

The 757 has several attributes that make it a strong 727-200F replacement candidate. For unit ATM costs and lease rates to be low enough, market values and converted freighter build costs have to fall. The right market values to make 757 conversion economic may be reached in only two years.

757-200 on the brink of a new life

With the oldest 757-200s approaching their 20th birthday and a few aircraft parked in the desert, market values are close to a level that make it economic for airlines and lessors to convert them to freighters. The total build costs incurred would almost be low enough for a lessor to make an economic case from their investment and the monthly lease rate of \$275,000-300,000, which is the rate that most freight carriers are prepared to pay.

757 freighter market

The 757-200 is a prime candidate for 727-200F replacement in both the small-express-package and general-freight markets. This is because the 757 and 727 share the same fuselage cross-section and use the same containers and pallets. This is especially important in the case of express-package operations.

The remaining life potential of 727s means their retirement may occur over an extended period. The rate of 757 conversions will therefore be protracted.

There are 260 727-200Fs in operation, although several US carriers have parked some aircraft in recent months. This follows a re-assignment of a United States Postal Service contract from several 727 operators to FedEx. FedEx itself has also experienced a fall in traffic, and parked some 727s. This may permanently reduce the 727 fleet, or traffic may recover and the capacity be required again. A recovery would either bring 727s back into operation or stimulate 757 conversions.

Besides 727 replacement, the 757-200 could be a suitable vehicle for adding capacity following traffic growth in the express-package and general-freight markets.

There are two versions of the 757-200 freighter. The first is the factory-built 757-200PF, with a structural payload close to 87,000lbs. Boeing offers a conversion programme, the 757-200SF, which has a structural payload of about 68,000lbs.

Small-package operations have packing densities of about 6.5lbs per cubic foot, while general freight is closer to 8lbs per cubic foot. Airlines will use both the main deck and underfloor space, and so have similar volumes at their disposal. The higher packing densities of general freight mean that volumetric payload will approach the structural payload of the 757-200PF.

Most airlines will prefer the lower build cost and corresponding lease rate of the 757-200SF to the 757PF's \$60 million list price.

Case for the 757 freighter

Airlines will only acquire 757-200SFs if airlines believe they generate unit costs per available ton-mile (ATM) equal to the 727-200 in its various types of operation.

Despite the 727-200's high cash-operating costs, it will be hard for the 757 to match the 727 because of the 757's higher finance-related charges. This will be especially true where the 727 is operated at low utilisations.

In some airlines the 727's will be fully depreciated and have zero finance charges. Some airlines in this situation, however, will have concluded sale and leaseback transactions and be paying a lease rental. An aircraft sold for \$6 million and leased for six years will require a lease rate of about \$100,000 per month. This is equivalent to a lease rate factor of 1.7%, and is also close to market lease rates for 727-200Fs.

These lease rates have the largest

influence on 727-200 unit ATM costs. Other cost categories with the largest influence (depending on aircraft type) are fuel, maintenance and flight crew.

Several operating scenarios can be used to analyse the 727-200's unit operating-cost performance, but most appropriate is an express-package operation generating low utilisations. This is typically based on one return flight per day for five or six days per week. Only 500-600 flight cycles (FC) are therefore generated each year. The number of flight hours (FH) depends on the average mission length. An 800nm average route length will have a block time of about 145 minutes, and so about 1,200 block hours (BH) would be generated annually. Average route lengths are often shorter, and annual utilisations will be less than 1,200BH.

The 727-200F carries 12 125-inch by 88-inch containers, providing 5,500 cubic feet on the maindeck. Bulk loading capacity in the belly takes total volume to about 6,700 cubic feet. With express packages packed at 6.5lbs per cubic foot, the 727-200F has a volumetric payload of 43,600lbs. A utilisation of 500FCs per year and packing density of 6.5lbs per cubic foot means the aircraft will generate about 7.9 million ATMs annually for an average sector length of 800nm. Productivity per flight is 15,900 ATMs.

Fuel prices are currently high, although they have been falling from the peak levels at the end of 2000 and start of 2001. High fuel prices will make it easier for the 757 to match the 727's unit costs, since the 727 has high fuel burn. Fuel prices of 80 cents per US Gallon have been used in this analysis.

Another of the 727's drawbacks are high maintenance costs. Maintenance costs fluctuate because of the opportunities airlines have to swap time-



expired modules for time-continued units when a glut of engines arises.

Fluctuations also occur because of the increasing availability of components on the aftermarket, and because of aircraft age and specification, engine model, maintenance programmes and the standard of previous maintenance.

Total aircraft maintenance costs in this analysis are taken as \$1,260 per BH. This includes an engine reserve rate of \$120 per engine flight hour (EFH). This cost per BH results in maintenance costs of about \$3,000 per trip.

