have come closer in recent years to the A320 and 737NG counterparts. This is explained by the fact that financing for new aircraft is becoming lower. This may then provide an opportunity to replace MD-80 fleets earlier than originally expected.

To assess the economics of MD-80 replacement, analysis of costs per available seat-mile on typical US and European operations should be made. This should reflect operations of the MD-80's major operators by using typical sector lengths and rates of aircraft utilisation.

The costs of fuel, maintenance, flight crew, navigation and user charges and aircraft finance costs are those which reflect the operating efficiency of each type.

In many cases the MD-80 operates sector lengths in the region of 600nm, as is the case with Delta Airlines, for example. A 600nm sector has a flight time of about 93 minutes.

A hub and spoke operation is typical in north America. This involves turnaround times between flights of about 60 minutes to allow flight scheduling, which is longer than necessary. European airlines are confined less to hub operations, but subject to longer delays and airport congestion. Turnaround times between flights are then similar. As a consequence airlines will be able to achieve an average of five 600nm flights per day on both continents. This will result in annual utilisations of 2,790FH and 1,800FC.

The economics of European operations will be affected by differences in operating cost elements. The two noticeable differences are air traffic control and airport user charges and financing costs.

With this pattern of utilisation the MD-80 generates about 154 million air-seat miles (ASMs) per year, compared to 162 million for the A320 and 173 million for the 737-800.

The A320 and 737-800 will provide the most direct comparison with the MD-80 in terms of costs per ASM. The smaller Airbus and Boeing aircraft will not have the economies of scale of the A320 and 737-800 and so higher costs per ASM. The A319 and 737-700 can, however, offer airlines scheduling flexibility.

The A321 and 737-900 provide capacity for growth and their size should reduce costs per ASM. In terms of MD-80 replacement, the important issue of the A321 and 737-900 is their ability to provide incremental capacity for more revenue generation compared to the MD-80's trip costs.

Fuel

Fuel burns for the MD-80 series and A320 and 737NG families for non-delayed and still air 600nm trips have been used for comparative purposes.

The A320 has about 20–25% lower fuel burn than the MD-80 series. The 737-800 is a few percentage points more fuel-efficient than the A320.

Fuel prices in 1998 were low, especially in the US. Prices of less than 50 cents per US gallon allowed major airlines to generate high profits. Fuel prices crept up during 1999 to the 60 cents level and

The 737NG family has won a large number of firm orders, but these are concentrated with American, Delta and Continental. Although the 737-800 can have lower ASM costs than MD-80s, current 737 orders are to replace older types such as the 727.

are continuing to increase. A fuel price of 65 cents has been used here, although some airlines are expected to pay more in 2000.

This high price amplifies the fuel efficiency of new aircraft over the MD-80, creating a 0.31 cents per ASM gap between the A320 and MD-83; and a 0.28 cents gap between the 737-800 and MD-83.

Maintenance

Like the DC-9, the MD-80 is durable and so has predictable airframe-related maintenance costs.

Including line maintenance, airframe checks, heavy component and line replaceable unit inventory costs, the MD-80 family has charges in the region of $535 per FH. Reserves for the JT8D-200 series are about $120 per engine flight hour (EFH), and so total aircraft maintenance charges are about $775 per FH.

The A320 family has airframe and component costs of about $510 per FH. Although close to the MD-80, the A320 and the A321 are larger in terms of seats. Some of the A320's component costs are more advanced and so are higher than those of the MD-80.

Typical reserves for the CFM56-5B are $70/EFH and $50 per engine flight cycle (EFC). For the 600nm sector being analysed here the CFM56 will have reserves of $102 per EFH.

The aircraft will then have total FH costs of $714, while the A321 will be slightly higher at $730.

The 737-300/-400 have FH airframe costs of about $505. The 737NG is expected to have up to 15% lower charges on the basis of a simpler maintenance programme, few parts and improved reliability. A conservative estimate of $480/FH has been used here. Likewise, a 5% lower EFH reserve has been used compared to the A320's CFM56-5B for the -7B series.

Total FH costs for the 737NG are then in the region of $676.

Flight crew

As already described, the A320 and 737NG families have the potential to exploit more productive flight crew utilisation.

The actual flight hours achieved by A320 and 737 crews will depend on each operator's fleet and policy with respect to mixed fleet flying.

The MD-80 is assumed to have an annual flight crew productivity of 700FH per year, while the Airbus and Boeing families are assumed to have higher efficiencies. In the case of one pilot group operating either the A319/20/21 or 737NG families, they would achieve an additional 25FH per year. The A320 and 737NG families will also be able to reduce simulator costs for airlines.

