

The high cost of the chartering of corporate jets has been superseded by the introduction of very light jets. These have low acquisition and maintenance costs and low fuel burns, and can consequently allow their operators to compete with airlines for business passengers.

Can 'mini airline' operations with very light jets be economic?

The use of very light jets (VLJs) by taxi and charter operators effectively working as 'mini airlines' has caught the industry's attention over the past two years. Large numbers of three- or four-seat aircraft are now flying with several operators on fare-paying, ad hoc or charter services in competition with airlines. VLJ operators do not have a schedule or fixed route networks, so will they be able to operate their aircraft at low enough cost levels and fill them with enough passengers and generate sufficient revenue to be economically viable?

VLJ strategy

VLJ operators have only recently begun offering mini airline charter services. They have come from the business-jet sector, where charter services have traditionally been offered with light, medium or heavy corporate jets, which are larger, heavier and more expensive to operate than VLJs. Corporate jets also have higher acquisition, capital and operating costs than VLJs (see table, page 33), which limit their market appeal and utilisation.

The first main element of mini airline strategy is to operate VLJs where there is limited or no direct airline service, or to provide business passengers with alternatives to flying from congested hub airports. These services are offered at rates similar to or higher than business-fares.

Major airports not only waste a lot of passengers' time because of congestion and security checks, but business passengers also have to fit their schedules around airline timetables. Many business

travellers aim to complete a business trip to a location a few hundred miles away within a working day. This is often not possible in North America and Western Europe due to the limited number of regular airline services on many routes. This adds further to passengers' costs because of the need to pay for hotels and other expenses. Where airline services are limited or non-existent, passengers are forced to drive or use time-consuming rail services.

Thousands of city-pairs in North America have a potential daily traffic volume of less than 15 passengers, which is the minimum an airline requires for a service to be economic. VLJ operators are therefore placing themselves in a market niche between corporate jet operators and regional airline services. The success or failure of VLJ operators depends on their filling the aircraft regularly and achieving acceptable levels of operating cost.

The second strategy element is to make the cost of operations low enough to stimulate demand to a level that results in higher rates of aircraft utilisation. This will push down costs related to the aircraft's capital cost, as well as other fixed costs, per available seat-mile (ASM) or per trip. This is helped by VLJs' relatively low capital costs: the four-seat Cessna Mustang has a list price of \$2.8 million; the three-seat Eclipse 500 a list price of \$2.15 million; the four-seat Embraer Phenom 100 a list price of \$3.44 million; the five-seat HondaJet a list price of \$3.99 million; the five-seat Citation I a list price of \$5.1 million; and the six-seat Citation II a list price of \$7.1 million.

A third element is that the light weight of these aircraft contributes to

lower cash operating costs, particularly fuel. Many VLJs also have simplified designs, and so have relatively low maintenance costs because some elements of maintenance that are required on other corporate aircraft or jetliners are absent and not required on the VLJs. VLJ operators also avoid some of the costs that airline operators have, including: cabin crew or flight attendants; in-flight entertainment; catering; and airport and passenger handling charges. Other absent or minimised costs relate to marketing, distribution, ticketing, revenue accounting and all aspects of sales generation.

DayJet

DayJet, based at Boca Raton, Florida started operations with the Eclipse 500 in October 2007. The operator says it has a fleet of 28 VLJs, although it has up to 1,400 aircraft on firm order and option. "Traditional charter operators hire out the whole aircraft, and the customer may have to pay to reposition the aircraft. Many Part 135 operators are buying VLJs to offer lower-cost corporate jet services," explains Traver Gruen-Kennedy, vice president of strategic operations at DayJet. "We can offer services at low rates, stimulate demand and consequently have relatively high levels of utilisation. We provide charter services in Florida and to other states in the South-Eastern US. Although we allow passengers to specify their route, and the departure times of their outbound and return flights, we are unique among most VLJ operators because we sell individual seats, rather than charter the whole aircraft. We will only operate if at least



two of the aircraft's three passenger seats are sold.