Flightcrew costs are based on an annual basic salary for a three-man crew of \$248,000. This is scaled up by 25% to account for crew allowances, and training and other employment costs. This is high for some freight operators, but others have salary scales in excess of major passenger operators.

Crew hours per year are taken as 550BH. This is less than passenger operations because a high proportion of night operations. This results in crew costs per trip of about \$1,400.

Total costs per trip for fuel, maintenance and flight crew are about \$7,800. A lease rate of \$110,000 per month adds \$2,600. Total costs for the four elements are \$10,400 per trip for a 800nm mission. This compares to a trip productivity of 15,900 ATMs. Unit costs are therefore 66 cents per ATM. This would be escalated to the region of 70 cents per ATM for a shorter average route length of 500-650nm.

If utilisation rates were doubled by

operating two return flights per day and 1,000FCs per year, the 727-200F's trip and unit cost per ATM would fall to about \$8,600 and 54 cents per ATM.

757 challenge

The 757 will have to meet this unit cost of 60-70 cents per ATM if it is to stand any chance of being accepted by the majority of freight operators.

A small number, like United Parcel Service, are able to generate higher utilisations with their 757s than their 727s. The majority of airlines will have to consider the 757 at the same low rate of utilisation as the 727.

In the case of small-package operations, the 757-200SF and -200PF will have similar volumetric payloads.

There is currently only one passenger-to-freighter programme for the 757, and this is a supplemental type certificate (STC) held by Boeing. Boeing's conversion provides capacity on the maindeck for 14 125-inch by 88-inch containers plus one LD-3 container. This takes total maindeck containerised volume to 6,310 cubic feet.

Lower deck volume adds a further 1,680 cubic feet, taking aircraft total to 7,990 cubic feet. The aircraft has a structural payload of 66,500lbs. A small package density of 6.5lbs per cubic foot means volumetric payload will be about 52,000lbs. This compares to 43,600lbs for the 727-200F using main and lower decks at the same density.

The 757-200 freighter conversion has

There are several types of 757 freighter. The 757PF has a structural payload of 87,000lbs and 15 container positions. The 757-200SF has 14 container positions and 66,500lbs payload. Other conversion STCs may be introduced and these may provide aircraft with 15 container positions.

a unique problem associated with the positioning of the original first passenger-entry door: This is adjacent to where a 15th container could be positioned, but would prevent crew entry. A passenger-to-freighter conversion STC has the option of closing the first left passenger door, and inserting a crew-entry hatch further forward, similar to that used on the -200PF. Although Boeing has not taken this option with the -200SF, other engineering companies considering developing a STC may opt to insert a crew-entry hatch to allow a 15th container. This will increase containerised volume over Boeing's conversion.

Pemco, for example, is considering developing an STC for the 757-200, which would be a 15-container specification. The maindeck containerised volume of this aircraft would be 6,870 cubic feet, and the aircraft total volume 8,550 cubic feet. A packing density of 6.5lbs per cubic foot would allow a volumetric payload of 55,600lbs, 3,600lbs more than Boeing's -200SF.

A converted aircraft with 15 containers would have the same volumetric payload as the -200PF when packed at 6.5lbs per cubic foot.

Depending on the conversion programme and specification, the 757-200 therefore has 19-23% more payload than the 727-200F.

757 unit cost

Because of the expected low utilisations in small package operations, the 757 will be most sensitive to finance and lease charges. XS Aviation has some passenger-configured 757-200s on lease, which it may convert to freighters in the 2003-2005 if the economics make sense. "The 757F will probably not bear a lease rate higher than \$275,000-300,000," says Paul Newrick, chief operating officer at XS Aviation.

Despite being larger, the 757 burns about 20% less fuel than the 727. Consequently the 757-200SF's unit ATM fuel cost is about 33% lower.

At a rate of utilisation of 500FCs per year, the 757-200SF will generate about 9.4 million ATMs per year for small-package freight packed at 6.5lbs per cubic foot. At a lease rate of \$300,000 per month, finance costs per trip will be \$7,200. The 757-200SF will therefore

757SF, TU-204 & 727-200F SPECIFICATION & BUILD AND PURCHASE COSTS

Aircraft type	757-200SF Boeing conversion	757-200SF Future conversion	Tu-204	727-200F
Structural payload (lbs)	66,500	83,000	59,700	58,300
Main deck containers	14	15	13	12
Main deck volume (cu ft)	6,310	6,870	5,954	5,496
Lower hold volume (cu ft)	1,680	1,680	1,570	1,200
Volumetric payload (lbs)	52,000	55,575	48,906	43,600
Current market value passenger aircraft \$million	17-22	17-22		
Conversion & handling system	8	5		
Heavy C check	1	1		
Component repairs	0.6	0.6		
Engine shop visit	1.5	1.5		
Total build cost \$ million	28-33	25-30		
List price \$ million			37	
Lease rate factor	1.1%	1.1%	0.9%	
Monthly lease rate \$	308,000-365,000	275,000-330,000	333,000	110,000

need to have lower cash operating costs than the 727-200F to match its unit cost per ATM.