Basic salaries in some airlines are related to aircraft size in terms of maximum take-off weight. Some US carriers, for example, have lower pay scales for the 737-300/-400 than they do for the MD-80 or A320. For the issue of MD-80 replacement, airlines will consider the A320 and 737NG families as overall same-size families. Consequently they will have equal salary scales for the three types.

US and European basic salary scales are similar. There is more variance, however, between airlines in Europe. Basic salaries for the two flight crew members are assumed to total $220,000 per year. The number of crew and annual cost per aircraft is determined by flight crew productivity and crews required per aircraft.

Additional costs for training, allowances and subsistence are taken as 20% of salary costs in this analysis. Efficiencies in training could result in savings for the A320 and 737 families.

Because of equal crew numbers and salaries and similar productivities, the crew seat-mile costs of the three basic types are similar. Larger seat numbers are the biggest cause of cost differences. The A320 has only a 0.08 cents lower cost than the MD-80 and the 737-800, only 0.13 cents lower.

User charges

User charges are higher in Europe than they are in the US. Landing fees for airlines in the US are an average of $2 per tonne of maximum take-off weight (MTOW). This adds 0.15–0.20 cents per ASM of cost, depending on type and seat capacity.

Navigation fees are virtually non-existent in the US. User charges in the US are then so small that a lower weight will not give an aircraft a cost advantage.

Landing fees in Europe are charged at the higher rate of $9 per tonne of MTOW. In the case of the 600nm routes studied here, the fees result in ASM costs of 0.68–0.91, depending on aircraft weight and seat numbers.

Neither the A320 and 737-800 have an advantage over the MD-80 large enough to make a difference on landing fees alone.

Navigation charges are normally

Finnair has ordered and taken delivery of A320s, but has still not decided whether to use them to replace DC-9s or MD-80s.

based on a weight factor related to the square root of MTOW tonnes divided by 50 and a standard $ rate.

These charges then add another 0.71–1.00 cents per ASM of cost. Despite the magnitude of these two charges, there is little difference between the MD-80, A320 and 737-800.

Finance & depreciation

In every cash cost category the MD-80 has proved to be close or equal in efficiency to the A320 and 737-800. The A320's and 737-800's finance charges are therefore important compared to those of the MD-80.

The oldest MD-80s are now 20 years old and a few will have had their finance leases fully paid out or be fully depreciated.

The majority of aircraft will still only be partially depreciated or have their finance leases still outstanding. Other aircraft will be placed on operating leases.

Some aircraft will have zero finance charges, but will nevertheless maintain a market value. Airlines with assets in this situation often like to realise their value by completing sale and leaseback transactions. This will then leave the airline with an operating lease rate for the remaining years that it operates the aircraft.

Market values of older MD-80s are estimated to about $9–11 million. A typical sale and leaseback structure with a monthly lease rate factor of 1.25% would then result in a rental of $125,000 for an early-built MD-81.

An early 1980s-built MD-82 still being paid out on a finance lease would have been acquired at that time for about $20 million. A typical 18-year finance lease would then have a monthly rate of about $175,000.

Younger aircraft would have higher rentals on finance leases, because of their high capital cost and the amount financed. Rates for late 1980s and 1990s built aircraft would be in the region of $240,000 per month.

These rates have to be compared to the finance lease rates that operators could get for new A320 or 737NG family aircraft. These depend on list prices and the sales discount that an airline can get. Sales discounts of 20% are not uncommon.

Current list prices for the A319, A320 and A321 average $46.2 million, $50.9 million and $61.6 million, respectively. Typical discounts would reduce the full amount to be paid out in a finance lease to $37.0, $40.7 and $49.3 million, respectively, for the A320 family.

Median list prices of the 737-700, -800 and -900 are $45 million, $54 million and $57 million, respectively. A 20% discount would reduce these to $36 million, $43.2 million and $45.6 million, respectively.

Besides purchase discounts the factors affecting monthly lease rates will be financing terms. The principal elements here are the interest rates that can be secured, the term of the transaction and the tax benefits the lease structure can provide.

Besides current market rates, interest charged will depend on the airline's credit rating. Credit ratings in the US have generally improved for most carriers. The US finance lease market is one of the few global regions still to provide substantial tax benefits.

Finance leases are often paid out over periods of up to 20 years. A rule of thumb in the past has been to take the monthly lease rate factor as 1% of the capital amount. With lower interest rates the monthly lease rate factor has now fallen.