"We have developed our own aircraft scheduling and reservation technology to take bookings from 30 days up to four hours in advance of departure," adds Gruen-Kennedy. "The system manages the fleet in real time so that we can coordinate the position of the aircraft and crews with the route and departure times of our customers. Our revenue management system allows travellers to provide a window of their preferred departure times. The wider the window, the lower the fares. The narrower the window the harder it is for us to fill the aircraft and position it, so the fares rise accordingly.

"We have identified a gap in the market in Florida and other parts of the South-Eastern US. In many cases people have to drive for several hours, because there is a lack of direct airline services," continues Gruen-Kennedy. "A perfect example is Boca Raton to Orlando, which takes three hours by car. The only airline service means a drive to Fort Lauderdale, and then air service to Orlando. This takes longer than driving. Another example is Boca Raton to Tallahassee. There is no direct airline service, only a connecting service via Atlanta. The only alternative flight option is a direct service that departs Fort Lauderdale at 4:30am. Driving takes seven hours. The airport-pair has a great circle distance of 329nm, so it would benefit from a direct air service.

"The average sector is 500nm, and takes 90 minutes," continues Gruen-Kennedy. "We have 6-8 flight cycles (FC) and 6-10 flight hours (FH) per day. We have two crews scheduled to operate on

each aircraft daily, which swap in the middle of the day."

Blink

UK taxi operator Blink operates from Farnborough airport, just 40 miles southwest of London. Passengers can be in the aircraft and ready for departure within 15 minutes of arrival at Farnborough. Blink has recently begun services to the European continent with the four-seat Cessna Mustang.

"Business travel in Europe is difficult because of congestion and security procedures at airports. This makes business travel time-consuming and more expensive than it needs to be. Airlines also offer limited frequencies and awkward schedules to many European cities from Heathrow and Gatwick. This therefore creates a large gap in the market that we are able to exploit," says Peter Leiman, managing director at Blink. "Our service has no formal check-in and we charge similar fares to airlines' business-class fares. We charter our four-seat Mustangs to corporations, and only charge on a one-way basis.

"If the aircraft is full, our fares are £500-700 (\$900-1,260) per person for a return to Paris, plus landing fees. This compares with £500 (\$900) for an airline business-class fare. Our return fare for London-Nice is £1,200-1,450 (\$2,160-2,600), plus landing fees per person. This compares to an airline business-class fare of £1,000 (\$1,800). The cost per person will be higher if the aircraft is occupied by two or three people, however.

Blink's buyers are able to specify their departure times, and many charter the aircraft for a whole day to complete a

The Cessna Mustang is a four-seat aircraft with a list price of \$2.8 million. Its lower fuel burn and acquisition price compared to the Embraer Phenom 100 means it is able to offer lower costs per seat than other VLJs.

round trip. "An example is a corporation chartering the aircraft for a day's return trip from London to Nice. One aircraft will operate to Nice, and a second will operate to London from Nice at the same time," explains Leiman. "We will eventually have a fleet based across the whole of Europe, with base aircraft, crews and stocks of spare parts in each region. By basing aircraft in different areas we can optimise scheduling and position them relatively quickly for passengers, who can specify their departure and arrival times up to 12 hours beforehand."

The important factor in an economic operation is aircraft capital cost and utilisation. The Cessna Mustang has a list price of \$2.8 million and Leiman estimates that Blink can generate about 1,000FH per year, although it is already generating 1,400FH per year on a pro-rata basis. Leiman says that an annual utilisation of 1,000FH is equal to operations of 4FH per day, five days per week.

JetBird

Irish operator JetBird has 50 Embraer Phenom 100s on order, and will start operations from London to up to 100 European secondary business destinations in spring 2009. It will use the four-seat VLJ from Biggin Hill, about 15 miles south of London, and the executive terminal at London Stansted Airport, about 40 miles north-east of London.

"We will sell the aircraft on demand, and all the capacity to a single corporation, since it is difficult or impossible to sell individual seats," says Stefan Vilner, chief executive officer at JetBird. "We will offer the aircraft at a similar cost to four business-class fares. We will have transparent pricing, offering the aircraft at a fixed rate per hour, although there may be some variations due to landing fees. We will not have an airline-like revenue management strategy, but will sell one fare close to departure.

VLJ fares & tariffs

The fares and tariffs charged by some of these operators can be compared with similar fares charged by airlines on the same or alternative routings.