The 757-200's total maintenance costs will be in the region of \$1,050 per BH. This includes an engine reserve rate of \$150 per EFH. This is equivalent to \$2,500 per trip.

Flightcrew salaries will be higher for the captain and first officer compared to the 727, but the absence of a flight engineer will lower the 757's annual crew cost. Annual salary of \$210,000 for a two-man crew, escalated for training and other employment-related charges, will convert to a trip cost of \$1,150; \$210 less than the 727.

The 757-200SF's cash operating costs of fuel, maintenance and flightcrew are about \$1,250 per trip lower than the 727's. Adding lease-rate charges, the 757-200SF's unit cost per ATM works out at 68 cents, virtually the same as the 727-200's, when a monthly lease rate of \$300,000 is used for the 757-200SF. This illustrates airlines' requirement for 757F's available at a monthly lease rate of about \$275,000-300,000. These unit ATM costs are equal to trip costs of about \$13,000 for the 757-200SF and \$10,400 for the 727-200F. Despite having similar unit ATM costs, 757 operators will have to cover the aircraft's \$2,600 higher aircraft-operating costs from its higher freight capacity.

If operators can operate two return flights per day, the 757-200SF's unit costs will be reduced to 49 cents per ATM; a five cent advantage over the 727-200.

757 freighter build cost

The 757's lease rate of \$275,000-300,000 required by freight airlines limits build cost to a maximum of about \$25 million, since the monthly lease-rate factor will be in the region of 1.1-1.3% of build cost.

A lessor will invest 15-20% equity in the aircraft, and will probably have to pay debt at an interest rate in the region of 8% per year. Amortisation of \$21.25 million debt at 8% over 12 years requires a monthly debt service charge of about \$230,000. Since lessors expect high annual rates of return on equity, the balance of a lease rental of \$275,000 per month should meet their requirements. A lower lease-rate factor of 0.9-1.0% per month would not be enough to amortise debt and pay a sufficient return on equity. Lessors will be able to accept a lower lease rate if cost of debt is reduced to 7%.

The Boeing conversion for the -200SF has a list price of \$7-8 million, not including the cost of a freight handling system or blanking passenger windows. Installation of a freight handling system may add in the region of a further \$0.5 million, taking a mid-range modification cost of \$8 million. Blanking windows will further add to the cost of modification. "Operators will naturally want to avoid a high maintenance requirement after conversion, so modification is best combined with a heavy C-check," explains Newrick. A heavy C-check will add about \$1 million. Additional maintenance will be determined by the

status of heavy components, such as landing gear, APU and thrust reversers, and engine condition. On average one of the heavy component items will require an exchange, and an engine shop visit may come due during or soon after conversion. Some lighter components, such as avionics, will also require repairs.

A conservative budget of \$600,000 for component repairs and \$1.5 million for an engine shop visit should be built into the anticipated build cost. This will take total maintenance and modification cost, under the Boeing programme, to \$11.1 million. This takes total build cost to about \$30 million at current values. This will result in a lease rate of about \$345,000 and unit cost of 73 cents per ATM. This will be too high for most operators. The maintenance and modification costs cap aircraft acquisition at about \$14-15 million and build costs at \$25-26 million for lease rates of \$275,000-300,000 and unit ATM costs of 68 cents to be possible. Values will therefore have to fall by at least another \$3-4 million for build costs to be low enough to generate the lease rate required.

"The Boeing conversion is a significant investment relative to current market values," says Newrick. "The other problem is that peak production for the 757-200 was between 1989 to 1994, and relatively few 757-200s built earlier than 1988 will come available with the right market values. Although it may be possible to purchase a younger parked 757 for about \$19 million, the additional cost of current conversion combined with maintenance will still take total build cost to about \$28 million (see table, page 16). For lease-rate factors of 1.1-1.3% per month, total build cost cannot exceed \$23-25 million".

Newrick believes it is still about two years premature to start 757 conversions. "Values will have approached the right level in 2003-2005 (since we anticipate a fall in value of about \$3-4 million), and in the meantime other conversion STCs will have come onto the market," says Newrick. "These programmes might be available at about 60% of the cost of Boeing's modification." This will be about \$5 million, including the cargo-handling system, and in some cases will provide aircraft with a maindeck capacity of 15 125-inch by 88-inch containers, providing 3,600lbs more volumetric payload. This would bring total build cost down to about \$22 million for the lowest value aircraft.