Financing terms for new airliners are usually over at least 16 years and so will be full payout structures. Terms are even 20 years and interest rates now as low as 6%. These terms mean a monthly lease rate factor of only 0.72% is required for a simple amortisation. With the added tax benefits of ownership, monthly lease rate factors can now be down as low as 0.65% per month.

These rates will consequently make new aircraft cheaper to finance and make them more attractive to airlines with older fleets that could be replaced.

With these financing terms, monthly rentals that fully pay out the 737-700, -800 and -900 acquired at a 20% discount will then be $234,000, $281,000 and $296,000, respectively. Monthly rentals for the A319, A320 and A321 would be $240,000, $265,000 and $320,000, respectively.

These rentals make the A320 and 737-800 competitive in comparison to older MD-80s, since they have close trip and ASM costs. The MD-81 with a $125,000 lease rate only has about a 0.40–0.50 cents per ASM advantage over the new aircraft, while the MD-82 with the higher rate has almost no lower costs.

European financing rates are more variable because of differing interest rates, finance lease terms and tax benefits for aircraft.

While Sweden and Germany maintain large tax benefits for aircraft, these are now reduced in the United Kingdom and in most other European countries.

Without considering tax benefits, interest rates and shorter terms mean basic amortisation rates will be in the region of 0.9% per month. Finance lease structures with high tax benefits could then reduce monthly lease rental factors to about 0.85%, while they would remain at about 0.9% in other states.

At the same discounted prices, the 737-700, -800 and -900 would have monthly lease rentals in Europe of $324,000, $389,000 and $410,000, respectively.

Rentals for the A319, A320 and A321 will be $333,000, $366,000 and $444,000, respectively.

The finance ASM costs for the 737s and A320 family would then be about 0.7 cents higher than in the US. European

financing terms make it harder for airlines economically to justify MD-80 replacement. The MD-81 has a cost advantage of more than 1.0 cent, while the MD-82 has a smaller advantage in the region of 0.60–0.90 cents.

Although airlines will require insurance for a variety of opportunities, only hull insurance, based on value, will be difference between types. Typical hull rates for major carriers in Europe and the US are only about 0.1% of value per year. This translates into very small costs of 0.01–0.03 cents per ASM for the aircraft studied here, being higher for the new aircraft.

Summary

The MD-80 presents an odd scenario. It is heralded as being durable, noise-compliant and efficient, yet for an old aircraft it has a cost per ASM profile unusually close the new replacement candidates.

In the US operation described, the MD-81, with a monthly lease rate of $125,000, has total costs of 4.38 cents. The A320 and 737-800 have costs of 4.88 and 4.70 cents per ASM.

Compared to its direct replacements, the A320 and 737-800, the MD-80 has small disadvantages in fuel, maintenance and flight crew. The MD-80 gains little in navigation and landing charges.

As always, the deciding of finance charges favours new aircraft. Although they have higher costs, their magnitude is low enough to make their total charges virtually identical to the MD-80.

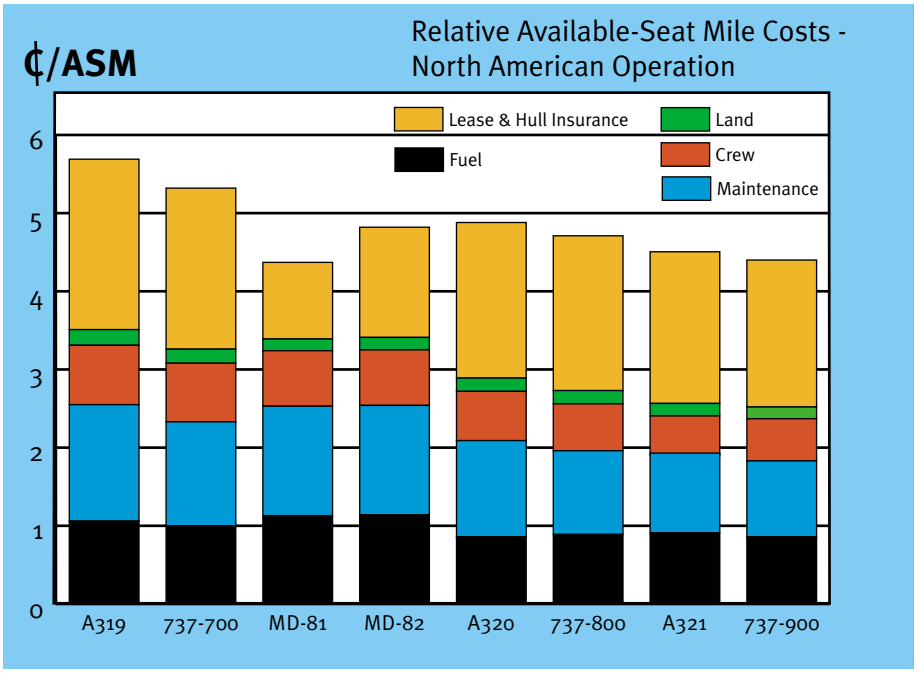
This is with the abnormally generous financing terms available to major airlines.