DayJet's tariffs on select routes in

Florida are interesting. On the 420nm Boca Raton to Macon, Georgia sector, for example, DayJet charges \$1,055-4,234 per seat for return fares, depending on how narrow is the passenger's required departure time window. There are no airline options in this case.

Another example is the 484nm Boca Raton to Montgomery route. DayJet offers return fares of \$1,140-4,792 per passenger. The fare charged again depends on the departure time window.

Straightforward comparisons are possible with Blink and scheduled carriers. An example is London-Stuttgart. Blink's operation would involve a total airport check-in and flying time of four and a half hours. This compares to at least five and probably six hours using the airline alternative. Blink charts the entire aircraft for £4,300 (\$7,750), and charges landing fees of £700 (\$1,250) in addition, bringing the total cost to £5,000 (\$9,000). This is equal to a cost per available seat of £1,250 (\$2,250) for the return flight. The British Airways business-class return fare is £670 (\$1,200) for a day trip. British Midland's return business-class fare is £810 (\$1,450), but a return trip is not possible within a day.

VLJs

A large number of VLJs are on the market or coming on to the market over the next few years. There are, however, three main types (*see table, this page*): the Eclipse 500; Cessna Mustang; and Embraer Phenom 100. The Eclipse 500 has a standard cabin of four seats, although DayJet configures the aircraft with three. The Mustang and Phenom 100 have four seats as standard. There is also the five-seat Hondajet and six-seat Embraer Phenom 300.

The Eclipse 500 is the smallest aircraft, with a list price of \$2.15 million and maximum take-off weight (MTOW) of 5,950lbs. It has the smallest cabin, with a width of 56 inches and length of 148 inches. The cabin length is shorter than the Mustang's or Phenom 100's, and means that the Eclipse 500's forward passenger seat on the port side is in the path of passengers as they enter the cabin door. Many operators therefore have one passenger seat on the port side, taking the number down to three.

The aircraft has a take-off field length of 2,342 feet, the shortest of these four main VLJs. The engines are rated at just 900lbs thrust.

The Eclipse 500's simplified design keeps its list price low and minimises its maintenance requirements. This allows its operators to provide private jet travel at unprecedented low rates. Eclipse Aviation provides a JetComplete program for operators.

VERY LIGHT JET SPECIFICATION DATA

Aircraft type	Eclipse 500	Cessna Mustang	Embraer Phenom 100
List price-\$ million	2.15	2.80	3.44
MTOW-lbs	5,950	8,645	N/A
Engines	PW610F	PW615F	PW535E
Engine thrust-lbs	900	1,460	1,615
Take-off distance-feet	2,342	3,110	3,400
Maximum cruise speed-kts	370	340	380
Maximum cruise speed-Mach	0.64		
Passenger seats	3	4	4
Passenger cabin width	56 inches	55 inches	61 inches
Passenger cabin length	N/A	117 inches	108 inches
Range 4 passengers nm	1,125	1,150	1,160

Despite this simplicity, the Eclipse 500 has a high cruise speed of 370 knots or Mach 0.64 (*see table, this page*).

The Eclipse 500 has been specified by DayJet, which has placed firm orders and options for 1,400 aircraft.

The Cessna Mustang is the second largest VLJ, with an MTOW of 8,645lbs and a four-seat cabin. The aircraft has a 2008 list price of \$2.8 million, but a larger cabin than the Eclipse 500, with a length of 117 inches and width of 55 inches. Pairs of seats are arranged facing each other. The aircraft does not have an enclosed lavatory.

The aircraft has a take-off field length of 3,110 feet, which is short enough to allow it to operate from a large number of secondary airports. The Mustang is powered by PW615F engines rated at 1,460lbs. These are larger variants of the PW610F that power the Eclipse 500.

The Cessna Mustang has a maximum cruise speed of 340 knots (*see table, this page*), making it one of the slowest VLJs. This makes a difference to flight times of 2-9 minutes on 400-600nm. It has a range of 1,000nm with four passengers.

The Embraer Phenom 100 is one of the largest four-seat VLJs on the market. Its cabin is slightly larger than the Mustang's, being 61 inches wide and 108 inches long, excluding the toilet. It has a list price of \$3.44 million, which is \$0.64 million more than the Mustang. The Phenom 100 is the only aircraft in its size class to have an enclosed toilet.