If the lowest value aircraft could now be modified under an alternative programme to Boeing's, total build cost could therefore be about \$3 million less than the current \$28-33 million (see table, page 16). These would have lease rates from about \$275,000.

Most freight carriers will not be able to justify acquiring 757-200s at the same market values that DHL bought ex-BA aircraft for. The lease rates most freight carriers are prepared to pay for 757Fs will not be higher than \$275,000. Market values will probably have to fall to about \$15-17 million for total build costs to allow these lease rates.

Aircraft converted in three or four years under an alternative programme to Boeing's will have a build cost of \$22-26 million. Financed at a lease rate factor of 1.2%, the lease rate will be about \$230,000 per month. This will push the 757's unit ATM costs down to about 59 cents, and lower than the 727-200's.

Lease rate factors in the region of 1.1-1.3% are possible with the 757 because it has 15-20 years of useful life left. The 727-200 has a shorter remaining life, and so lease rate factors will have to be higher for debt to be amortised over a shorter period. The risk of obsolescence is also greater with the 727.

The youngest 727s are now 19 years old, and the majority are between 22-28 years. It is argued that younger converted 727-200As are the best replacement for the 727-200F. The glut of aircraft available means build costs for these models are now in the region of \$4-6 million, down from \$7-9 million two years ago. The remaining 5-10 year life of 727-200As means that monthly lease-rate factors will have to be in the region of 2.0-2.5%, and even as high as 3%. Lease rates will then be \$90,000-115,000.

757 alternatives

The 757's appeal comes from its identical fuselage cross-section and ability to use the same maindeck containers as the 727. The 757 also offers a 19-23% increase in capacity, depending on conversion programme used.

Few narrowbody alternatives exist that can either equal or exceed the 727-200's size. The only candidate that can meet this specification is the Tu-204, which has the same cross-section as the 727/757. The Tu-204 is able to use the same containers and pallets used by the 727/757. These are 125 inches in width and 88 inches in length.

The Tu-204 has capacity for 13 maindeck containers, providing 5,950 cubic feet of container volume. An additional 1,570 cubic feet of lower-deck volume takes the aircraft total to 7,500 cubic feet, providing a volumetric payload of 48,900lbs. The aircraft therefore provides a 5,800lbs increase in capacity over the 727-200 (see table, page 16).

The Tu-204 is only available as a factory-built aircraft from Sirocco



Aerospace. Its list price is \$37 million, which would translate into a lease rate of \$333,000 if a lease-rate factor of 0.9% could be obtained. This may be difficult for the Tu-204 to achieve. While the Tu-204 does not yet have western certification, Sirocco Aerospace is in the process of getting certification by the Joint Airworthiness Authority, which should be completed by the end of 2002. There are currently a few western operators, including UK carrier Air Rep, using the Tu-204 on a wet-lease basis.

The Tu-204's fuel burn is known to be similar to the 757's and both types could also have similar flightcrew and maintenance costs. The Tu-204 may have lower flightcrew salaries on account of its smaller size if a western airline opted for the type. The Tu-204's use of the same RB211-535E4 engines as the 757 means that the same engine reserves could be secured for the two. In fact, the Tu-204's engines will be new and so will achieve longer intervals to the first two or three shop visits than a 14-18 year old 757 with engines that have been removed several times. The Tu-204 should be able to get lower engine-maintenance reserves.

The biggest unknown with the Tu-204, however, is that there is not yet a comprehensive customer and technical support operation. This makes maintenance costs unpredictable, but Sirocco Aerospace naturally realises the need for a comprehensive support system and is in the process of developing this.

With a technical support mechanism in place, the Tu-204 should be able to

achieve maintenance costs similar to the 757's, ensuring that the Tu-204 should achieve similar fuel, maintenance and flightcrew costs per trip as a 757-200. The Tu-204 would therefore have to be offered at a similar lease rate to the 757, meaning that a purchase discount in the region of 10% may have to be offered. In this case, the Tu-204's unit ATM costs would be close to the 757-200SF's.

Summary

Aircraft bought at the lowest market values and converted with the Boeing programme will have build costs in the region of \$28-33 million and corresponding lease rates of \$310,000-365,000. Operated in a similar way to the 727-200F, the 757-200SF would have unit costs about 7 cents higher.

After two or three years market 757-200 values will have fallen by \$3-4 million. Build costs will be \$25-30 million, and lease rates of \$275,000-300,000. These will have unit costs of 68 cents per ATM, making them economic compared to the 727-200F.

With an alternative freight conversion programme, build costs will be reduced by a further \$3 million to \$22 million for aircraft with the lowest market values. Corresponding lease rates will be about \$230,000, and generate unit costs of 59 cents per ATM.

Conversion of 757-200s for small package freight operations will therefore be economically viable for more airlines after about another two or three years. 