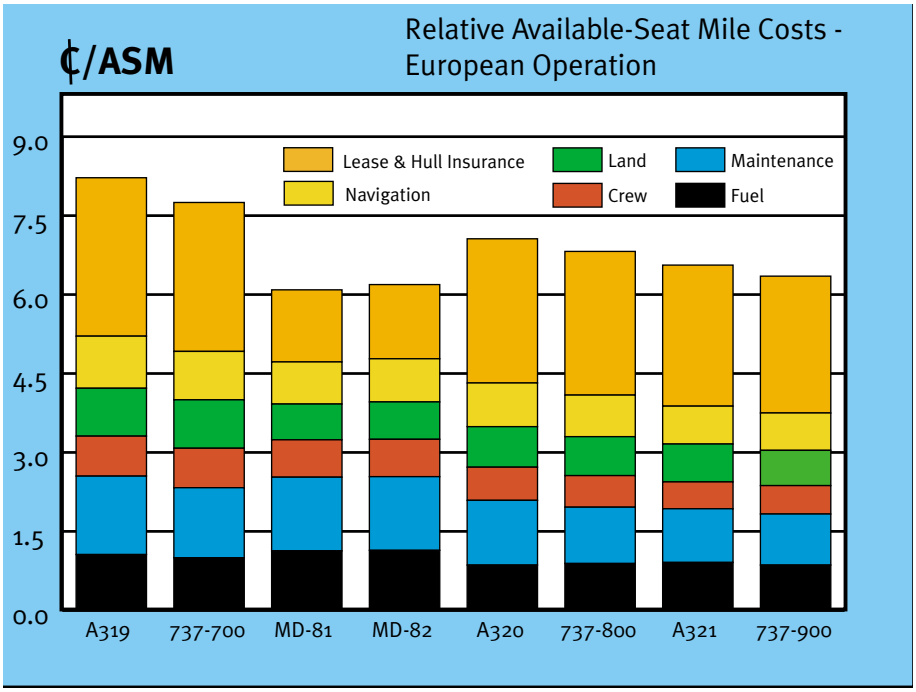
Despite less generous financing terms in Europe, the differences between the MD-80 and replacement contenders is only 0.60–1.10 cents in favour of the old aircraft.

Interestingly, the DC-9-50's ASM US costs of 6.1 cents on a 450nm route are higher than those of the A319 and 737-700 analysed here on a 150nm sector. With the A321 and 737-900 offering lower costs per ASM than the MD-80 through larger seat numbers, the A320 and 737NG families have no problem in providing airlines with economic replacement candidates for their MD-80 fleets.

The most important factors in an airline's own situation are fuel prices, rising maintenance costs of older aircraft, the financing terms that can be secured for new orders and a secondary market for the MD-80.

Fuel prices are currently high, but long-term predictions cannot be made. Financing terms are generous, particularly in the US. Although interest rates fluctuate, the long-term global trend appears to be downwards and stable. Tax





benefits are likely to remain in the US, but European carriers will be increasingly challenged to find attractive financings. One issue, not included here, is the use of residual value guarantees that have further aided in reducing effective lease rate factors.

The final factor is a prolific MD-80 aftermarket. The analysis here assumes a sale and leaseback transaction for fully financed and depreciated aircraft. This will only be possible while there is little liquidity in the MD-80 market.

Airlines unable to sell their oldest aircraft can still operate them at zero finance and depreciation charges. This will reduce total operating costs by about 1.35 cents, making them harder to replace. This is a real prospect for a large number of MD-80s coming onto the market.

Despite the attractive economics of new aircraft, many MD-80 operators, including American and Alitalia, have large numbers of older types to retire. Operators with large fleets are aware of the dangers of a decision by them to retire on the values of their aircraft. "American and Delta will dictate the MD-80 market," says McDonald at Delta. "We know that by retiring a large number of aircraft the market value of MD-80s will be pushed down from the current theoretical value."

Current fleet plans and the lack of a substantial MD-80 aftermarket indicate that retirement from major airlines will be a long process, drawn out over many years, despite the attractive economics of new aircraft. One possible market that may yet emerge is China, although it has so far has avoided used aircraft. Even South America is declining as a dumping ground for used aircraft. AC