The Phenom 100 is powered by PW535E engines rated at 1,615lbs thrust. The aircraft has a take-off field length of 3,400 feet and maximum cruise speed of

380 knots. This is marginally faster than the Eclipse 500, so the two will have similar flight times on 300-600nm sectors.

The Phenom 100's maintenance programme has a major airframe check once every 600FH or calendar year, depending on which comes first. At expected rates of utilisation achieved for air taxi operators, the aircraft will require two airframe checks per year. If performed as a block check, it is expected that it will take about one week to complete.

Embraer offers the Phenom 100 with a technical support programme known as Embraer Executive Care (EEC). This is a fixed-cost per-hour programme, and includes exchange of rotables, expendables and consumables, parts carriage and insurance, and access to the Fly Embraer portal which provides various types of customer support.

Embraer's Enhanced EEC programme covers the EEC plus scheduled and unscheduled maintenance labour, consumables used during maintenance checks, and a mobile recovery service for aircraft on the ground (AOG) situations.

Engine shop-visit maintenance, life limited part replacement, spare engine coverage, and supply of engine-related line replaceable rotables are covered under Pratt & Whitney Canada's Eagle Service Plan (ESP). There are various levels of coverage, but taking the Gold ESP and Enhanced EEC programmes covers all elements of maintenance.

Route line checks will be done by pilots, and mechanics will only be needed for non-routine maintenance and defects.

This can be provided by Embraer under the EEC programme from its own service centres with mobile recovery services.

VLJ economics

The economics of VLJ operations in a 'mini airline' style of operation can be simply analysed on typical sector lengths. Fares and tariffs charged by example operators give an indication of what revenues can be expected.

Operating costs are relatively simple to examine. VLJ operators do not bear several aircraft operating costs incurred by airlines, including cabin crew and catering costs. The four largest costs are aircraft financing, fuel, maintenance and flightcrew. The Eclipse 500, Cessna Mustang, and Phenom 100 have been analysed using two stage lengths of 400nm and 600nm (*see table, page 36*).

Operations

The rate of aircraft utilisation, the amount of positioning flights that have to be flown, and average sector lengths are important factors influencing trip costs.

VLJ operators expect to make at least two revenue-generating FCs at either end of the day, although it is possible there will be demand for an additional revenue-

earning sector. This will be the operating pattern five days per week, with little or no activity at the weekend. On this basis, the aircraft would generate 500 revenue FCs per year. The number of FCs is unlikely to vary, with sectors from 300nm to 600nm. The number of FHs will therefore be higher as average sector length increases.

An allowance must be made for positioning flights, and FCs and FHs are increased by 15% to account for the additional costs of employing flightcrew, fuel and maintenance. Taxi time, which is relatively short for this type of operation, also affects aircraft productivity. A time of 10 minutes has been used, which will be typical for the type of airports these operators use. Block times for a 400nm sector are 84-86 minutes for the three types. This results in annual total block hours (BH) of 805-825 for the three aircraft, with time for positioning flights included (*see table, page 36*). Block times on a 600nm sector are 117-126 minutes, and translate into total BH of 1,100-1,210 per year for the three aircraft (*see table, page 36*).

Aircraft financing

Aircraft financing cost can be examined as a monthly lease rate factor

of 0.85% of aircraft list price. This gives monthly lease rentals of \$18,275 for the Eclipse 500, \$23,800 for the Cessna Mustang and \$29,240 for the Embraer Phenom 100 (*see table, page 36*). These are equal to lease rentals per trip of \$440 for the Eclipse 500, \$570 for the Mustang, and \$700 for the Phenom 100. The costs per seat are close for the three-seat Eclipse 500 and four-seat Mustang at \$143-146. The Phenom's higher cost of \$175 may be worthwhile given its larger cabin and attraction for business passengers. The costs per trip and per seat do not change with different sector lengths as analysed here, with the number of FCs remaining unchanged. Costs would be lower if purchase discounts are secured.

Fuel consumption

Fuel burn for these aircraft is 100-145USG for a 400nm trip for the three types (*see table, page 36*). These are then escalated by 15% to account for the positioning flights. At a price of \$3 per USG, the adjusted trip fuel costs are \$345-500 for the three types on the 400nm sector (*see table, page 36*). This is equal to \$115-125 per seat.

Fuel burn on the longer 600nm sector is 134-193USG for the three aircraft (*see*

table, page 36), and has been escalated by 15% to account for positioning flights. Trip fuel costs are \$462-666 for the three aircraft (see table, page 36).

Maintenance

The cost of providing maintenance and technical support for the aircraft is simplified by each of the manufacturers supplying comprehensive support programmes that can be paid for on a per FH basis.

Eclipse Aviation's JetComplete programme includes several elements, the first of which is a comprehensive maintenance coverage comprising labour, rotatable parts and expendables for scheduled maintenance and unplanned inspections and maintenance. It also covers the cost of managing airworthiness directives (ADs) and service bulletins (SBs). There is also support for AOG situations, flight planning and weather briefings. A fourth major element covers data services to provide navigation data updates and engine trend monitoring. The cost for the initial three years of operation is \$147 per FH.

Eclipse estimates that the additional costs for tyres and brakes are \$4.25 per FH. A final element of maintenance is Pratt & Whitney Canada's Silver Eagle

Service Plan (ESP) for the PW610F at a rate of \$154 per FH. The Gold ESP provides all required elements of maintenance support for engines, and will be close to \$200 per FH. These put the total cost for the three elements at about \$350 per hour.

The technical support for the Cessna Mustang is provided in three parts. The first of these is ProParts, which provides airframe and avionic rotatable components for the first five years of operation. This starts off at a rate of \$20 per FH, and climbs to \$95 per FH in the fifth year.

The second element, PowerAdvantage Plus, is an engine support module that includes engine shop maintenance, and spare engine rentals during engine maintenance. This is available at \$93-103 per engine flight hour (EFH), or \$186-206 per FH for the two engines.

The third element is ProTech, a maintenance package that includes scheduled maintenance, minor engine inspections, unscheduled labour, engine removal and reinstallation, and consumables. This costs \$80 per FH in North America, and \$92 per FH in Europe.

The total for the three packages is \$365 per FH in North America and \$380 per FH in Europe in the third year of operation, and \$5-10 per FH higher in

the fifth year.

The enhanced EEC programme for the Embraer Phenom 100 costs \$188 per FH for the first three years of operation, rising to \$306 per FH in the fourth and fifth years. However, these rates only apply to private owners with utilisations of 150-350FH per year. Embraer says that the rates for fleet owners achieving 600-1,000FH per year are likely to be lower, although it cannot be exact about the cost. The scope of the Enhanced EEC programme could also be wider, and include on-site stocks of rotatables, for example.

The cost of Gold ESP is \$180 per FH for both engines under the Silver programme. The Gold programme will include support for rotatables and AOG assistance, and will cost more than \$200 per FH.

The total cost for all maintenance for the Phenom 100 will be up to \$400 per FH for the first three years, and a maximum of \$500 per FH in the fourth and fifth years. The rates of the Enhanced EEC for fleet operators will bring them down to levels lower than this.

Flight crew

Air taxi operators enjoy several advantages over airlines in flightcrew-



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OPERATING COSTS OF VERY LIGHT JETS

Area of operation	N. America	N.America	N.America	Europe	Europe	Europe
Aircraft type	Eclipse 500	Cessna Mustang	Embraer Phenom 100	Eclipse 500	Cessna Mustang	Embraer Phenom 100
Sector length-nm	400	400	400	400	400	400
Block hours/year	805	824	815	805	824	815
Monthly lease rental-\$	18,275	23,800	29,240	18,275	23,800	29,240
Trip lease rental-\$	439	571	702	439	571	702
Fuel burn-USG	115	144	167	115	144	167
Fuel cost-\$	345	431	500	345	431	500
Maintenance cost/FH-\$	350	365	400	350	380	400
Maintenance trip cost-\$	564	602	652	564	626	652
Annual crew cost-\$	118,892	121,723	120,308	190,228	194,757	192,492
Trip crew cost-\$	238	243	241	380	390	385
Total trip cost-\$	1,585	1,848	2,094	1,728	2,018	2,239
Sector length-nm	600	600	600	600	600	600
Block hours/year	1,121	1,208	1,169	1,121	1,208	1,169
Monthly lease rental-\$	18,275	23,800	29,240	18,275	23,800	29,240
Trip lease rental-\$	439	571	702	439	571	702
Fuel burn-USG	154	196	222	154	196	222
Fuel cost-\$	154	147	166	154	147	166
Maintenance cost/FH-\$	350	365	400	350	380	400
Maintenance trip cost-\$	785	881	935	785	918	935
Annual crew cost-\$	165,600	178,338	172,677	264,960	285,342	276,283
Trip crew cost-\$	331	357	345	530	571	553
Total trip cost-\$	2,017	2,396	2,648	2,216	2,646	2,856

related costs. The main one is that the pattern of operation means crews will rarely have to be stationed away from base overnight. The obvious benefit is that operators do not have to bear the costs of hotels and related expenses.

VLJ operators will typically recruit first officers with one or two years' experience after gaining the appropriate licences. Promotion to captain will be awarded in two to three years in most cases. Some operators have begun with senior captains or two captains, but this will change to regular crews once operations have been established. Annual salaries for captains in North America are \$50,000-60,000, but are higher in Europe. Typical rates are \$85,000, although there is wide variation in pilot remuneration between countries.

First officer salaries in North America will be \$30,000, and in Europe \$43,000. Basic salary for a full crew complement will therefore be \$80,000 per year for North American crews, and \$125,000-130,000 for European crews. Operators will incur additional employment costs such as employer's insurance, pension contributions, uniforms, training, allowances and transport. A factor of 20% of basic salaries has been added to account for these items, which takes total annual employment cost per crew to about \$100,000 in North America, and \$150,000-155,000 in Europe.

Crew productivity also affects crew costs per trip and per seat. The short-haul

nature of operations and returning to base most nights means productivity will be relatively high, so 650BH per year is assumed. When factored for total BH flown per year, operators will need 1.2-1.3 crews per aircraft on 400nm sectors, and 1.7-1.9 crews on 600nm routes. Overall crew costs per trip will be \$240-245 per BH for 400nm routes, and \$60-80 per seat (see table, page 36). Crew costs for 600nm sectors will be \$330-360 per BH, and \$86-110 per seat.

Total costs

Total costs for European operations are 9-10% higher than in North America.

The Eclipse 500 clearly has lower trip costs, but its fewer seats make its costs per seat \$70-80 higher than the Phenom 100's and Mustang's. The Phenom 100's costs per seat are lower than the Eclipse's, but only by \$4-16. The Phenom 100, however, has higher costs per seat than the Mustang by \$55-60. The largest difference in costs per seat is therefore between the Mustang and Eclipse 500.

In a North American operation, total costs for the Eclipse 500 are \$1,585 on a 400nm sector, rising to \$2,017 for a 600nm operation (see table, page 36). These are equal to \$528 per seat on a 400nm trip, and \$672 per seat on a 600nm route. Trip costs for the European operation are \$1,728 and \$2,216 for 400nm and 600nm sectors. Costs per seat are \$576 and \$739.

Total costs for the Mustang in the North American operation are \$1,848 for a 400nm trip, rising to \$2,396 for a 600nm sector (see table, page 36). These are equal to \$462 per seat on a 400nm route, and \$599 per seat on a 600nm sector.

Trip costs are \$160-600 higher for a European scenario, and seat costs \$40-60 higher than in the North American one.

The Phenom 100 has the highest trip costs, at \$2,100 on the 400nm North American sector and \$2,239 in the European route. Costs for the two 600nm routes are \$2,648 and \$2,856.

These costs compare well with the fares charged by some VLJ operators. If successfully chartered, the tariffs charged should leave sufficient margin for the operators to cover overheads, indirect operating costs and marketing expenses. Many VLJ operators charge for the entire aircraft, the main drawback being that most corporations will only be attracted to the service if they can fill three or four seats of the aircraft.

The major challenge facing VLJ operators, however, is having enough marketing strength to fill the aircraft on a regular basis at the tariffs charged. Inadequate levels of demand will compromise utilisation and increase positioning flights. [AC](#)

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